THE RELATIONSHIP OF SELF-EFFICACY FOR LEARNING AND PERFORMANCE IN PHYSICS AND METACOGNITIVE SELF-REGULATED PHYSICS LEARNING WITH PHYSICS ACHIEVEMENT OF FORM 3 STUDENTS AT DOMASI DEMONSTRATION SECONDARY SCHOOL IN MALAWI

Austin Bondawambinga Kalambo

I.D. No. 6029557

A Thesis Submitted in Partial Fulfillment of the
Requirements for the Degree of
MASTER OF EDUCATION
in Curriculum and Instruction
Graduate School of Human Sciences
ASSUMPTION UNIVERSITY OF THAILAND
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Field of Study: CURRICULUM AND INSTRUCTION

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Accepted by the Graduate School of Human Sciences, Assumption University in Partial Fulfillment of the Requirements for the Master Degree in Education

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ABSTRACT

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Key Words: SECONDARY PHYSICS, STUDENT ACHIEVEMENT, SELF-EFFICACY, SELF-REGULATION, MOTIVATION, DOMASI DEMONSTRATION SECONDARY SCHOOL, MALAWI

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The study was aimed at determining the relationships among self-efficacy for learning and performance in physics, metacognitive self-regulated physics learning and physics achievement of Form 3 physics students at Domasi Demonstration Secondary School in Malawi. The Motivated Strategies for Learning Questionnaire (MSLQ) was adapted and used to collect data on self-efficacy for learning and performance in physics and metacognitive self-regulated physics learning from 40 Form 3 physics students at Domasi Demonstration Secondary School in Malawi in their Term 3 of the 2019 academic year. The physics achievement scores of the students were collected by an end of Term 3 physics examination. A multiple correlation coefficient analysis was used to determine the relationships among self-efficacy for learning and performance in physics, metacognitive self-regulated physics learning and physics achievement of the Form 3 physics students. It was revealed that the relationship of self-efficacy for learning and performance in physics and metacognitive self-regulated physics was moderately strong and positively correlated. Similarly, physics achievement and self-efficacy for learning and performance in physics were also moderately strong and positively correlated. Lastly, the relationship between physics achievement and metacognitive self-regulated physics learning was revealed to be weak but positively correlated. The findings, further, indicated that a moderately strong and positive significant relationship existed between self-efficacy for learning and performance in physics and metacognitive self-regulated physics learning with physics achievement. Recommendations for students' support, teaching strategies, and future research are provided.

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Austin Bondawambinga Kalambo

Assumption University of Thailand

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CHAPTER I

INTRODUCTION

This chapter presents important sections such as background of the study, statement of the problem, research questions, research objectives, research hypotheses, theoretical framework, conceptual frameworks, scope of the study, definitions of terms and significance of the study.

Background of the Study

Developed countries across the world have instituted policies to include literacy in science and technology in their education (Bencze, 2010; Nampota, Thomson & Wikeley, 2009). As a result, non-industrialized nations have also prioritized science education in their school educational programs in light of its conceivable contribution towards the growth of economy and enhancement of development, hence fighting poverty. The advancement of education that typifies science, in Malawi, is backed in Malawi Vision 2020 (Government of Malawi, 2015), the 2017 Science and Technology Policy for Malawi (National Comission for Science and Technology, 2017) and Secondary School Curriculum and Assessment Review (SSCAR) Framework (Malawi Institute of Education, 2015). The Malawi government strategies, additionally, have singled out science as a remedy to enhance development and growth for the economy as indicated by policy direction which underlines a move from a net expending and importing nation to rather a net exporting one (Ministry of Finance Economic Planning and Development, 2016). Nampota et al. (2009) likewise contended that there is a solid connection between human capital development and science education. This connection has been exploited by ASEAN nations to spur development and advancement. Considering the trend in Malawi policies, a type of education that bridges the gap is henceforth vital towards accomplishing such visions and promptly sets its people to ably take part in an economic growth and development that is driven by science and technology.

With a purpose of actualizing the Malawi government policy direction and aspirations of her people, the Malawi Ministry of Education, Science and technology (MoEST) introduced science and technology a subject in primary schools (Fabiano, 2002). MoEST also, in 2015, split physical science into physics and chemistry, and has made these subjects core in secondary education (Malawi Institute of Education, 2015). Further, the Malawi government established the Malawi University of Science and Technology (MUST) in 2012 to promote science education for the economic development of Malawi.

In spite of these policy directions, it has been observed countrywide of pitiable learners' involvement and achievement in science subjects both in primary and secondary schools (Dzama, 2006). This has an enormous effect on the learners' career routes. To address the poor performance and participation in science subjects, the Ministry of Education, Science and Technology (MoEST) has taken a number of interventional measures to address the challenges. The measures include provision of a variety of textbooks, Student Interactive Workbooks (SIW), laboratory manuals, physics charts, physics compact discs and laboratory resources. MoEST has also procured physics laboratory mobile kits for schools without proper laboratory infrastructure, and facilitated science summer camps and fairs for the students (Malawi Institute of Education, 2015). Provision of these resources has been complemented with professional development of the teachers. The teachers have been oriented, countrywide, to physics curriculum and have been trained at science education centers in Kenya and Japan through the Strengthening of Mathematics and Science in Secondary Education (SMASSE) project. Physics teachers also meet during school holidays to share best practices and use of the resources in physics in cluster centers. They are also drilled in effective science education methods at designated training centers in Malawi with an ultimate goal of improving student achievement in physics.

However, Bandura (1989) explained that learning takes place in a social context with a dynamic and bi-directional interplay of the individual, the condition, and behavior (Bandura, 1989). The reasons for student low achievement in physics can, therefore, be equally inherent in social contexts of students' self-efficacy for learning and performance and metacognitive self-regulation of physics learning. Bandura (1986) explained self-efficacy as an individual's conviction about her or his capacity to perform a specific task (Bandura, 1989). He further contended that self-efficacy rouses one's feelings, opinions, motivation and behavior hence having an impact on selection of activities, student endeavors, and individual level of execution (Bandura, 1989; Pajares, 2018). Equally critical is metacognitive self-regulated learning where students direct, alter, and keep up their learning activities. Zimmerman accentuates that a person who is self-regulated utilize explicit techniques during learning in order to accomplish the expected academic goals (Zimmerman & Martinez-Pons, 1990) .

The interventional measures taken by MoEST are, therefore, expected to create a conducive environment for physics learning to take place where the teachers are empowered with requisite skills, knowledge and resources for physics education which ultimately translate into students' interests, better practices and achievement in physics.

Statement of the Problem

Student achievement in physics and chemistry in national examinations has been lower than other subjects in Malawi including Domasi Demonstration Secondary School (Dzama, 2006). Dzama also observed that the number of students pursuing these subjects in secondary schools in Malawi is decreasing.

MoEST has taken a number of steps to address students' low achievement in physics (Malawi Institute of Education, 2015), as indicated above, and Domasi Demonstration Secondary School was used as one of the model schools for implementation of the interventions (Japan International Cooperation Agency, 2016). It is to the researcher's expectation that the provision of a variety of physics materials and multi-modal teacher professional development programs were to enhance students' learning, their beliefs, practices and interest in the subject leading to high achievement. More importantly, at the school, the interventions were expected to positively transform Form 3 physics students' thinking about their ability to learn physics by developing their confidence (self-efficacy) and self-management practices to physics learning (metacognitive self-regulation). However, as observed by physics teachers at Demonstration Secondary School, students' physics achievement of Form 3 students at the school was still low (F. Kasenda, personal communication, February 27, 2019). In face of this scenario, the researcher, therefore, believes that lack of metacognitive self-regulation for physics learning and self-efficacy for learning and performance in physics amongst Form 3 physics students is one of the reasons for low achievement in physics.

To the researcher's knowledge, there had been no previous research done on students' self-efficacy, self-regulation and achievement in secondary school physics education in Malawi. The researcher, therefore, decided to develop a research study to examine the relationship of self-efficacy for learning and performance in physics and metacognitive self-regulated physics learning with physics achievement of Form 3 students at Domasi Demonstration Secondary School in Malawi.

Research Questions

The study aimed at answering the following research questions.

1. What is the level of self-efficacy for learning and performance in physics of Form 3 students at Domasi Demonstration Secondary School in Malawi?
2. What is the level of metacognitive self-regulated physics learning of Form 3 students at Domasi Demonstration Secondary School in Malawi?
3. What is the level of physics achievement of Form 3 students at Domasi Demonstration Secondary School in Malawi?
4. Is there a significant relationship of self-efficacy for learning and performance in physics and metacognitive self-regulated physics learning with physics achievement of Form 3 students at Domasi Demonstration Secondary School in Malawi?

Research Objectives

The research objectives are outlined as follows.

1. To determine the level of self-efficacy for learning and performance in physics of Form 3 students at Domasi Demonstration Secondary School in Malawi.
2. To determine the level of metacognitive self-regulated physics learning of Form 3 students at Domasi Demonstration Secondary School in Malawi.
3. To determine the level of physics achievement of Form 3 students at Domasi Demonstration Secondary School in Malawi.
4. To determine whether there is a significant relationship of self-efficacy for learning and performance in physics and metacognitive self-regulated physics learning with physics achievement of Form 3 students at Domasi Demonstration Secondary School in Malawi.

Research Hypothesis

The following research hypothesis was formulated to guide this study.

There is a significant relationship of self-efficacy for learning and performance in physics and metacognitive self-regulated physics learning with physics achievement of Form 3 students at Domasi Demonstration Secondary School in Malawi at .05 significance level.

Theoretical Framework

This section will introduce the theoretical framework of the study.

Social Cognitive Theory

Social cognitive theory (SCT), developed by Bandura in 1986, postulates that learning takes place in a social setting with a dynamic and reciprocal interaction of the person, the condition, and behavior (Bandura, 1989). The special feature of SCT is the stress on social impact, external and internal social reinforcement. SCT takes into account the special manner by which individuals obtain and sustain behavior, while additionally considering the social conditions in which people execute specific behaviors. The theory, further, considers an individual's past encounters, which predict whether behavioral activity will take place. These past experiences impact reinforcements, prospects, and expectancies, all of which shape whether an individual will participate in a particular behavior and the reasons why an individual takes part in that behavior (Bandura, 1989).

Social cognitive theory, therefore, depicts a model of causation that emphasizes the dynamic interaction between people (personal factors), their behavior, and their environments as demonstrated in a construct called triadic reciprocal determinism (Bandura, 1989). In this construct, conduct, perception and other individual elements, and environmental impacts all work as connecting determinants that impact one another reciprocally (Bandura, 1989). Corresponding causation does not imply that the diverse sources of impact are of equivalent intensity. Some might be more intense than others. Nor do the equal impacts all happen at the same time. It requires time for a causal factor to apply its impact and actuate reciprocal impacts.

Bandura (1986) also developed self-efficacy and self-regulation theories as part of the social cognitive theory.

Self-efficacy theory. Self-efficacy alludes to an individual's inner self-belief about their capacity to accomplish a fruitful result in a given assignment (Bandura, 1989). Self-efficacy is affected by four critical sources of information: performance accomplishments, vicarious experience, verbal persuasion, and physiological information (Alegre, 2014; Bandura, 1989; Bernstein et al., 1996; Sadi & Uyar, 2013). Bandura (1994) expressed the most grounded contributing source to self-efficacy is mastery experience. Achievement increases self-efficacy. Failure diminishes self-efficacy, particularly if it happens before a solid feeling of self-efficacy is developed.

Self-Regulation theory. Self-regulation theory (SRT) is a system of cognizant individual management that includes the way toward controlling one's own thoughts, practices, and emotions to achieve objectives. Self-regulation is comprised of three stages, and people must function as providers of their own inspiration, conduct, and improvement inside a system of reciprocally interrelating influences. Baumeister, Schmeichel and Vohs (2005) distinguish four segments of self-regulation: standards of desirable behavior, motivation to meet standards, monitoring of situations and thoughts that lead ending said standards, and finally, willpower.

The self-regulatory system is a focal point of causative processes. They not only mediate the effects of the majority of external influences, but also offer the ground to intentional action. Self-regulation engages three main sub-functions as an independent directing system. The initial sub-function involves examining an individual's behavior. Self-monitoring provides information anticipated in setting up performance standards and examining an individual's progress to their attainment. In the second sub-function, individuals examine their behaviors based on their set standards, circumstances they are facing and appraisal of the practices. The referential assessments bring the action to the third sub-function, affective self-reactions of an individual's issued opinion on performances. Anxious self-penalties support and initiate behavior that induce satisfaction people derive from their actions.

Conceptual Framework

The conceptual framework was developed based on the knowledge base in education and previous empirical studies. There are two independent variables which are metacognitive self-regulated physics learning and self-efficacy for learning and performance in physics. The dependent variable is physics achievement. These variables were tested in Malawi on 40 Form 3 physics students studying at Domasi Demonstration Secondary School using multiple correlational analysis. Figure 1 shows the conceptual framework used in the study.

