THE UNITED REPUBLIC OF TANZANIA

MINISTRY OF EDUCATION, SCIENCE AND TECHNOLOGY

NATIONAL EXAMINATIONS COUNCIL OF TANZANIA

STUDENTS' ITEMS RESPONSE ANALYSIS REPORTON FORM TWO NATIONAL ASSESSMENT (FTNA) 2024

CIVIL ENGINEERING SURVEYING

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073 CIVIL ENGINEERING SURVEYING

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FOREWORD

This report presents the Students' Items Response Analysis (SIRA) on Form Two National Assessment on the subject of Civil Engineering Surveying conducted in 2024. The report aims to provide feedback to all education stakeholders on the factors that contributed to the student's performance in Civil Engineering Surveying subject.

The Form Two National Assessment (FTNA) is a formative evaluation that intends to monitor students' learning outcomes and provide feedback that teachers, students and other education stakeholders can use to improve the teaching and learning process. This analysis shows justification for the student's performance in the Civil Engineering Surveying subject. The students who attained high scores demonstrated their ability to understand the demands of the questions as well as enough knowledge, skills and competence in the subject matter. Students who scored low marks lacked adequate knowledge of the concepts tested and failed to respond according to the demands of the questions.

The report identifies students' strengths and weaknesses, which, in return, will help to improve learning before sitting for their national assessment. It will also help teachers to identify the challenging areas and act appropriately during the teaching and learning process.

The National Examinations Council of Tanzania (NECTA) expects that the feedback provided in this report will enable the education stakeholders to take proper measures to improve the teaching and learning of Civil Engineering Surveying subject. Consequently, students will be able to acquire knowledge, skills and competence indicated in the syllabus for better performance in future assessments and examinations.

The Council appreciates the contribution of all those who participated in preparing this report.

Dr. Said Ally Mohamed
EXECUTIVE SECRETARY

1.0 INTRODUCTION

This report presents a detailed analysis of the students' performance on Form Two National Assessment (FTNA) 2024 in Civil Engineering Surveying subject. The assessment adequately covered the Form Two Syllabus for Technical Secondary School Education issued in 2019 and as per the National Assessment format issued in 2021.

The Civil Engineering Surveying assessment consisted of three sections namely A, B and C with a total of 10 questions. Section A comprised of two (2) questions (1 and 2) weighing 10 and 5 marks respectively, to make a total of 15 marks. Question 1 consisted of ten multiple-choice items (i - x) and was constructed from various topics namely: *Surveying Tools and Equipment, Surveying Methods, Chain Surveying and Linear Measurements,* and *Compass Surveying*. Question 2 had five matching items (i - v) drawn from the topic of '*Safety Management and Rules*'.

Section B consisted of seven (7) questions (3 to 9). The questions required the student to provide short answers and were derived from various topics namely: *Surveying Tools and Equipment, Introduction Surveying Methods, Chain Surveying and Linear Measurements, Civil Surveying Techniques for Small Areas Practice* and *Surveying Methods.* Each question carried 10 marks, making a total of 70 marks. Section C, had one (1) structured question derived from the topic of *Compass Surveying.* This question had 15 marks. Therefore, the total paper weight is 100 marks.

A total of 197 students sat for this assessment. The performance was generally average, where 118 (59.90%) of the students passed with average and good performance while 79 (40.10%) of the students failed. The students' performance in FTNA 2024 is illustrated in Table 1 and Figure 1.

Table 1: The Students' Performance in Civil Engineering Surveying

Scores	Remarks	General Students Performance	
		Number	Percentage (%)
0 – 29	Weak	79	40.10
30 – 64	Average	117	59.39
65 – 100	Good	01	0.51
Total		**197**	**100**

The distribution of scores and students' performance in Civil Engineering Surveying subject is shown in Figure 1.

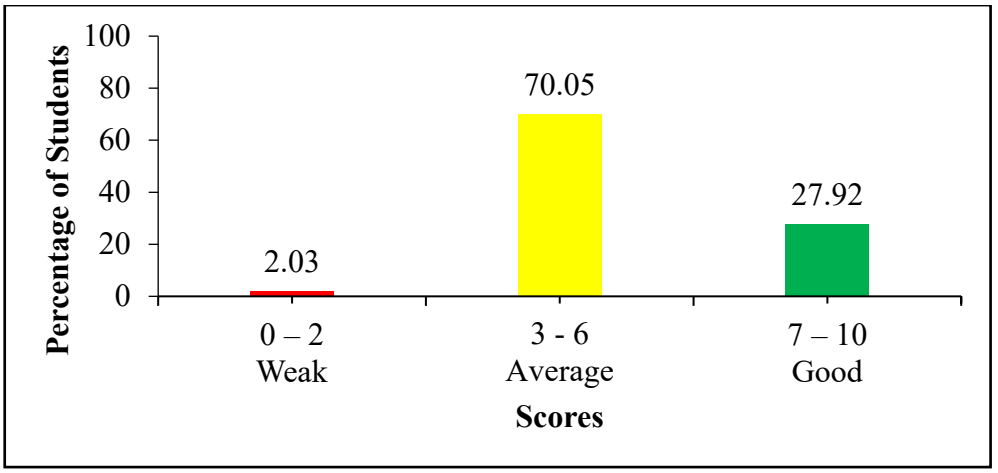


Figure 1: *The Distribution of Students' Performance in Percentage*

Among the students who sat for the Civil Engineering Surveying assessment in the year 2024, 01 (0.51%) scored grade B, 32 (16.24%) students scored grades C, 85 (43.15%) scored grade D, and the remaining 79 (40.10%) students failed by scoring grade F.

The range of the students' performance for each question was determined and an analysis of the strengths and weaknesses of the students' responses was done. Sample extracts of students' good and poor responses are used to illustrate the cases presented. At the end of this report, conclusion and recommendations are made to help students, teachers, parents and other education stakeholders to take necessary measures to improve the teaching and learning process in the Civil Engineering Surveying subject.

2.0 THE ANALYSIS OF THE STUDENTS' RESPONSES IN EACH QUESTION

2.1 SECTION A: OBJECTIVE QUESTIONS

This section consisted of two questions 1 and 2. Question 1 required the students to choose the correct response from among the four given alternatives and write its letter in the box provided. Question 2 required the students to match the hazards encountered in the land survey described in List A with the correct related terminology listed in List B by writing the letter of the correct response beside the item number in the table provided.

2.1.1 Question 1: Multiple Choice Items

The question consisted of ten multiple choice items (i) to (x), which carried one (1) mark each, making a total of 10 marks for the question. The analysis in this question shows that 197 (100%) students attempted the question, where 4 (2.03%) scored from 0 to 2 marks, 138 (70.05%) scored from 3 to 6 marks and 55 (27.92%) scored from 7 to 10 marks. The score intervals used for grading students' performance on this question are shown in Table 2.

Table 2: Score Intervals of Students' Performance in Question 1

Scores Range	General Performance		Remark
	Number of students	Percentage (%)	
0-2	4	2.03	Weak
3-6	138	70.05	Average
7-10	55	27.92	Good
Total	**197**	**100**	

The performance of the students in this question was good as 193 (97.97%) students scored from 3 to 10 marks, followed by 4 (2.03%) students who scored from 0 to 2 marks. The performance of the students in this question is summarized in Figure 2.

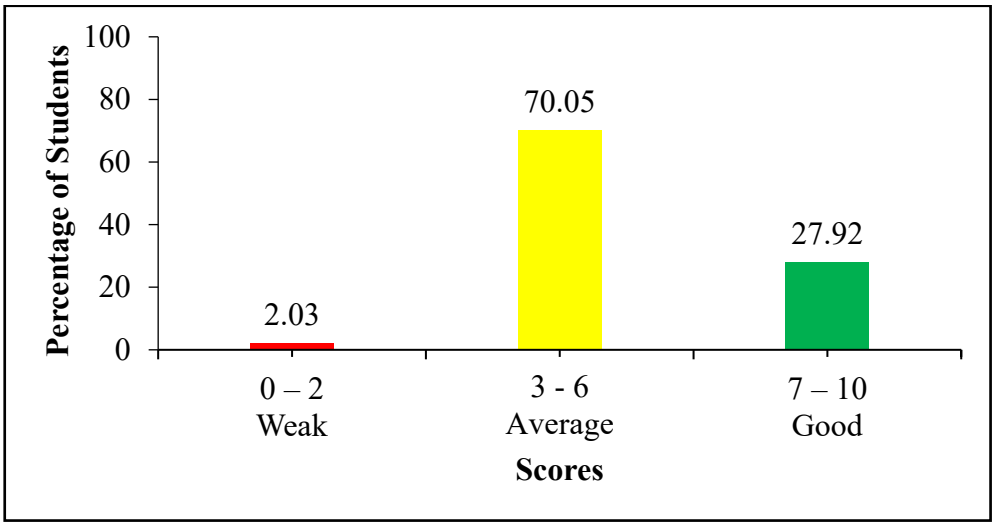


Figure 2: *The Students' Performance in Question 1*

The student's strengths and weaknesses in choosing responses for individual items of question 1 are analysed as follows:

Item (i) was developed from the topic of *Surveying Tools and Equipment*. Students were required to identify a set of important tools which are required for compass surveying. The item intended to measure students' ability to differentiate between tools and how they can be used in different surveying works. The question was:

Identify a set of important tools which are required for compass surveying.
A *Compass, Arrows, Metallic tape, Picks axe and Plumb bob*
B *Compass, Ranging rods, Metallic tape, Arrows and Plumb bob*
C *Compass, Ranging rods, Metallic tape, Square and Plumb bob*
D *Compass, Ranging rods, Linear tape, Hammer and Plumb bob*

The correct response for this item was *B*, '*Compass, Ranging rods, Metallic tape, Arrows and Plumb bob'*. The students who opted for this alternative were aware that picks axe, square and hammer are unnecessary tools for compass surveying. Prismatic compass, measuring tape, tripod stand, arrows, ranging rods, pegs, plumbing fork or plumb bob, field book are most often used during fieldwork on compass surveying. Students who choose alternatives *A, C* and *D*, were incorrect because each of these alternatives have at least one incorrectly listed tools in the respective set of compass surveying tools.

Item (ii) was set from the topic of Chain Surveying and Linear Measurement, whereby students were required to identify the factor which might be the source of the systematic error when tape is used to conduct chain surveying in the field. The item intended to measure the student's understanding of the types of errors encountered during chaining or linear measurements. The question was:

When tape is used to conduct chain survey in the field, systematic errors may occur. Which factor might be the source of the error?
A *Misreading of the tape* *B* *Miscounting of tape lengths*
C *Variation in tension to the tape* *D* *Poor straightening of the tape*

The correct alternative was *D*, '*Poor straightening of the tape*'. The students who opted for alternative were aware that the systematic errors are caused by the surveying equipment, observation methods, and certain

environmental factors. Under the same measurement conditions, these errors will have the same magnitude and direction (positive or negative). The students who opted for alternatives *A*, *B* and *C* failed to recall that the most reliable causes of systematic errors are errors caused by surveying equipment.

Item (iii) was constructed from the topic of *Surveying Methods*, whereby students were required to select a suitable method that would be proper to use in linear measurements in a certain plot. The item intended to measure the student's understanding of various methods used in linear measurements. The question was as follows:

Suppose you are a surveyor and you are planning to make linear measurements in certain plot. Which method will you use?

A	*Direct measurement*	*B*	*Indirect measurement*
C	*Precise measurement*	*D*	*Electrical measurement*

The correct response was *A*, '*Direct measurement*'. Students who opted for this alternative were aware that *direct measurement* is a fundamental technique in surveying that involves using tools to physically measure distances between two points. Other alternatives such as *C; Precise Measurements* involve repeating the measurements that are close to each other. *B; Indirect measurements* is the measurement that depends on other measurements, for example the height of a tree, the distance across a lake and the distance between two locations. Similar triangles, the Pythagorean theorem and Thales shadow theorem may be used as methods for indirect measurements to get specific measurements. Alternative D: *electrical measurements,* the surveyor needs a supportive device such as Electronic Distance Measurement (EDM) which is a surveying technique that uses electromagnetic waves to measure the distance between two points.

Item (iv) was developed from the topic of *Surveying Methods*, whereby students were required to recognize the acceptable shape of the area when linear and chaining surveying is conducted at a small area for correct and accurate measurements. The item intended to measure students' understanding of basic principles used in linear and chaining surveying in order to minimize errors during surveying. The question was:

Linear and chaining surveying is conducted at a small area for correct and accurate measurements. Which among the following is the acceptable shape of the area?

A	*Trapezium*	*B*	*Triangle*
C	*Rectangle*	*D*	*Parallelogram*

The correct alternative was *B*, '*Tringle*'. Students who opted for alternative *B* were aware that triangulation survey are key method in surveying, where a network of triangles is used to measure distances and angles with high precision. These surveys play a fundamental role in establishing accurate control networks, which serve as the backbone for both large-scale mapping and engineering projects. The shape of the triangle is more precise compared with the other shapes obtained in alternatives *A, C* and *D*. These alternative shapes are not used for conducting surveying but can be used in computing areas and volumes of the plan by subdividing the total area into simple geometrical shapes.

Item (v) was set from the topic of *Chain Surveying and Linear Measurement*, whereby, students were required to determine the distance of a line AB which was supposed to be 125.510 m long if the tape could not expand. The item intended to measure students' ability to perform simple calculations to determine the true length of the line from point A to point B by using a tape which extended to a certain length due to the expansion. The question stated was as follows:

A surveyor surveying the site was taking linear measurements of a line AB by using a tape of 30 m long. After completing a survey, the tape was extended to 30.023 m long due to the expansion. Determine the distance of a line AB which is supposed to be 125.510 m long if the tape do not expand.

A	*125.550 m*	*B*	*125.600 m*
C	*125.606 m*	*D*	*125.625 m*

The correct response was alternative *C*, *125.606 m*. Students who opted for this alternative were able to calculate the true length by using the correct formula. The true length was obtained by multiplying the measured length of the line (125.510 m) with the ratio of the incorrect length of the chain (30.023 m) by the true length of the chain (30 m). Those students who opted for other alternatives responded to the item by trying one among the alternatives *A, B* and *C*, they failed to recall the fact used to find true length.

Item (vi) was extracted from the topic of *Compass Surveying*, students were required to choose the correct response from the given alternatives of temporary adjustments for the prismatic compass. Adjustments of a surveying compass refer to the processes of aligning, calibrating, and fine-tuning the instrument to ensure it provides accurate and reliable measurements. This item intended to measure students' ability to make an adjustment temporarily on a prismatic compass during compass surveying. The question was as follows:

Which one of the following are temporary adjustments for the prismatic compass?

