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DEPARTMENT OF ELECTRICAL AND AUTOMOTIVE TECHNOLOGY

INSTRUCTIONAL GUIDE TO DEMONSTRATE THE EFFECTS OF THE ENVIRONMENT ON ELECTRICAL CIRCUIT IN THE MINING INDUSTRY

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DECLARATION

STUDENT'S DECLARATION

I **AKANSAKE SAMUEL** hereby declare that apart from the references which have been duly cited, this dissertation is my own original work. It has neither been submitted in part nor in its entirety for another degree at this university or elsewhere.

…….. …….

Signature Date:

SUPERVISOR'S DECLARATION

I, hereby declare that the preparation and presentation of this project work was supervised in accordance with the guidelines on supervision of project work laid down by the University of Education, Winneba.

PROFFESOR WILLIE OFOSU

Signature: …… Date: ……

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Finally, I would like to acknowledge my sponsors, parents, siblings, and loved ones whose contributions either directly or indirectly have resulted in the success of this study.

DEDICATION

This dissertation is dedicated to God for the wisdom and blessings He bestowed on me to undertake this study. It is also dedicated to my sponsors and loved ones for their financial, physical and emotional support God bless you.

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ABSTRACT

The study was designed to investigate the impacts of mining on electrical circuits in the catchment communities with specific reference to Damperyaw mining company. A careful observation of the activities of Damperyaw mining community at the catchment areas in terms of effects of the prevailing environmental conditions reveal that, most catchment communities have issues and concern about how the mining activities are affecting their electrical gargets and appliance. The descriptive survey was used for the study with a sample size of 35 respondents. The data collection instrument was questionnaire. Data collected was processed using the Statistical Product for Service Solutions (SPSS). Findings of the assessment indicate that, most of the respondents (70 %) were engaged in farming as their main occupation. A greater percentage of the respondents acknowledged the fact that at Damperyaw Mining undertakes both surface and underground mining. It was established that, 3 (8.6%) of the respondents stated the lecture method 2 (5.7%) stated discussion method, 16 (45.7%) said field trip method and 14 (40.0%) said demonstration method. Respondents argued that as a result of the field trip method of teaching them the working of mining helps to get the concepts faster as compared to other methods. From the survey, majority of the respondents of the total sample population admitted that mining contribute to some environmental conditions, such as dust, temperature and humidity. It could be concluded that mining activities contributes to the state and nature of electrical circuits in which these electricals are found. The density of dust in the atmosphere could affect the functionality of that electrical components. From the results of this study, it is recommended that the management of the Damperyaw mining centre should provide adequate instructional and technical resources to enable trainees undergo through effective teaching and learning of simple electrical circuits in the mining industry.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

In recent times, there has been growing public concerns about teaching and learning in Ghanaian schools especially with regard to science. Science education at the primary and secondary levels of schooling is an essential component for achieving a holistic education. Science is important for economic growth and social development.

Science education, according to Curriculum Research and Development Division (2007) of Ghana education service, will equip young people with the necessary process skills and attitudes that will provide a strong foundation for further studies in science at the upper levels of education and beyond. It will also provide children with the interest and inclination toward the pursuit of scientific work. Science has evolved over the years due to breakthrough discoveries and inventions consequently its necessity cannot be over emphasized. Knowledge of science is required for the progress of any society especially in developing nations.

This means that scientific and technological literacy is crucial for all individuals, especially in developing countries where there is the need to progress and develop to meet the developmental growth agenda and also to elevate the standard of living of their populace (CRDD, 2007).

Gluckman (2011) explains that there are three other associated objectives of science education for all young people during their compulsory school years. That is, primarily, all children need to have a practical knowledge of how simple circuits function. In order words they need adequate understanding in order to appreciate the technological setting in which they exist and work. Hence enhancing the impact and quality of science

education is vital to ensuring that the global community can meet the growing set of challenges facing the world today, whether in food security, disease reduction, or industrial innovation.

1.2 Statement of the Problem

World Bank Group (2011) posits that mining activities contribute negatively to the environmental conditions in their communities either through direct and indirect means. Another school of thought holds that mining operations have adverse effects on the local population. Mining affects their livelihood while the influx of foreigners into their community puts pressure on existing and usually inadequate social amenities. These consequently result in causing environmental problems ranging from waste rock and tailing disposal, land disturbance; air, water and noise pollution and ground vibration as a result of blasting.

A careful study of the mining activities of the Damperyaw Mining Centre shows the adverse it has had on the local community. The electrical gadgets and appliances of the inhabitants are negatively affected as a results of the effects of the environmental conditions. To improve upon the current situation of the teaching and learning of mining related topics, mining lesions must be made real to trainees through appropriate teaching methods, use of good instructional materials and improvisation where it is indispensable.

Preliminary investigations brought to light how handicapped most of the instructional guide, which were predominantly two-dimensional in nature, were, in assisting effective teaching and learning of science.

The researcher therefore seeks to develop and instructional guide to demonstrate the effects of the environment on electrical circuit in the mining industry.

1.3 Aim and Objectives of the Project

The main objective (aim) of this work is to determined the effect of the environmental condition in the mining community on electrical circutes.

The specific objective is to:

I. find out and describe existing instructional guides used for teaching of electrical circuits at Dampayaw Mining Training Centre.
II. determine the effect of prevailing environmental conditions on electrical circuits.

1.4 Research Questions

1. What are the instructional guides used for teaching electrical circuit systems in Dampayaw Mining Training Centre?
2. What are the effects of environmental conditions on electrical circuits?

1.5 Relevance and Delimitation of the Study

This research will aid teachers to effectively teach students on topics related to electrical circuits. An instructional guide will be developed which will help both teachers and students at the Dampayaw Mining Centre to easily understand electrical circuits. This research will also serve as a source of reference material for teachers, educators, students, writers, stakeholders and the general public.

The study will be limited to the development of an instructional guide for teaching and learning simple electrical circuits at Dampayaw Mining Training Centre, Ashanti Region of Ghana.

1.6 Organization of the Study

Chapter one of the research discusses the background information relevant to the study, statement of the problem, purpose and objectives of the study, research questions, significance of the study, delimitation and organization of the study. Chapter two is devoted to the review of related literature. The review has been done in themes covering various aspects of the research topic. Also, the third chapter presents research methodology. This covers research design, population, sample and sampling procedure, instrument for data collection and administration. Chapter four on the other hand focuses on a presentation and analysis of the collected data in the study. This is done with reference to the various research questions. The final chapter focuses on the summary of findings, implications for teaching, conclusions, and recommendations for further research.

CHAPTER TWO

LITERATURE REVIEW

2.1 Instructional Guide

In order to facilitate effective teaching and learning, it is important for the teacher to implement a resource or a technology which will be able to address the needs of all learners irrespective of each learner's background, intelligence level or academic needs. Various instructional materials may be employed by the teacher to help him effectively teach a subject or lesson for the understanding of all learners (Chamunorwa, 2010).

Broadly, the term instructional materials (IMs) as stated by Lewis (2013) refers to a range of educational materials that teachers use in the classroom to support specific learning objectives. Olumorin, Yusuf et al. (2012) adds that they are those materials that help teachers to teach with ease and learners to learn without stress. Ministry of Education (1974) as cited in Agbadzi (2009) states that the use of teaching and learning materials is very important at all levels of pre-university education. According to Olumorin, et al. (2012), IMs appeal to the five senses. On the other hand, they are used by teachers to convey and put emphasis on information, arouse interest and ease the learning process (Rius, et al. 2009).

Current trends show that instructional materials have been given other names. Some of these names include Instructional Media, Teaching and Learning Aids (TLA), Teaching and Learning Materials (TLMs), Educational Media (EM) and Instructional Resources (IRs). For the purpose of this study, the terms would be used interchangeably and only refer to the instructional materials used in teaching in the classroom.

2.1.1 Types of Instructional Guides

Instructional media encompasses all the materials and physical means which an instructor may use to implement teaching and facilitate students' achievement of teaching objectives. This may include traditional materials such as chalkboards, handouts, charts, slides, overheads, real objects and videotape or film, as well as newer materials and methods such as computers, DVDs, CD-ROMs, the internet and interactive video conferencing (Agudzeamegah,2014). Florano (2011) categorizes instructional media into text media, audio media, visual media, motion media, people media, manipulative media and multimedia. These different media are the basic components in teaching and learning at all levels of education especially pre-school and primary school levels. These instructional materials help children to visualise and handle objects in order to assimilate the information their teachers provide (Shankar, 1980; as cited in Anini, 2011).