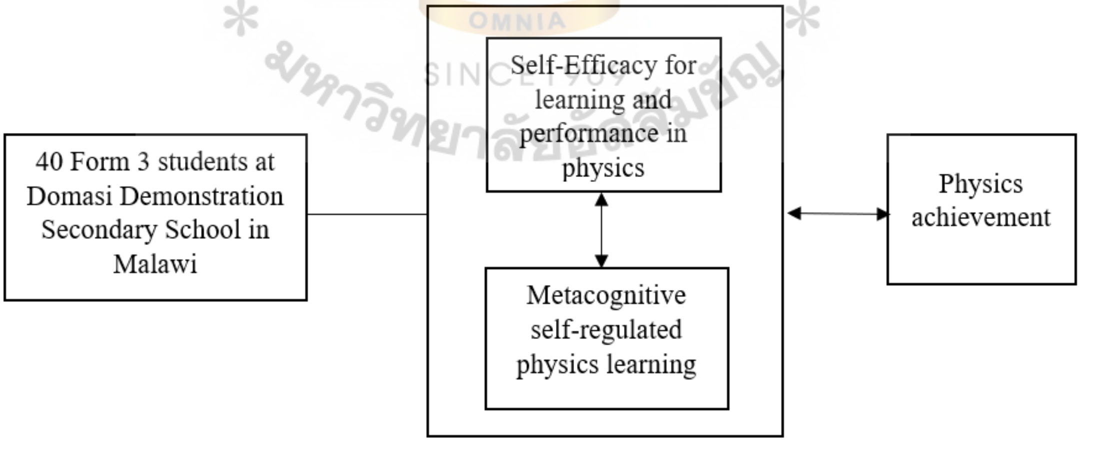

***Figure** 1*. Conceptual framework for the study.

Scope of the Study

The study took place at a government secondary school in the South East Education Division (SEED) in Malawi and concentrated on social cognitive theory, self-regulation theory and self-efficacy theory to determine their relationships with physics achievement of students.

In Malawi, secondary school classes span from Forms 1 to 4. However, Form 4, the highest level, is an examination class. This means that students in this class sit for national examinations in their third term. There was a fear that Form 4 teachers and students may consider it a waste of their time to participate in a study given the high importance they attach to national examinations. Similarly, there was also a fear that Forms 1 and 2 students may have difficulties in expressing themselves effectively about their physics learning in English and, therefore, decided to conduct the study among Form 3 students.

This study, therefore, focused on 40 Form 3 physics students at Domasi Demonstration Secondary School in Malawi in their third term of 2019 school year. The class has 80 students, but only half of the students take physics. The study was limited to these 40 students that take physics. The students were of mixed sexes; male and female, and generally from poor families.

The study further dwelled on the 40 Form 3 students' physics self-efficacy at Domasi Demonstration Secondary School in Malawi, their self-regulation for learning physics and the students' physics achievement. It endeavored to establish relationship of metacognitive self-regulated physics learning and self-efficacy for learning and performance in physics with physics achievement of the students at Domasi Demonstration Secondary School.

The study used Motivated Strategies for Learning Physics Questionnaire (MSLPQ) to determine the students' levels of self-regulated physics learning and self-efficacy for learning and performance in physics while students' physics achievement was determined by end of Form 3 physics examination.

Definitions of Terms

The following list are terms used in this research study.

Domasi Demonstration Secondary School

A government day secondary school for boys and girls in South East Education Division in Malawi. The school is used to develop and propagate best practices in secondary education.

Form 3

A British system of assigning levels to classes; denoting Grade 11 in the American system.

Physics Achievement

The ability to attain success in physics with great grades. In this study physics achievement means total scores in physics attained at the end of Term 3 of the 2019 school year expressed as percentages.

Social Cognitive Theory

Learning takes place in a social environment with an active and mutual interplay of the individual, environment, and conduct (Bandura, 1989).

Metacognitive self-regulated physics learning. In this study, means the ability of students to understand and control their physics learning environment (Zimmerman, 2001) as measured by Motivated Strategies for Learning Physics Questionnaire (MSLPQ).

Self-Efficacy for learning and performance in physics. In this study, means beliefs of students in their capability to accomplish certain tasks in physics successfully (Bandura, 1977; Zimmerman, 2000) as measured by Motivated Strategies for Learning Physics Questionnaire (MSLPQ).

Significance of the Study

The findings of the research will benefit an array of stakeholders including students, teachers, school administrators, and the Malawi Ministry of Education, Science and Technology.

Students

Students will benefit from the knowledge of positive link among self-regulated physics learning and self-efficacy for learning and performance in physics levels and physics achievement. With this knowledge, the students are bound to enhance their beliefs that they can do better in physics and take more responsibility of their learning, leading to higher achievement in physics. Higher physics achievement can increase their chances of being accepted at university or enter other science related fields.

Teachers

The expected increased physics achievement due to increased students' metacognitive self-regulated physics learning and self-efficacy for learning and performance in physics levels will provide physics teachers with the knowledge and techniques to enhance the students' self-efficacy and self-regulation levels. With the increased levels, physics teachers will be able to teach physics at a higher cognitive level and in a class of autonomous learners.

Administrators

The researcher anticipates that increased physics achievement realized from metacognitive self-regulated physics learning and self-efficacy for learning and performance in physics, students will likely perform better on national tests leading to a higher reputation for a school. Administrators will also be able to mount programs in schools that supports developing students' self-efficacy and self-regulation in physics learning.

Malawi Ministry of Education, Science and Technology

The knowledge that increase in students' metacognitive self-regulated physics learning and self-efficacy for learning and performance in physics increases physics achievement will be a source of policy direction where the ministry will be able to put in place policies that promote the development of these traits in students across the country.

This chapter discussed the background of the study, the statement of the problem, research questions and objectives, research hypothesis, scope of the study, definitions of terms, and significance of the study. Chapter II will review literature related to the research, previous research on students' metacognitive self-regulated physics learning and self-efficacy for learning and performance in physics and achievement, social cognitive theory, self-regulation theory and self-efficacy theory, and background to Domasi Demonstration Secondary School

CHAPTER II

REVIEW OF RELATED LITERATURE

The previous chapter covered the background of the study, statement of the problem, research questions, objectives and hypotheses, theoretical framework, conceptual framework, scope of the study, definitions of terms and significance of the study. This chapter presents a review of the theory and research literature which provides the theoretical foundation of this study aimed at finding out the relationship of self-efficacy for learning and performance in physics and metacognitive self-regulated physics learning with physics achievement of Form 3 students at Domasi Demonstration Secondary School in Malawi. The chapter, specifically, describes background information on social cognitive theory, self-regulation theory, self-efficacy theory, previous research findings on students' metacognitive self-regulated physics learning, self-efficacy for learning and performance and physics achievement. The chapter concludes with the background of Domasi Demonstration Secondary School, and the Form 3 physics class.

Among the various factors which have an impact on academic achievement of learners including social factors such as family and peers, student personal factors such as self-efficacy and self-regulation, and school factors such as quality of instruction, resource availability and use, and school culture (Crosnoe, Johnson & Elder, 2004), of particular interest to this study are student factors that have components of motivation and metacognitive self-regulated learning. Bandura explained most of these factors in social cognitive theory (SCT) which are further supported by his self-efficacy theory (SET) and self-regulation theory (SRT).

Social Cognitive Theory

In SCT, learning is emphasized from the social environment (Bandura, 1996). Bandura's SCT posits that learning occurs in a social environment with a dynamic and mutual interaction of the person, behavior, and the environment. SCT is distinctively characterized by its stress on social influence, internal and external social support. It takes into consideration the exceptional way how people attain and sustain their conduct, as it additionally considers the social environment in which people implement their behavior (Bandura, 1996). Further, the SCT, take into consideration a person's previous experiences, which determine if an act of the behavior will take place. These previous experiences have an effect on support, anticipations, and expectancies. Together, they, determine the chances of an individual taking part in a particular behavior including the rationale for taking part in that behavior (Bandura, 1989). It is, therefore, evident that people, through the triadic interactions, have a part to play in influencing events and the course of their lives.

Triadic Reciprocal Determinism

Traditionally, human behavior had been repeatedly described as a one-way determinism. These approaches portrayed formation and operation of behavior by internal dispositions or by environmental effects (Bandura, 1989). To the contrary, SCT champions a causation model encompassing triadic reciprocal determinism where cognition, behavior and other environmental effects, and personal factors together function as interrelating causal factors which have an effect on one another in both directions (Bandura, 1989). The model does not imply that the various sources of influence are of the same strength nor do they all happen at the same time. The model, rather, acknowledges that a causal factor takes time to apply its influence and initiate mutual effects.

Bandura (1978) further summed up determinism as the process of complex interacting factors that together create chances of an outcome rather than being absolutely decided by the events alone. To this effect, he proposed the triadic reciprocal interaction consisting of environmental factors, personal factors, and behavior (see Figure 2).

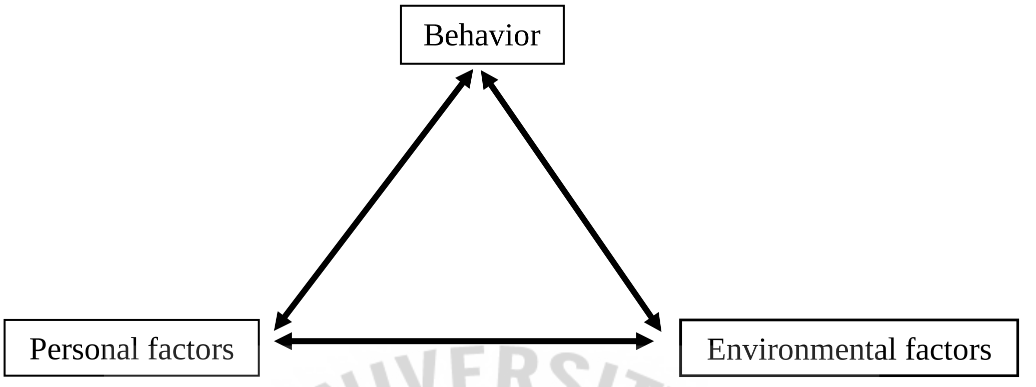

Figure 2. Illustration of interacting causal factors in triadic reciprocal determinism. Adopted from "Six Theories of Child Development: Social Cognitive Theory," by A. Bandura, 1989, *Annals of Child Development*, *6*, p. 3. Copyright 1989 by JAI Press.

In this reciprocal determinism model, personal factors, behavior and environmental factors influence each other in both varied strength and time (Bandura, 1978). In the behavior and personal factors reciprocal causation, there exists an interface among affect, thought and action. Bandura (1989), argued that beliefs, expectations, goals, self-perceptions and intentions provide form and guidance to behavior. Behavior is influenced by what individuals think and accept as true (Bandura, 1986; Bower, 1975). Actions of the individuals are also affected by natural and external effects. These actions, as a result, act to regulate the thinking patterns of the individuals and their emotional responses. The personal factor likewise incorporates the natural characteristics of the living being. The behavior of a person is affected, and his or her abilities also hindered, by sensory and neural systems, and physical structure. Sensory systems and brain configurations are, thus, adjustable by social encounters (Black, Greenough, & Wallace, 1987).

Reciprocity of personal and environmental influences is explained in the environmental and personal factors section of the model. The section affirms that peoples' expectations, convictions, emotional inclinations and capabilities get made and changed by social effects which pass on information and activate mental reactions by means of demonstration, guidance and social influence (Bandura, 1986). Lerner (1982) observed that each individual likewise draws out various responses from his or her social condition by his or her physical qualities, for example, one's sex, race, age, and physical appeal, separated from confessions and actions. Individuals comparatively actuate diverse social responses relying upon their socially given jobs and status.

Finally, the behavior and environment section of the model highlight the reciprocal impact between them. In daily activities, behavior of individuals alters environmental conditions and is, as a result, changed also by the same conditions it generates. For example, a student disturbed by noise from outside his study room may close the windows or change the room in order to concentrate on his studies. This implies that environment is not a static thing that unavoidably works against people. Individuals make and select environments by the way they act. Behavior, in this manner, singles out among many possible environmental impacts will become possibly the most important factor and the modes they will assume. In turn, environmental impacts determine, to some extent, which types of behavior are created and enacted. This makes individuals, therefore, become both outcomes and makers of their environment.

It follows then that students' behavior is not simply a reaction to the environment around them, but rather a reciprocally dynamic interaction between them. Neither their personal attributes, nor environmental factors independently determine students' behavior, but they interact and determine each other (Bandura, 1978).

Pajares (2002) stated that teachers can use social cognitive theory as a guide to all three parts of the triad. Teachers can work to improve personal factors of students which includes emotional states, self-efficacy and beliefs, and academic skills. Pajares further observed that teachers can work to improve the behavior of students such as work habits and study skills. Lastly, he pointed out that teachers can also work on classroom environment, providing an environment conducive to learning and learning opportunities.

This construct of controlling human action by way of individuals' beliefs in their abilities in influencing the environment and producing wanted results of their activities is further explained in Bandura's theory of self-efficacy.

Self-Efficacy Theory

Bandura (1986) developed self-efficacy theory (SET) as a subset of his social cognitive theory. Self-efficacy refers to a person's belief in his abilities to successfully carry out particular tasks (Bandura, 1977; Zimmerman, 2000). The actual ability does not necessarily match a person's belief about his or her abilities to succeed (Bandura, 1977). It is a belief that will cause action despite the current circumstance. For example, if an individual believes in attaining a goal, he or she will keep on pushing to achieve that goal even if they encounter obstacles along the way (Bandura, 1977). The amount of determination individuals will invest in a task is determined by their self-efficacy beliefs. These beliefs will also dictate how long the individuals will keep on exerting effort when faced with challenges. People with high-efficacy levels expect success from their efforts. Pajares (2005) observed that individuals with high self-efficacy beliefs when they foresee their efforts yielding success increase their efforts and vary their strategies and techniques. These individuals also experience greater levels of confidence to attempt new tasks and are less likely to surrender when encountering problems (Bandura, 1977).