A *Centering, levelling, focusing the prism*
B *Centering, focusing the prism, adjustment of sight vane*
C *Adjustment of needle, focusing the prism, adjustment of levels*
D *Centering adjustment of needle, adjustment of pivot point*

The correct response was alternative *A*, '*Centering, levelling, focusing the prism*'. Students who opted for this alternative were familiar with the use of the prismatic compass and knew the two important adjustments should be made before using a compass either temporary or permanent. Temporary adjustments, also known as station adjustments, are those that need to be made every time the instrument is set up at a new location. The temporary adjustments compensate for the variations in instrument position and local conditions that occur as the survey progresses from one point to another. The process of making temporary adjustments is relatively quick but requires attention to detail. It typically takes a few minutes at each new station but saves considerable time and improves accuracy in the long run. These adjustments ensure accurate readings for each survey point by centring the instrument, levelling and focusing the prism. Students who opted for *B*, *C* and *D*, were not able to choose the correct response because those sets of adjustments contained a step of adjustments done during permanent adjustment either adjustment of level or adjustment of sight vane.

Item (vii) was constructed from the topic of *Compass Surveying*. Students were required to identify the reference meridian used by surveyors to measure bearings that pass through the geographical South Pole, North Pole and any point on the surface of the earth. The item intended to measure students' skills on imaginary lines of longitude on the earth that extend from the North to the South Pole. The question was as following:

The reference meridian used by surveyors to measure bearings that passes through the geographical South Pole, North Pole and any point on the surface of the earth is known as

A	*grid meridian*	*B*	*true meridian*
C	*arbitrary meridian*	*D*	*magnetic meridian*

The correct alternative was B, '*true meridian*'. Students who opted for this alternative were familiar with an imaginary line that runs from the North Pole to the South Pole and is used to indicate longitude. A meridian is a fixed reference direction on the Earth's surface, relative to which the bearings of survey lines are expressed. A meridian is a fixed direction on the surface of the Earth, serving as a reference for expressing the bearings of survey lines. Compared to other meridians, a true meridian, also known as a geographical meridian, is only giving fundamental concept in geodesy and surveying. It is defined as the line of intersection between the Earth's surface and a plane containing the North Pole, South Pole, and the observer's position. This line represents the true north-south direction at any given location on Earth.

Item (viii) was extracted from the topic of *Chain Surveying and Linear Measurement*, whereby students were required to identify the sketch that was prepared during reconnaissance. The item intended to measure students' understanding on the information that helps plan the survey and determine the most suitable chain line. The item was:

Before surveying the school area, reconnaissance was conducted. Which sketch was prepared during reconnaissance?

A	*Reference sketch*	*B*	*Offset sketch*
C	*Check line sketch*	*D*	*Index sketch*

The correct alternative was *D*, '*Index sketch*', also known as a key plan, which is a hand-drawn sketch of an area that is prepared during a reconnaissance survey. It is a basic outline of the survey work that was done and shows the skeleton of the survey. It's a location sketch of the ground that's created during the preliminary inspection of an area to be surveyed. Other alternatives are sketches showing the general arrangement of lines, as well as the main features of the area and object details or boundaries, such as roads and buildings.

Item (ix) was developed from the topic of *Surveying Tools and Equipment*, whereby students were required to show the arrangement of the field book

in which measurements are noted in surveying. This item intended to measure students' understanding of the correct arrangement of the field book used to record data and make notes while working on a job site. The question was as follows:

The note book in which measurements are noted is known as the field book. How should it be arranged?

A	*Single line and double line*	*B*	*Single line and three line*
C	*Double line and three line*	*D*	*Double line and triple line*

Those students who opted for alternative *A*, '*Single line and Double line*', were able to choose the correct response from the given alternatives because the correct arrangement of field books is single line and double line. There are two main field books used in the site which are single line and double line field book and their main difference is the number of red or blue lines that run down the middle of each page. Field books should be made of high-quality, opaque paper and be about 20 cm x 12 cm in size. Those who opted for alternatives *B*, *C* and *D* were wrong because there is no field book in surveying arranged in that form.

Item (x) was set from the topic of *Chain Surveying and Linear Measurement*, whereby students were required to identify type of the method which is used in reciprocal ranging when a problem arises if chaining is free but vision is obstructed. The item intended to measure students' ability to apply the different methods in chaining surveying when chaining is free but vision is obstructed. The question was as follows:

In chain surveying a problem arise if chaining is free but vision is obstructed. To solve this problem, reciprocal ranging is resorted and chaining is done. Which of the following method is used in a reciprocal ranging?

A	*Indirect method*	*B*	*Direct method*
C	*Stepping method*	*D*	*Rise and fall method*

The correct answer was *C*, *'Stepping method'*. This is a common surveying approach which can solve the problem encountered if chaining is free but vision is obstructed. Reciprocal ranging, also known as indirect ranging, is used when the ends of a survey line are not visible from each other, it can be due to intervening ground or a long distance between the points. This method involves selecting two intermediate points close to the chain line so that both

endpoints are visible. Other methods such as direct ranging i used when the endpoints of a survey line are visible to each other. This method involves establishing intermediate points along the chain line by observing from the end stations. It can be done by eye or with an optical instrument like a theodolite or line ranger. Also alternative *D*, *Rise and fall method* concerned with a surveying technique that determines the elevation difference between two points. It's often used in construction and design to create accurate site plans.

2.1.2 Question 2: Matching Items

The question required the students to match items (i - v) described in List A with responses in List B by writing the letter of the corresponding response beside the item number. Each item in this question carried 01 mark, making a total of 05 marks. The question was designed to test the students' awareness of hazards encountered in land surveying. The question was as follows;

*Match the descriptions of hazards encounter in land surveying in **List A** with correct types of hazards in **List B** by writing a letter of the corresponding response below the item number in the table provided.*

List A	***List B***
(i) When Surveyors works in outdoor environments may be exposed in slips, trips, falls, uneven ground that increase the risk of injury.	*A Communication hazards*
(ii) Mishandling of surveying device such as total stations, GPS devices or devices failure can lead to injuries or accidents.	*B Psychological hazards*
(iii) Surveyors working near roads or highways are at risk of being struck by passing vehicles.	*C Traffic hazards*
(iv) Surveying involves assessing existing slabs or groundwork such as bridges posing a risk of collapse or slabs failures.	*D Physical hazards*
(v) Incorrect information can lead to misunderstand, errors in data collection, or delays in emergency response.	*E Equipment hazards*
	F Structural hazards
	G Weather condition

The analysis of students' performance in this question shows that 6 (3.05%), students scored from 0 to 1 mark and 191 (96.95%) scored from 4 to 5 marks. The ranges of scores used to grade students' performance in this question are presented in Table 3.

Table 3: Score Intervals of Students' Performance in Question 2

Scores Range	General Performance		Remark
	Number of Students	Percentage	
0 – 1	6	3.05	Weak
2 – 3	33	16.75	Average
4 – 5	158	80.20	Good
Total	**197**	**100**	

The general performance of students in this question was good as 191 (96.95%) scored from 2 to 5 marks, and 6 (3.05%) scored from 0 to 1 mark. Figure 3 shows the overall students' performance in question 2.

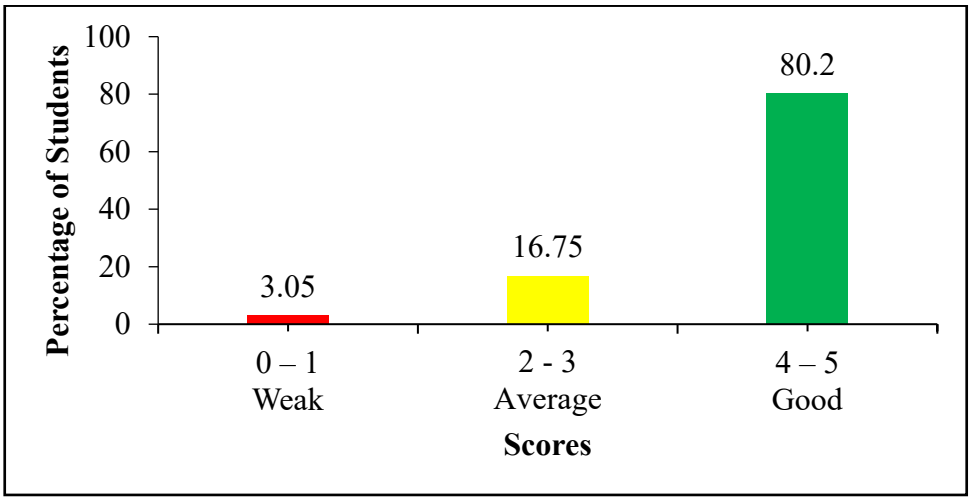


Figure 3: *The Students' Performance in Question 2*

The student's strengths and weaknesses in choosing responses for individual items of the question 2 are analysed as follows:

Item (i): the students were required to provide the correct response that matches correctly with the description *"When Surveyors works in outdoor environments may be exposed in slips, trips, falls, uneven ground that increase the risk of injury."* The correct response was D "*Physical hazards"*. Students who were able to select the correct response could identify this hazard

using the appropriate term for illustration. On the other hand, students who selected other responses such as "*equipment hazards*" had no sufficient knowledge and skills because this distractor was closely related to item (ii) "*Mishandling of surveying device such as total stations, GPS devices or devices failure can lead to injuries or accidents"* where device or instruments cause an accident.

Item (ii): the students were required to match correctly the description "*Mishandling of surveying device such as total stations, GPS devices or devices failure can lead to injuries or accidents".* The correct response was *E*, *"Equipment hazards".* The only way to avoid an accident from instruments used during surveying is to encourage students to handle the instruments with care and use the instruments properly. Many of the students lacked knowledge on the various accidents caused by the devices they use, therefore opted for the other alternatives.

Item (iii): the students were required to provide a suitable response that matches correctly with the statement "*Surveyors working near roads or highways are at risk of being struck by passing vehicles."*. The correct response was *C*, "*Traffic hazards*". Any movement such as vehicles, ships or person's movements in an area, along a street, through an air plane, over a water route or whatever, are called traffic. Therefore, through these movements accidents may occur to the user of a path. The accidents that occurred in this situation are considered an accident caused by traffic hazards or the user of a path. Other responses remain as they are and are self-sufficient with a different meaning than the correct response, the students who failed to respond correctly lacked general knowledge about the common hazards.

Item (iv): the students were required to choose the correct match of the described statement "*Surveying involves assessing existing slabs or groundwork such as bridges posing a risk of collapse or slab failures"*. The correct response was *F*, "*Structural hazards*". Working on a construction site means working with or alongside large operational plant machinery and tools, working at different heights and in environments where hazardous materials may be present. Therefore, when performing surveying in that area accidents may occur. Structural hazards normally are encountered by surveyors or other workers. Other students failed to match these two related terms and failed to select correct response.

Item (v): the students were asked to match correctly the statement "*Incorrect information can lead to misunderstand, errors in data collection, or delays in emergency response"*. The correct match was *A*, "*Communication hazards*". Survey teams often work in remote locations with limited communication capabilities and need extra techniques to communicate with the team. Poor communication can lead to problems and emergencies not being addressed quickly enough. If working in a remote area, cell phones may not be reliable, so you should have an alternative way to communicate, such as radios or walkie-talkies. Delaying to get information on time can cause accidents that could have been avoided if the information that should have arrived had arrived on time.

In general, this question required general knowledge of hazards in surveying to be able to answer it correctly. But few students failed due to their limited knowledge of various hazards caused during land surveying. Extracts 1.1 and 1.2 show samples of student's correct and incorrect responses respectively.

Answer

List A	(i)	(ii)	(iii)	(iv)	(v)
List B	D	E	C	F	A

Extract 1.1*:* A sample of the student's correct responses to Question 2

Answer

List A	(i)	(ii)	(iii)	(iv)	(v)
List B	C	A	F	B	E

Extract 1.2: A sample of the student's incorrect responses to Question 2

2.2 SECTION B: SHORT ANSWER QUESTIONS

This section consisted of seven (7) questions from 3 to 9, each carrying 10 marks making a total of 70 marks. The score ranges used for grading students' performance in this section are indicated in Table 4.

Table 4: Score Intervals for Questions 3 to 9

Score Range (Marks)	Remarks
0 – 2.5	Weak
3 - 6	Average
6.5 - 10	Good

2.2.1 Question 3: Introduction to Civil Engineering Survey

This question was extracted from the topic of *Introduction*. This question required the students to briefly explain the meaning of the given terms, surveying, levelling, chaining, plane surveying and reconnaissance as used in civil engineering surveying. The question stated as follows:

Briefly explain the meaning of the following terms as used in civil engineering surveying.

(a) Surveying (b) Levelling (c) Chaining
(d) Plane Surveying (e) Reconnaissance

The question was attempted by 197 students, where 45 (22.84%) students scored from 0 to 2.5 marks, 84 (42.64%) students scored from 3 to 6 marks and 68 (34.52%) students scored from 6.5 to 10 marks. These data are summarized in Table 5.

Table 5: The General Students' Performance in Question 3

Scores Range	General Performance		Remark
	Number of Students	Percentage	
0 – 2.5	45	22.84	Weak
3 – 6	84	42.64	Average
6.5 – 10	68	34.52	Good
Total	**197**	**100**	

The performance in this question was good as 152 (77.16%) of all students scored from 3 to 10 marks while 45 (22.84%) students scored from 0 to 2.5 marks. Figure 4 represents the students' performance who attempted this question.