Fianu (1999) also postulates that IMs are either visual or audio-visual. According to him, materials that are considered visual are those teachers use to make visual impressions on the learner for effective understanding of what is taught. They include instructional resources, printed and other objects such as three-dimensional objects that are produced with local materials, program instructions, and instruction package among others (Olumorin, et al., 2012). Audio-visual materials, on the other hand, are anything seen and heard which makes instruction or teaching more effective (Rius et al., 2009).

Also the following are more examples of IMs (Leus, 2002) alphabet books, alphabet chart, calendar, chart, easy reader, flash card, flip chart, poster, sentence building cards, sentence building grid, syllable wheel, word building cards, and word slide .

2.1.2 Advantages of Instructional Guide

According to Jekayinfa (n.d.) the selection of materials which are related to the basic contents of a lesson helps students to have an in-depth understanding of lessons. It also makes lessons attractive to them, thereby arousing their interest and thus, motivating them to learn. Similarly, good instructional materials are those that require minimum intervention from the teacher. Nikky (2010) mentions that some advantages of using IMs are that they supplement in verbal instructions, make learning permanent, provide variety, help get the attention of students and save time and energy. IMs also encourage healthy classroom interaction, help the teacher to create an environment for learning for beginners and are helpful in creating positive environment for discipline. They also assist in meeting individual differences as well as provide speech training to pupils. Olumorin et al. (2012) add that IMs can be used to teach large classes, are cheaper to produce and encourage class participation.

IMs can be purchased or made by teachers or schools. Richards (2012) asserts that teachers or institutions preparing their own IMs hold certain advantages. These include:

3. Relevance of materials to learners' and institutional needs that reflect local content, issues and concerns.
4. It also develops expertise among staff, giving them a greater understanding of the characteristics of effective materials.
5. The reputation of the institution or teacher is enhanced by demonstrating commitment to providing materials specifically for their students.
6. Finally, flexibility of materials produced as they can be revised or adapted as needed, giving materials greater flexibility than imported IMs and commercial course books.

Potential disadvantages include cost; because quality IMs requires time as well as resources to produce. Development of instructional materials is a specialized skill and not all teachers are capable of producing good materials, therefore, teacher-made materials may not have the same standard of design and production quality as commercially produced instructional materials.

Olumorin et al. (2012), however, emphasize that some factory produced or imported IMs are developed based on foreign ideas and culture. A locally produced IM will on the other hand reflect objects that can easily be identified in the child's environment depending on where the child resides or his background.

2.1.3 Criteria for Selection of Instructional Guide

Though IMs are crucial for effective teaching and learning, teachers and schools have to be cautious when choosing these materials. The choice of IMs should be made based on the aims and objectives of each lesson since an aid used in one lesson might not relay the same message when used in another lesson. This implies that there are specific roles that each IM plays in the teaching and learning process. Consequently IMs if not properly chosen might misinform pupils rather than aid their understanding of the lesson. There is therefore the need for teachers to acquire materials that satisfy the learning objectives of the different lessons to be taught, understand the role of IMs and more importantly get training on how to use them.

In this light, Leus (2002) posits that the following criteria should guide a teacher or school in their selection of IMs. These include: Appropriateness, Authenticity, Interest, Organization, Balance and Cost. Farrant (1996:169) also explains that, good educational media are those that require minimum intervention from the teacher. Good instructional material needs little or no explanations, stimulates ideas, demands an active response

from the learner, and must be appropriate to the maturity and culture of the user as well as be flexible in use. They should also provide enjoyment and be strongly made and wear well.

This means that in the selection of IMs for instruction, consideration should be given to the mutuality of the material to be used by both learners and teachers as a study resource. For instance, IMs for science should provide a main source of science content, present specific views about the nature of scientific practices, and how scientific knowledge is developed. This is because IMs can serve as a major influence on how science should be taught by teachers. IMs should help to produce instruction that actively engages students in the learning process and encourages the inclusion of hands-on engagement with daily occurrences laying emphasis on student responsibility since these are more likely to increase conceptual understanding; hence, a good IM should fulfil these.

2.2 Environmental Condition in Mining Communities

According to Weber-Fahr (2002) surface mining though less dangerous than underground mining, has a greater impact on surface landscapes. Surface mining requires the removal of massive amounts of top soil in order to gain access to the minerals, which can cause erosion, loss of habitat, and dust pollution. It can cause heavy metals to dissolve and seep into both ground and surface water thereby destroying marine habitats and pollute drinking water sources. Vast agricultural lands are destroyed through surface mining which consequently affects food production in the country, and the sources of income for the people affected (Weber-Fahr, 2002).

Pavloudakis and Roumpos (2004) note that the most dramatic change which occurs during surface mining is the disturbance and associated change in land configuration and

vegetation. According to Mensah (1998) abandoned or orphaned mines are a source of serious concern as they continue to cause pollution and damage the environment. Additionally mining operations can lead to health risks that may be caused by water pollution or dust, noise, and the chemicals used to extract minerals from the soil. Weber-Fahr (2002) discusses a cross-study analysis of environmental damage as a result of mining operation in 51 mining countries across the globe put about 60% of the residents in these communities at risk.

2.3 Mining and Opportunities

The discovery, extraction and processing of mineral resources is widely regarded as one of the most environmentally and socially disruptive activities undertaken by businesses (Peck &Sinding, 2003). Indeed, as Warhurst (2001) notes, many of the environmental disasters or human rights incidents that have contributed to growing public concern about the activities of mining companies over the last 40 years have taken place in the extractive industries. The mining sector, therefore, is a key topic in debates about social and environmental responsibility (Cowell et al., 1999). However despite the disadvantages associated with mining there are others who believe it presents a lot of benefits for communities where such mining takes place and the country at large.

2.4 Learning through Direct Experience

Learning through direct experience, according to Agudzeamegah (2014), is a process that engages students in direct and active interactions with objects or phenomena in their immediate environment. This is usually done by the use of one or more of the five senses (sight, touch, hearing, smell, and taste). Learning through direct experience is crucial to successful learning across all phases of life, from infancy through senior adult years.

Learners thrive in learning environments or in classrooms that offer practical and hands-on experience. Learning from direct experiences is important to allow students to witness, observe and describe concepts based on their own interactions and first-hand knowledge of a shared experience with others in the community (Gabrielson & Hsi, 2012). Direct experience is necessary to gain understanding, create, change or refine a mental representation when students have little or misconstrued knowledge of a certain topic (Agudzeamegah, 2014).

Learning through direct experience is also referred to as experiential learning. Experiential learning shifts from textbooks as the fundamental or exclusive storehouse of knowledge and involves a constant exchange between students' immediate experiences and their individual reflections in order to re-examine previously held ideas and influence future experiences and behaviour. It also seeks to transform experience into newly formed knowledge. McGill and Beaty (1995) as cited in Dunn (2002:2) state that Kolb proposed a four-stage learning process with a model that is often referred to as experiential learning.

Experiential learning theory is a holistic viewpoint that combines experience, perception, cognition and behaviour (Vygotsky, 2013). Kolb believed that "learning is a process whereby knowledge is created through the transformation of experience" (Kolb, 1984:38). As explained by Vygotsky, 2013 the four-stage learning cycle shows how experience is translated through reflection into concepts, which in turn are used as guides for active experimentation and the choice of new experiences. The cycle has the following stages:

i. First stage – *Concrete Experience*: this is where a learner actively experiences an activity such as fieldwork or laboratory exercise.

ii. Second stage – *Reflective Observation*: this is when a learner consciously reflects on the experience. Third stage – *Abstract Conceptualization*: this is where the leaner attempts to mentally formulate a model or theory based on what is observed. Fourth Stage – *Active Experimentation*: this is where the learner attempts to plan how to test a theory or plans for a forthcoming experience.

The learning process can begin at any of the stages though one must flow into the other as it is continuous. That is, there is no limit to the number of cycles that can be made in a learning situation. This theory asserts that without reflection we would simply continue to repeat our mistakes (Dunn, 2002). Fig. 1 shows a diagram of the cycle.