Students with perceived high self-efficacy levels are confident enough such that they set high achievement goals and work to attain them. Self-efficacy levels in these students will quickly recover in the advent of occasional failures (Alqurashi, 2016). Students that persevere and complete difficult tasks will often experience an increase in self-efficacy levels, but people that give up quickly will regularly attribute failure to absence of abilities and reinforce their low self-efficacy levels. Students who possess high self-efficacy levels interpret occasional failures as inadequate preparation or effort and will strive harder for the next task (Bandura, 1977). When they experience failure or after some hindrances, they intensify and maintain their effort anticipating achievement (Bandura, 1994).

Students who possess low levels of self-efficacy experience low motivation. These students expend low exertion and determination in attempting to comprehend concepts, and surrender immediately when the solution is not self-evident (Bandura, 1977). Students with lower self-efficacy will focus their attention on potential obstacles or perceived lack of ability instead of focusing on ways to accomplish the task (Bandura, 1994). Lower effort usually results in lower performance. The self-efficacy level is linked directly to motivation and perseverance. Low motivation and low perseverance usually result in low performance (Bandura, 1977). Students who possess low self-efficacy levels exhibit a habit of interpreting failure as an expected outcome due to their inadequate skills. Failure is accepted as expected and no behavior is changed, and low self-efficacy levels are reinforced (Bandura, 1977). Students with low self-efficacy levels, also, have a tendency to concentrate on their own beliefs in their inability to succeed and the problems they are likely to encounter and, thus, the probability of failure instead of trying to think about how to succeed. They give up quickly because they do not expect success from their efforts (Alqurashi, 2016).

Factors affecting self-efficacy. Bandura (1977) observed that there are four main sources that self-efficacy derives from. He cited the sources as verbal persuasions, vicarious experiences, mastery experiences, and emotional and physiological states.

Mastery experiences is the greatest source that contributes to self-efficacy since they spring from the person's own achievements and not from observing others or support from outside sources (Bandura, 1977). They are the collection of an individual's own fruitful encounters in his area of engagements. Self-Efficacy is increased and self-protective behaviors decreased with extra positive encounters of mastery experiences. They also lower anxiety, permitting more clear-thinking capacities to flourish (Bandura, 1977). Usher and Pajares (2009) observed that mastery experiences are powerful in motivating student persistence in trying to accomplish difficult and challenging tasks resulting in positive outcomes. A series of positive mastery experiences overshadows intermittent failure. Intermittent failures followed by success through perseverance can increase self-efficacy levels. Past successful experiences have the potential of leaving a long-term impact on self-efficacy. On the other hand, initial or progressive failures, decrease levels of self-efficacy. Bandura (1977) explained further that these rehashed progressive failures in endeavoring mastery experience lowers levels of self-efficacy and intensify shirking behavior. Interpretation of mastery experiences is more important than the actual accomplishment (Bandura, 1977).

Secondly, another way of enriching efficacy self-beliefs is by vicarious experiences. These experiences are interior convictions created from watching someone else, seen to be of comparative capacities, accomplishing the desired conduct effectively without bad outcomes. It is a conviction of an individual that if others, that are believed to be of comparative capacities, can achieve the target, so therefore they can likewise accomplish the target or possibly advance to accomplishing it (Bandura, 1977). However, due to the fact that this factor relies upon watching others, and the view of equivalent capacities, falls short to be powerful or dependable in strengthening self-efficacy beliefs as mastery experiences. Bandura (1977) further observed that the opposite is also true, seeing a student perceived to be of equal or greater ability fail will lower the self-efficacy to attempt the same task. The vicarious experiences effect is enormously affected by the apparent likenesses between the model and the learner. The greater the target learner perceives similarities to the model learner, it follows that the more the impact on the learner's self-efficacy. If the perceived abilities of the model learner are much different than the target learner, then there is little influence (Bandura, 1994).

Verbal persuasions are another source of self-efficacy. These are encouraging statements from someone else. It is an endeavor, regardless of legitimate proof, to cause somebody to accept they can achieve a task that has conceivably overpowered them previously. The influence can be negative or positive. Bandura (1977) observed that this part of self-efficacy, just like vicarious experiences, too is not strong because it is not created from one's own achievements. The recipient may or may not believe in the source of encouragement. An individual’s belief in the knowledge of the source will affect the internalization of the encouragement and the contribution to self-efficacy. A track record of successes and failures of mastery experiences is likely to be stronger than verbal encouragement (Bandura, 1977). However, students who are encouraged and persuaded verbally (by teachers, parents, significant others) that they have the necessities to achieve a given assignment are likely to display and sustain greater effort than those who experience self-doubt in face of a problem.

Emotional and physiological states is the last self-efficacy source. Bandura (1977) observed that these raised feelings stem from an individual's impression of the circumstance and from dread of failure. Fear of an expected circumstance can bring about greater anxiety that leads to the real circumstance. Emotional and physiological states are interpreted through cognitive processes. Heightened emotional states are not necessarily negative. It is important, how the emotional and physiological states are interpreted. Individuals who have higher levels of self-efficacy regularly understand elevated emotional states as invigorating and enhancing execution. Individuals who have lower levels of self-efficacy typically understand increased emotional states as imminent disappointment and the fear and uneasiness are raised, and execution is repressed (Bandura, 1977). It follows then that if students carry out a task under a high level of stress or anxiety, it may reduce their self-efficacy and affect their performance (Bandura, 1994). Physical factors such as illness can also affect the performance of students.

Self-efficacy-Activated processes. In Bandura's SET, self-efficacy influences an individual's behaviors through four main psychological processes; affective, motivational, selection, and cognitive (Bandura, 1994). During cognitive processes, self-efficacy shapes the way a person plans action and organizes their thoughts before displaying a behavior. Individuals with a high feeling of efficacy see achievement positively and along these lines, boost performances. They fix, for themselves, ambitious goals and strongly commit to their attainment while individuals who are skeptical of their efficacy, think about failure situations and center on the numerous things that can prevent them from succeeding. Success becomes illusive while battling with self-doubt. Predicting events and developing means to be in charge of those that have an effect on their lives is a major function of thought and requires effective cognitive processing of ambiguous and vague information.

In the motivational process, people motivate themselves and create beliefs on what can be achieved in their mind first; they anticipate possible results, lay down goals for themselves, and work out their action plans for future achievement. In the event of barriers and catastrophes individuals with prevailing self-doubt in their abilities lower their attempts or quit without delay. To the contrary, people who strongly believe in their abilities apply more effort to overcome obstacles in face of failure. The intense endurance and refusal to quit yields performance achievements (Bandura, 1992).

The beliefs of individuals in their coping abilities, in the affective process, have a bearing on the level of motivation, and on the amount of depression and stress one goes through in intimidating or tough circumstances. Perceived self-efficacy that exerts influence on stress-causing-elements also heavily affects anxiety awakening. Individuals who have faith in managing threats effectively do not call up distressing thought configurations. On the other hand, individuals that have no faith in controlling threats suffer elevated anxiety awakening as they focus too much on shortfalls in dealing with the threats. These individuals magnify threats and regard many parts of their environment as full of danger. This causes stress in them and adversely affects their functioning. Prevention of anxiety arousal and behavior is therefore controlled by perceived coping self-efficacy. Individuals having a compelling feeling of self-efficacy are more daring to face demanding and intimidating tasks than counterparts with little self-efficacy feeling.

During the selection process individuals create beneficial environments and engage in purposeful activities. Through their personal efficacy beliefs, they influence their lives by selecting the types of undertakings to engage in and proactively manage their environments. They disregard undertakings and conditions they accept outperform their adapting capacities. However, they willingly carry out tough undertakings and choose conditions they see themselves as capable of managing. Through the choices people make, they develop various capabilities, social networks and interests which decide courses of life. Whichever factor, subsequently, that have an effect on the selection of conduct can strongly influence the bearing of self-awareness because of the social impacts working on choosing situations.

These influences keep on promoting particular capabilities, values, and interests, way after the efficacy decisive determining factor has provided its initiating influence (Bandura, 1989).

Pajares and Miller (1995) cited many research articles which established only a weak correlation between achievement and self-efficacy. He advised that self-efficacy is task and domain specific. For example, physics is a domain while laboratory experiments could be tasks for a student to perform. A task or domain that is poorly defined weakens the predictive power of self-efficacy regarding performance (Pajares & Miller, 1995). This observation builds on Bandura's (1989) assertation that an accurate evaluation of an individual's own abilities is greatly beneficial and time and again has proven critical to effective functioning.

Self-regulation and self-efficacy have a positive relationship between them. A learner who have high self-efficacy beliefs in a goal or task regulates his behavior towards achieving the goal or task (Bandura, 1986).

Self-Regulation Theory

The Bandura (1991) social cognitive theory (SRT) observes that the behavior of an individual is, to greater extent, broadly inspired and controlled by continual self-influence. The main self-regulative process functions through self-monitoring of an individual's own behavior, its causes and effects; judgement of an individual's own behavior regarding individual standards and environmental conditions; and influences of self-response (Bandura, 1991).

Bandura (1986) believed people apply both reactive and proactive approaches to regulate their behavior. Students reactively endeavor to achieve goal states given by the teacher. They can proactively set new goals for themselves after accomplishing the former goals. Furthermore, internal or external self-regulation can take form. Factors from external sources, for example, societal values, outside rewards, and backing from other individuals influence self-regulation. Correspondingly, they are internal components that influence self-regulation. Bandura (1986) recognized self-observation, judgmental procedure, and execution attribution as the three central factors which add to inward self-regulation.

In self-observation, Bandura (1986) observed that individuals monitor their own performance and adjust their behavior accordingly to regulate it. The self-observed factors are to some extent reliant on the environment. For example, in mastery situations, people focus on quality, amount, speed, and novelty while in interpersonal circumstances, they concentrate on being social and upholding moral behavior (Bandura, 1986).

During the judgmental process a personal assessment of the outcomes of their behavior is made. People exploit various ways to make these judgments. For instance, people use their personal standards to assess their performance without comparing it to others. They also utilize a standard of reference where they compare how they are performing to how other people are performing or to outside standards such as norms. Peoples' judgments are also influenced by the value they assign to a task or skill which dictates where and how people focus their efforts (Bandura, 1986).

Lastly, the way people explain failure and success in their lives (execution attribution) affects peoples' self-regulatory processes. Inner ascriptions of achievement yield to continued determination during difficult instances. In contrast, outside ascriptions can either yield self-reinforcement or self-discipline contingent on an individual's standards and conduct (Bandura, 1986). This affective self-response indicates how perceptions help to drive conduct and why human conduct is not exclusively a component of his environment.

Bandura (1986) also observed that self-regulation is not involuntary. It must be activated by difficulties in meeting required learning standards. Self-regulatory processes can, therefore, be initiated and disabled. For example, after people have embraced social and moral behavioral benchmarks, they actuate self-regulation systems when they disregard either social endorsements or assumed self-sanctions. In social sanctions individuals dread social criticisms if their conduct negates foreseen societal standards while in assumed self-sanctions people avoid flouting personal standards due to self-punishment. To deactivate their self-regulatory mechanisms, people redefine their behavior, disperse or oust responsibility, mutilate, limit, or overlook undesirable behavior outcomes, or accuse the victim. Self-regulation is, therefore, knowingly called to play or abandoned (Bandura, 1986).

Expounding Bandura's self-regulation construct and focusing it on learning, Zimmerman (2001) looked at self-regulation being a self-mandate process that enables students change their intellectual capacities into associated competencies of task. Self-regulation is a technique or a system which students engage in overseeing and composing their musings including changing them into abilities utilized in their own learning. Zimmerman (2001) further observed that with the goal for learners to be self-regulated, they should know about their own manner of thinking and be propelled to effectively take an interest in their personal learning procedures.

In self-regulated learning, learners are held to have their own capacity in improving their learning. This is accomplished by a careful use of metacognitive and motivational strategies, thereby making learners proactive in selecting, structuring and even creating a helpful learning environment. Learners correspondingly have a significant duty of deciding on the form as well as the degree of instruction they need. Zimmerman (2001) indicated that self-regulated learning theories aim at explaining and describing ways a specific learner will learn and succeed in spite of seeming inadequacies in mental ability, social-environmental personal history or in the excellence of schooling. In the same way, self-regulated learning theories also aim at explaining and describing the reasons a learner might not succeed in learning in spite of apparent good intellectual ability, social-environmental personal history, or quality of schooling. Due to these reasons, self-regulated learning has become one of the crucial fields of educational practice and focus (Pintrinch, 2000; Reynolds & Miller, 2003).

Winnie and Perry (2006) observed that self-regulated students are conscious of their scholastic strong and weak points. They argued that because of this, self-regulated students possess strategies they employ to deal with the day by day encounters of their academic tasks. Consequently, self-regulation should not be considered as a standard method of learning, but rather a way in which learners engage to attain their learning goals individually.