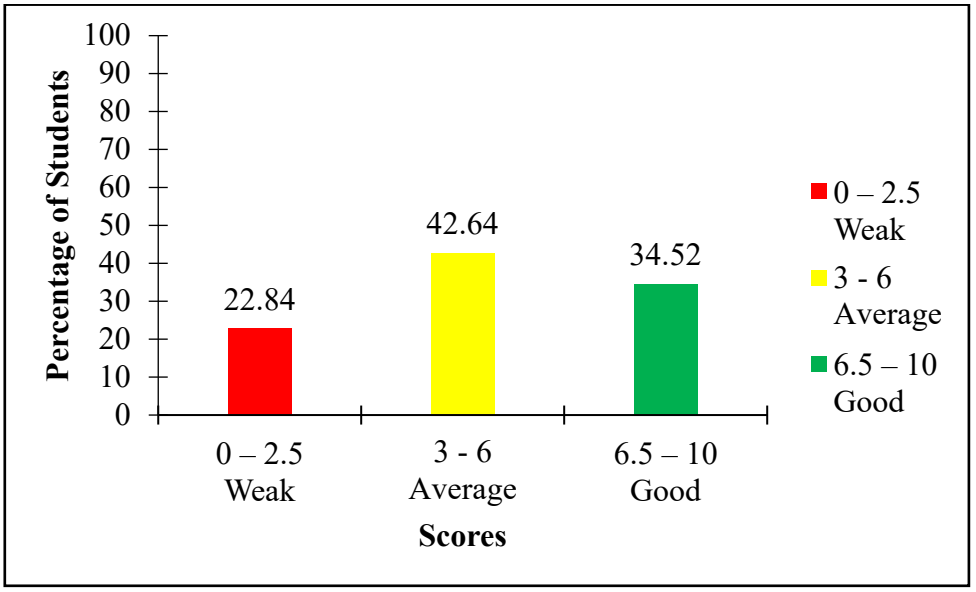


Figure 4: *The Students' Performance in Question 3*

According to the information shown in Figure 4, many students did well on this question. Students under this group had sufficient knowledge on the topic of Introduction to Civil Engineering Survey. The students provided the meaning of five basic terms used in civil engineering surveys, such as; civil surveying is an engineering operation that involves assessing and recording details about an area of land. Another term is levelling which is a surveying technique used in civil engineering to determine the relative height of points. The term chaining is a basic and effective method for surveying small, level areas, such as residential properties, where detailed accuracy isn't required. Also Plane surveying is the method of measuring small areas of the earth's surface by disregarding curvature and geoid effects. Lastly is the reconnaissance which is a preliminary inspection of an area in civil engineering to determine the best route options for more detailed investigation. The sufficient description given by the students enable them to score good marks in this question. Extract 2.1 shows a sample of student's correct response.

3. Briefly explain the meaning of the following terms as used in civil engineering surveying.

(a) Surveying

Is the field of study in which involves positioning the features above, below and on the earth's surface.

(b) Leveling

Is the process of determine one height relative to another. This levelling process can be done by using ranging arrows, ranging rods, chain or tape.

(c) Chaining

Involves taking the measurements between two points by using tape measure or chain

(d) Plane Surveying

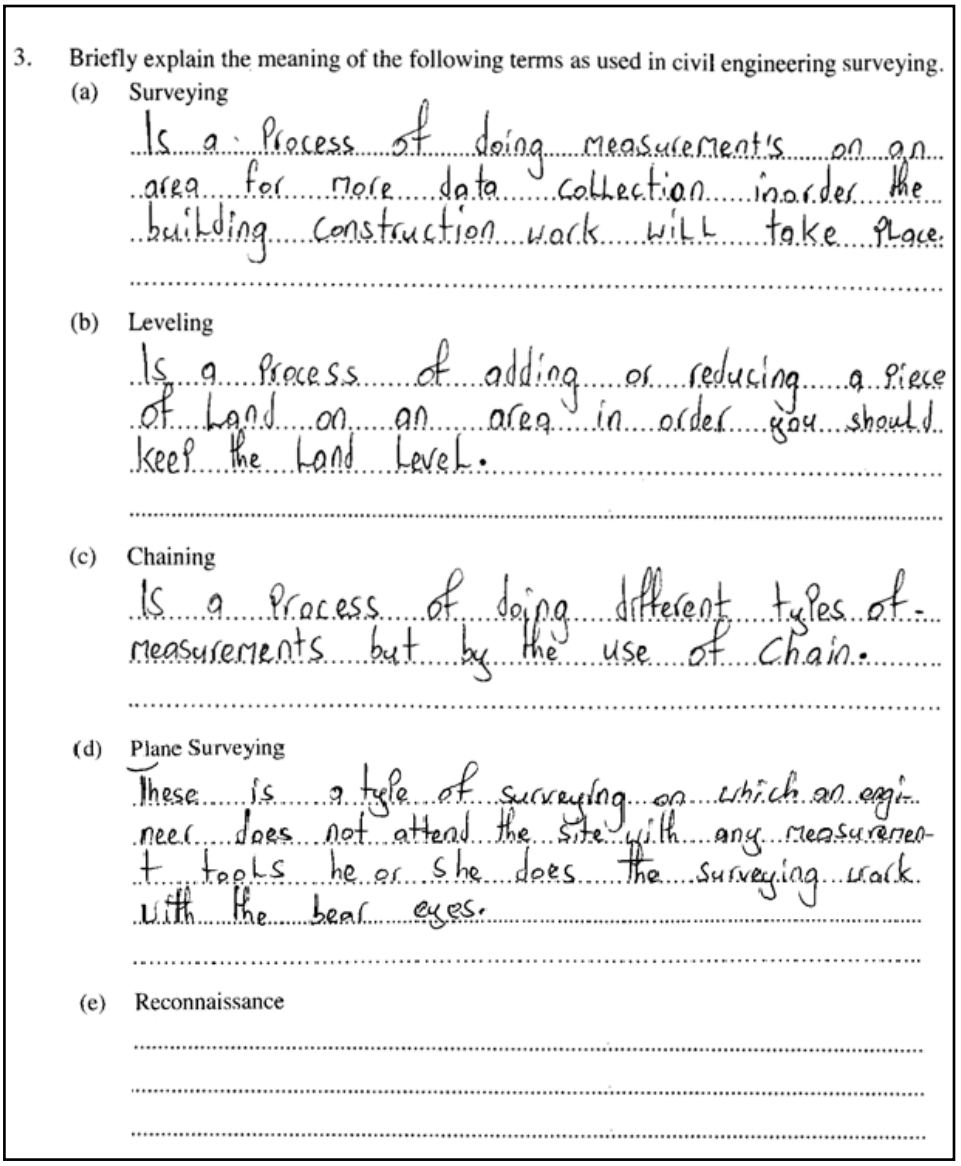
Is the branch of surveying in which involves the small and flat surface of the earth.

(e) Reconnaissance

Is the primary investigation of the area before start any surveying activities. for example activities involves in reconnaissance survey are choosing the stations, marking the stations on the ground, offsetting and witnessing.

Extract 2.1: A sample of the correct responses to Question 3

Despite more than 75 percent of the students who attempted this question scored good mark, still, some of the students failed to score good marks on the question and some scored zero mark. Inability to understand the demand of the question is the main reason for the students to score zero mark. On the other hand, the students who provided irrelevant responses indicated to have insufficient knowledge on this topic. Extract 2.2 demonstrated a sample of students who responded incorrectly to the question.



3. Briefly explain the meaning of the following terms as used in civil engineering surveying.

(a) Surveying

Is a Process of doing measurement's on an area for more data collection inorder the building construction work will take Place.

(b) Leveling

Is a Process of adding or reducing a piece of Land on an area in order you should keep the Land Level.

(c) Chaining

Is a Process of doing different types of measurements but by the use of Chain.

(d) Plane Surveying

These is a type of surveying on which an engineer does not attend the site with any measurement tools he or she does the surveying work with the bear eyes.

(e) Reconnaissance

Extract 2.2: A sample of the incorrect responses to Question 3

2.2.2 Question 4: Chain Surveying and Linear Measurements

The question consisted of two parts (a) and (b). In part (a), the students were required to describe the two methods of measuring the distance directly. In part (b), (i) were required to determine the total number of pipes which were used to cover the entire distance and (ii) the cost of pipe used, if the cost of one pipe of 6 m long is Tsh. 60,000/=. The question stated that;

A surveyor conducted chain survey for water supply project. During the survey of water pipeline from water source to village storage tank, the distance was found to be 6600 m. If PVC pipes of diameter 75 mm and length 6 m were used;

(a) Describe the two methods of measuring the distance directly.

(b) (i) Determine the total number of pipes which are used to cover the entire distance.

(ii) If the cost of one pipe of 6 m long is Tsh. 60,000/=, what is the total cost of pipe used?

This question was attempted by 197 (100%) students, where 52 (26.40%) students scored from 0 to 2.5 marks. The students who scored from 3 to 6 marks were 54 (27.41%) while 91 (46.19%) of students scored from 6.5 to 10 marks. Generally, the students' performance in this question was good as 145 (73.60%) of the students scored from 3 to 10 marks. A total of 52 (26.40%) students scored from 0 to 2.5 marks. This data is summarized in Table 6 and Figure 5.

Table 6: The General Students' Performance in Question 4

Scores Range	General Performance		Remark
	Number of Students	Percentage	
0 – 2.5	52	26.40	Weak
3 - 6	54	27.41	Average
6.5 - 10	91	46.19	Good
Total	**197**	**100**	

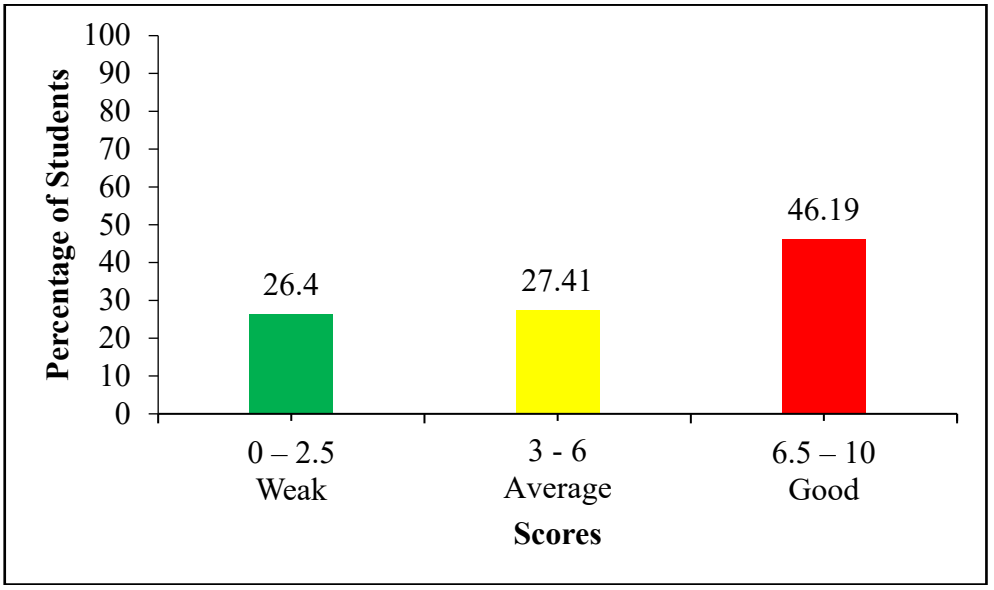


Figure 5: *The Students' Performance in Question 4*

Based on Figure 5, the general performance of students in this question was good as 145 (73.60%) of the students scored from 3 to 10 marks. The students' good performance on this question was contributed by their ability to meet the requirements of the question and sufficient knowledge on computation skills in the topic of *Chain Surveying and Linear Measurements.* The majority of students were able to describe two methods of measuring the distance directly and also able to calculate the total number of pipes which are used to cover the entire calculated distance. The students in part (b) (ii) were also able to find the total equivalent cost of the pipe used to cover the entire distance. Extract 3.1 shows a sample of student's correct responses to question 4.

4. A surveyor conducted chain survey for water supply project. During the survey of water pipeline from water source to village storage tank, the distance was found to be 6600 m. If PVC pipes of diameter 75 mm and length 6 m were used;

(a) Describe the two methods of measuring the distance directly.

i) Measuring distance by pacing
This is a direct method of determing the distance by counting the number pace from the starting point to the point where is the ending.

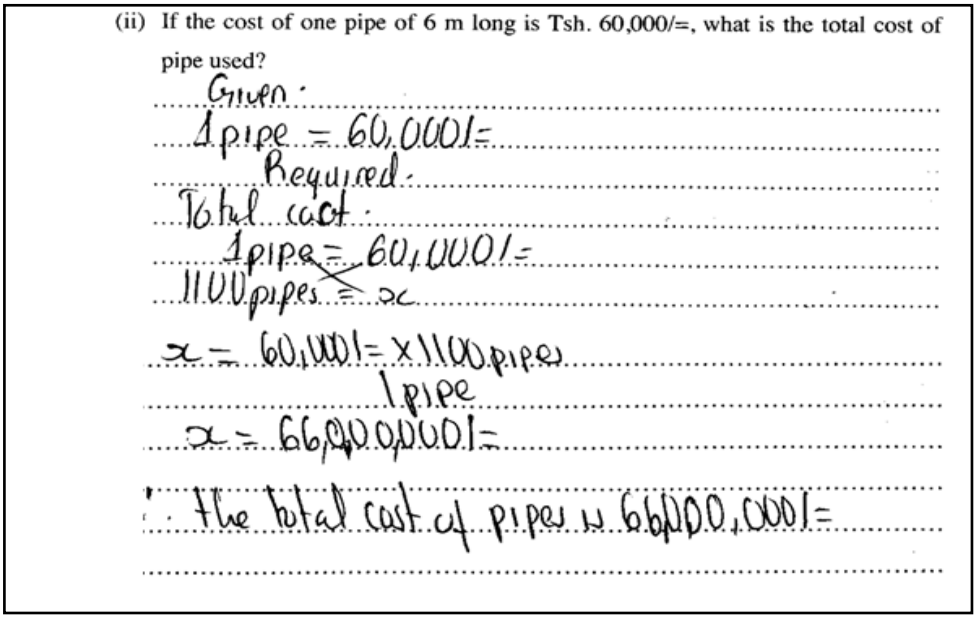
ii) By chaining or taping:- This is also a direct method which involves the use of a chain or a tape to measure the distance from one point to another point.

(b) (i) Determine the total number of pipes which are used to cover the entire distance.

Total distance = 6600m
Length of one pipe = 6m.
Required
Total number of pipes.
From.
1 pipe = 6m
x = 6600m

$x = \frac{1\text{pipe} \times 6600\text{m}}{6\text{ m}}$

x = 1100 pipes ∴ the total no of pipes is 1100


(ii) If the cost of one pipe of 6 m long is Tsh. 60,000/=, what is the total cost of pipe used?