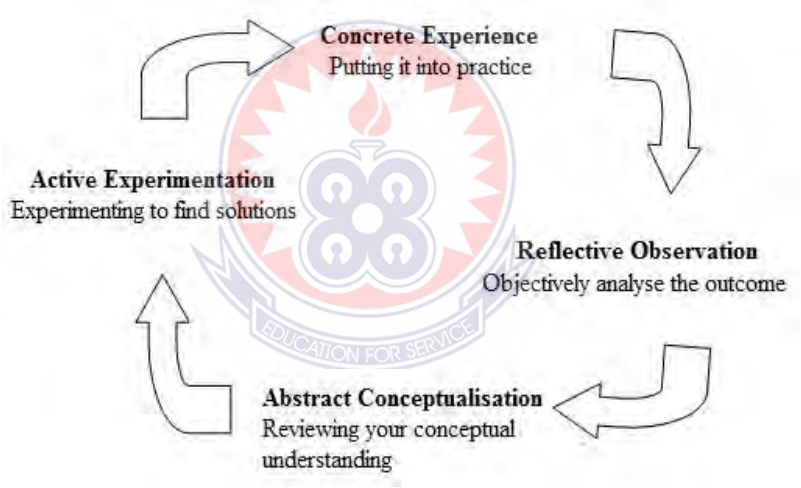

Figure 1: Kolb‟s Cycle of Experiential Learning

Source: www.naturalcuriosity.com

In totality, learning through direct experience supports learning through the senses of touch, sight, hearing, smell and taste. It promotes better understanding, retention and recollection of information. Learning can be administered better in an environment where learners can interact with real objects, explore their potentials and deduce facts about them without necessarily being told, and draw objective conclusions about what

they learn so that they understand issues better. This will ensure that lessons learnt are retained in the brain hence the impact on learners will last longer.

In line with this, Opoku Asare (2000) discusses the significance of learning through physical objects and situations. He cites studies of various philosophers of early times such as Rousseau, Herbart, Pestalozzi, Froebel and Comenius whose specialty with child education emphasized how important it is for children to learn through their senses to make a topic under discussion more understandable.

The implication is that pupils will retain in their minds what they see better than what they only hear this will result in better learning outcomes. This confirms Edgar Dale's theory of the Cone of Experience

Poth, (2013) which explains in percentage wise what extent a learner learns by the five senses or with a combination of activities. Figure 2 is a diagram of the Cone of experience.

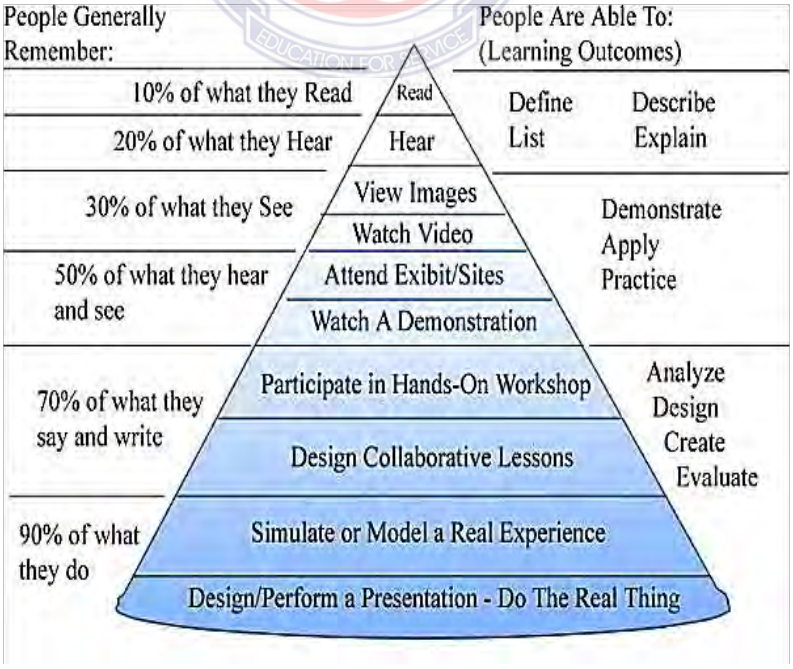

Figure 2: Dale's Cone of Experience

Source: teacherworld.com

Reading from the bottom up, Fig. 2 shows that 90% of what students learn is remembered when they imitate a real experience while 70% of what they learn is retained when they participate in the activity. As the senses of sight and hearing are utilized through actions such as watching a demonstration in class and attending educational trips or exhibitions, 50% of what learners see and hear is retained. But making use of the senses by themselves individually such as sight, hearing or reading yield very low results and so students learn 30%, 20% and 10% respectively. This indicates how important it is for children to be involved in demonstrative and hands-on activities in the classroom in order to achieve maximum learning outcomes and retention of what is. To this effect, Anang (2011) states that the teaching of Science is made more effective when there is the use of real objects, role play and improvisation or illustrations.

2.5 Active Learning

Active learning is a process whereby students engage in activities, such as reading, writing, discussion, or problem solving that promote analysis, synthesis, and evaluation of class content (Centre for Research on Learning and Teaching, 2013). Adler (1982) as cited in Bonwell (2000), states that all genuine learning is active, not passive. It is a process of discovery in which the core agent is the learner, not the teacher. Learners learn what they care about and remember what they understand. Learning is not an observer activity; students do not learn much just by sitting in class listening to teachers, memorizing pre-packaged assignments and spitting out answers. Students must talk about what they are learning, write about it, relate it to past experiences and apply it to their daily lives. Learners must also make what they learn part of themselves (Ericksen, 1982; Chickering & Gamson, 1987 as cited in Bonwell, 2000). Yeboah (2008) adds that students and their learning needs are at the centre of active learning.

There are several teaching strategies that can be employed to actively engage students in the learning process, which includes group discussions, problem solving, case studies, role plays, journal writing and structured learning groups. The benefits of using such activities include improved critical thinking skills, improved retention and transfer of new information, increased motivation and enhanced interpersonal skills. Using active learning does not mean the abandonment of lecture format, but it does take class time.

Lecturers or tutors who use active learning pause frequently during the period to give students a few minutes to work with the information they have been provided. For some lecture-based classes, using active learning may be a bit more challenging because of class size or room limitations such as fixed seating; therefore, breaking students into groups under these circumstances may not be possible, but other strategies such as individual writing or paired activities are quite possible and this leads to good results (Vygotsky, 2013).

Bonwell (2000) summarizes active learning as involving learners in doing things, and thinking about the things they are doing. This suggests that in active learning, learners are involved more than in passive listening. That is, they are engaged in activities such as reading, discussing, writing and others placing greater emphasis on developing student skills and less emphasis on transmission of information. The exploration of attitudes and values is stressed and learner motivation is increased especially for adult learners. There is usually immediate feedback from instructors and so learners are involved more in analysis, synthesis and evaluation.

2.5.1 Challenges in Education

Wagner and Benavente-McEnery (2006) opine that Science Education is often under attack from many quarters today. Many lament its cost ineffectiveness in light of standardized tests while post-modernists critique the idea there are ever any truths to seek. Others also claim that science education leaves students with little sense of what science is really all about. The idea that science is an academic adventure, full of excitement, mystery and tentativeness is seemingly lost. Teaching and Learning Research Programme (2006) states that there is general concern about the outcomes of Science education at school. In the United Kingdom for example, representatives of industry say that more high-grade scientists, technicians and engineers are needed if the country is to compete successfully in technology-intensive worldwide markets. Less young people study Science in school once it is no longer compulsory. This results in fewer applications for Science degrees. Additionally the number of young people pursuing non-graduate occupations involving Science or technology is significantly reduced, leading to skills shortage in many sectors.