Learner self-regulation is, therefore, desired due to its influences on academic and behavioral outcomes. Self-regulation techniques assist in the active involvement of seemingly inactive learners in the educational process. Zimmerman (2001) noted that learners need to view learning as an action that they accomplish for themselves in a progressively proactive manner, and not as a secret encounter that jumps out at them as a result of teaching. Letting students play an increasingly dynamic part in their learning positions students in the driver's seat and in command of their learning.

Self-regulation practices are extensively used by productive people, and learners to accomplish a task effectively and efficiently. In the course of accomplishing an undertaking, they regulate different techniques and screen how effective every procedure is at the same time evaluating and deciding on the subsequent action plan. Effective learners use different modes of self-regulation. Through using self-regulation strategies, the academic performance of the learners can be significantly improved. The utilization of self-regulation strategies helps learners to perform tasks better and independently (Zimmerman, 2001).

Motivated Strategies for Learning Questionnaire (MSLQ)

The MSLQ created by Pintrich, Smith, Garcia and McKeachie in 1991 as a self-administering questionnaire. The research instrument was initially used to measure high school and university students' motivation and learning strategies (Pintrich et al., 1991). The instrument consists of two sections - a learning strategies section (50 items total) and a motivation section (31 items total). This study will adapt and utilize only one of the nine subscales of learning strategies – metacognitive self-regulation, and one of the six subscales of the motivation section of the MSLQ – self-efficacy for learning and performance. Other subscales of the instrument will not be used in the current research.

Previous Research Findings on Students' Self-Efficacy, Self-Regulation and Achievement

This section covers previous research findings on relationships among students' self-regulation, self-efficacy, and achievement.

Ratsameemonthon (2013) carried out a study with 988 Thai undergraduate students in Songkhla Province, Thailand. In her study, with 76% female and 24% male subjects studying business administration or science, were sampled. She compared three different predictor models. Model 1 examined self-efficacy as a mediator between achievement and achievement goals; Model 2 investigated achievement goals being a mediator between achievement and self-efficacy; and, lastly, Model 3 examined achievement goals and academic self-efficacy predicting academic achievement. Ratsameemonthon established that academic self-efficacy greatly predicted academic achievement.

Lent, Brown and Larkin (1984), in the United States, studied university students pursuing engineering and science majors. They found that almost all of the students with high subject matter self-efficacy successfully completed the following four quarters, while of students with low subject matter self-efficacy only 60% persisted.

Hassan, Alasmari and Ahmed (2015) at the University of Jazan in Saudi Arabia studied self-efficacy influences in predicting academic achievement of special education students. In the study, data collection and analysis comprised questionnaire technique and descriptive statistics. The study involved 100 students selected randomly from study groups as a sample. The results indicated that the self-efficacy levels among the students was high. Results on self-efficacy influences in predicting academic achievement showed a positive relationship between the two valuables ($r = .45$, $p < .01$). This means students' self-efficacy was very important to enhance their academic achievement. Further, when the mean of academic achievement between higher and low self-efficacy was compared using a dependent samples *t*-test, the study revealed higher self-efficacy had a greater mean than low self-efficacy. The difference was significant at the level of .05. This means there were differences among students with higher and lower self-efficacy degrees in academic achievement; student's with high self-efficacy had high academic achievement, and *vice versa*.

At the University of Pretoria in South Africa, Human-Vogel and Vogel (2016) carried out a study in materials science on self-efficacy and academic commitment as predictors of academic achievement. They based their theoretical framework on self-regulation theory, and focused on the role of academic commitment and self-efficacy. The sample was comprised 127 second year engineering students. These students responded to a Materials Science Self-Efficacy Scale and an Academic Commitment Scale. The hypothesis that academic commitment and self-efficacy would predict student's score was tested by correlation and regression analysis. The findings revealed that materials science self-efficacy strongly predicted the students' final semester score ($\beta = .30$, $p < .001$). In addition, the results showed that students with self-descriptions that comprised subject specific capability feelings, had high probability of doing well in materials science academics and other related subjects as well.

Shaine (2015), in a study in an elementary school in Ethiopia, investigated the effect of self-efficacy and self-regulated learning strategies on academic achievement of learners. The study used a random sampling technique where 169 learners (127 females and 42 males) were selected at Degol Primary School to participate in the research. Correlation analysis indicated that all the relationships were significant with anticipated directions. The multiple regression analysis showed that self-regulation, cognitive strategy and self-efficacy together explained 44.80% of the variance in academic achievement. The outcome of stepwise regression analysis indicated that self-efficacy was the only significant predictor variable to the primary school learners' academic achievement leaving out cognitive strategy and self-regulation.

Los (2014), in an online survey, studied 316 undergraduates to investigate effects of self-regulation and self-efficacy on academic achievement. College GPA scores of the students were reported first as their academic outcome measure. After that, the students responded to prompts on self-regulation and self-efficacy through the MSLQ. The findings showed that there was a significant relationship between self-efficacy for self-regulated learning and self-regulation subscales. Self-efficacy for self-regulated learning was also significantly related to academic outcome. The study also supported the relationship between self-regulation and self-efficacy. Further, the study uncovered that learners with a greater self-efficacy degree exploited greater varied range of cognitive and metacognitive self-regulation strategies leading to the improvement of their academic achievement.

In another study of undergraduates, Bakar, Shunaibu and Bakar (2017) studied the correlation between academic achievement and self-regulated learning among the students at of Universiti Sultan Zainal Abidin (UniSZA) in Malaysia. In the study, 364 students (162 male and 202 female) from the nine university faculties were randomly selected to take part in the research. A strong relationship between self-regulated learning and academic achievement was reported from both correlation and regression analysis of the data. Further, the findings showed a high positive correlation between students' use of learning strategies and self-efficacy beliefs, and academic achievement. Likewise, the regression analysis results indicated learning strategies and self-efficacy were higher GPA good predictors. The strongest predictor of academic achievement amongst the variables was self-efficacy.

Alegre (2014), at San Ignacio de Loyola University in Peru, conducted a study on first-year students at the university. The study aimed at determining the relationship among self-regulated learning, academic self-efficacy and year-one students' academic performance. He sampled 284 students; of which 146 were female and 138 were male students at the university. These students were in the second term of the 2013 academic year. A General Academic Self-Efficacy Questionnaire, an incidental and non-probability procedure, a University Academic Self-Regulated Learning Questionnaire; and the students' GPA were used to establish the relationship. Correlation coefficients from the results indicated that academic self-efficacy (r = .35, p < .01); academic performance and self-regulated learning (r = .33, p < .01) were both low, positive and significant. Furthermore, the correlation between self-regulated learning and academic self-efficacy were significant, moderate and positive (r =.65, p < .01).

Background of Domasi Demonstration Secondary School

Domasi Demonstration Secondary School is part of the Domasi College of Education (DCE). The DCE was founded in 1993 to specifically train secondary school teachers. It was previously called the Domasi Teacher Training Center and trained primary school teachers. The purposes of establishment of the DCE was the enrollment of new secondary school leavers to train them as secondary school teachers and the retraining of primary school teachers who teach at secondary schools without proper qualifications to the diploma level. To date, the DCE specializes in the training of secondary school teachers and is certified to provide diploma and degree courses. However, from its inception, the DCE used the facilities and equipment for the original primary school teacher training. It faced shortages in terms of the basic facilities and equipment required for secondary school teacher training. Under these circumstances, the Government of Malawi made a request for grant aid to the Government of Japan for a project to expand facilities at the Domasi College of Education. The expansion of the facilities included the construction of Domasi Demonstration Secondary School, staff housing, female hostels, a computer workshop and gymnasium and the provision of educational equipment among others. The establishment of the demonstration secondary school was meant to enhance secondary education quality by providing opportunities for learners to practice teaching, development of better teaching methods and research work (Japanese International Cooperation Agency, 2017).

The demonstration secondary school has broadened its original mandate and now serves as one of the national training centers for physics teachers under a project of the Strengthening Mathematics and Science in Secondary Education (SMASSE). Malawi has been carrying out the SMASSE project in the South East Education Division, where the school is, since 2004 and across the nation since 2008. The project activities are aimed at improving the quality of instruction and learning by moving from teacher-centered to Student-centered methodology. The project assessments have uncovered that teachers who have taken an interest in the training have obtained significant abilities and information that have improved learning of the students (Japanese International Cooperation Agency, 2017).

The Malawi Ministry of Education, Science and Technology (MoEST) has also used Domasi Demonstration Secondary to pilot its interventions including in science education and assessment. For these reasons, Domasi Demonstration Secondary School is moderately resourced with teaching and learning resources including human and laboratory resources. It is also, therefore, better positioned to represent teaching and learning interventions in secondary school physics education and the curriculum environments these interventions are implemented in Malawi. This will enhance the applicability of the current study's results.

However, in spite of this accomplishment, a few teachers, particularly those in Community Day Secondary Schools (CDSSs) face difficulties in applying the student-centered methodologies in their lessons because of large classes, low levels of knowledge in subject matter, and insufficient teaching and learning materials (Japan International Cooperation Agency, 2017).

Form 3 Physics Class

The Form 3 physics class is the second cohort of the new (2015) secondary school curriculum and have studied physics for 3 academic years. Students in this curriculum are given an opportunity to either specialize in humanities or sciences. Students opting for the science route must take physics and chemistry in addition to other subjects of their choice. These students have also studied physics and chemistry in their two previous classes; Forms 1 and 2. They are also generally perceived as smarter students in comparison to their counterparts specializing in the humanities.

The Form 3 physics class at Domasi Demonstration Secondary School is a mixed sex class with an average age of 17. They are also operating in one of the moderately resourced government secondary schools. The school has good laboratories, physics teachers, well-furnished classrooms, and quiet environment. Compared to schools of similar caliber in Malawi, their challenge lies in the nonexistence of boarding facilities which may have a potential of reducing their study time. Students are expected to start their lessons from 07:30 hours, have a lunch break between 12:00 and 13:00 hours, and finally knock off at 15:30. This routine is repeated from Monday through Friday. Students from this class walk or ride bicycles to school from within a radius of about 10 km. The long distances could make some students feel physically tired when reaching school since the terrain ranges from undulating to hilly.

The physics curriculum. The curriculum is mainly divided into junior physics (covering Forms 1 and 2) and the senior physics (covering Forms 3 and 4). As such, two syllabuses are available one for junior physics and the other for senior physics. The syllabuses further indicate what should be taught at a specific grade level (i.e., Form) but leaves to discretion of a teacher as to what should be taught in a specific term of an academic year. In Form 3 students learn measurements II, scientific investigations, kinetic theory of matter, thermometry, pressure, gas laws, scalar and vector quantities, linear motion, work, energy, power and machines, current electricity, electrical potential difference, resistance, electrical circuits, power and energy, oscillations, waves, and sound. At school level, a physics teacher organizes this content into three terms of a Form 3 academic year to adapt to local conditions. There are no national physics examinations from Forms 1 to 3. However, students sit for national physics examinations in Form 4. The national physics examinations for Malawi School Certificate of Education (MSCE) comprises all the content in junior and senior physics. This makes teachers set end of term examinations with any content from the first term in Form 1 to the time the examination is set and administered. The end of Term 3 physics examination for Form 3 physics students may therefore comprise any content from Forms 1 to 3 to reflect the practice in MSCE physics examinations. Physics teachers, however, give more weighting to content covered in the term examinations are administered (i.e., Term 3 of Form 3 in this study)

This chapter reviewed theory and research literature aimed at explicating the relationship of metacognitive self-regulated physics learning and self-efficacy for learning and performance in physics with physics achievement. Chapter III will provide the procedures that will be used in the research process of this study.

CHAPTER III

RESEARCH METHODOLOGY

This chapter will provide the research design, and the population and sample used in the current study. The chapter will also present the research instrument, the validity and reliability of the research instruments, data collection method and data analysis.

Research Design

This study employed a quantitative correlational research design where data obtained from study variables' measurements was analyzed to determine the extent of the relationship variables among them.

The purpose of this research was to investigate the relationship of self-efficacy for learning and performance in physics and metacognitive self-regulated physics learning with physics achievement of Form 3 students at Domasi Demonstration Secondary School in Malawi. For this purpose, a correlational design was developed and conducted to measure the relationship of self-efficacy for learning and performance in physics and metacognitive self-regulated physics learning with physics achievement.

The level of student self-efficacy for learning and performance in physics was measured by the self-efficacy scale drawn from the Motivated Strategies for Learning Questionnaire (MSLQ) (Pintrich et al., 1991) with minor adaptations to reflect physics learning. The level of metacognitive self-regulated physics learning was measured by the relevant sub-scales, also from the MSLQ (Pintrich et al., 1991). Physics achievement was measured by the Form 3 end of Term 3 physics examination at Domasi Demonstration Secondary School. At the end of the research, descriptive statistics (means and standard deviations) and correlational analysis (multiple correlation coefficient, *R*) were used to determine whether there was a significant relationship of self-efficacy for learning and performance in physics and metacognitive self-regulated physics learning with physics achievement of the Form 3 students.

Population

There were 80 students in Form 3 at Domasi Demonstration Secondary School in Term 3, 2019. These students either took a humanities or a sciences route in their studies. The study targeted 40 students who had taken the sciences route and who were also studying physics in Term 3 of 2019 academic year. Physics is one of the compulsory subject students must take in the sciences route. The students were both male and female, and generally from poor families. The total population of the study was, therefore, 40 students.