Given:

1 pipe = 60,000/=

Required:

Total cost:

1 pipe = 60,000/=

1100 pipes = x

$x = \frac{60,000/= \times 1100 \text{ pipes}}{1 \text{ pipe}}$

$x = 66,000,000/=$

∴ The total cost of pipes is 66,000,000/=

Extract 3.1: A sample of the correct responses to Question 4

Further analysis shows that, majority of the students performed well, but few students were not able to score pass marks. Statistics data show that 52 (26.40%) students scored from 0 to 2.5 marks. Students' poor performance was attributed to irrelevant responses and lack of sufficient knowledge, also failure to meet the requirements of the question. These students also demonstrated that they had inadequate knowledge of linear measurements even in simple calculations. For instance, in part (a) of the question one student mentioned "*tape measures and ruler*", as the correct methods used in measuring the distance directly. The students failed to recall that chaining and pacing are the correct methods that can be used. In part (b) of the questions a student attempted the calculation but failed to arrive at the correct answer due to incorrect data interpretation and erroneous value substitution. Extracts 3.2 is a sample of incorrect responses to question 4.

4 A surveyor conducted chain survey for water supply project. During the survey of water pipeline from water source to village storage tank, the distance was found to be 6600 m. If PVC pipes of diameter 75 mm and length 6 m were used;

(a) Describe the two methods of measuring the distance directly.

i) Tape measure – this is the method of measuring distance and

Ruler – is the method of obtaining distance

(b) (i) Determine the total number of pipes which are used to cover the entire distance.

Solution.

$1m = 1000mm$

$x \times 75mm$

$\frac{75mm \times 1m}{1000mm} = \frac{1000mm \times x}{1000mm}$

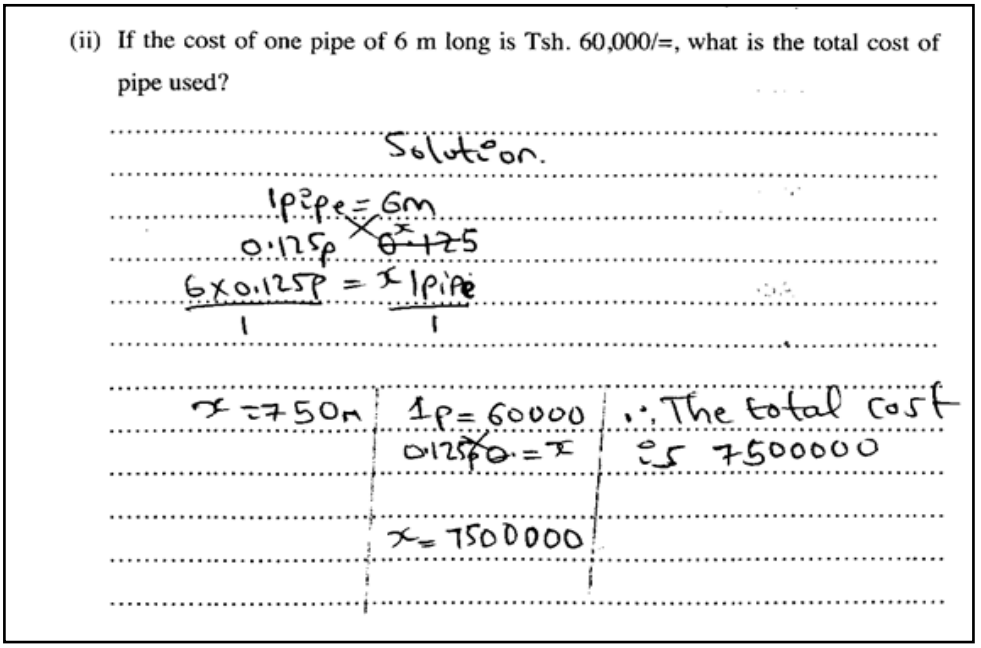
$x = 0.75m$

$1p = 6m$

$x \times 0.75m$

$\frac{0.75 \times 1}{6} = 0.125$

∴ The total number is 0.125 pipes


(ii) If the cost of one pipe of 6 m long is Tsh. 60,000/=, what is the total cost of pipe used?

Solution.

1 pipe = 6m

0.125p

$\frac{6 \times 0.125p}{1} = \frac{x}{1}$ 1 pipe

$x = 750m$ | 1p = 60000, $0.125p = x$, $x = 7500000$ | ∴ The total cost is 7500000

Extract 3.2: A sample of the incorrect responses to Question 4

2.2.3 Question 5: Surveying Tools and Equipment

In this question, the students were required to suggest five precautions which should be taken while entering data in the field book during surveying practices. The objective of this question was to test the students' skills on caring when recording the data in the field book. The question stated that;

During surveying practices, the field data are entered in the field book and later these data should be worked on. Suggest five precautions which should be taken while entering data in the field book.

The analysis of students' performance in this question shows that 166 (84.26%) students out of 197 scored from 0 to 2.5 marks. The students who scored from 3 to 6 marks were 20 (10.15%), while 11 (5.58%) students scored from 6.5 to 10 marks. The general students' performance in this question was weak as 166 (84.26%) of the students scored from 0 to 2.5 marks. This analysis is illustrated in Table 7 and Figure 6.

Table 7: The General Students' Performance in Question 5

Scores Range	General Performance		Remark
	Number of Students	Percentage	
0 – 2.5	166	84.27	Weak
3 - 6	20	10.15	Average
6.5 - 10	11	5.58	Good
Total	**197**	**100**	

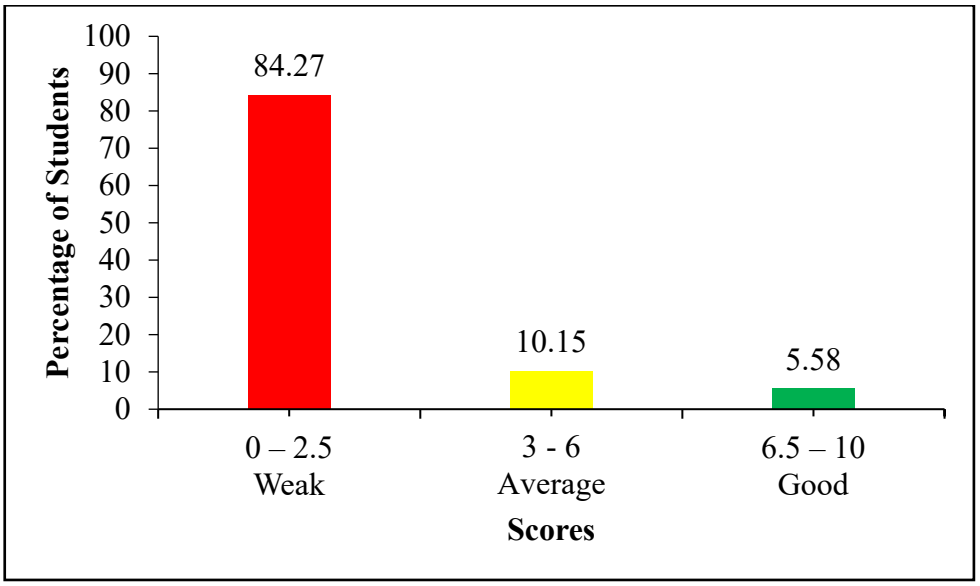


Figure 6: *The Students' Performance in Question 5*

Analysis reveals that 84.2 percent of the students scored below pass marks. The massive failure contributed to several reasons such as; some of the students could not grasp the knowledge from the topic concerned and some did not understand the demand of the question. Most of the students describe the factors to be considered during surveying or the proper way of recording. The students were supposed to know that; all measurements should be noted as soon as they are taken, and each chain line should be recorded on a separate page. Normally it should start from the bottom of one page and end on the top of another. No line should be started from any intermediate position. Also, should avoid over-writing, once the data is recorded so that, it is not repeated elsewhere. The poor responses led the student to score lower or zero mark in this question. Extract 4.1 shows a sample of student's poor responses to this question.

5. During surveying practices the field data are entered in the field book and later these data should be worked on. Suggest five precautions which should be taken while entering data in the field book.

(a) Proper recording of the datum which have been measured on the site

(b) Listening carefully when conducting surveying activities when the follower is reading the datum to be recorded

(c) Before recording data ensure accuracy and absence of error when conducting surveying activities

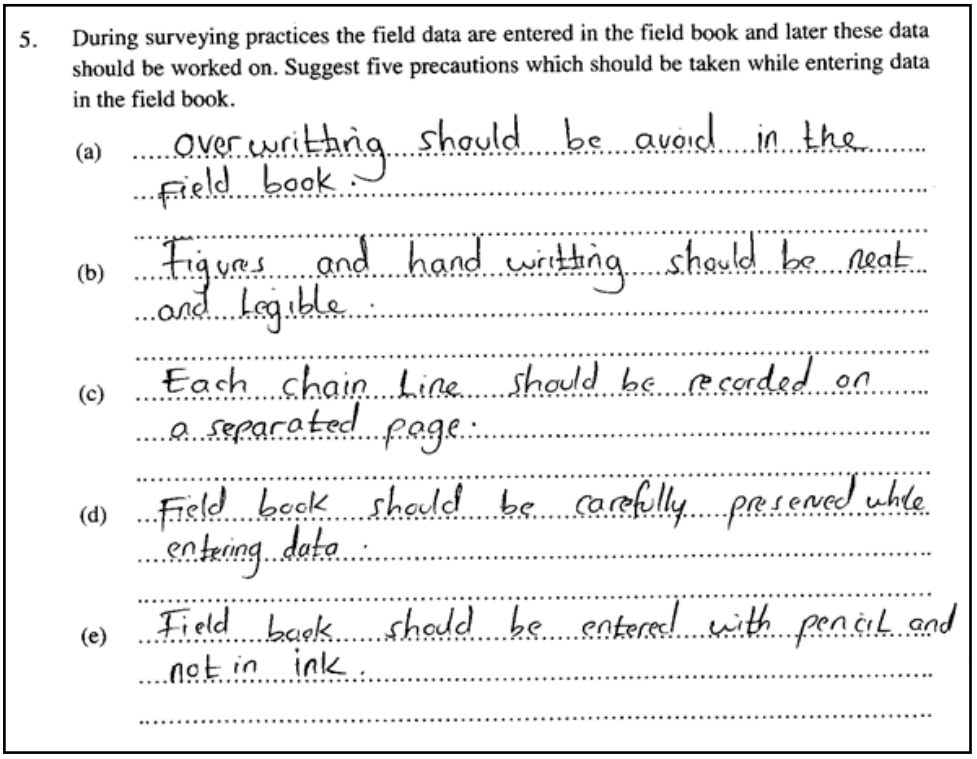
(d) Make sure the instrument wed in measuring distance or angles of the surveying line are not damaged

(e) Establishing atleast two points and working from whole to part in surveying activities.

Extract 4.1: A sample of incorrect responses to the Question 5

In Extract 4.1, students provided irrelevant responses to the question. The student wrote the factors considered when conducting fieldwork for chain surveying instead of writing the precautions when entering data in the field book.

However, analysis shows that 31 (15.73%) students who scored between 3 to 10 marks had sufficient knowledge of the precautions which should be taken while entering data in the field by writing two to five correct precautions. There are many precautions but the students were supposed to write only five of them. Extract 5.2 is a sample of correct responses from one of the students who attempted this question.


5. During surveying practices the field data are entered in the field book and later these data should be worked on. Suggest five precautions which should be taken while entering data in the field book.

(a) over writting should be avoid in the Field book.

(b) figures and hand writting should be neat and legible.

(c) Each chain line should be recorded on a separated page.

(d) Field book should be carefully preserved while entering data.

(e) Field book should be entered with pencil and not in ink.

Extract 4.2: A sample of correct responses to the Question 5

In Extract 4.2, student managed to provide the correct precautions by writing short and clear sentences and hence scored good mark.

2.2.4 Question 6: Chain Surveying and Linear Measurements

The question had two parts: (a) and (b). Students were required, in part (a), to give four ways to adjust the chain when is either too long or too short and in part (b), to calculate the area from the given data collected from the chain survey as indicated in the table. The question stated that;

(a) In taking measurement in the field by using chain, the chain can be adjusted when is found too long or too short under normal circumstances. How can you adjust the chain when is either too long or too short? Give four ways in each case.

(i) Adjustment when the chain is too long.

(ii) Adjustment when the chain is too short.

(b) During data collection, the surveyor established the data in the given table. Calculate the area of each figure.

Surveying Data

S/N	*Figure*	*Chainage (m)*	*Base (m)*	*Offsets*	*Mean (m)*	*Area (m^2)*
1.	*AJG*	*0 - 100*	*100*	*0 & 50*	*25*	
2.	*JGFM*	*100 - 300*	*200*	*50 & 250*	*150*	
3.	*MFEP*	*300 - 650*	*350*	*250 & 210*	*230*	
4.	*PED*	*650 - 950*	*100*	*210 & 0*	*105*	
5.	*ABK*	*0 - 180*	*180*	*0 & 160*	*80*	
6.	*BKNC*	*180 - 490*	*310*	*160 & 180*	*170*	

The analysis of students' performance in this question shows that 93 (47.21%) students out of 197 scored from 0 to 2.5 marks, 91 (46.19%) students scored from 3 to 6 marks and 13 (6.60%) students scored from 6.5 to 10 marks. The general performance of students in this question was average as more than 50 per cent of the students who attempted this question scored above pass marks as illustrated both in Table 8 and Figure 7.