The problem is even worse when looked at from a gender perspective, that is, girls are less interested in Science education than boys; hence, women choose fewer academic studies in Math, Science and Technology (MST). In fact, at the European level, girls account only for 31% of MST graduates (Rocard et al., 2007). Rocard et al. (2007) state that the reasons why young people do not develop interest for Science are complex, however, there is firm evidence that indicates a connection between attitudes towards Science and the way Science is taught. A recent report issued by the Organisation for Economic Co-operation and Development (OECD, 2006) on Evolution of Student Interest in Science and Technology Studies identified some causes as:

- The discomforting circumstances of some primary school teachers that are asked to teach subjects in which they lack enough self-confidence and knowledge.
- The traditional chalk and talk methods with which teachers are more comfortable are often chosen and avoid inquiry-based methods that necessitate them to have deeper integrated Science understanding. The focus therefore becomes memorizing rather than on understanding;
- Furthermore, burdensome workloads that leave little time for meaningful experiments are reported.

Another report "Europe Needs More Scientists" adds that science subjects are often taught in a much too abstract way. It explains that "It is abstract because it is trying to put forward fundamental ideas, most of which were developed in the 19th century, without sufficient experimental, observational and interpretational background and without showing sufficient understanding of their implications" (Rocard et al., 2007:8).

2.6 Challenges in Education in Ghana

Science is poorly taught in schools, with many schools lacking well-equipped laboratories and workshops. Results for public examination demonstrate poor performance in mathematics and science with pass rates of 59% and 51% respectively in the 2000 Senior Secondary Schools Certificate Examination (MoE, 2003). An interview with Professor Allotey as cited in Ameyaw-Akumfi (2004) also revealed that, results for 2002 SSSCE indicated that over 40% students failed core mathematics, elective mathematics and physics and over 60% failed to get Grade D in all the pure science subjects. The situation becomes even more alarming when students with grade E are grouped with those who scored F since universities in Ghana do not accept grade E.

Ghana cannot build a strong science and technology base with poor performance of students.

According to Ameyaw-Akumfi (2004), science education has not achieved its primary purpose of improving the social, cultural and economic conditions of the country. But Ghana's participation in the global knowledge system depends on the development of a strong science and technology knowledge base which is currently the currency for economic and social transformation of nations. Ameyaw-Akumfi continues to point out the many factors which have contributed to poor performance of students in science and its related subjects. The government of Ghana estimated in 2003 that less than 15% of Ghanaians from the ages of fifteen years and above were scientifically literate. Ameyaw-Akumfi cites the following factors as responsible for this state:

- Inadequate resource allocation to science and mathematics teaching and learning at all levels of education, leading to poorly equipped laboratories and workshops.
- Inadequate government commitment to the development of science and technology.
- Poorly-developed science and technology innovation system resulting in the lack of interaction among the different agencies connected with science and technology.
- Use of uncreative and outmoded methods of teaching and learning in the schools e.g. chalk and talk approach, textbook dependent, examination-oriented teaching learning by rote memorization (chew-pour-pass-forget), lack of science practical in most schools and even where they are done they are designed in cook book manner to confirm known answers.

- Non-utilization of community resources in science teaching and learning and de-contextualised curricula.
- Inadequate number of teachers of mathematics, technology and science
- Unmotivated teachers.
- Most primary and junior secondary school teachers are ill-prepared to teach science and mathematics.
- Post graduate research in science, technology and mathematics which should form the basis for developing the capacity for innovation and change is very low.

Also studies by Anamuah-Mensah and Asabere-Ameyaw (n.d) in basic schools in Ghana, on trends in international mathematics and science studies show that:

- The overall performance of Ghanaian students in science tests are very low; the overall average score of 255 placed Ghana at 45th position, while the international average is 474.
- The average percentage correct on all science test items for each participating Ghanaian student was 19%.
- There was a very large variation in science abilities among the students with some scoring as low as 52 and others scoring as high as 450.
- Pupils' weakest content area was in physics.
- Students performed well at the factual knowledge level but not the conceptual understanding and reasoning and analysis levels.

The studies highlighted the following weaknesses in the way Science and Mathematics were taught in basic schools in Ghana:

- There was no provision made in the curricula for teaching children with different abilities.

- Students were taught by teachers who were not specialists in Science or Maths.
- Teaching was dominated by demonstration and lecture.
- Students spent considerable time on homework but the nature of home-work did not seem to improve their achievement.

With reference to pre-service teacher preparation, the following weaknesses were identified to affect Science and Mathematics education in Ghana. These are low emphasis given to subject matter content during pre-service, disconnection between theory and practical application while the teaching of science and mathematics at the primary level is conducted in English which is not the mother tongue of students.

Moreover, most teachers of science in basic schools do not have the qualification to teach science as most of them come from a background in humanities. As a result, they are ill-prepared to answer the progressively more complex questions about science that pupils may ask. The inability of some teachers to answer pupils' questions with confidence and zeal then kills the children's confidence, enthusiasm and spirit of enquiry can be lost (Gluckman, 2011).

Ameyaw-Akumfi therefore suggests that qualified teachers and quality teaching are the most important determinant of a good science education. The success of Ghanaian students in science education and the progress of the nation will depend on quality science teaching which will ensure the development of the innate capacities of all students. Quality teaching builds a strong foundation in basic science and leads also to the acquisition of better research skills. The country needs to attract, train and retain a new breed of teachers with skills required in nurturing scientific inquiry and understanding and developing innovative capacity in the youth. Such teachers must be knowledgeable, enthusiastic, dedicated, creative, and assess their performance as well as

their students' performance and must be ready to utilize locally available resources and new technologies in their work.

To sum up, the foundation for the learning of science is laid down in basic schools; therefore science must be given greater emphasis at the basic school level. Teachers in basic schools should be given effective training and support to enable them to provide exciting and fulfilling teaching and learning of science experiences to pupils to strengthen the teaching and learning of science in basic schools. A select group of science specialist teachers can be created to provide support, mentor and guide other basic school science teachers in schools. Teacher education programmes should allow opportunities for primary teacher trainees to specialize in science. Basic school teachers with weak skills in science should be given support to upgrade their knowledge and skills. It is therefore imperative that every basic school has access to resources and experts who assist teachers to provide the best science education to pupils (Ameyaw-Akumfi, 2004; Gluckman, 2011).

Children in basic schools are fascinated with the world around them. They have a spirit of enquiry and an eagerness for life that needs to be encouraged by teachers of science. Therefore, teachers and all stakeholders involved should seek and work hard to encourage and sustain that scientific curiosity, understanding, critical thinking and enthusiasm in children.

CHAPTER THREE

METHODOLOGY

3.1 Research Design

The qualitative research design was adopted for this study. Qualitative research is "a holistic approach that involves discovery" (Williams, 2007:3). According to Denzin and Lincoln (2000) as cited in Ospina (2003:3), qualitative research involves an interpretive and naturalistic approach that allows "qualitative researchers study things in their natural settings, attempting to make sense of or to interpret phenomena in terms of the meanings people bring to them." Qualitative research as one of the main research paradigms is concerned with the opinions, feelings and experiences of individuals which are used to produce subjective data. It describes social phenomena as they occur naturally and attempts not to manipulate situations under study; situations are interpreted and described from participants' viewpoint (Hancock, 2002). According to Leedy (2002:133), a researcher "cannot afford to skim across the surface" of a problem being researched into since he must get to the bottom of issues and investigate to have a complete understanding of the phenomenon being studied; qualitative research method provides such an opportunity. Rubin and Babbie (2001) also state that qualitative research has the ability to provide comprehensive viewpoint that result in a deeper understanding of the topic under study.

Some advantages of qualitative research, according to Hancock (2002), are that it describes social phenomena as they occur naturally. This means qualitative research offers a unique and rich approach to understanding the what, how and why of events in relation to a particular setting. Osuala (2005) also postulates that qualitative research method enables the researcher to gain new insights, develop new concepts and discover problems that exist within the phenomenon.

However, some weaknesses associated with qualitative research are that data is collected through direct encounters such as interviews or observations and so it is time consuming; and large samples cannot be worked with due to the intensive and time consuming nature of data collection.

3.1.1 Reasons for Adopting Qualitative Research

Since this study does not concern itself with statistical procedures of investigation, it was appropriate to adopt the qualitative research approach because it provides the opportunity for researchers to study in-depth how environmental conditions affect electrical circuits. Qualitative data gathered will be analysed to uncover and to understand the extent to which electrical circuits are affected by the environment.