This population was also targeted because they had studied physics for three years and were preparing to sit for national examinations in 2020. As such, it was expected that they had developed some motivation and strategies for learning physics. Domasi Demonstration Secondary School, also, has qualified physics teachers who are moderately resourced to represent conditions in most conventional secondary schools in Malawi. This made the results more representative of most students learning physics in Malawi.

Sample

The participants were comprised of a population sample of Form 3 physics students, i.e., all 40 students taking physics at Domasi Demonstration Secondary School in Term 3 of 2019.

In line with the Malawi Ministry of Education Science and Technology (MoEST) selection policy, the school should enroll 80 students distributed equally according to gender (40 male students, 40 female students). Further to the MoEST policy, at this grade level, students can either take a sciences route or a humanities route. The sciences route includes physics and chemistry among other core and elective subjects. As it was expected 40 students took part in the study. The sample of this study is therefore 40 students (19 female, 21 male).

Research Instruments

With the intention of accomplishing the objectives of the current study, two research instruments were used. These instruments were the Motivated Strategies for Learning Physics Questionnaire (MSLPQ) and the End of Term 3 Physics Examination.

The Motivated Strategies for Learning Physics Questionnaire (MSLPQ)

For the researcher to measure students' levels of self-efficacy for learning and performance and metacognitive self-regulated physics learning in physics, a research instrument known as The Motivated Strategies for Learning Questionnaire (MSLQ) was chosen. The questionnaire was created in 1991 by Pintrich, Garcia, Smith and McKeachie, and has 81-items. It comprises two sections: The learning strategy and motivation sections. The motivation examines expectancies (control of learning beliefs, and self-efficacy for learning and performance), student values (task value, and intrinsic and extrinsic goal orientation), and affective beliefs (test anxiety).The learning strategies section examines resource management strategies (effort regulation, time and study environment, peer and learning help seeking) and cognitive and metacognitive strategies (elaboration, rehearsal, organization, critical thinking, self-regulation and metacognitive). The two MSLQ sections are based on learning strategies and general cognitive view of motivation. The learning strategies has 31 items in regards to students' utilization of various cognitive and metacognitive strategies. It also has 19 items regarding student management of various resources. The motivation section consisting of 31 items assesses students' value beliefs and goals about the subject.

MSLQ can be either used as a whole or its subscale (Duncan & McKeachie, 2005). From MSLQ, the Motivated Strategies for Learning Physics Questionnaire (MSLPQ) was created for this study (see Appendix A). MSLQP, from the seven (7) motivation scales in MSLQ, only used self-efficacy for learning and performance which has eight (8) expectancy components items. It excluded subscales of extrinsic goal orientation, intrinsic goal orientation, task value, test anxiety and control of learning beliefs. Likewise, from the nine (9) learning strategies scales in MSLQ only the 12-item metacognitive self-regulation subscale was utilized. The study did not use subscales of elaboration, rehearsal, organization, time, study environment, critical thinking, effort regulation, help seeking and peer learning.

In these sub-scales, students responded to items concerning their perception of their self-efficacy for learning and the self-regulation strategies they employ in the process of learning respectively.

With the intention of meeting the purpose of the current research, the items were slightly modified to examine students' learning strategies and motivation for learning physics. The word *course* was replaced with the word *physics*. All items in the subscales use a 7-point Likert-type scale, ranging from 1 *(not at all true of me)* to 7 *(very true of me)*.

Scoring of the questionnaire required students to rate themselves on a seven-point Likert-type scale from "not at all true of me" to "very true of me." Scales were constructed by taking the mean of the item that make up the scale. Negatively worded items were marked "reversed". Before a students' score were calculated, the researcher reversed the ratings of the negatively worded items. For reversed items, a student who had circled 1 for that item received a score of 7 and so on. Likewise, a 1 became a 7, a 2 became 6, a 3 became a 5, a 4 remained a 4, a 5 became a 3, a 6 became a 2, and a 7 became a 1 (Pintrich et al., 1991).

The levels of self-efficacy for learning and performance, and metacognitive self-regulation was reported on a 7-point rating scale. As every item ranged from 1 (minimum) to

7 (maximum), based on the number of items, the level judgement was based on the mean scores for the subscale. The researcher interpreted the level of students' self-efficacy for learning and performance in physics, and students' metacognitive self-regulated physics learning into a 7-point rating scale using equal intervals as given in Table 1.

Table 1

Interpretation of the Scores of Motivated Strategies for Learning Physics Questionnaire Results

Likert-type scale	Score	Scale	Interpretation
Not all true of me	1	1.00 – 1.50	Very low
	2	1.51 – 2.50	Moderately low
	3	2.51 – 3.50	Slightly low
	4	3.51 – 4.50	Neither high nor low
	5	4.51 – 5.50	Slightly high
	6	5.51 – 6.50	Moderately high
Very true of me	7	6.51 – 7.00	Very high

Validity and reliability of MSLPQ. The MSLQ, from which MSLPQ was developed, developers tested its scales for construct validity of the using confirmatory factor analysis and all sub-scales acceptable factor validity (Pintrich et al., 1991). The questionnaire has also been subjected to instrument assessment studies and found to be consistent with advances in education (Duncan & Pintrich, 1996). It has been adopted by many scholars and universities such as the University of Michigan and the University of Texas, Austin. For example, Sadi and Uyar (2013) studied Turkish high school students in which they investigated both direct and indirect relationships among metacognitive self-regulated learning strategies, effort regulation strategies, self-efficacy for learning and performance, time and study environmental management strategies, cognitive self-regulated learning strategies and biology achievement. Their research reported substantial internal consistence reliability values for self-efficacy for learning and performance, and metacognitive self-regulated learning used in the study. In another study of Grade 9 students at Ekamai

International School in Thailand which was aimed at corelating relationship between motivational goal orientation for learning Chinese as a foreign language and Chinese achievement, Lin and Lynch (2016), reported Cronbach's alpha coefficient of .95 for self-efficacy items.

A number of previous studies have also used MSLQ successfully (Cook, Thompson & Thomas, 2011; Feng & Lina, 2010; Halmilton & Akhter, 2009; Lin & Lynch, 2016). Table 2 describes its reliability.

Table 2

Internal Reliability of MSLQ

	Cronbach's alpha			
Questionnaire	MSLQ by Pintrich et al. (1991)	Said and Uyar's research (2013)	Lin and Lynch's research (2016)	This study
Self-efficacy for learning and performance	.93	.80	.95	.87
Metacognitive self-regulation	.79	.72	-	.73

The end of Form 3 physics examinations was used to measure physics achievement of the students.

End of Term 3 Physics Examination

The examinations were drawn from the physics curriculum standards and following the national physics examination structure. The structure which included item distribution and weighting across topics according to Bloom's cognitive taxonomy, conditions of administration, scoring and reporting have been used across the country and over a number of years.

The examinations with 120 marks comprised 40 short answer items and two (2) essay items. It was taken for maximum of two (2) hours in accordance with the national physics examination standards (see Appendix B). A marking scheme was developed for the paper to avoid bias in grading (see Appendix C). The marking scheme comprised examination items and correct responses to the items. Each correct response in the was assigned a mark. To further guide the raters, essay items and items requiring descriptive responses were allocated a mark to key points and words in the responses. Responses requiring calculations had marks assigned to key stages of the calculation process and the final answer. The marks from the paper (out of 120 marks) were translated into a percentage score and reported as physics achievement in this study. The total score for the examinations was 100 percent.

Validity and reliability. The end of Term 3 physics examination was developed by two qualified physics teachers according to physics national examinations' standards. These teachers had been teaching physics in secondary schools for more than seven years and were also assistant national examiners in physics. The head of the sciences department of the school reviewed the papers to verify compliance to the standards before administration to students. The examinations also followed the national physics examination format in item construction, administration, scoring, evaluation and reporting. The examination had a marking scheme to ensure reliability in scoring items. The marking scheme indicated how each mark should be awarded to an item.

The school also, by virtue of being a demonstration secondary school, had been used to pre-test a number of MoEST assessment tools and other educational items. As such, teachers and the school system operate at a higher level of educational practice including formulation of physics examinations.

The reliability of the examination was further estimated using a split-half method and inter-rater reliability. Objective items (26) that solicited a single correct response were isolated from the examination paper. These 26 examination items were assigned numerical values and spilt into two halves (i.e., even and old numbers). Reliability coefficients were obtained in form of Cronbach's alphas, Spearman-Brown coefficient, and Guttman-Brown split-half coefficient as indicated in Table 3 below.

Table 3

Internal Reliability of Objective Items of End of Term 3 Physics Examination

Measure			Coefficient
Cronbach's alpha	Part 1	Value	.81
		N of items	13
	Part 2	Value	.73
		N of items	13
	Total *N* of items		26
Correlation between forms			.76
Spearman-Brown coefficient	Equal length		.86
	Unequal length		.86
Guttman-Brown split-half coefficient			.85

Table 3 indicates different methods of estimating internal reliability of a test by split-half method. In all methods, the coefficients suggested high internal reliability of end of Term 3 physics examination.

Further, they were 18 items that required varied responses (e.g., essay, calculations). These items were also isolated from the examination paper. The 18 items were graded by two teachers to generate inter-rater reliability. One marking scheme was used by both raters. The students' grade was calculated by finding the average of two scores from the raters. The grades indicated minor differences in scoring by both raters (*M* = 37.10, *SD* = 2.15). The percentage agreement of the two raters was 78.90%. This suggested that the inter-rater reliability was high.

The percentage score obtained in the 2019 end of Term 3 physics examination and indicated in the student academic record were used in this research as the students' physics achievement. These scores were interpreted in equal intervals as indicated in Table 4 below.

Table 4

Interpretation of the End of Term 3 Physics Achievement

Physics score	Interpretation
0 – 20	Very low
21 – 40	Low
41 – 59	Moderate
60 – 79	High
80 – 100	Very high

Collection of Data

The researcher requested permission from the headteacher of Domasi Demonstration Secondary School to collect data (see Appendix D). After the permission was granted the researcher administered MSLPQ to Form 3 physics students on 15th October 2019. However, prior to administration of the questionnaires the researcher held a briefing session with the Form 3 physics teachers and students about the aim of the study and administration procedures.

The researcher explained to the students that the MSLPQ was not to be graded and had no wrong or correct answers but only required their sincerity in responding to it. The students filled in the questionnaire independently after guiding them on how to respond to the items using a sample item. Following the recommendation by MSLQ developers (Pintrich et al., 1991), administration time was set to maximum of 30 minutes to complete the MSLQP. When students had finished responding to the questionnaire, the researcher collected the questionnaires for analysis.

The next phase of data collection awaited administration of end of term 3 physics examination, scoring and recording of the results. The researcher collected written examination papers and a copy of the results for analysis.

Data Analysis

The study used descriptive statistics (means and standard deviations) as well as multiple correlation (*R*) coefficient analysis to analyze the quantitative data to be collected and hence address the research objectives previously discussed. The objectives and analysis methods are summarized below.

1. To determine the level of self-efficacy for learning and performance in physics of Form 3 students at Domasi Demonstration Secondary School in Malawi.
   Method: Means and standard deviations were used to determine the levels of self-efficacy for learning and performance in physics.
2. To determine the level of metacognitive self-regulated physics learning of Form 3 students at Domasi Demonstration Secondary School in Malawi.
   Method: Means and standard deviations were used to determine the levels of physics metacognitive self-regulated learning.
3. To determine the level of physics achievement of Form 3 students at Domasi Demonstration Secondary School in Malawi.
   Method: Means and standard deviations were used to determine the levels of achievement.
4. To determine whether there is a significant relationship of self-efficacy for learning and performance in physics and metacognitive self-regulated physics learning with physics achievement of Form 3 students at Domasi Demonstration Secondary School in Malawi.

Method: A multiple correlation analysis (using multiple correlation coefficient) was used to determine whether there is a significant relationship of self-efficacy for learning and performance in physics and metacognitive self-regulated physics learning with physics achievement.

Summary of the Research Process

The following table summarizes the research process.

Table 5

Summary of the Research Process

Research objective	Source of data or sample	Data collection method or research instrument	Method of data analysis
1. To determine the level of self-efficacy for learning and performance in physics of Form 3 students at Domasi Demonstration Secondary School in Malawi	Form 3 physics students at Domasi Demonstration Secondary School in Term 3 2019	Self-efficacy levels using MSLPQ	Mean and standard deviation
2. To determine the level of metacognitive self-regulated physics learning of Form 3 students at Domasi Demonstration Secondary School in Malawi	Form 3 physics students at Domasi Demonstration Secondary School in Term 3 2019	Self-regulated learning levels using MSLPQ	Mean and standard deviation
3. To determine the level of physics achievement of Form 3 students at Domasi Demonstration Secondary School in Malawi	Form 3 physics students at Domasi Demonstration Secondary School in Term 3 2019	End of Form 3 physics examination	Mean and standard deviation
4. To determine whether there is significant relationship of self-efficacy for learning and performance in physics and metacognitive self-regulated physics learning with physics achievement of Form 3 students at Domasi Demonstration Secondary School in Malawi	Form 3 physics students at Domasi Demonstration Secondary School in Term 3 2019	Self-efficacy and self-regulated learning levels using MSLPQ, and end of Form 3 physics examination scores	Multiple correlation analysis (using multiple correlation coefficient)

This chapter presented the research design, and the population and sample used in the research. It also covered the research instruments, the validity and reliability of the research instruments, data collection method and data analysis. The next chapter will present the research findings.