Table: 8: The General Students' Performance in Question 6

Scores Range	**General Performance**		**Remark**
	Number of Students	**Percentage**	
0 – 2.5	93	47.21	Weak
3 - 6	91	46.19	Average
6.5 - 10	13	6.60	Good
Total	**197**	**100**	

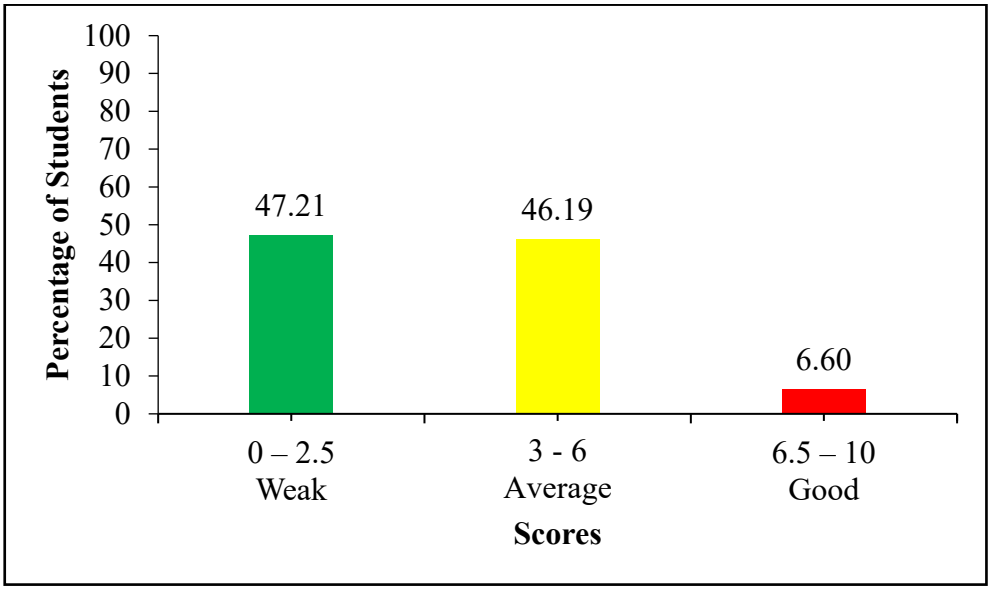


Figure 7: *The Students' Performance in Question 6*

Figure 7 shows that 52.79 percent of the students scored above pass marks. These students comprehended the requirements of the question and also had sufficient knowledge of the concepts of *Chain Surveying and Linear Measurements*. In part (a) students were required to give the four ways of adjusting the chain when is too long and four ways to adjust the chain when is too short. In this part the students were able to show the way to adjust a chain that is too long in surveying. During adjustment you need to carefully close up the joints of the chainrings by slightly hammering them to reduce the overall length. If the issue is significant, you might need to replace worn or damaged chain links with new ones to achieve the correct standard length. But when the chain is too short you can adjust it by physically straightening bent links, inserting additional rings to lengthen it, and carefully flattening any circular rings that might cause a reduction in length. However, it's crucial to first verify the chain's actual length against a standard measure and apply a correction factor to your measurements if necessary, rather than simply trying to adjust the chain on-site without proper calibration.

In part (b), students were able to calculate the area of each figure presented on the given table by applying a simple calculation of finding area (length x breadth) or (length x height) which was calibrated by a meter (m). Extract 5.1 shows a sample of student's correct responses to question 6.

6. (a) In taking measurement in the field by using chain, the chain can be adjusted when is found too long or too short under normal circumstances. How can you adjust the chain when is either too long or too short. Give four ways in each case.

(i) Adjustment when the chain is too long.

- close the joints of the rings
- hammering the elongated rings
- Replacing some old rings by new rings
- Remove some of the ring

(ii) Adjustment when the chain is too short.

- straightening the bent rings
- open the joints of the rings
- Replacing the old rings by same lager rings
- Insert new rings were necessary

(b) During data collection, the surveyor established the data in Table 1. Calculate the area of each figure.

Table 1: Surveying Data

S/N	Figure	Chainage (m)	Base (m)	Offsets	Mean (m)	Area (m^2)
1.	AJG	0 - 100	100	0 & 50	25	
2.	JGFM	100 - 300	200	50 & 250	150	
3.	MFEP	300 - 650	350	250 & 210	230	
4.	PED	650 - 950	100	210 & 0	105	
5.	ABK	0 - 180	180	0 & 160	80	
6.	BKNC	180 - 490	310	160 & 180	170	

(i) AJG = 100 x 25

Area = 2500 m^2

(ii) JGFM

s/n

200 x 150

Area = 30000 m^2

(iii) MFEP

s/n

350 x 230

Area = 80500 m^2

(iv) PED

s/n

100 x 105

Area = = 10500 m^2

(v) ABK = 180 x 80

Area = = 14400 m^2

(vi) BKNC

s/n

310 x 170

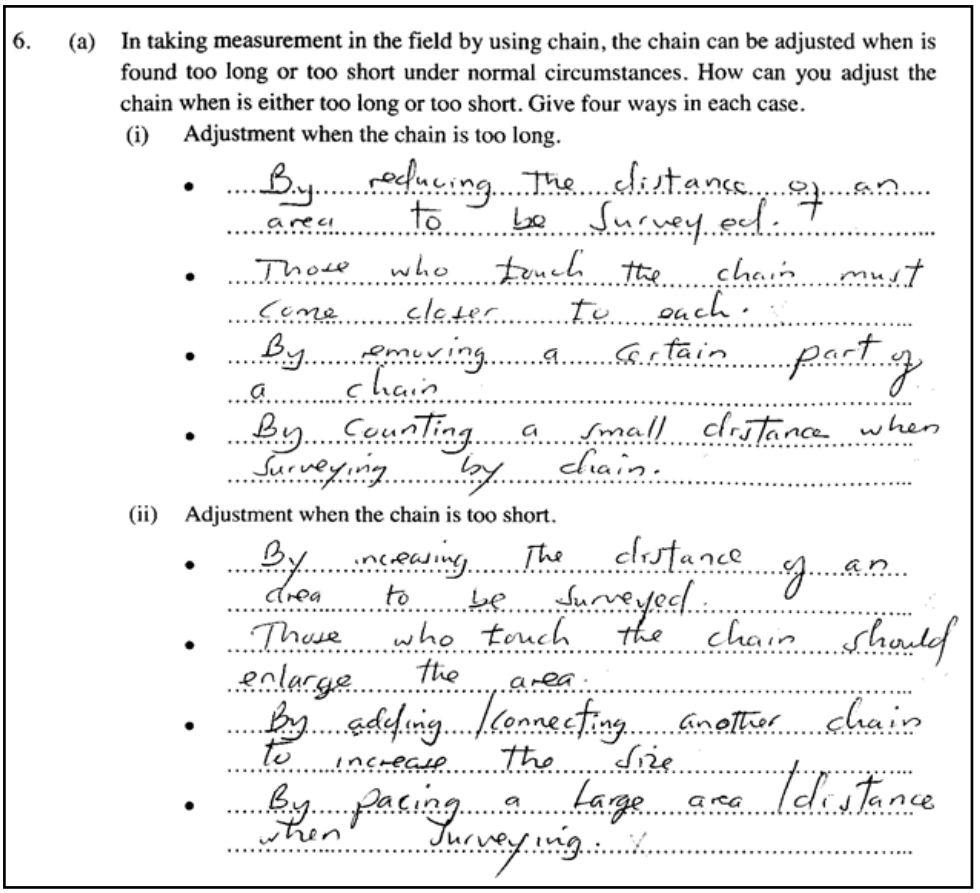
Area = 52700 m^2

Extract 5.1: A sample of correct responses to Question 6

In Extract 5.1, the student provided relevant responses to all the two parts indicating adequate knowledge of the topic and understanding of the requirement of the question.

On the other hand, there were 93 (47.21%) students who failed to score pass marks. The analysis reveals that several reasons accounted for the students' poor performance, such as; students lacked the ability to fully grasp and master the knowledge related to the topic, and some were unable to understand the requirements of the question.

In part (a) more students provided incorrect responses contrary to the question demand. For instance, some of the students suggested to reduce the distance of the area to be surveyed when the chain is too long and increasing the distance of the area to be surveyed when the chain is too short. In part (b), students failed to calculate the area of the figures by using data established by the surveyor and recorded in the given table. Most of the students failed to interpret the data recorded on the table and failed to recognise which data may be used with a suitable formula to calculate the area. Thus, the area in this case is the mean value (the integral of a continuous distance of one or more variables over a given range divided by the measure of the range) multiplied by the distance obtained on the difference between two points of measured distance. Extract 5.2 is a sample of incorrect responses to question 6.



6. (a) In taking measurement in the field by using chain, the chain can be adjusted when is found too long or too short under normal circumstances. How can you adjust the chain when is either too long or too short. Give four ways in each case.

(i) Adjustment when the chain is too long.

- By reducing the distance of an area to be surveyed.
- Those who touch the chain must come closer to each.
- By removing a certain part of a chain
- By counting a small distance when surveying by chain.

(ii) Adjustment when the chain is too short.

- By increasing the distance of an area to be surveyed
- Those who touch the chain should enlarge the area.
- By adding /connecting another chain to increase the size
- By pacing a large area /distance when surveying.

(b) During data collection, the surveyor established the data in Table 1. Calculate the area of each figure.

Table 1: Surveying Data

S/N	Figure	Chainage (m)	Base (m)	Offsets	Mean (m)	Area (m^2)
1.	AJG	0 - 100	100	0 & 50	25	
2.	JGFM	100 - 300	200	50 & 250	150	
3.	MFEP	300 - 650	350	250 & 210	230	
4.	PED	650 - 950	100	210 & 0	105	
5.	ABK	0 - 180	180	0 & 160	80	
6.	BKNC	180 - 490	310	160 & 180	170	

(i) AJG
50/25 = 2 m
∴ Area = 2 m^2

(ii) JGFM
234/54 5 m^2
∴ Area = 5 m^2

(iii) MFEP
46φ/23φ = 2m
Area = 2 m^2

(iv) PED
0/105 = 0
Area = 0 m^2

(v) ABK
160/80 = 2 m^2
Area = 2 m^2

(vi) BKNC
340/170 2 m^2
Area = 2 m^2

Extract 5.2: A sample of incorrect responses to Question 6

In Extract 5.2, the student provided irrelevant responses to all parts of the questions. In part (a) students failed to show how to adjust the chain when is either too long or too short, and also failed to calculate the different figures as indicated in the given table.

2.2.5 Question 7: Surveying Techniques for Small Areas Practice

This question required the students to summarize the procedures to be followed when plot chain surveying data. The question intended to measure the student's ability to use scale and drawing sheet preparation. The question was as follows;

Summarize ten procedures you will follow to plot chain surveying data.

The analysis of students' performance in this question shows that 173 (87.81%) scored from 0 to 2.5 marks, 23 (11.68%) students scored from 3 to 6 marks, and 1 (0.51%) student scored between 6.5 to 10 marks. The general performance in this question was poor as 173 (87.81%) students who attempted this question scored pass marks from 0 – 2.5 marks. The rest 24 (12.19%) students scored between 3 and 10 marks. This analysis is illustrated in Table 9 and Figure 8.

Table 9: The General Students' Performance in Question 7

Scores Range	General Performance		Remark
	Number of Students	Percentage	
0 – 2.5	173	87.81	Weak
3 - 6	23	11.68	Average
6.5 - 10	1	0.51	Good
Total	**197**	**100**	

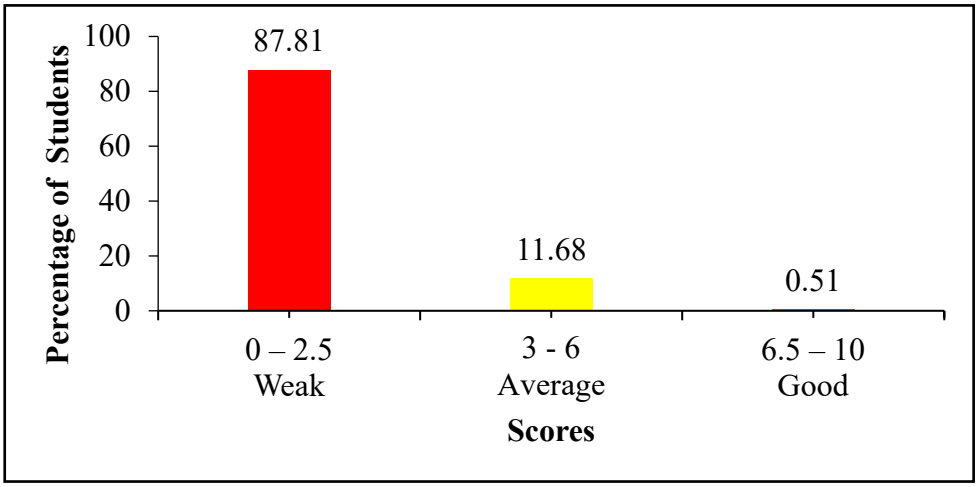
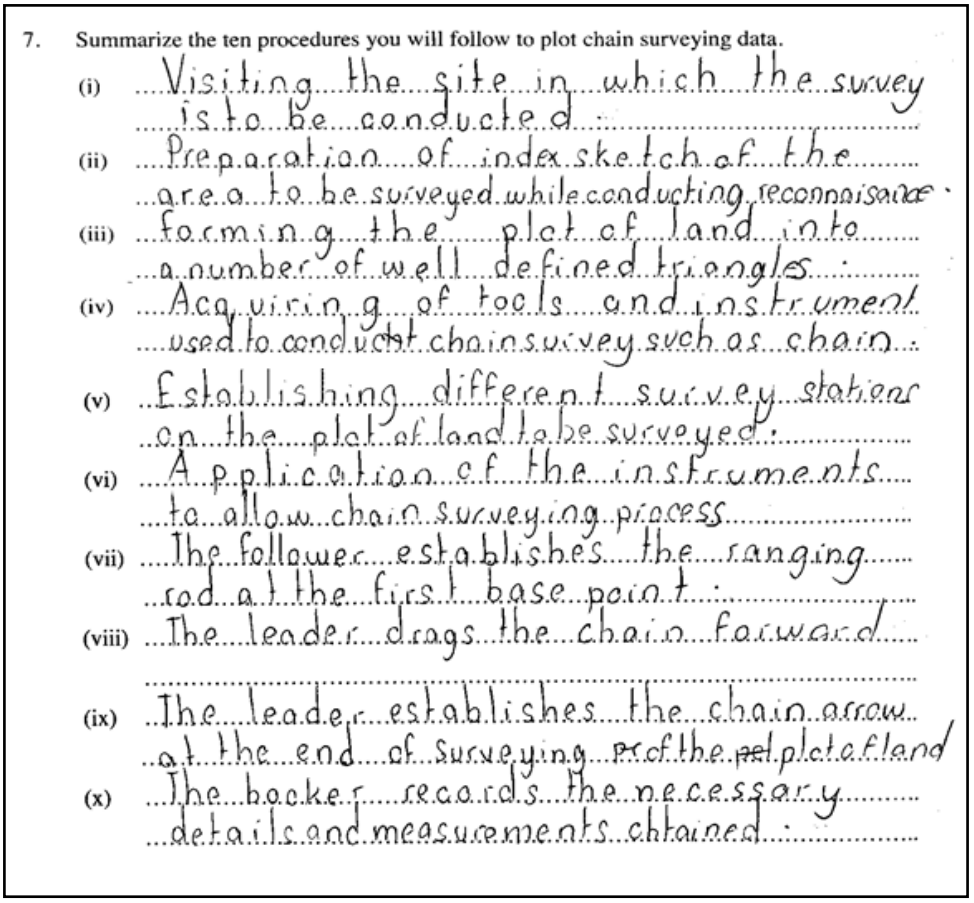


Figure 8: *The Students' Performance in Question 7*

Based on Figure 8, the general performance of students in this question was poor as 173 (87.81%) of the students scored from 0 to 2.5 marks. The students' poor performance was attributed by irrelevant responses, lack of sufficient knowledge, and failure to meet the requirements of the question. Plotting refers to representing previously surveyed objects on paper, to a suitable scale, in accordance with their shape and size.