3.2 Research Methods

The researcher will employ the Descriptive and Experimental research approaches of qualitative research and make use of observation and unstructured interviews as instruments for data collection. The descriptive research approach offers researchers the opportunity to obtain information concerning the phenomena to describe what exists with respect to variables or conditions in a situation (Key, 1997). Descriptive research is also defined by Shuttleworth (2008) as a scientific method which involves observing and describing the behaviour of a subject without influencing it in any way. The descriptive research method will give the researcher the opportunity to give a detailed account of current situation at the area of study.

Additionally, the experimental research method will also be used for data collection for the study. Experimental research is the systematic and scientific approach to research in which the researcher influences one or more variables, and controls and measures any

change in other variables (Blakstad, 2008). Also Key (1997) explains that it is an attempt by a researcher to maintain control over all factors that may affect the result of an experiment; in doing this, the researcher attempts to determine or predict what may occur.

3.3 Population

Anhwere (2013) defines a population as the entire aggregation of study groups that satisfy a designated set of criteria. This implies that whatever the basic unit, the population always involves the total aggregation of elements in which the researcher is interested. The population for the study will be two head teachers, 5 physics teachers and 60 pupils in the study setting.

3.3.1 Target Population

A target population for a study, according to Hayes (2011), is the entire population in which the researcher is interested. Since the whole population was clearly unreachable, a section of the population was chosen for the study. Therefore, the target population for the study will be made up of two head teachers, 6 teachers and 50 pupils.

3.3.2 Accessible Population

Hayes (2011) states that accessible population is the population of subjects available for a particular study; usually a non-random selection from the target population and it is from the accessible population that researchers draw their samples. The accessible population for the study will include one head teacher, 2 teachers and 35 trainees who were available and willing to participate in the research.

3.3.3 Sample and Sampling

Sampling, according to Osuala (2005), is taking a portion of the population as a representation of the total population. Sampling can also be described as depending on a cross-section of a target population to perform an experiment or an observational study. This is because it is usually not possible to study an entire population. Ruane (2005) therefore explains that samples offer a practical solution to the daunting task of studying entire populations. Samples are used to "stand in" for a larger population. In this sense, samples can be very efficient devices which allow researchers to look at the "few" in order to know about the many.

3.3.4 Sampling Design

The sampling design that will be adopted for the study affects the extent to which the results can be generalized. In this study the convenience and purposive sampling techniques will be employed. According to Lucas (2012), in convenience sampling members of the population are chosen based on their relative ease of access; and Hayes (2011) adds that selection is based on the most readily available persons as subjects in a study. Convenience sampling will be used in selecting primary basic school for the study. Proximity of the school to the researcher was taken into consideration. It saved the researcher time in the collection of data.

Oliver (2006) explains that purposive sampling is a form of non-probability sampling in which decisions concerning the individuals to be included in the sample are taken by the researcher based upon a variety of criteria which may include specialist knowledge of the research issue, or capacity and willingness to participate in the research. The purposive sampling technique will be used to select teachers, head teachers and pupils because they possess knowledge and information needed for the study.

3.4 Data Collection Instruments

In accordance with the research approach, the study adopted interview and observation as means of collecting data for the study.

3.4.1 Observation as a Tool for Gathering Data

Observation involves descriptions of activities, behaviours, actions, dialogue, interpersonal interactions, organisation or community processes or any other aspect of observable human experience. The data gathered from observations consist of detailed descriptions of the environment within which the observation was made (Lemanski & Overton, 2011). According to Asare-Forjour (2009), direct observation of behaviour is an essential means of evaluating the work of schools and teachers. In the field of education, observation comes in handy to critically determine a teacher's teaching skills and assessment of practical skills. It aids researchers to answer specific research questions and to document observations (Ruane, 2005).

A total of 30 questions were used for the two observation checklists to be used for the research. The designed checklists were vetted with the help of colleagues for the necessary corrections to be effected and then it was submitted to the research supervisor for approval. The observation checklists were piloted to ensure that they were error – free and would be appropriate for the data collection.

3.4.2 Interviews as a Tool for Gathering Data

Interviews refer to personal exchange of information between an interviewer and an interviewee. Good interviews seek to make the dialogue comfortable, and conversational (Ruane, 2005). According to Lemanski and Overton (2011) interviews consist of open-ended questions and probes which produce in-depth response about people's

experiences, perceptions, opinions, feelings and knowledge. Data includes word for word quotations and enough content to be interpretable. Ruane (2005) adds that of all the data collection instruments available in search for information the interview strikes many as the single best device for promoting understanding and getting at the truth. Interviews may be structured, semi-structured or unstructured.

Unstructured interviews will be used to seek answers to specific questions from heads of schools and teachers adopting the face-to-face approach. A conversational approach to interviewing was adopted by the researcher to ensure that teachers were comfortable in participating and willing to share information freely as explained by Hancock (2002). He states that qualitative interviews should be fairly informal. An interview guide will, however, be used to streamline the various discussions.

3.5 Types of Data

The two types of data needed for this research will be primary and secondary data. Primary data that to be collected will include field notes from observing classroom and interviews with teachers and school heads. Secondary data will be gathered from books, journals, online documents, published and unpublished thesis, school records and other documents.

3.6 Data Collection Process

A letter from the Department will be presented to the head teachers and teachers of the school explaining the purpose of the research. Approval from the head teachers and teachers will enable the researcher to commence with observation sessions in the school. The researcher will then visit the school on the approved dates and times for the

scheduled observations. Results of the observation and interviews carried out will be presented in Chapter Four.

CHAPTER FOUR

PRESENTATION AND ANALYSIS OF DATA

This chapter presents an analysis of the data collected from respondents, who were either staff or students in the chosen basic school. The outcome of the research was based on both the quantitative and qualitative approaches of investigations used. As mentioned in Chapter Three, the sample size of the study respondents was 38. The first section of the analysis will contain the analysis of the socio-demographic characteristics and background information of the respondents. This is then followed by the main objectives of the survey. Finally, the last section discusses the summary of all the views of the respondents on instructional guide to demonstrate the effects of the environment on electrical circuit in the mining industry. The second section of the analysis will discuss the response of participants in the study.

4.1 Socio-Demographic Characteristics of the Respondents

This section begins with the presentation and analysis of data on the gender distribution of the respondents. A total of 38 trainees and teaching staff took part in the questionnaire survey with the mean age being 38.2±3.6 years with the minimum and maximum ages ranging from below 30 and 44 years respectively. A significant higher proportion of the the respondents were male. Thus 32 out of the 35 trainees were male while 3 out of the total trainee respondents were female. The next variable to be discussed is the age distribution of the respondents. This is shown on Table 4.1.

Table 1: Age Distribution of Respondents

Age in Years	Frequency	Percent
Below 30	2	5.7
Between 30 and 34 years	13	37.1
Between 35 and 39 years	14	40.0
Between 40 and 44 years	6	17.1
Total	**35**	**100.0**

Source: Field Work, June 2016

With regards to the age distribution of respondents, as shown in Table 1, most of the respondents were between 35 and 39 years. This is the typical age distribution expected of working class in Ghana. The data also shows that 13 (37.1%) of the total respondents were aged between 30 and 34 years. This distribution indicates that a lot of youths are employed in the mining sector.

4.2 Study Area (Damperyaw Mining Community)

The Damperyaw Mining Community is located in the central part of Ashanti Region of Ghana with a total land area of approximately 425 km^2. It used to be among one of the smallest districts in the Ashanti Region until 2004. The community is located at 55km from Kumasi.

The municipality lies in the west semi-equatorial zone characterized by double rainfall maxima occurring in June and October; the first rainy season from May to June and the second from September to October. The mean annual rainfall is between 125mm and 175mm. The dry seasons are really distinct with the main season commencing in

November and ending in late February. Temperature is found to be fairly uniform ranging between 26ºC in August and 30ºC in March. Relative humidity is generally high throughout the year, ranging between 70% -80% in the dry season and 75% -80% in the wet season (Ansa-Asare and Asante, 2005).

4.2.1 Sex Distributions of Respondents

Figure 4.2 shows the sex distribution of respondents. Majority of the respondents (83.3 %) were males with the remaining 16.7 % being females. Statistical similarities were observed (p> 0.05) in relation to sex distribution of respondents in the research communities.