CHAPTER IV

RESEARCH FINDINGS

This chapter presents the research findings. The findings were generated from data collected from 40 Form 3 students, in Term 3 of the 2019 academic year, at Domasi Demonstration Secondary School in Malawi.

The researcher used the MSLPQ to measure the students' self-efficacy for learning and performance in physics and their metacognitive self-regulated physics learning. End of Term 3 physics examination were used to measure students' physics achievement. Data was collected from the 40 physics students in Form 3 at Domasi Demonstration Secondary School in Malawi. These students had attended physics classes for the whole of Term 3 in the 2019 academic year. The research objectives have been used to present and organize the findings as follows.

Research Objective 1

Research Objective 1 was to determine the level of self-efficacy for learning and performance in physics of Form 3 students at Domasi Demonstration Secondary School in Malawi in Term 3 of the 2019 academic year.

Table 6 that follows shows frequency distribution of the students' self-efficacy for learning and performance in physics mean scores including their interpretation.

Table 6

The Frequency Distribution of Students' Self-Efficacy for Learning and Performance in Physics Mean Scores and their Interpretation

Variable	Mean scores	Number of students	Interpretation
Self-efficacy for learning and performance in physics (8 items)	1.00 – 1.50	0	Very low
	1.51 – 2.50	0	Moderately low
	2.51 – 3.50	0	Slightly low
	3.51 – 4.50	0	Neither high nor low
	4.51 – 5.50	1	Slightly high
	5.51 – 6.50	8	Moderately high
	6.51 – 7.00	31	Very high

The data in Table 6 show that only one (1) student had self-efficacy for learning and performance in physics mean score between 4.51 and 5.50 (considered slightly high). This was followed by 8 students who scored between 5.51 and 6.50. These mean scores are considered moderately high according to the interpretation provided in Table 1 in Chapter III. Finally, 31 students had very high mean scores between 6.5 and 7.00. No student had a very low, moderately low, slightly low, or neither high nor low self-efficacy for learning and performance in physics.

Table 7 below highlights the mean score of the self-efficacy for learning and performance in physics of the students as measured by MSLPQ. Table 7 also highlights standard deviation of the reported mean scores. However, the means and standard deviations for each self-efficacy for learning and performance in physics item are shown in Appendix E.

Table 7

Mean, Standard Deviation and Interpretation for Students' Self-Efficacy for Learning and Performance in Physics

N	*M*	*SD*	Interpretation
40	6.62	.21	Very high

The data in Table 7 show that the mean score of self-efficacy for learning and performance in physics for the whole sample was 6.62. According to Table 1 in Chapter III and Table 6 above, this value is considered as very high self-efficacy for learning and performance in physics.

Research Objective 2

Research Objective 2 was to determine the level of metacognitive self-regulated physics learning of Form 3 students at Domasi Demonstration Secondary School in Malawi in Term 3 of the 2019 academic year.

Table 8 below presents the frequency distribution and interpretation of students' metacognitive self-regulated physics learning mean scores and their interpretation.

Table 8

The Frequency Distribution and Interpretation of Students' Metacognitive Self-Regulated Physics Learning Mean Scores

Variable	Mean score	Number of students	Interpretation
Metacognitive self-regulated physics learning (11 items)	1.00 – 1.50	0	Very low
	1.51 – 2.50	0	Moderately low
	2.51 – 3.50	0	Slightly low
	3.51 – 4.50	0	Neither high or low
	4.51 – 5.50	17	Slightly high
	5.51 – 6.50	14	Moderately high
	6.51 – 7.00	9	Very high

The data in Table 8 above show that the number of students with metacognitive self-regulated physics learning mean scores between 4.51 and 5.50 (considered slightly high) was 17. Fourteen (14) students had mean scores between 5.51 and 6.50. These scores are considered moderately high. Finally, nine (9) students had very high mean scores between 6.51 and 7.00. No student had a very low, moderately low, slightly low, or neither high nor low metacognitive self-regulated physics learning scores.

Table 9 that follows shows the mean score and standard deviation of metacognitive self-regulated physics learning at Domasi Demonstration Secondary School in Malawi in Term 3 of the 2019 academic year. The mean scores and standard deviations for each metacognitive self-regulated physics learning item are shown in Appendix F.

Table 9

Mean, Standard Deviation and Interpretation for Students' Metacognitive Self-Regulated Physics Learning

N	*M*	*SD*	Interpretation
40	5.80	1.35	Moderately High

The data in Table 9 above show that the mean score of metacognitive self-regulated physics learning for the whole sample was 5.80. According to Table1 in Chapter III, this value is considered as moderately high metacognitive self-regulated physics learning for the students.

Research Objective 3

Research Objective 3 was to determine the level of physics achievement of Form 3 students at Domasi Demonstration Secondary School in Malawi in Term 3 of the 2019 academic year.

Table 10 that follows presents the frequency distribution and interpretation of students' physics achievement of Form 3 physics students at Domasi Demonstration Secondary School in Malawi in Term 3 of the 2019 academic year.

Table 10

The Frequency Distribution and Interpretation of Students' Physics Achievement

Physics score	Number of students	Interpretation
0 - 20	2	Very low
21 - 40	13	Low
41 - 59	12	Moderate
60 - 79	8	High
80 - 100	5	Very high

Table 10 shows that the number of students with physics achievement values between 80 and 100 (considered very high) was five (5). Eight (8) students, with high achievement levels, had scores between 60 and 79. There were 12 students who scored between 41 and 59. This achievement was interpreted as moderate according to the interpretation scale of Table 4 in Chapter III. Thirteen students had low achievement with scores between 21 and 40. Finally, two (2) students had very low scores between 0 and 20.

Table 11 below shows the mean value, range and standard deviation of physics achievement of Form 3 students at Domasi Demonstration Secondary School in Malawi in Term 3 of the 2019 academic year. The physics achievement scores for each student are shown in Appendix G. For the level of physics achievement in the Form 3 students, a weighted percentage was used. The weighted percentage was calculated from the students' end of Term 3 physics examination which had a total of 120 marks. This resulted in possible scores between 0 to 100. The actual students' scores ranged from 11% to 88%.

Table 11

Mean, Standard Deviation and Interpretation for Students' Physics Achievement

N	Range	*M*	*SD*	Interpretation
40	11-88	49.72	21.76	Moderate

The data in Table 11 show that the average student's physics achievement was 49.72. This was based on the end of Term 3 physics examination results for the whole sample. According to the interpretation Table 1 in Chapter III, this value is considered as moderate physics achievement.

Research Objective 4

Research Objective 4 was to determine whether there was a significant relationship of self-efficacy for learning and performance in physics and metacognitive self-regulated physics learning with physics achievement of Form 3 students at Domasi Demonstration Secondary School in Malawi in Term 3 of the 2019 academic year.

Table 12 shows the bivariate correlations among self-efficacy for learning and performance in physics, metacognitive self-regulated physics learning and physics achievement values of Form 3 students at Domasi Demonstration Secondary School in Malawi in Term 3 of the 2019 academic year.

Table 12

Bivariate Correlations Between Self-Efficacy for Learning and Performance in Physics, Metacognitive Self-Regulated Physics Learning and Physics Achievement (N = 40)

Variables	1	2	3
1. Self-efficacy for learning and performance in physics	-		
2. Metacognitive self-regulated physics learning	.46**	-	
3. Physics achievement	.40**	.39*	-

Note. **. indicates that correlation is significant at the 0.01 level (2-tailed) while *. indicates that correlation is significant at the 0.05 level (2-tailed).

Table 12 indicates a significant relationship of self-efficacy for learning and performance in physics and metacognitive self-regulated physics learning with physics achievement of Form 3 physics students at Domasi Demonstration Secondary School at .05 level. The findings of individual relationships among the variables were as follows.

The relationship of self-efficacy for learning and performance in physics and metacognitive self-regulated physics was moderately strong and positively correlated (r = . 46, p = .003). In the same way, self-efficacy for learning and performance in physics and physics achievement were also moderately strong and positive (r = .40, p = .010). The last relationship was between metacognitive self-regulated physics learning and physics achievement. The relationship was weak but positively correlated (r = .39, p = .012).

Table 12 also shows that multicollinearity was not a problem since the correlation between the independent variables were relatively moderate, thus allowing for a multiple correlation analysis (using multiple correlation coefficient) as shown in Table 13 below.

Table 13

Multiple Correlation Coefficient Analysis Between Self-Efficacy for Learning and Performance in Physics, and Metacognitive Self-Regulated Physics Learning with Physics Achievement

Independent variables	*R*	R^2	*dfs* Between groups	*dfs* Within groups	*F*	*p*
Self-efficacy for learning and performance in physics and metacognitive self-regulated physics learning	.47	.22	2	37	5.14	.011

Table 13 indicated that there was a strong positive significant relationship between self-efficacy for learning and performance in physics and metacognitive self-regulated physics learning with physics achievement ($R = .47$, $p < .05$) at .05 significance level. It also showed that the independent variables explained 22% of the variance of physics achievement ($R^2 = .22$, F (2,37) = 5.14, $p < .05$). The other 78% of the variance of physics achievement is explained by other factors.

In this chapter, the researcher presented the study findings of the relationship of students' self-efficacy for learning and performance in physics and metacognitive self-regulated physics learning with physics achievement. In Chapter V, the researcher will discuss major findings presented above, the conclusions from the findings, research objectives and hypothesis, and finally makes recommendations to different stakeholders.

CHAPTER V

CONCLUSIONS, DISCUSSION, AND RECOMMENDATIONS

This chapter presents a summary of the study. Further, it gives major findings, the conclusions from the findings, discussion in relation to the research objectives and hypothesis findings. Finally, the chapter makes recommendations to teachers, students, administrators and future researchers in connection with the relationship among metacognitive physics learning, self-efficacy for learning and performance in physics and physics achievement of Form 3 students at Domasi Demonstration Secondary School in Malawi.

Summary of the Study

The purpose of the study was to determine whether there was a significant relationship of self-efficacy for learning and performance in physics and metacognitive self-regulated physics learning with physics achievement of Form 3 students at Domasi Demonstration Secondary School in Malawi.

The study was conducted on 40 Form 3 students at Domasi Demonstration Secondary School in Malawi in Term 3 of the 2019 academic year. The MSLPQ was administered to the 40 students at the end of Term 3. Students responded to items concerning their levels of self-efficacy for learning and performance in physics, and metacognitive self-regulated physics learning. The students' end of Term 3 physics examination grades were used to determine their physics achievement. In all cases, a statistical software program was used to analyze the data.

Further, the study worked toward addressing four research objectives and one research hypothesis. To determine the levels of self-efficacy for learning and performance in physics, metacognitive self-regulated physics learning, and physics achievement means and standard deviations were used. To establish the relationships of the three research variables, bivariate correlations were calculated, and multiple correlation analysis (using multiple correlation coefficient) was conducted.

Summary of the Findings

There were four objectives in this study.

Research Objective 1

The first objective was to determine the level of self-efficacy for learning and performance in physics of Form 3 students at Domasi Demonstration Secondary School in Malawi in Term 3 of the 2019 academic year. It was found that the mean level of self-efficacy for learning and performance in physics of the students was very high.

Research Objective 2

The second objective was to determine the level of metacognitive self-regulated physics learning of Form 3 students at Domasi Demonstration Secondary School in Malawi in Term 3 of the 2019 academic year. Results indicated that the students' mean level of metacognitive self-regulated physics learning was moderately high.

Research Objective 3

Research Objective 3 was to determine the level of physics achievement of Form 3 students at Domasi Demonstration Secondary School in Malawi in Term 3 of the 2019 academic year. The results showed that the mean level of the students' physics achievement was moderate.

Research Objective 4

Research Objective 4 was to determine whether there was a significant relationship of self-efficacy for learning and performance in physics and metacognitive self-regulated physics learning with physics achievement of Form 3 students at Domasi Demonstration

Secondary School in Malawi in Term 3 of the 2019 academic year. The results indicated a significant relationship of the three variables. Further, the results indicated that the relationship of self-efficacy for learning and performance in physics and metacognitive self-regulated physics was moderately strong and positively correlated. Similarly, self-efficacy for learning and performance in physics and physics achievement were also moderately strong and positive. The last relationship was between metacognitive self-regulated physics learning and physics achievement. This relationship was found to be weak but positively correlated. The findings, further, indicated that there was a moderately strong and positive significant relationship between the independent variables (self-efficacy for learning and performance in physics and metacognitive self-regulated physics learning) with the dependent variable (physics achievement). The findings also showed that the self-efficacy for learning and performance in physics and metacognitive self-regulated physics learning explained 22% of the variance in physics achievement.

Conclusions

From the findings, the following conclusions were drawn.

Research Objective 1

The finding from Objective l revealed that the mean level of students' self-efficacy for learning and performance in physics was very high. This suggests that the Form 3 students at Domasi Demonstration Secondary School in Malawi in Term 3 of the 2019 academic year have very strong beliefs in their capability to successfully achieve certain tasks in physics. The findings of this study showed that self-efficacy for learning and performance in physics was not an issue among the Form 3 students at the school in Malawi in Term 3 of the 2019 academic year.

Research Objective 2

The finding from Objective 2 revealed that the mean level of students' metacognitive self-regulated physics learning was moderately high. From the findings, it can be seen that these students have strong self-directed processes through which they transform their mental abilities into task related skills to regulate their physics learning. The students' use of metacognitive self-regulated learning strategies in physics at the school is, therefore, not an issue.