There are three main steps to follow, before plotting data, including choosing a baseline, selecting a suitable location for the baseline and plotting the data. During plotting, the survey's data on the map or plan, prepare a sheet which is used to plot data by leaving a margin of 2 – 4 cm around the sheet/paper. The majority of the students failed to summarize these and scored a zero mark. Extract 6.1 shows a sample of students' incorrect responses to question 7.


7. Summarize the ten procedures you will follow to plot chain surveying data.

(i) Visiting the site in which the survey is to be conducted

(ii) Preparation of index sketch of the area to be surveyed while conducting reconnaisance

(iii) forming the plot of land into a number of well defined triangles

(iv) Acquiring of tools and instrument used to conduct chain survey such as chain

(v) Establishing different survey stations on the plot of land to be surveyed.

(vi) Application of the instruments to allow chain surveying process

(vii) The follower establishes the ranging rod at the first base point

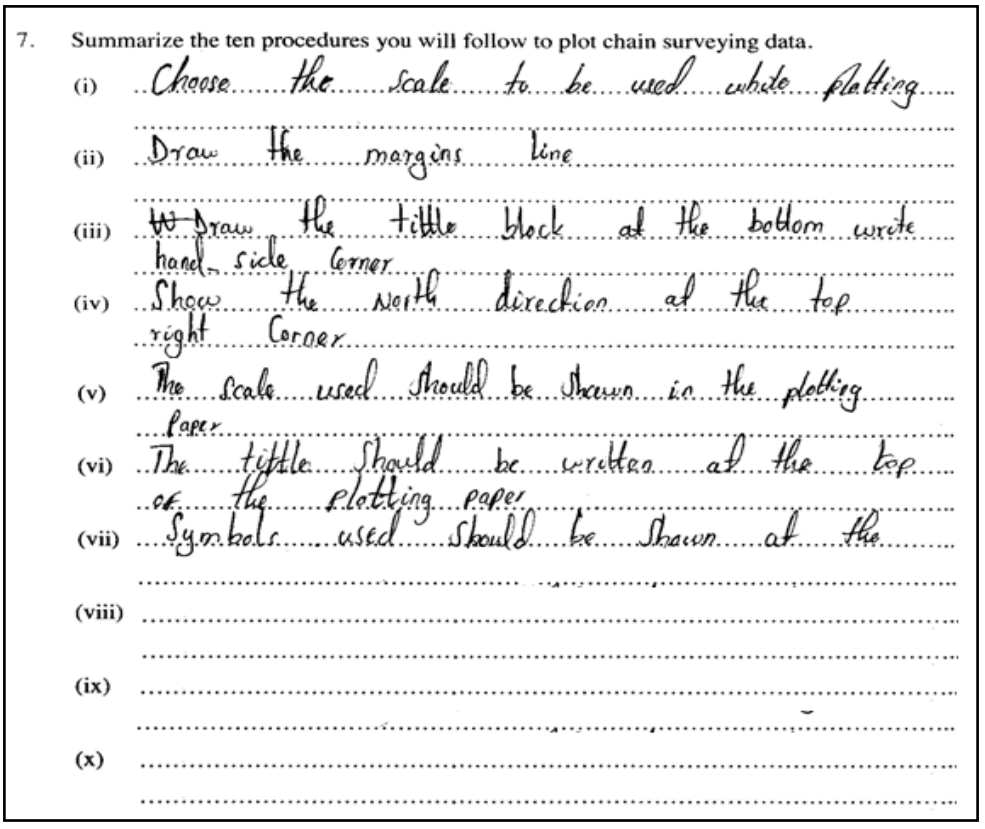
(viii) The leader drags the chain forward

(ix) The leader establishes the chain arrow at the end of surveying ~~of the~~ plot of land

(x) The booker records the necessary details and measurements obtained

Extract 6.1: A sample of incorrect responses to Question 7

Despite this massive failure, there were (12.19 percent of students who scored pass and above pass marks. These students had sufficient knowledge of chain surveys and managed to summarize some of the procedures to plot chain surveying data. The procedure for plotting chain surveying data in civil engineering involves selecting a suitable scale, choosing a baseline, and then plotting the data. Therefore, students should thoroughly understand the steps involved to accurately plot the data. This ensures that the data yields better results that enable engineers' offices to make informed decisions for the greater benefit of the respective projects. Some students managed to provide at least a few procedures, demonstrating that they have some knowledge on the topic. However, they were unable to fully explain all the required procedures as requested in the question. Extract 6.2 shows a sample of an average responses to question 7.


7. Summarize the ten procedures you will follow to plot chain surveying data.

(i) Choose the scale to be used while plotting

(ii) Draw the margins line

(iii) Draw the tittle block at the bottom write hand side corner

(iv) Show the north direction at the top right corner

(v) The scale used should be shown in the plotting paper

(vi) The tittle should be written at the top of the plotting paper

(vii) Symbols used should be shown at the

(viii)

(ix)

(x)

Extract 6.2: A sample of correct responses to Question 7

In Extract 6.2, a student managed to give only seven procedures as required in this question and scored good marks.

2.2.6 Question 8: Introduction to Civil Engineering Survey

In this question, the students were required to relate given terms as far as the survey is concerned The question intended to measure the student's ability to differentiate the interrelated terms as far as the survey concerned. The question was as follows;

How do the following terms are interrelated as far as survey is concerned?
(a) Back sight and Height of instrument
(b) Datum and benchmark

The analysis of student's performance in this question shows that 193 (97.97%) students scored from 0 to 2.5 marks, and 4 (2.03%) students scored between 3 and 6 marks. The general performance in this question was poor because 193 (97.97%) students who attempted this question scored below pass marks. This analysis is illustrated in Table 10 and Figure 9.

Table 10: The General Students' Performance in Question 8

Scores Range	General Performance		Remark
	Number of Students	Percentage	
0 – 2.5	193	97.97	Weak
3 - 6	4	2.03	Average
6.5 - 10	0	0.00	Good
Total	**197**	**100**	

The overall analysis of students' performance on this question was weak, as 193 students (97.97%) scored between 0 and 2.5 marks. Among them, 181 students (91.88%) scored zero.

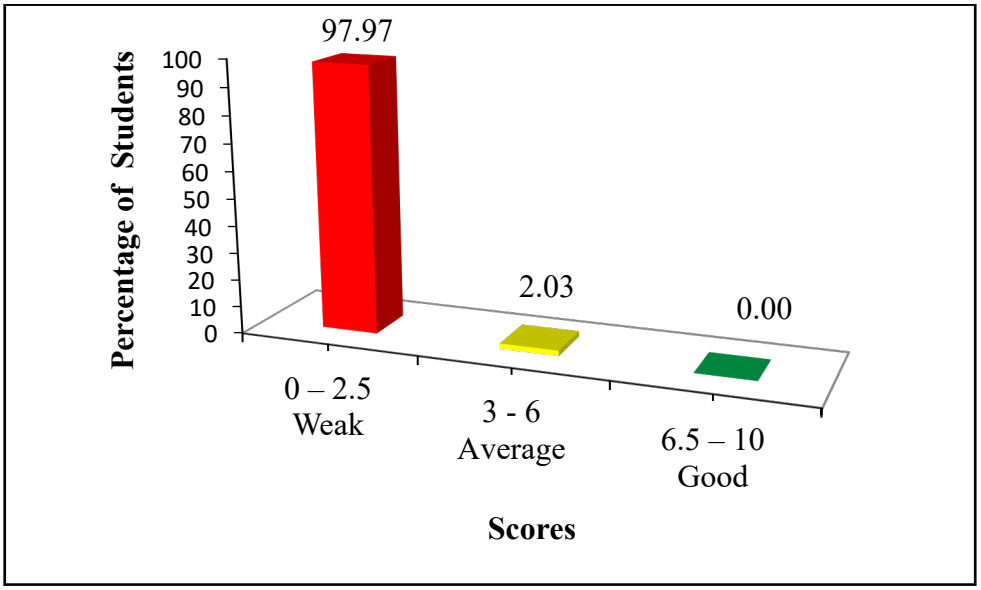


Figure 9: *The Students' Performance in Question 8*

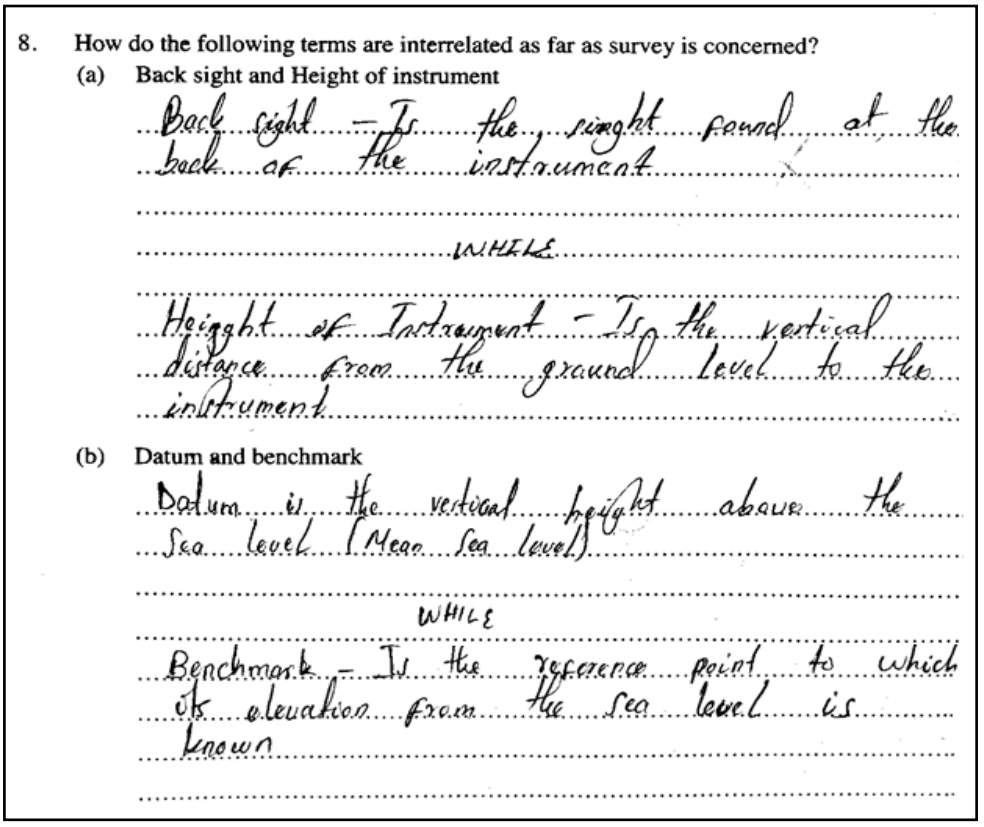
These students did not understand the requirements of the question and demonstrated insufficient knowledge of the concepts covered in Introduction to Civil Engineering Survey.

Based on Table 10 and Figure 9, this was the poorest performed question, with 97.97% of students scoring below pass marks. Most of the students did not understand the requirements of the question and demonstrated insufficient knowledge of the concepts covered in the introduction to civil engineering survey. This is the basic topic for the student to learn, whereby the students should learn the meaning of survey. In this area, the student is expected to learn the objectives of the survey, its branches and types of survey. Also, the students should learn the common terminologies used in the survey and know the importance of surveying.

The students demonstrated that they had inadequate basic skills in surveying. For instance, in part (a) different students had various incorrect responses such as "*back sight is the sight found at the back of the instrument*" while "*height of instrument is the vertical distance from the ground level to the instrument*". These responses were incorrect because back sight refers to the first staff reading taken in any set-up of the instrument while levelling has been perfectly done. This reading is always taken on point of reducing level on benchmark or change point. Relatively, the height of instrument is obtained when an instrument is properly levelled and the reduced level of the

line collimated. This was obtained by adding backsight reading and the reduced level of the benchmark or changing point on which the staff reading was taken.

In part (b), the majority of the students failed to relate between datum and benchmark. Generally, a datum is a reference level, while a benchmark is a fixed point with a known elevation. Datums are used to create a standardized base elevation, while benchmarks are used to measure the elevation of other points. The students in this part try to relate these two terms by providing incorrect responses "*datum is the vertical height above the sea level (mean level)"* while "*benchmark is the reference point to which its elevation from the sea level is known"*. The students tried to recall the facts between these two terms but they failed to remember and organize correct information properly about the similarity of these two terms and, therefore scored a zero mark. Extract 7.1 shows a sample of students' incorrect responses to question 8.


8. How do the following terms are interrelated as far as survey is concerned?

(a) Back sight and Height of instrument

Back sight - Is the sight found at the back of the instrument

WHILE

Height of Instrument - Is the vertical distance from the ground level to the instrument

(b) Datum and benchmark

Datum is the vertical height above the Sea level (Mean Sea level)

WHILE

Benchmark - Is the reference point to which its elevation from the sea level is known

Extract 7.1: A sample of the incorrect responses to Question 8

Extract 7.1 shows the student who provided irrelevant responses to all five points in this question and failed to score pass marks.
Despite the massive failure of the students in this question, one student was able to answer part (b) of this question and scored 5 marks. Such student was capable of comprehending the question demand and gave the correct ideas on datum and benchmark.

Students were supposed to relate the back sight and height of instrument as back sight is the first staff reading taken in any set-up of the instrument after the levelling has been perfectly done. This reading is always taken on point of reducing level on bench mark or change point, while height of the instrument is the condition when levelling instrument is properly levelled, the reducing level of line of collimation is known as the height of instrument. This obtained by adding back sight reading and the reducing level of the bench mark or changing point on which the staff reading was taken. In part (b) datum is any surface to which elevations are referred. The commonly used datum in the world is the mean sea level from which elevations are referred as below or above the sea level. While a bench mark is a relatively permanent point of reference whose elevation with respect to some assumed datum is known. It is used either as a starting point for levelling or as a point checking the level.

2.2.7 Question 9: Surveying Method

This question had two parts, (a) and (b) whereby students were supposed to write the (a) duties of the persons, (i) A leader and (ii) A follower during the chaining process and in part (b) to differentiate between the stepping method and from indirect method as used in chaining on sloping ground. The question was as follows;

(a) Mention two duties of each of the following persons during chaining process:
   (i) A leader
   (ii) A follower
(b) Differentiate the stepping method from indirect method as used in chaining on sloping ground.