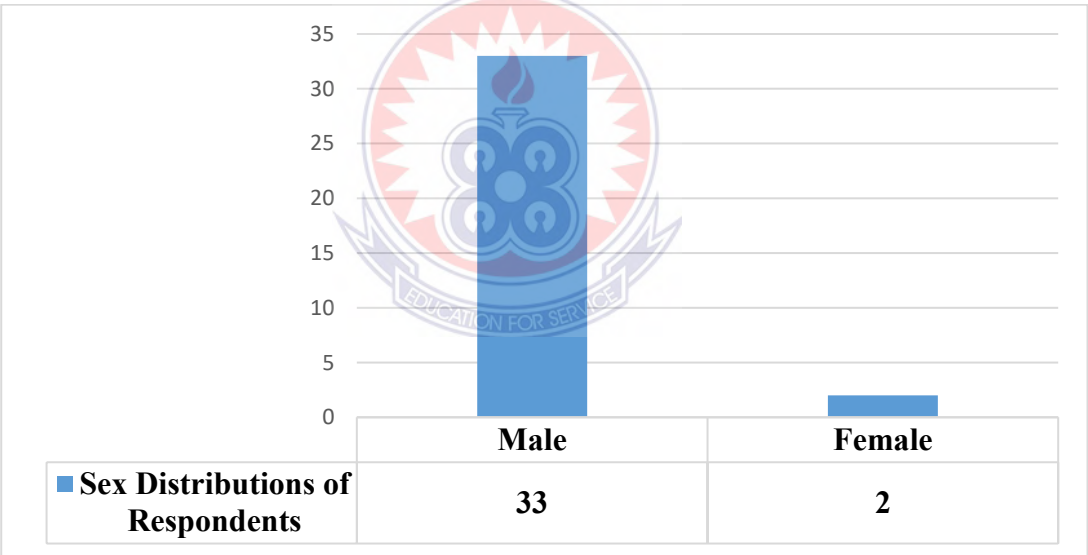

Figure 3: Sex Distributions of Respondents

Source: Field Work, June 2016

The next section discusses the category of teaching staff distribution of the respondents. To conduct fair discussions, the staffs were grouped in two levels that is the staff and the management staff.

4.2.2 Age Distribution of Staff

The age distribution of the staff respondents also comprised a dominant number of 2 (representing 67%) youths between 31 and 40 years and only 1 stuff member was 51years and/or above (representing 33%), shown in Figure 3. Figure 4 shows the distribution of staff distribution according to their age.

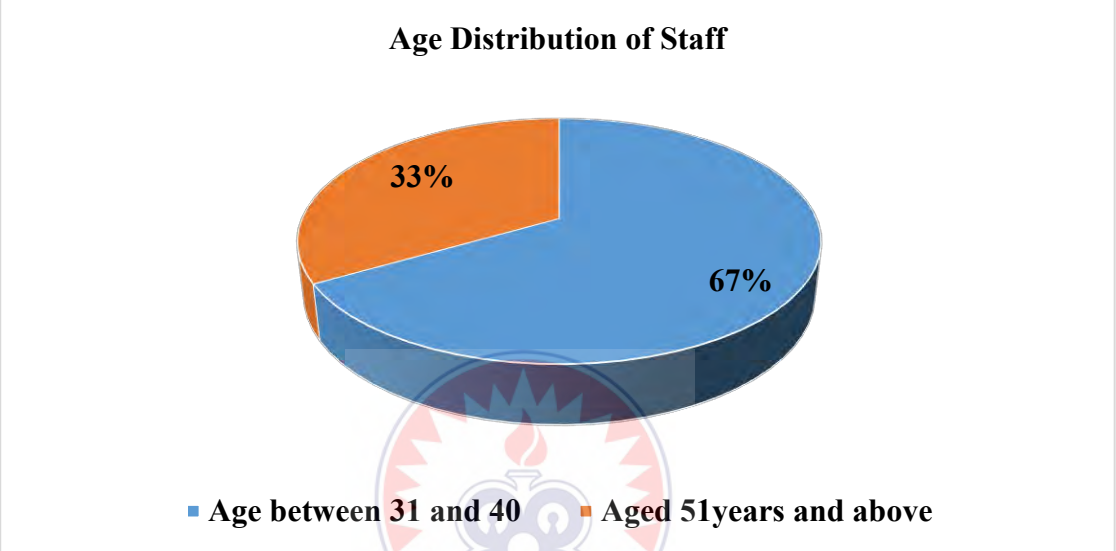

Figure 4: Shows the Distribution of Staff Distribution According to their Age

Source: Field Work, June 2016

This age distribution in Figure 4.1 shows the presence of relatively young people below 50 years and who still have many years of active service ahead of them before retirement. However the level of experience and competence of these younger staff and how they matter in the scheme of work and decision making is another researchable area that could be looked into.

As presented in Tables 4.1 and Figure 4.1, the respondents who took part in the survey are qualified to give their opinion. This was evident from the fact that 85% of the

respondents from the community had lived in the community for over five years and 77% of the organisational respondents have over two years knowledge of the process.

4.3 Operational Activities of Damperyaw Mining Community

The principal occupation of a majority of the respondents (70 %), as shown in Figure 5, is farming. Their second most important occupation is small scale mining which constitutes 20 %. Only 3.3 % of the respondents were engaged in trading while 6.7% of them were engaged in other occupations such as livestock rearing.

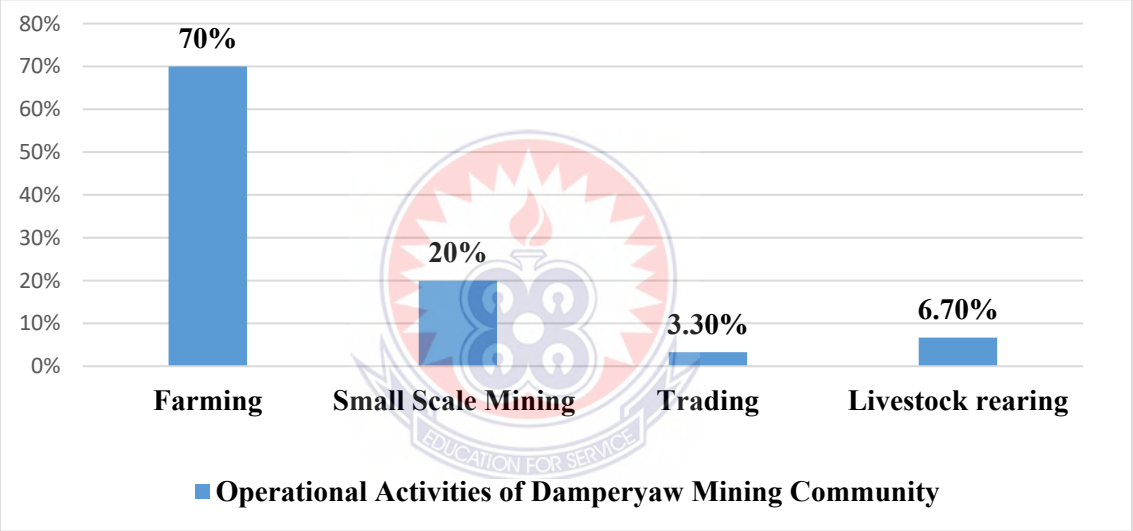

Figure 5: Operational Activities of Damperyaw Mining Community

Source: Field Work, June 2016

4.4 Mining Methods at Damperyaw Mining Centre

Respondents' were interviewed about the methods of mining used by minng organizations in their communities. Almost all of them listed underground and surface mining as the mining methods used by these organisations.

Some respondents were, however, quick to note that there were also "gallamsey" mining activities carried out in the mining area. Nonetheless Table 2 illustrates respondents' knowledge of mining methods in their communities.

