THE UNITED REPUBLIC OF TANZANIA MINISTRY OF EDUCATION, SCIENCE AND TECHNOLOGY NATIONAL EXAMINATIONS COUNCIL OF TANZANIA

## STUDENTS' ITEMS RESPONSE ANALYSIS REPORT ON THE FORM TWO NATIONAL ASSESSMENT

 (FTNA) 2022
## ARCHITECTURAL DRAUGHTING

## THE UNITED REPUBLIC OF TANZANIA

MINISTRY OF EDUCATION, SCIENCE AND TECHNOLOGY NATIONAL EXAMINATIONS COUNCIL OF TANZANIA

# STUDENTS' ITEMS RESPONSE ANALYSIS REPORT ON THE FORM TWO NATIONAL ASSESSMENT 

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## FOREWORD

This report presents Students' Items Response Analysis (SIRA) on Form Two National Assessment in Architectural Draughting subject which was conducted in November 2022. This report aims to provide feedback to all educational stakeholders on the factors that contributed to the students' performance in Architectural Draughting.

The Form Two National Assessment (FTNA) is a formative evaluation which intends to monitor students' learning and to provide feedback that teachers, students and other educational stakeholders can use to improve teaching and learning processes. This analysis shows justification for the students' performance in the Architectural Draughting subject. It reveals that students had good performance in the topic of Architectural Draughting and Occupation Information, Instrument Equipment and Materials, Layout of the Drawing or Paper Formatting, Blending of Straight Line and Curves, Geometrical Figures, Dimensions, Auxiliary View and Perspective Drawing. However, when it comes to Lettering and Orthographic Projection their performance is poor. Factors that affected the students' responses include inadequate knowledge of particular concepts, the failure to interpret the requirements of questions, poor command of the English Language and the inability to answer questions which required the practical knowledge and skills in designing, sketching and drawing various building components.

The report will help to identify students' strengths and weaknesses so as to improve learning before sitting for their Certificate of Secondary Education Examination (CSEE). It will also help teachers to identify the challenging areas and take appropriate measures during teaching and learning process.

The National Examinations Council of Tanzania (NECTA) expects that the feedback provided in this report will highlight the challenges which education stakeholders should take proper measures to improve teaching and learning of Architectural Draughting subject. Consequently, students will 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 to prepare this report.


Dr. Said A. Mohammed<br>EXECUTIVE SECRETARY

### 1.0 INTRODUCTION

This report provides a detailed analysis of the performance of students on Form Two National Assessment (FTNA) in the Architectural Draugting paper in the 2022. The paper adequately met the requirements of the Civil Engineering Syllabus for Technical Secondary School Education issued in 2019. Also, the paper was set according to Assessment Format issued by NECTA in 2022.

The paper had seven (7) questions, distriuted in three sections namely $\mathrm{A}, \mathrm{B}$, and C . Section A comprised of two (2) objective questions which were multiple-choice items and matching items. This section carried a total of 15 marks. Section B consisted of three short answer questions, with a total of 45 marks. Section C had two (2) structured questions each weighing 20 marks. All questions in all sections were compulsory.

A total of 490 students sat for this paper in 2022 assessment. The number of students who sat for this paper in 2021 was 487, which indicates an increase of students by $0.6 \%$ in 2022. Generally, the performance of students was average, as only 150 ( $30.6 \%$ ) of the students who sat for the assessment passed, whereas 340 (69.4\%) failed. The distribution of the scores of students' is summarized in Table 1.

Table 1: Students' Performance in Architectural Draughting Subject

|  |  | General Students' Performance |  |
| :--- | :--- | :---: | :---: |
| Scores | Remarks | Number | Percentage (\%) |
| $0-29$ | Weak | 340 | 69.4 |
| $30-64$ | Average | 147 | 30 |
| $65-100$ | Good | 3 | 0.6 |
|  | Total | $\mathbf{4 9 0}$ | $\mathbf{1 0 0}$ |

This report analyses students' responses and abidence by the requirements of questions. In this analysis, a brief note is provided on what the students were required to do and the reasons for their performance. Samples of students' correct and incorrect responses are also inserted in the form of extracts to illustrate the cases presented. Histograms, pie charts and tables are also used to summarize the students' performance in a particular question. The analysis categorizes the performance of the students in three groups namely good, average and weak, manifested by score ranges : $65-100,30-64$ and $0-29$, respectively. Green, yellow and red colours are used to represent the three categories of performance. Finally, the report gives the conclusion and recommendations for implementation.