The analysis of students' performance in this question shows that 122 (61.93%) students scored from 0 to 2.5 marks and 75 (38.07%) students scored between 3 to 6 marks. General performance in this question was

average as 75 (38.07%) students scored above the pass marks, as illustrated in Table 11 and Figure 10.

Table 11: The General Students' Performance in Question 9

Scores Range	General Performance		Remark
	Number of Students	Percentage	
0 – 2.5	122	61.93	Weak
3 - 6	75	38.07	Average
6.5 - 10	0	0.00	Good
Total	**197**	**100**	

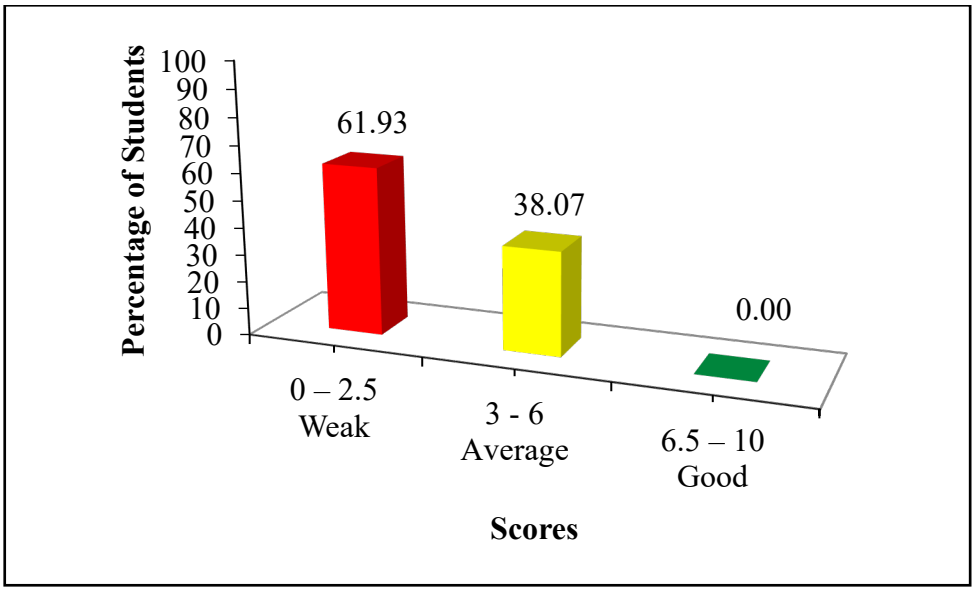


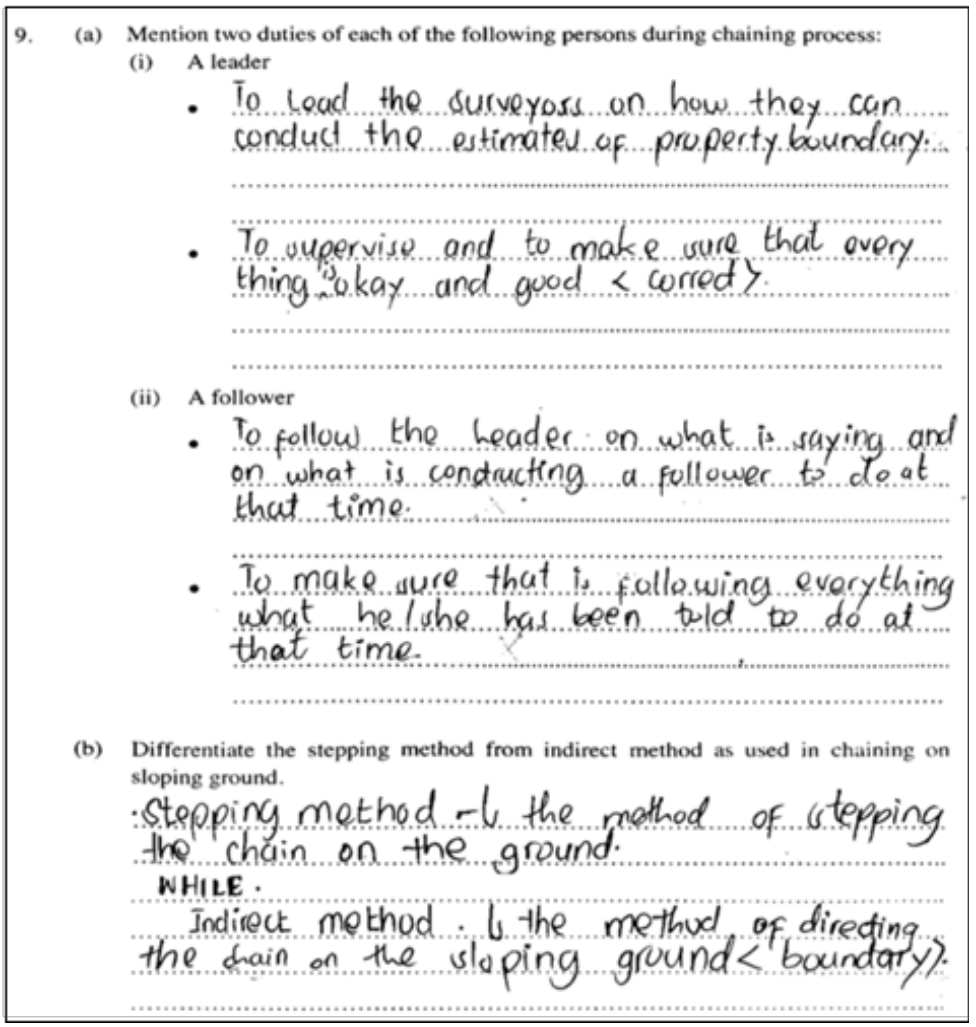
Figure 10: *The Students' Performance in Question 9*

The general performance of students for this question was average as 75 (38.07%) scored above pass mark. Despite, the average performance shown by students in this question, the results were not satisfactory because all the students who passed this question did not exceed the pass marks. This result indicates that the students failed to provide accurate and well-informed answers to this question.

Although the overall performance shows that the students performed average in this question, in reality most of them scored low marks. Even for those who passed did not exceed the average scoring marks of the question. This is among poorly performed question.

In part (a) the students failed to give the duties of *a leader* and *a follower* during surveying work. The students were supposed to know that a leader is a chainman at the front of the chain who drags it forward, inserts arrows at the end of each chain length, and follows the follower's directions, and the follower is a chainman at the back of the chain who picks up the arrows inserted by the leader. Normally, the follower is usually more experienced than the leader and is responsible for giving instructions to the leader, this chaining is a surveying technique that's best for measuring small, flat areas with simple details.

In part (b) the students were required to differentiate between the stepping method and indirect method as used in chaining on sloping ground. Students were supposed to know that chaining is a surveying technique that's best for measuring small, flat areas with simple details. When a chain is used in the measurement of a sloping area, a stepping or indirect method may be used. The main difference between the stepping method is the direct method and the indirect method which is also known as the hypotenusal allowance method takes measurement indirectly. In indirect method surveyor uses Pythagoras theorem to calculate horizontal distance, example of incorrect responses is shown in Extracts 8.1.



9. (a) Mention two duties of each of the following persons during chaining process:

(i) A leader

- To Lead the surveyoss on how they can conduct the estimates of property boundary.
- To supervise and to make sure that every thing is okay and good < corred >.

(ii) A follower

- To follow the leader on what is saying and on what is conducting a follower to do at that time.
- To make sure that is following everything what he/she has been told to do at that time.

(b) Differentiate the stepping method from indirect method as used in chaining on sloping ground.

·Stepping method - is the method of stepping the chain on the ground.

WHILE.

Indirect method . is the method of directing the chain on the sloping ground < boundary).

Extract 8.1: A sample of the incorrect responses to Question 9

Extract 8.1, demonstrates a sample of a student who failed to provide correct responses. This student lacked adequate knowledge and skills in this question.

2.3 SECTION C: STRUCTURED QUESTION

This section consisted of one question, weighing 15 marks. The score ranges used for grading and the performance of students in the question set in this section are indicated in table 10.

2.3.1 Question 10: Compass Surveying

This question was extracted from the topic of Compass Surveying. This question required the students to analyse the differences between prismatic

and surveyor's compass instruments. The question stated as follows:
Analyse five differences between prismatic and surveyor's compass instruments.

The analysis of students' performance in this question shows that 187 (94.92%) students scored from 0 to 4.5 marks, 8 (4.06%) students scored from 4.5 to 9.5 marks, and 2 (1.02%) students scored between 10 to 15 marks. The general performance of students in this question was poor as 187 (94.92%) students scored below pass marks. This analysis is summarized in Table 12 and Figure 11.

Table 12: The General Students' Performance in Question 10

Scores Range	General Performance		Remarks
	Number of Students	Percentage	
0 – 4	187	94.92	Weak
4.5 – 9.5	8	4.06	Average
10 - 15	2	1.02	Good
Total	**197**	**100**	

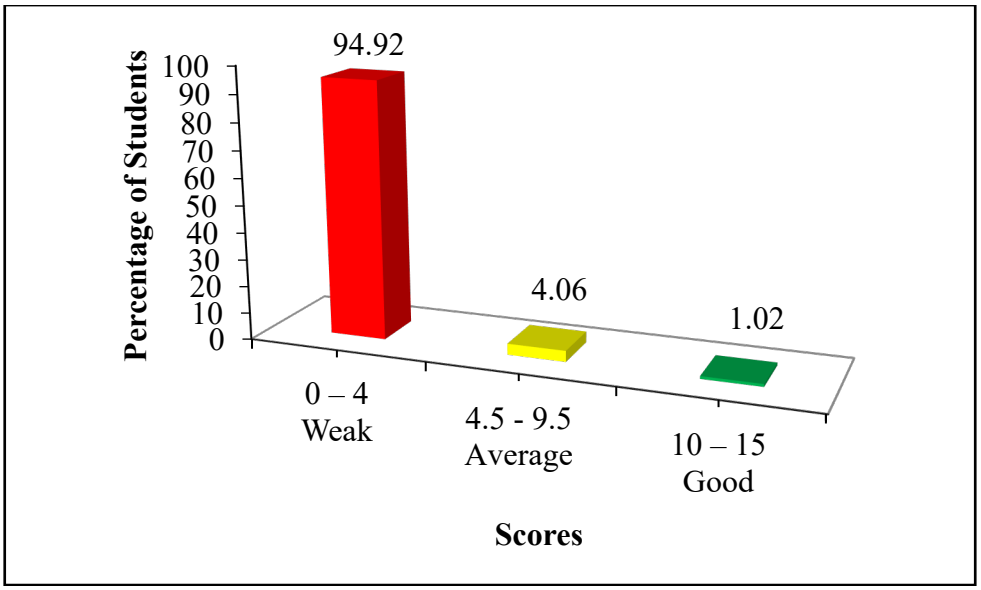
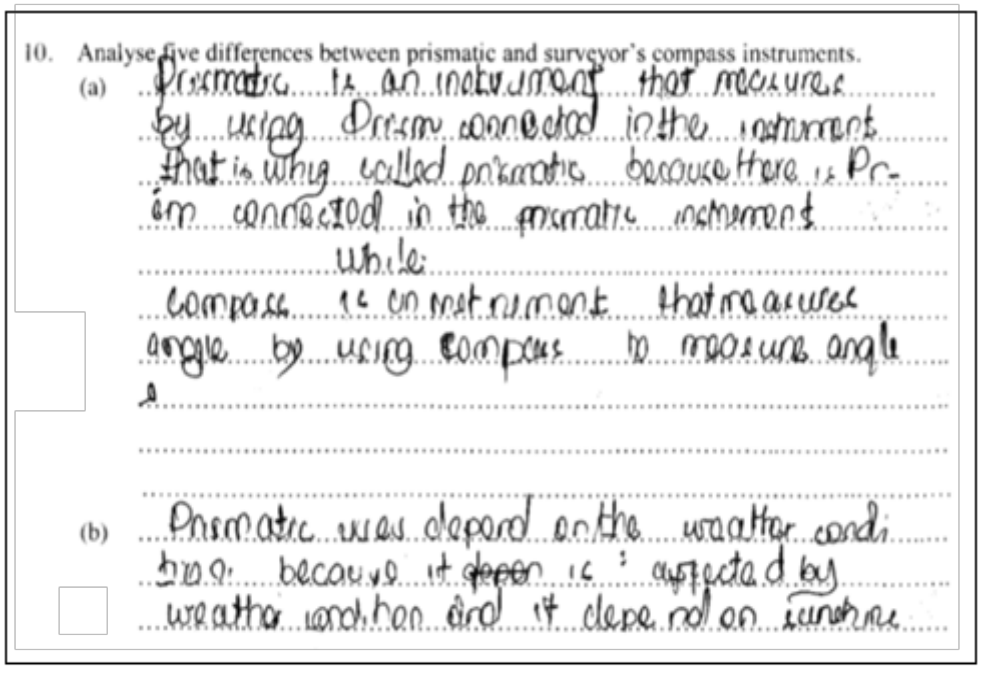


Figure 11: *The Students' Performance in Question 10*

Analysis reveals that 94.92 percent of the students scored below the pass marks. The majority failure was attributed by several factors, as reflected in the students' poor performance. These include lack of understanding of the topic, as many students struggled to grasp the necessary knowledge, and