Research Objective 3

The finding from Objective 3 revealed a mean level of students' physics achievement was moderate. The results suggest that the Form 3 students at Domasi Demonstration Secondary School in Malawi in Term 3 of the 2019 academic year is moderate meaning the students' achievement in physics is neither high nor low. It can be concluded that the students' achievement in physics should be increased through the combined efforts of the school, the teachers and the students themselves since physics achievement is not determined by students' motivation and learning strategies alone.

Research Objective 4

The finding from Objective 4 revealed a significant relationship of self-efficacy for learning and performance in physics and metacognitive self-regulated physics learning with physics achievement of Form 3 physics students at Domasi Demonstration Secondary School at .05 level. The findings suggest physics achievement in schools can be increased for at least 22% through increasing students' levels of self-efficacy for learning and performance in physics and metacognitive self-regulated physics learning. The other 78% of physics achievement can be increased by other variables such as resource management strategies, student values, and affective beliefs (Pintrich et al., 1991). Therefore, it can be concluded that it is very important for students, teachers, administrators, and the Malawi Ministry of

Education, Science and Technology to understand that physics achievement can increase for at least 22% by increasing students' self-efficacy for learning and performance in physics and metacognitive self-regulated physics learning.

Discussion

The findings of this study are encouraging and reflects the global literature despite being local to a school in Malawi, involving a small sample and particular to a specific class.

Self-Efficacy for Learning and Performance in Physics, and Metacognitive Self-Regulated Physics Learning

Form 3 physics students' results indicated a moderately strong and positive relationship between their self-efficacy for learning and performance in physics and metacognitive self-regulated physics learning. This was expected since students that exhibit higher self-efficacy levels end up using deeper and more sophisticated self-regulation strategies including metacognition (Pintrich et al., 1991). Further, previous studies indicate that lower level strategies are more frequently utilized by students with low self-efficacy (Berger & Karabenick, 2011; Pintrich et al., 1991) while individuals who believe they are capable (high self-efficacy) utilize higher level strategies such as metacognitive self-regulation (Pintrich, 2000; Wolters, Pintrich, & Karabenick, 2005). In a study of Grades 5, 8 and 11 students in New York city, Zimmerman and Martinez-Pons (1990) where gifted students were compared to regular students, demonstrated that higher self-efficacy levels are present in gifted students, leading to higher self-regulation levels in the highly efficacious students, with a large effect. Further, students with a greater degree of self-efficacy exploit a more varied range of cognitive and metacognitive self-regulation strategies leading to the improvement of their academic achievement (Los, 2014).

Self-efficacy is an essential foundation of self-regulation. Students who have confidence in developing their own strategies to successfully achieve their academic targets should also have confidence in their ability to implement the developed strategies (Zimmerman, 1989). As such, self-efficacy for self-regulated learning poses an important factor of overall self-efficacy. Not only does self-regulation provide motivation, but it also guides students' efforts and strategies, in regard to understanding the challenges that they will face on their way to achieving mastery of the topic or subject at hand (Boekaerts & Niemivirta, 2000). Furthermore, this process provides a link between students' self-regulatory processes and specific social learning, as part of the social cognitive approach to learning. It follows that the higher the self-efficacy for learning and performance, the higher the self-regulation, and *vice versa.*

The current study has reflected a common agreement among researchers which indicates that a person's perceived self-efficacy level is positively associated with their self-regulation level (Bandura, 1994; Zimmerman & Schunk, 2001). Thus, students who demonstrates high self-efficacy levels also demonstrates high self-regulation levels. Similarly, students who demonstrates low self-efficacy levels equally demonstrates low self-regulation levels (Alegre, 2014; Alqurashi, 2016; Bakar, Shuaibu & Bakar, 2017; Los, 2014; Sadi & Uyar, 2013; Shaine, 2015).

Self-Efficacy for Learning and Performance in Physics, and Physics Achievement

Examining the relationship between physics achievement and self-efficacy for learning and performance in physics of this study sample, there was a moderately strong and positive correlation between the two variables. The correlation was expected based on available literature on the constructs and previous studies (Hassan, Alasmari & Ahmed, 2015; Schunk & Pajares, 2002; Vogel & Human-Vogel, 2016). These studies, in common with the current study, indicated that students who consider themselves more efficacious about performance in their studies perform better than those with low self-efficacy. These students who nurture high beliefs of self-efficacy appear to possess a strategy to press on when encountering difficulties in physics courses. They confidently tackle challenging physics tasks and activities. In contrast, students who have low beliefs of self-efficacy do not expect doing well as they do not believe in their abilities to do well (Bandura, 1991; Schunk & Pajares, 2002).

Academic motivation and achievement are also influenced by self-efficacy (Schunk & Pajares, 2002). Students with high self-efficacy in an area persist longer in trying to achieve results, are more resilient to occasional failures and have better academic achievement. In comparison, students with low self-efficacy quickly give up on overcoming obstacles and suffer in their academic performance (Schunk & Pajares, 2002). A number of studies have revealed, further, that academic self-efficacy is the greatest predictor of academic achievement (Hassan, Alasmari & Ahmed, 2015; Ratsameemonthon, 2013; Vogel & Human-Vogel, 2016). Furthermore, the findings of this study showed that students' whose self-descriptions comprised capability feelings in a particular subject, had high probability of doing well in that subject (Ergul, 2004; Lin & Lynch 2006; Radovan, 2011). Students who have low self-efficacy perceptions of themselves as learners of any subject are more likely than those who have high self-efficacy perceptions to quit learning while confronted with difficult tasks, to show negligible dedication to the targets they set to pursue, and to attribute their lack of success to other factors other than themselves (Bandura, 1997). As a result, self-efficacy can be a key center of attention in physics education and to those wishing to improve achievement of students in physics.

Metacognitive Self-Regulated Physics Learning and Physics Achievement

The findings of this study indicated that metacognitive self-regulated physics learning strategies had a weak but positive correlation with physics achievement. This means students who control their cognition have high achievement in physics. These findings too were expected and are consistent with related literature in education (Alegre, 2014; Alqurashi, 2016; Bakar, Shuaibu & Bakar, 2017; Los, 2014; Sadi & Uyar, 2013; Shaine, 2015). Similarly, to the current study, when students set explicit learning objectives in type of outcomes and additionally performance, the students apply techniques which are regarded proper to accomplish the learning objectives. They further screen the viability of these chose strategies or learning procedures; survey or assess individual accomplishments with respect to the expected objectives or result, and set new learning objectives and plan for new learning activities once the learning targets have been accomplished. They also take charge of their learning and are able to control their cognitive strategies to achieve successful learning progress. The observation may reflect the situation in the current study in Malawi in view that the Form 3 students are expected to sit for a high-stake examination in the following year leading to their first employable certification in education, the main determinant to entry into universities and other institutions of higher learning.

Several studies (Alegre, 2014; Alqurashi, 2016; Bakar, Shuaibu & Bakar, 2017; Los, 2014; Sadi & Uyar, 2013; Shaine, 2015) have also showed that use of deeper metacognitive self-regulatory strategies is predictive of higher academic outcomes than that of the lower-level self-regulation strategies of general cognition. Other studies have also demonstrated that students who perform well in their academics are to a greater extent self-regulated learners than those with lower academic performance (e.g., Alegre, 2014; Agustiani, Cahyad, & Musa, 2016; Alqurashi, 2016; Bakar, Shuaibu & Bakar, 2017)

Self-Efficacy for Learning and Performance in Physics, Metacognitive Self-Regulated Physics Learning and Physics Achievement

The findings indicated a moderately strong, positive and significant relationship between the combined independent variables (self-efficacy for learning and performance in physics and metacognitive self-regulated physics learning) with the dependent variable, physics achievement. The combined independent variables also explained 22% of the variance of physics achievement. The findings mean that the higher the score the student gets in one of the variables, the higher the score the student will get on the other two variables, and *vice versa*. This suggests that, in the current study, the higher the students' self-efficacy for learning and performance in physics levels, the better the metacognitive self-regulated physics learning levels, and the higher the physics achievement levels.

The findings were expected considering the reported moderately strong and positive correlation of each independent variable with the dependent variable. Students who believe in their abilities to learn and perform take responsibility of their own learning and are inclined to achieve higher in their academics. Similarly, students with low self-efficacy exercise little control on their learning and tend to achieve less in their studies (Bandura, 1997; Schunk & Pajares 2002). Further, it was suggested that self-efficacy for learning and performance in physics contributed greatly to physics achievement compared to metacognitive self-regulated physics learning. These findings are consistent with theoretical reasoning in this study (Bandura, 1997) and is also reflected in a number of studies (e.g., Alegre, 2014; Bakar, Shunaibu & Bakar, 2017; Los, 2014; Shaine, 2015) for a basic reason that efficacious students are likely to engage into different learning strategies in addition to metacognitive self-regulation to achieve high scores.

Physics achievement for Form 3 students was expected to be low according to physics teachers at the school (F. Kasenda, personal communication, February 27, 2019). However, the findings indicated a moderate physics achievement. The positive change, though minor, in physics achievement can be attributed to interventional measures towards low achievement by the Malawi Ministry of Education, Science and Technology (Malawi Institute of

Education, 2015). These measures included training of physics teachers, provision of different physics resources and sharing of best practices in physics instruction amongst physics teachers.

Recommendations

The following recommendations for students, teachers, administrators and Ministry of Education and future researchers are based on the current study findings.

Recommendations for Students

The findings of this research have showed that students with high self-efficacy for learning and performance in physics will also have high use of metacognitive self-regulated physics learning strategies and high physics achievement, and *vice versa.* Through more dedicated practice on meta-cognitive learning, students should, therefore, develop positive self-confidence in their capabilities to learn and perform in physics, take control of their own learning, and think of what they are reading or studying as they do physics by setting personal goals and monitoring their activities put in place to achieving the goals. This will increase their scores in physics.

Recommendations for Teachers

The findings of the research have demonstrated that physics achievement can be increased by increasing self-efficacy for learning and performance in physics and metacognitive self-regulated physics learning. Teachers should strive in motivating students to have self-confidence in learning physics and taking control of their own learning in order to increase students' physics achievement. Teachers must model learning that promotes metacognitive learning in students.

Recommendations for Administrators and Malawi Ministry of Education

This research has indicated that students who believe they can do better in physics and manage their physics learning have higher scores in physics. The administrators should, therefore, encourage physics teachers to motivate their students and mount professional development sessions to teach teachers how to model metacognitive learning in physics. The Malawi Ministry of Education and administrators should also provide and offer a learning environment that helps students develop self-confidence in learning physics. They can provide adequate resources such as laboratory materials, interactive workbooks, textbooks and models for physics learning and train teachers to effectively use the resources so that students develop self-confidence in learning physics as they interact with the resources. Administrators should also mount programs such as science fairs, class projects, field visits, design competitions so that students develop self-confidence in and control of their physics learning.

Recommendations for Future Researchers

This research had limitations as it was confined to a single grade level and at one school, small sample (N = 40), and one type of school setting, among others. It is necessary for future researchers to conduct further research with larger samples drawn from different schools in Malawi with a variety of teachers, students and in different education divisions in order to get representative relationship among metacognitive self-regulated physics learning, self-efficacy for learning and performance and physics achievement. Metacognitive self-regulated physics learning, and self-efficacy for learning and performance only explained 22% of the variance in physics achievement in this study. It is, therefore, recommended that future researchers should consider taking into account the role of other research variables including other variables such as resource management strategies, student values, and affective beliefs in physics learning.

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APPENDICES

APPENDIX A

Research Instrument I

Motivated Strategies for Learning Physics Questionnaire (MSLPQ)

Student Code:______________________ Date: ___________________________

Motivated Strategies for Learning Physics Questionnaire (MSLPQ)

Part I. Demographic Information

1. Gender (circle one) Male Female
2. Age _________ years
3. Class level Forms 1 2 3 4
4. How many subjects are you taking this term? _________________
5. How many periods per week do you learn physics? _______________
6. Do you attend all classes? Yes No

Part II. Self-Efficacy and Performance for Learning physics

The following items ask about your motivation and attitudes about physics class. **Remember there are no right and wrong answers, just answer as accurately as possible**. Use the scale below to answer the questions. If you think the statement is very true of you, circle 7; if a statement is not at all true of you, circle 1. If a statement is more or less true of you, find and circle the number between 1 and 7 that best describes you.

1	2	3	4	5	6	7
not at all true of me						very true of me

Example

I feel I can become a university physics professor.