Table 2: Respondents' Knowledge of Mining Methods at Damperyaw Mining Company

Mining Methods	Frequency	Percent (%)
Surface	13	37.
Underground	17	48.6
Gallamsey	5	14.2
Total	**35**	**100**

Source: Field Work, June 2016

4.5: Instructional Delivery Method at Damperyaw Mining Centre

The main focus of this section was to find out about the different methods used by instructors in mining centres to train or teach new recruits. The feedback obtained from respondents are shown in Table 3

Table 3: Instructional Method at Damperyaw Mining Centre

Method of Instruction	Frequency	Percent
Lecture Method	3	8.6
Discussion Method	2	5.7
Field Trip Method	16	45.7
Demonstration	14	40.0
Total	**35**	**100.0**

Source: Field Work, June 2016

Table 3 shows the Instructional Methods used to teach new recruits in the selected mining community. It indicates that 3 respondents who constitute 8.6% of the respondents answered the Lecture Method was used while 2 (5.7%) stated the Discussion Method. Then 16 (45.7%) said the Field Trip Method was used and 14 (40.0%) agreed to the use of the Demonstration Method. Respondents were however in favour of the Field Trip Method as they argued that this method helped them to understand concepts faster than the other methods. This affirms Mensah's (1998) assertion that the best way to teach people is through the practical aspect of the subject.

4.6 Availability of Instructional Guides for teaching simple electrical circuits at Damperyaw Mining Centre

In order to ascertain the use of instructional guides for teaching electrical circuits at the selected mining centres, the question was posed to respondents. Their response to the question can be found in Table 4.

Table 4: Instructional guide for the teaching and learning of electrical circuits

Availability of Instructional guides	Frequency	Percent
Yes	15	42.9
No	20	57.1
Total	**35**	**100.0**

Source: Field Work, June 2016

An analysis of Table shows that 57.1% of the respondents responded in the negative while 42.9% responded in the affirmative. A larger percentage of the training centres do not have instructional guides to guide their teaching of electrical circuits to new recruits. Those respondents who had instructional guides get their information from text books on electricity, notes books produced by instructors, syllabus, picture charts, and sheet of papers with electrical circuits.

4.7 Environmental conditions in Damperyaw Mining Community as Reported by Respondents

From the survey, majority of the respondents of the total sample population admit that mining contributes to some environmental conditions. They mention dust, high temperature and humidity as the conditions that exist in mining communities.

4.7.1 Dust Conditions in Damperyaw Mining Community

Air pollution is associated with surface mining. Through surface mining particulate matter such as chemicals with unpleasant smell, dust and smoke are released into the atmosphere which adversely affects residents. The respondents were hence concerned with the consequences of such pollution on them. Furthermore, they complained about the emission of dust particles into the atmosphere during periods of blasting, clearing of vegetation and loading and haulage of other materials by heavy trucks. Respondents noted that dust does not only reduce visibility but also causes cardiovascular diseases in residents.

Their concerns were confirmed by field observation. It was discovered that pollution increased or decreased depending on one's proximity to the mining sites.

4.7.1.1 Effects of Dust on Electrical Circuits

Dust by itself can be conductive, causing "tracking" and even arcing between components on electrical circuits as well as causing overheating because heavy accumulation of dust can act as an insulating "blanket".

According to Tencer & Moss, (2002) dust, when combined with humidity and other vapours in the air, can lead to even worse "tracking" and arcing between components on simple electric circuit. Depending on the voltages involved and the circuitry, this can lead to all manner of intermittent and "unexplained" phenomena. Certain types of dust when combined with humidity can even be slightly corrosive to electrical components.

The respondents explain the effects of dust on electrical circuits in the following responses:

"Dust is very harmful. Dust bunnies, those little piles of dust you find, can actually cause arcing and can short equipment out".

"Dust and debris primarily causes damage to electrical circuits such as computer and mining circuits by interfering with fans and functioning as insulation, causing the circuit to heat up. High levels of heat ***can*** *cause early failure of components, and excessive, intense heat can cause critical components to fail unexpectedly" [sic]*

A thick layer of dust can act as an insulator and cause higher power in simple circuit chips to overheat.

The responses of the respondents are in agreement with Tencer & Moss, (2002) as they stated that "dust has effect on simple electrical circuit for several reasons":

- ✓ It can insulate the devices causing them to overheat.

- ✓ It can attract moisture causing leakage problems.
- ✓ It can be directly conductive also causing leakage problems.
- ✓ It can cause poor contact in relays, switches and connectors.
- ✓ It makes it more difficult to service the equipment.

Dust is known to be one of the major causes of this condition, and most (86%) of the respondents noted that dust generated through surface mining operations like rock blasting, ore excavation, ore haulage and ore crushing and grinding were responsible for the high incidence of dust in the Damperyaw Mining community. Dust is both a nuisance and constitutes an electrical hazard that causes arcing and carbon tracking in higher voltage apps (Down and Stocks, 1978).

4.7.2 Gas Conditions and its Effect on Electrical Circuits in Damperyaw Mining Community

Air is a mixture of nitrogen, oxygen, carbon dioxide, argon, and trace gases. As a result of the activities in the mining centre, a lot of gases are produced. During an interview with the safety manager of the Damperyaw mining company, he notes when dust and water (vapour) are added they form or become gas.

Hence this section focused on finding out the sources of gas in the atmosphere of the mining community. The findings are shown in Figure 6.

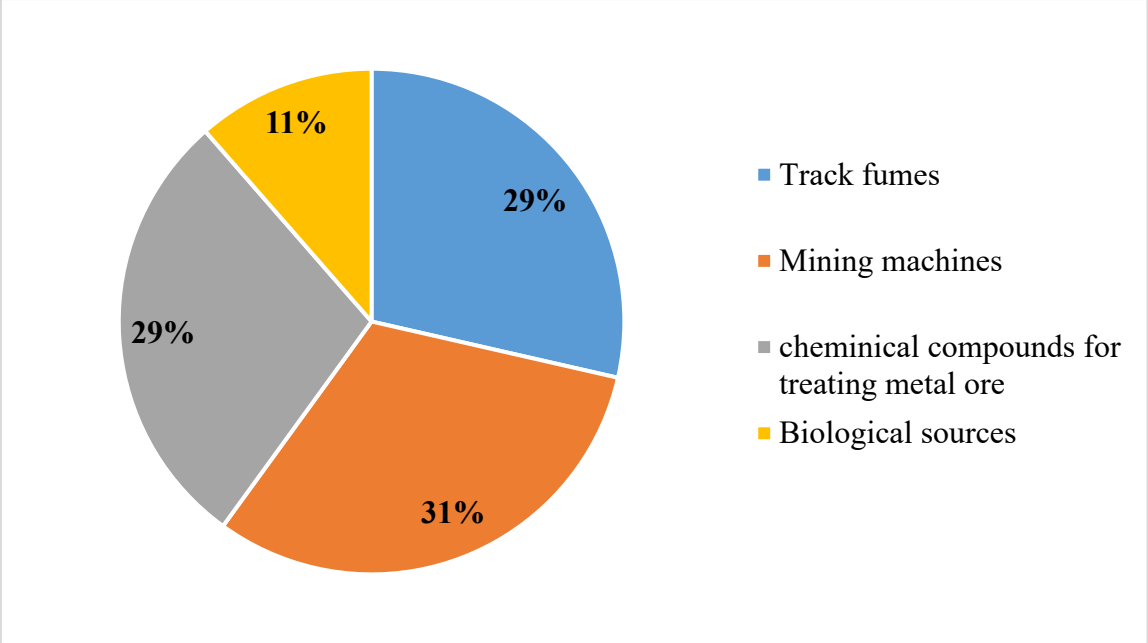

Figure 6: Sources of Gases in the Environment

Source: Field Work, June 2016

From Figure 6, it is clear that in the process of gold extraction certain poisonous gases emitted into the environment during different stages of the extraction. Examples of these poisonous gases are sulphide, carbon, arsenic trioxide, cyanide and others. These are highly toxic and harmful to both human health and electrical circuits if high concentrations are released into the atmosphere.

An official at the Treatment Plant of the Company noted that

There are periods of air pollution as concentration of these chemicals in the air sometimes becomes high, resulting in gas fuse and others. In addition, there are events of exposures to the chemicals such as cyanide, harmful materials and others by both workers and people close to the surrounding communities. [sic]

He added that these gases sometimes affect the functionality of electrical components at their plant. These include cuts in electrical power, loss of circuits which affects the

operations of the mine. The interior and exterior parts of computers are filled with dust which can cause electrical shorts.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

This chapter provides a summary of the study; conclusions arrived at based on the findings, and gives recommendations that are aimed at addressing the problems identified in the study.