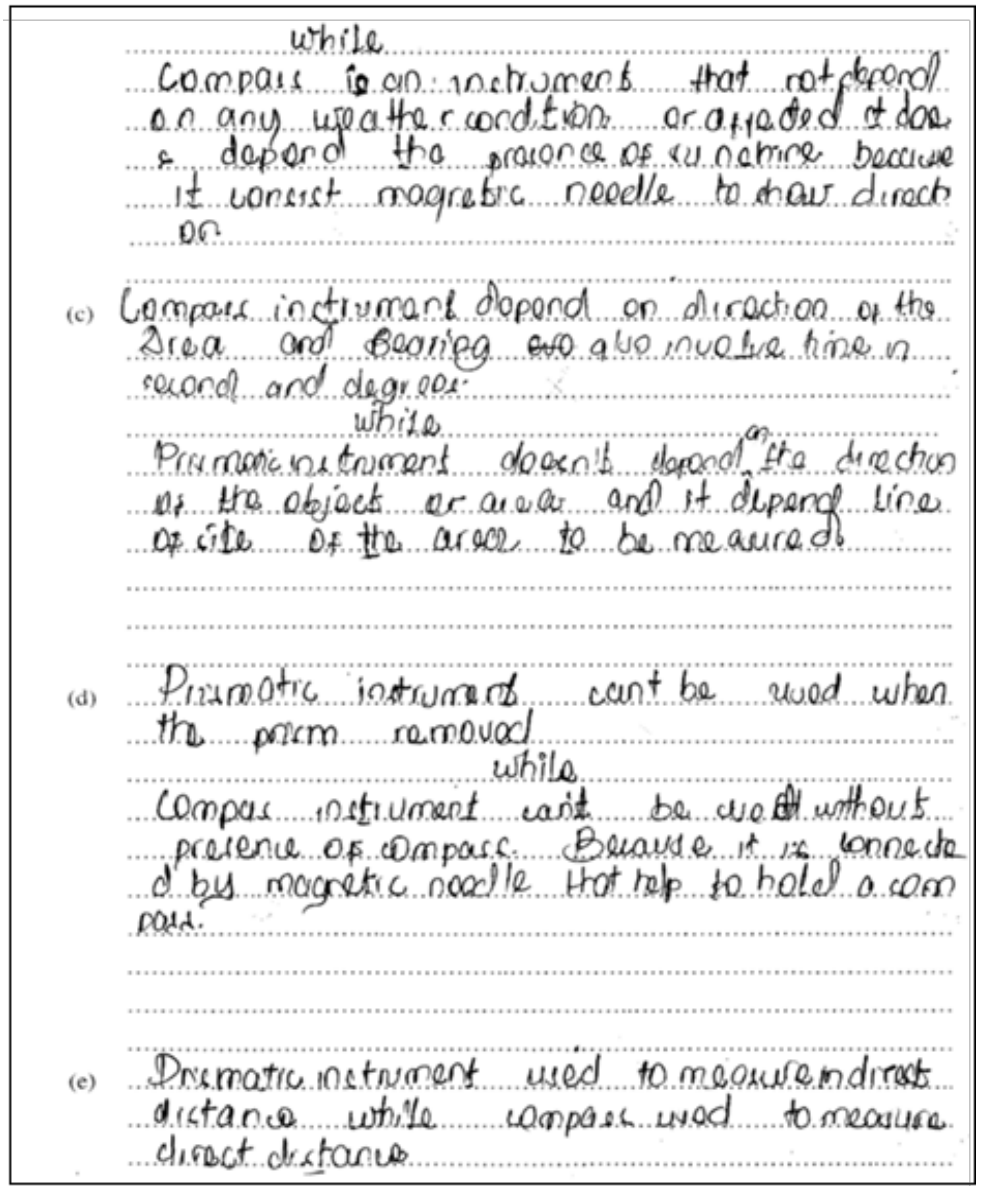
inability to comprehend the demands of the question. The main differences between a prismatic compass and a surveyor's compass are found in six aspects which are prisms. A prismatic compass has a prism to help with precise observations, while a surveyor's compass does not. *Readings,* a prismatic compass can take readings without moving your eye, while a surveyor's compass requires you to move your eyes to sight the object and read the graduated circle. Another aspect is *Graduation*, where a prismatic compass has a graduation range of 0° to 360°, while a surveyor's compass has four quadrants, each with a graduation range of 0° to 90°. Also in *Bearing* a prismatic compass can measure a whole circle bearing (W.C.B.), while a surveyor's compass can measure reduced bearing. On the aspects of *Size* and *Use*, a surveyor's compass is larger and more traditional than a prismatic compass, but a prismatic compass is used for navigation and surveying, while a surveyor's compass is used for measuring horizontal angles and magnetic bearings.

Many students completely failed to provide the correct answers. Among them, some wrote irrelevant information or provided answers that did not align with the requirements of the question. Some of them tried to explain the meaning of prism or compass without completely relating to the prismatic or surveyor's compass as used in civil engineering surveys. Extract 9.1 shows a sample of students' poor responses to question 10.


10. Analyse five differences between prismatic and surveyor's compass instruments.

(a) Prismatic is an instrument that measures by using Prism connected in the instrument that is why called prismatic because there is Prism connected in the prismatic instrument while compass is an instrument that measures angle by using compass to measure angle

(b) Prismatic uses depend on the weather condition because it depend is affected by weather condition and it depe not on sunshine



while
Compass is an instrument that not depend on any weather condition or affected it doe s depend the presence of sunshine because it consist magnetic needle to show direct on.

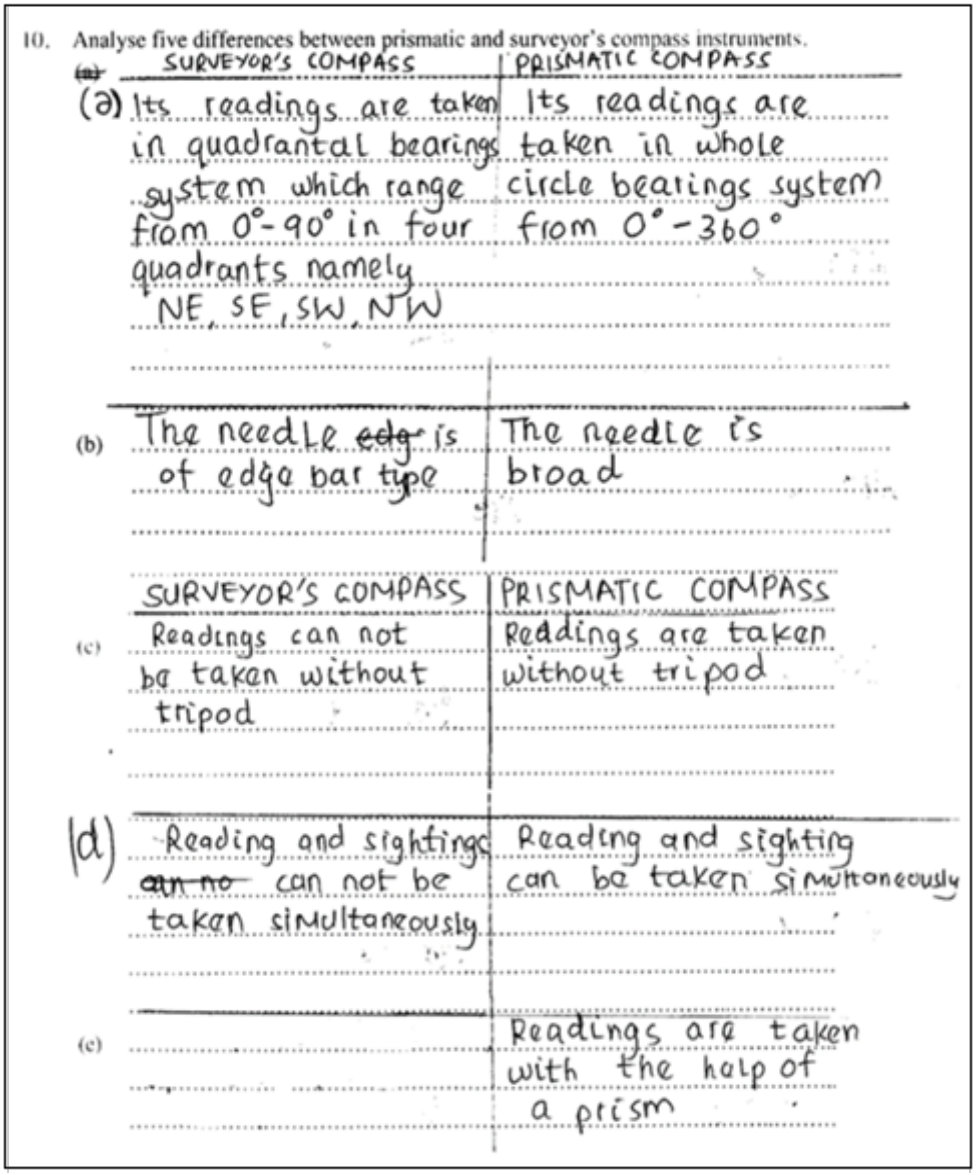
(c) Compass instrument depend on direction of the area and bearing are also involve time in second and degrees.
while
Prismatic instrument doesn't depend the direction of the object or area and it depend time of site of the areas to be measured.

(d) Prismatic instrument cant be used when the poem removed
while
Compass instrument can't be used without presence of compass. Because it is connected by magnetic needle that help to hold a compass.

(e) Prismatic instrument used to measure indirect distance while compass used to measure direct distance.

Extract 9.1: A sample of the incorrect responses to Question 10

On the other hand, there were 10 (5.08%) students who managed to score pass marks. The analysis reveals several factors contributing to the students' good performance. These students demonstrated sufficient knowledge of the topic, particularly in practical activities. They were able to answer the question well and achieved high marks. Extract 9.2 is a sample of good responses to question 10.


10. Analyse five differences between prismatic and surveyor's compass instruments.

	SURVEYOR'S COMPASS	PRISMATIC COMPASS
(a)	Its readings are taken in quadrantal bearings system which range from 0°-90° in four quadrants namely NE, SE, SW, NW	Its readings are taken in whole circle bearings system from 0°-360°
(b)	The needle ~~edg~~ is of edge bar type	The needle is broad
(c)	SURVEYOR'S COMPASS Readings can not be taken without tripod	PRISMATIC COMPASS Reddings are taken without tripod
(d)	Reading and sightings ~~an no~~ can not be taken simultaneously	Reading and sighting can be taken simultaneously
(e)		Readings are taken with the help of a prism

Extract 9.2: A sample of the correct responses to Question 10

Extract 9.2 is a sample of responses that illustrates a sample of good responses to question 10.

3.0 ANALYSIS OF THE STUDENTS' PERFORMANCE PER TOPIC

The students' performance in Civil Engineering Surveying was average as shown in the analysis of each question. The paper covered seven topics including *Civil Engineering Surveyor, Surveying Tools and Equipment, Safety Management and Rules.* Other topics are *Introduction Surveying Methods, Chain Surveying and Linear Measurements, Compass Surveying* and *Surveying Techniques for Small Areas Practice.*

The analysis indicates that the students had good performance on the topic of *Safety Management and Rules* (96.95%). However, the students had an average performance on the topics of *Chain Surveying and Linear Measurements* (63.20%), *Introduction to Civil Engineering Survey* (39.56%) and *Introduction to Surveying Methods* (38.07%). Weak performance was observed on the topics of *Surveying Tools and Equipment* (15.74%), *Surveying Techniques for Small Areas Practice* (12.18%) and *Compass Survey* (5.08%). A summary of performance for each question and topic is provided in Appendices A and B, respectively.

4.0 CONCLUSION AND RECOMMENDATIONS

4.1 Conclusion

The general performance of students in Civil Engineering Surveying subject in 2024 was average, given that only 118 (59.90%) students ranged on average and good performance while 79 (40.10%) of the students failed.

The students' performance in questions 1, 2, 3 and 4 was good while the performance in questions 6 and 9 was average. The poorly performed questions were 5, 7, 8 and 10 from the topics of *Surveying Tools and Equipment, Surveying Tools and Equipment, Surveying Techniques for Small Areas Practice, Introduction to Civil Engineering Survey* and *Compass Survey* respectively.

Most students who performed poorly on those questions failed to understand the questions' requirements and had inadequate knowledge of the topics tested. Moreover, they lacked the necessary skills and practical experience, particularly in the topics of *Introduction to Surveying Methods, Techniques for Small Areas Practice* and *Compass Survey*, which prevented them from providing accurate answers. Therefore, students need to put more effort in

studying Civil Engineering Surveying Subject, with a focus on practical exercises, to enhance their competencies.

4.2 Recommendations

Based on the performance observed in this analysis, the following recommendations are worth noting for students and teachers:

(a) Recommendations to Students

(i) Students should read carefully the instructions before attempting the questions so as to understand the demands of the questions.

(ii) Students are encouraged to search and study relevant materials from books or internet sources in order to widen their knowledge. This will help them to grasp relevant and modern concepts and theories applied in the building and construction industry.

(iii) Students should be involved in practical works (activities) whenever they get a chance, this will lead them to learn by doing.

(iv) Students should frequently practice drawing various surveying sketches during their practical surveying sessions to strengthen their memory on surveying principles during surveying works.

(b) Recommendations to Teachers

(i) Teachers should provide more exercises, homework, assignments, and timely feedback, as well as conduct tests to prepare students before they sit for the National Assessment so as to improve students' performance.

(ii) Teachers should assist students in developing practical skills so that they can integrate theoretical knowledge with practical experience, thereby acquiring the expected competencies.

(iii) Teachers are advised to read the Students Item Response Analysis (SIRA) report more often to identify the challenging areas and be able to help the students appropriately during the teaching and learning process at schools.

(iv) Teachers may use interactive projectors during teaching to make learning more active and productive. Through this method, students can see visual aids, like colourful charts, diagrams and videos which help them to acquire the expected skills of the subject matter.

Appendix A

Analysis of the Students' Performance in Each Question

S/N	Topic	Question Number	Percentage of Students who Scored 30% or More	Remarks
1	Surveying Tools and Equipment Introduction Surveying Methods Chain Surveying and Linear Measurements Compass Survey	1	97.97	Good
2	Safety Management and Rules	2	96.95	Good
3	Introduction to Civil Engineering Survey	3	77.16	Good
4	Chain Surveying and Linear Measurements	4	73.60	Good
5	Chain Surveying and Linear Measurements	6	52.79	Average
6	Introduction to Surveying Methods	9	38.07	Average
7	Surveying Tools and Equipment	5	15.74	Weak
8	Surveying Techniques for Small Areas Practice	7	12.18	Weak
9	Compass Survey	10	5.08	Weak
10	Introduction to Civil Engineering Survey	8	2.03	Weak

Appendix B

Analysis of the Students' Performance Per Topic

S/N	Topic	Question Number	Percentage of Students Who Scored 30% or More	Remarks
1	Surveying Tools and Equipment Introduction Surveying Methods Chain Surveying and Linear Measurements Compass Survey	1(Multiple Choice Items)	97.97	Good
2	Safety Management and Rules	2	96.95	Good
3	Chain Surveying and Linear Measurements	4&6	63.20	Average
4	Introduction to Civil Engineering Survey	3 & 8	39.56	Average
5	Introduction Surveying Methods	9	38.07	Average
6	Surveying Tools and Equipment	5	15.74	Weak
7	Surveying Techniques for Small Areas Practice	7	12.18	Weak
8	Comass Survey	10	5.08	Weak