1	2	3	4	5	6	7
not at all true of me						very true of me

Item

1. I believe I will receive an excellent grade in physics class.

1	2	3	4	5	6	7
not all true of me						very true of me

2. I'm certain I can understand the most difficult material presented in the readings for physics class.

1	2	3	4	5	6	7
not at all true of me						very true of me

3. I'm confident I can understand the basic concepts taught in physics class.

1	2	3	4	5	6	7
not at all true of me						very true of me

4. I'm confident I can understand the most complex material presented by the teacher in physics class.

1	2	3	4	5	6	7

not at all
true of me

very true
of me

5. I'm confident I can do an excellent job on the assignments and tests in physics class.

1	2	3	4	5	6	7

not at all
true of me

very true
of me

6. I expect to do well in this physics class

1	2	3	4	5	6	7

not at all
true of me

very true
of me

7. I'm certain I master the skills being taught in physics class.

1	2	3	4	5	6	7

not at all
true of me

very true
of me

8. Considering the difficulty of physics, the teacher, and my skills, I think I will do well in physics class.

1 2 3 4 5 6 7

not at all true of me — very true of me

Part III. Metacognitive Self-Regulation Strategies

The following items ask about your learning strategies and study skills for physics class. **Remember there are no right and wrong answers. Answer the questions about how you study in this physics class as accurately as possible**. Use the same scale to answer the remaining questions. If you think the statement is very true of you, circle 7; if a statement is not all true of you, circle 1. If a statement is more or less true of you, find the number between 1 and 7 that best describes you.

1 2 3 4 5 6 7

not all true of me — very true of me

Item

9. During class time I often miss important points because I'm thinking of other things.

1 2 3 4 5 6 7

not at all true of me — very true of me

10. When reading for physics, I make up questions to help me focus my reading.

1 2 3 4 5 6 7

not at all
true of me

very true
of me

11. When I become confused about something I'm reading for physics class, I go back to figure it out.

1 2 3 4 5 6 7

not at all
true of me

very true
of me

12. If physics materials are difficult to understand, I change the way I read material.

1 2 3 4 5 6 7

not at all
true of me

very true
of me

13. Before I study new physics material thoroughly, I often skim it to see how it is organized.

1 2 3 4 5 6 7

not at all
true of me

very true
of me

14. I ask myself questions to make sure I understand the material I have been studying for physics class.

1 2 3 4 5 6 7

not at all true of me — very true of me

15. I try to change the way I study in order to fit the physics requirements and teacher's teaching style.

1 2 3 4 5 6 7

not at all true of me — very true of me

16. I often find that I have been reading for physics class but don't know what it was all about.

1 2 3 4 5 6 7

not at all true of me — very true of me

17. I try to think through a topic for physics class and decide what I am supposed to learn from it rather than just reading it over when studying.

1 2 3 4 5 6 7

not at all true of me — very true of me

18. When studying for physics class I try to determine which concepts I don't understand well.

1	2	3	4	5	6	7

not at all
true of me

very true
of me

19. When I study for this physics class, I set goals for myself in order to direct my activities in each study period.

1	2	3	4	5	6	7

not at all
true of me

very true
of me

20. If I get confused taking notes in physics class, I make sure I sort it out afterwards.

1	2	3	4	5	6	7

not at all
true of me

very true
of me

APPENDIX B

Research Instrument II

End of Term 3 Physics Examination

Sample Items

1 a. Figure**1** is a diagram showing a traditional musical instrument which consists of wooden bars of different lengths. Use it to answer the questions that follow.

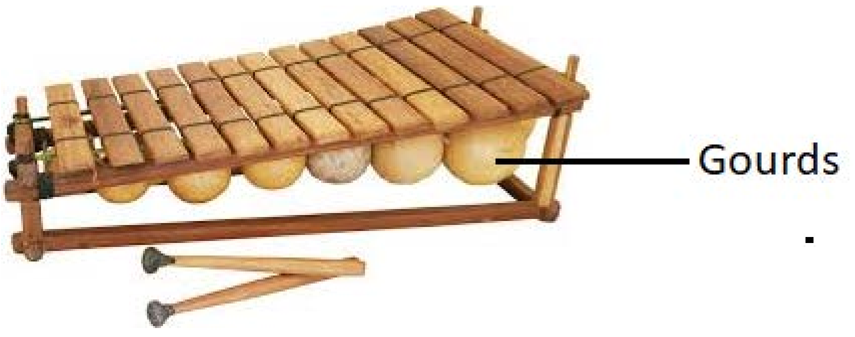


Figure 1

(i) Name the instrument

____ (1 mark)

(ii) How does the instrument produce sound?

____

____ (1 mark)

(iii) Why are wooden bars made of different lengths?

____

____ (1 mark)

(iv) What is the purpose of putting gourds under each wooden bar?

____

____ (1 mark)

b. Figure **2** is a graph of amplitude against frequency for an oscillation system.

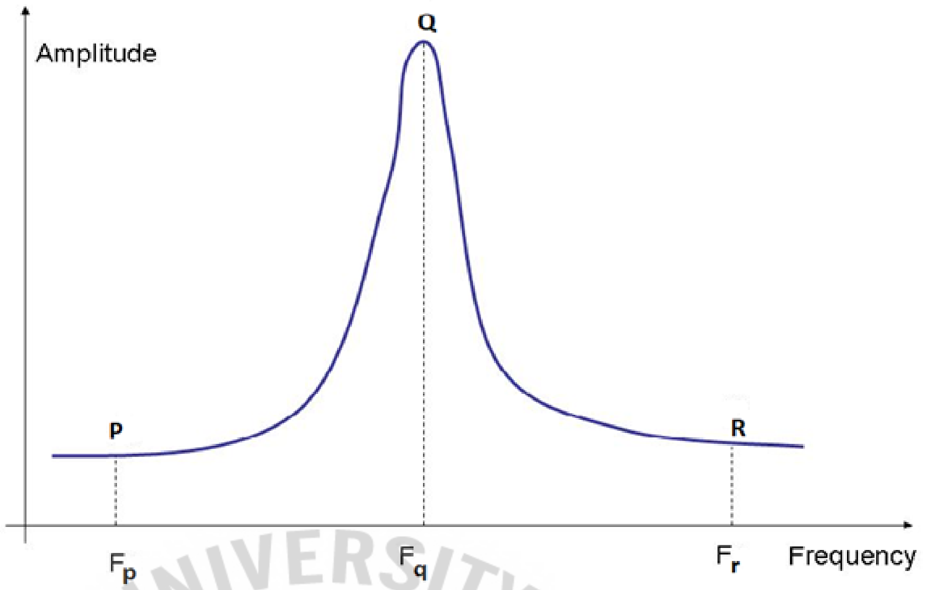


Figure 2

(i) At what point is the system in resonance?

____ (1 mark)

(ii) Give a reason for the answer in **2d**(i).

____

____ (1 mark)

c. Why is resonance dangerous to a vibrating system?

____

____ (1 mark)

d. (i) Define an echo

____

____ (1 mark)

(ii) A boat hears the echo from a sound wave 5 sounds after it has been emitted. If the speed of sound in the water is 1400m/s. Calculate the depth of the sea.

(3 marks)

2. With the aid of a labelled diagram, describe an experiment that you would carry out to show that sound wave requires a medium for propagation.

____ (10 marks)

APPENDIX C

Research Instrument II

End of Term 3 Physics Examination

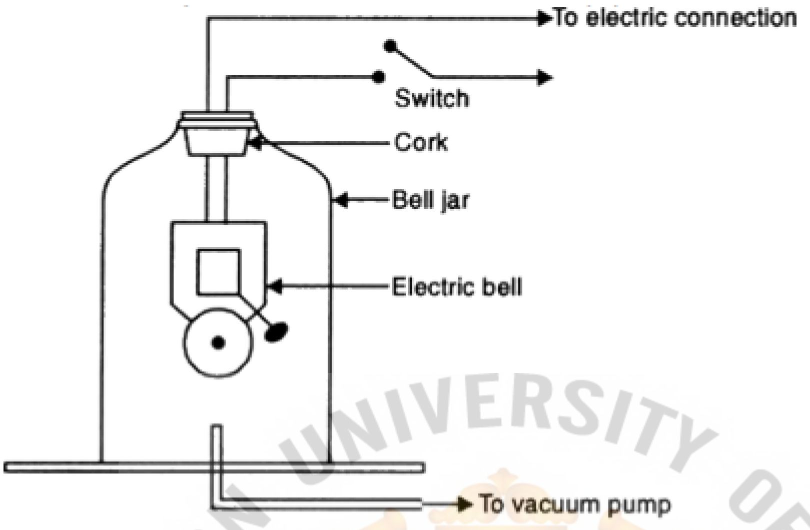
Sample Marking Scheme

A. Marking Scheme Sample (Short Answer)

Question No.	Answer	Marks
1a.		
(i)	Xylophone	1
(ii)	By vibrations of the wooden bars	1
(iii)	To produce sound of different frequencies	1
(iv)	To increase the amplitude of the sound waves	1
1b.		
(i)	F_q	1
(ii)	The amplitude is at the highest point	1
1c.		
	Resonance can breakdown a vibrating system	1
1d.		
(i)	Is a reflected sound	1
(ii)	Depth = Speed x time Speed = 1400m/s, time = 5s, depth ? Depth = 1400m/s x 5s = 7000 m	1 1 1

B. Marking Scheme Sample (Essay)
Question No. 2 Answer

i) Set up the following



(1 mark for electrical connection assembly)

(1 mark for bell jar airtight assembly)

(1 mark for electric bell assembly)

(1 mark for vacuum pump assembly)

ii) When we turn on the switch, we hear the sound of the bell. ***(1 mark)***

iii) Now, we pump out the air from the jar using a vacuum pump. ***(1 mark)***

The sound becomes fainter.

iv) When most of the air has been removed, we hear a very faint sound. ***(1 mark)***

v) When there is air inside the jar, sound travels through it to the wall of the jar. ***(1 mark)***

vi) This makes the wall to vibrate which in turn, sends sound to us. ***(1 mark)***

vii) When air is removed, sound from the bell cannot travel to the wall of the jar. ***(1 mark)***

viii) Therefore, we can see that the sound waves need material medium for propagation.

(Total 10 marks)

APPENDIX D

Data Collection Letter

Graduate school of Human Sciences

Assumption University of Thailand

The Motivated Strategies for Learning Physics Questionnaire

(MSLPQ)

Mr Austin B Kalambo is a student in the Master of Education Program in Curriculum and Instruction, Graduate School of Human Sciences at Assumption University of Thailand. He is conducting research on "**The Relationship of Self-Efficacy for Learning and Performance in Physics and Metacognitive Self-Regulated Physics Learning with Physics Achievement of Form 3 Students at Domasi Demonstration Secondary School in Malawi'** for his thesis.

In this regard, Mr. Austin B Kalambo is seeking your participation in the research.

All information collected from you shall be treated with confidentiality and shall be used for education purposes only. They researcher shall endeavor not to report characteristics of any individual respondent but rather as a group.

Feel free to provide the information and ask for clarification where it is not clear.

This is not an examination and there is no correct answer

Thanks for your cooperation.

APPENDIX E

Means and Standard Deviations of Students' Self-Efficacy for Learning and Performance in Physics Frequency Distribution for Each Item

Table 14

Means and Standard Deviations of Students' Self-Efficacy for Learning and Performance in Physics Frequency Distribution for Each Item

Item	*M*	*SD*	*N*
I believe I will receive an excellent grade in physics class.	6.50	.99	40
I'm certain I can understand the most difficult material presented in the readings for physics class	6.25	1.06	40
I'm confident I can understand the basic concepts taught in physics class.	6.82	.45	40
I'm confident I can understand the most complex material presented by the teacher in physics class.	6.55	.71	40
I'm confident I can do an excellent job on the assignments and tests in physics class.	6.68	.69	40
I expect to do well in this physics class	6.88	.40	40
I'm certain I master the skills being taught in physics class.	6.50	.75	40
Considering the difficulty of physics, the teacher, and my skills, I think I will do well in physics class	6.80	.41	40
Total	6.62	.21	40

APPENDIX F

Means and Standard Deviations for Students' Metacognitive Self-Regulated Physics Learning for Each Item

Table 15

Means and Standard Deviations of Students' Metacognitive Self-Regulated Physics Learning for Each Item

Item	*M*	*SD*	*N*
During class time I often miss important points because I'm thinking of other things	4.68	1.79	40
When reading for physics, I make up questions to help me focus my reading.	5.30	1.76	40
When I become confused about something I'm reading for physics class, I go back to figure it out.	6.42	.88	40
If physics materials are difficult to understand, I change the way I read material.	6.02	1.53	40
Before I study new physics material thoroughly, I often skim it to see how it is organized.	5.90	1.57	40
I ask myself questions to make sure I understand the material I have been studying for physics class.	5.78	1.37	40
I try to change the way I study in order to fit the physics requirements and teacher's teaching style	5.88	1.32	40
I often find that I have been reading for physics class but don't know what it was all about.	5.15	1.72	40
I try to think through a topic and decide what I am supposed to learn from it rather than just reading it over when studying.	5.88	1.27	40
When studying for physics class I try to determine which concepts I don't understand well.	6.20	.97	40
When I study for this physics class, I set goals for myself in order to direct my activities in each study period	6.32	.89	40
If I get confused taking notes in physics class, I make sure I sort it out afterwards.	6.02	1.12	40
Total	5.80	1.35	40

APPENDIX G

Table 16

Form 3 Students' End of Term 3 Physics Achievement

Student	End of Term 3 Physics Scores	Student	End of Term 3 Physics Scores
1	50	36	15
2	69	37	43
3	48	38	30
4	65	39	51
5	36	40	80
6	88		
7	74		
8	56		
9	71		
10	33		
11	84		
12	88		
13	53		
14	33		
15	31		
16	43		
17	23		
18	71		
19	49		
20	27		
21	22		
22	77		
23	58		
24	43		
25	68		
26	54		
27	81		
28	30		
29	32		
30	70		
31	11		
32	21		
33	32		
34	53		
35	26		