5.1 Summary of Findings

The rationale behind this study was to develop and instructional guide to demonstrate the effects of the environmental conditions on electrical circuit in the mining industry. The descriptive survey design was used to collect, analyse and describe the data of the survey. Questionnaires developed by the researcher were used to obtain data after which they were analysed using the Statistical Products for Service Solutions (SPSS) programme.

The information obtained indicates that majority of the respondents were engaged in farming as their main occupation, with the second occupation being small scale mining and whereas only 3.3 % were engaged in trading. Other members of the Damperyaw mining community were engaged in other occupations such as livestock rearing.

Also 16 (45.7%) of the respondents stated that the Damperyaw Mining Training Centre uses the field trip method as an instruction method. Respondents argued that they best understood what was taught during the use of the field trip method of teaching.

The information obtained also indicates that majority of the respondents admit that mining negatively affects the environment. Mining pollutes the environment with dust and chemicals.

Dust by itself can be conductive, causing "tracking" and even arcing between components on electrical circuit as well as causing overheating since heavy accumulations can act as an insulating "blanket".

Finally, mining produces highly toxic gases that are both harmful to humans and electrical circuits when releases into the environment in high amounts.

5.2 Conclusions

In conclusion the Damperyaw mining community has dust, chemicals and gas in its environment as a result of the activities of surface and deep mining.

It is concluded that mining activities negatively affect the functioning of electrical circuits in this community.

It could also be concluded that mining activities in the area have polluted the quality of water in this community considering the high levels of True colour, Total 78 Suspended Solids, Iron, Arsenic and Mercury which exceed the EPA and WHO levels.

The research was not carried out without certain constraints. Among the constraints encountered were financial constraints due to lack of funding, problems with data collection (including respondents' bias and reluctance to answer questions) and lack of co-operation from some institutions. Another major constraint was the inadequate time allotted for the completion and submission of this work.

5.3 Recommendations

From the results of this study, it is recommended that;

1. The management of the Damperyaw mining centre should provide adequate instructional and technical resources for teaching and learning of simple electrical circuits in the mining industry to enable trainees undergo thorough and effective learning.
2. Due to the effects of environmental conditions on electrical circuits, it is recommended that appropriate technologies should be used to check the effects of these conditions on electrical flow and efficiency.
3. Traditional authorities should be transparent and desist from permitting illegal miners to operate in their communities. Chiefs and elders of all the communities in the municipality however need to be sensitised on the consequences of illegal mining.
4. Formalizations of small scale mining and other types of resource exploitation would also go a long way to reduce environmental impacts; clean technologies will significantly reduce impacts on
5. Mining companies, Government, Minerals Commission, Water Resources Commission, Ghana Water Company Limited and the District Assemblies should adopt method or technology that removes high levels of toxic chemicals from the water bodies in the study area.

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APPENDIX A

INTERVIEW GUIDE FOR TEACHERS AND SCHOOL HEAD ON INSTRUCTIONAL GUIDE TO DEMONSTRATE THE EFFECTS OF THE ENVIRONMENT ON ELECTRICAL CIRCUIT IN THE MINING INDUSTRY IN ASHANTI REGION

1. Name of School: ……...
2. Category of School: (a) Government [ ] (b) Private [ ]

School Head and Teacher's Background Information

3. **Gender:** (a) Male [ ] (b) Female [ ]
4. **Age:** (a) Below 30 [ ] (b) Between 30 and 34 years [ ] (c) Between 35 and 39 years [ ] (c) Between 40 and 44 years [ ] (d) Between 45 and 49 years [ ] (e) Between 50 and 54 years [ ] (f) Above 54 years [ ]
5. **Qualification:** (a) GCE "O" Levels [ ] (b) GCE "A" Levels [ ] (c) Higher National Diploma (HND) [ ] (d) Diploma in Basic Education (DBE) [ ] (f) Bachelor / Post-Graduate Degree [ ] If others, please specify. …….....
6. **Years of experience:** (a) Between 1 and 5years [ ] (b) Between 6 and 10years [ ] (c) Between 11 and 15years [ ] (d) 16years and above [ ]

Objective 1: To Find out and describe Existing Instructional Guides Used for Teaching and Learning of Electricity at Dampayaw Mining training Centre.

7. In teaching electrical circuits, which teaching methods do you use? (a) Lecture Method [ ] (b) Discussion Method [ ] (c) Field trip Method [ ] (d) Demonstration [ ] If others, please specify ……..……..
8. Do you know of any Instructional guide for the teaching and learning of electrical circuits? (a) Yes [ ] (b) No [ ]

9. What are the available instructional guides for teaching and learning of electricity in your school? ……
10. Who provides the guide for your classroom for teaching at the centre? .....
11. Are the needed Guides available for use in the classroom? a) Yes b) No
12. What are the environmental conditions in your classrooms?.....

    ……

    ……..……
13. Is the classroom temperature in your classroom too high? a) Yes b) No
14. Is the classroom temperature in your classroom too low? a) Yes b) No
15. Do the rains enter your classroom anytime it rains? a) Yes b) No
16. Are your classrooms dusty? a) Yes b) No
17. Are your classrooms too moist? a) Yes b) No

Objective Two: To Determine the Effect of the Identified Environmental Conditions on Electrical Circuits.

18. How do pupils in your class respond to these environmental conditions when you are teaching? (a) Trainees participate in class [ ] (b) Trainees answer questions correctly [ ] (c) Trainees demonstrate understanding [ ] (d) Trainees pay attention [ ] (e) Trainees play in the classroom [ ] (f) Trainees sleep in the classroom [ ] Please specify if others ……..…….....……
19. What are the effects of rain or water on electrical circuits?.....

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20. What are the effects of dust on electrical circuits? .....

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21. What are the effects of moisture on electrical circuits?.....

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APPENDIX B

INTERVIEW GUIDE FOR TRAINEES ON INSTRUCTIONAL GUIDE TO DEMONSTRATE THE EFFECTS OF THE ENVIRONMENT ON ELECTRICAL CIRCUIT IN THE MINING INDUSTRY IN ASHANTI REGION

1. Name of School: ……...

School Head and Teacher's Background Information

2. **Gender:** (a) Male [ ] (b) Female [ ]
3. **Age:** (a) Below 30 [ ] (b) Between 30 and 34 years [ ] (c) Between 35 and 39 years [ ] (c) Between 40 and 44 years [ ] (d) Between 45 and 49 years [ ] (e) Between 50 and 54 years [ ] (f) Above 54 years [ ]
4. **Qualification:** (a) GCE "O" Levels [ ] (b) GCE "A" Levels [ ] (c) Higher National Diploma (HND) [ ] (d) Diploma in Basic Education (DBE) [ ] (f) Bachelor / Post-Graduate Degree [ ] If others, please specify. …….....

Objective 1: To Find out and describe Existing Instructional Guides Used for Teaching and Learning of Electricity at Dampayaw Mining training Centre.

5. In learning electrical circuits, which teaching methods do your instructor use? (a) Lecture Method [ ] (b) Discussion Method [ ] (c) Field trip Method [ ] (d) Demonstration [ ] If others, please specify ……..
6. Do you know of any Instructional guide for the teaching and learning of electrical circuits in your school? (a) Yes [ ] (b) No [ ]
7. What are the available instructional guides for teaching and learning of electricity in your school? ……
8. Who provides the guide for your classroom for teaching at the centre?

   .....

9. Are the needed Guides available for use in the classroom? a) Yes b) No
10. What are the environmental conditions in your classrooms?.....

    ……

    ……

11. Is the classroom temperature in your classroom too high? a) Yes b) No
12. Is the classroom temperature in your classroom too low? a) Yes b) No
13. Do the rains enter your classroom anytime it rains? a) Yes b) No
14. Are your classrooms dusty? a) Yes b) No
15. Are your classrooms too moist? a) Yes b) No

Objective Two: To Determine the Effect of the Identified Environmental Conditions on Electrical Circuits.

16. How do you respond to these environmental conditions when your instructor is teaching? (a) I participate in class [ ] (b) I answer questions correctly [ ] (c) I demonstrate understanding [ ] (d) I pay attention [ ] (e) I sleep in the classroom [ ] Please specify if others …….....……
17. What are the effects of rain or water on electrical circuits?

    ……

    ……..……..

18. What are the effects of dust on electrical circuits? .....

    ……

    ……

    What are the effects of moisture on electrical circuits?.....

    ……

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