### 2.0 THE ANALYSIS OF THE STUDENTS' RESPONSE IN EACH QUESTION

### 2.1 SECTION A: OBJECTIVE QUESTIONS

This section consisted of two questions that covered concepts from different topics. Question 1 consisted of 10 multiple-choice items, each carrying 1 mark, making a total of 10 marks. Question 2 consisted of 5 matching items, each carrying 1 mark, making a total of 5 marks. The score ranges used for grading the students' performance in this section have been shown in each question.

### 2.1.1 Question 1: Multiple Choice Items

This question had ten (10) multiple-choice items from (i) to (x). It required students to choose the correct answer from among the four (4) alternatives (A D) and write its letter in the box provided. The items were constructed from nine (09), topics namely Architectural Draughting and Occupation Information; Instrument, Equipment and Materials; Layout of the Drawing or Paper to Formatting; Blending of Straight Lines and Curves; Geometrical Figures; Pictorial Drawing; Dimensions; Auxiliary Views and Perspective Drawing.

A total of $490(100 \%)$ students attempted the question, of which 124 ( $25.3 \%$ ) scored marks from 0 to 2 . Students who scored from 3 to 6 marks were 357 ( $72.9 \%$ ), whereas $09(1.8 \%)$ students scored from 7 to 10 marks. The performance of the students in this question is summarized in Figure 1.


Figure 1: The Students' Performance in Question 1

Figure 1 shows that the students' performance in this question was good, since the majority ( $74.7 \%$ ) of the students scored average marks and above. That is, most students managed to choose the correct answers in many items. However, $124(25.3 \%)$ students performed poorly in the questions.

Students who performed well in the question demonstrated a good ability in applying knowledge of various topics in identifying the correct answers among the given alternatives. However, most of the students failed in items (vii) from the topic of Pictorial Drawings and (viii) from the topic of Dimension. The analysis of the students' responses shows that most of the students correctly chose items (ii) from the topic of Instruments, Equipment's and Materials, and (ix) from the topic of Architectural Draughting and Occupation Information. The rest of the items were performed averagely.

The strengths and weaknesses of the students in choosing correct answers for individual items in the question are analysed as follows:

Item (i) was developed from the topic of Auxiliary Views. It requires the students' to use the knowledge on a auxiliary projection to identify the type of auxiliary view projected onto a plane that is perpendicular to one of the principal planes of projection. The question was:

Which type of auxiliary view is projected onto a plane that is perpendicular to one of the principal planes of projection?

| A | Secondary | B | Primary |
| :--- | :--- | :--- | :--- |
| $C$ | Successive | $D$ | Revolved |

Alternative B, 'primary' was the correct response. Students who chose this item were knowledgeable of the auxiliary view as projected onto a plane. The majority of students who chose other distractors $\mathrm{A}, \mathrm{C}$, and D at random were unable to classify or distinguish different types of auxiliary views formed in relation to inclined lines.

Item (ii), was set from the topic of Instruments, Equipment's and Materials. It tested students' ability on identifying grades of pencil. The question stated:

You are given the following grades of pencil lead: $3 B, 4 B, 5 B$ and $6 B$. Which of these grades has the softest lead?

| $A$ | $3 B$ | $B$ | $4 B$ |
| :--- | :--- | :--- | :--- |
| $C$ | $5 B$ | $D$ | $6 B$ |

Alternative D , ' $6 B$ ' was the most correct response and was chosen by the majority of the students. Such students were knowledgeable of the grades of pencils as coded by figures and letters. Other distractors $\mathrm{A}, \mathrm{B}$, and C were actually soft, but not as softer as 6 B , Students who chose such item were not aware that the grade becomes softer, the more as the figure placed in front of the letter B increases. A few of the students who were not conversant with the grades of pencils chose the responses randomly.

Item (iii) was extracted from the topic of Instruments, Equipment's and Materials. It required students to identify or recall a piece of drafting equipment used to prepare a drawing of an object with curves, which have no constant radii. The item tested the students’ knowledge of architectural drawing instruments. The question asked:

Suppose you are preparing a drawing of an object with curves which have no constant radii. Which piece of the drafting equipment will you use?

| A | Fench curve | B | Dividers |
| :--- | :--- | :--- | :--- |
| $C$ | Compass | $D$ | Template |

The correct answer was A, 'French curve', Students who chose this response were familiar with drafting equipment used to construct curves. Students who chose alternative B, 'Dividers' were wrong because a divider is used for comparing sizes, dividing line segments, and measuring distances.

Students who chose response C, 'Compass' were also wrong because a compass is used to inscribe circles or arcs. It is also used to mark out distances as a divider. Furthermore, Students who opt for the response D, 'Template' did not realize that a template is used to quickly add precisely measured circle and arc elements to a drawing without an aid of a scaled ruler or compass.

Item (iv) was set from the topic of Layout of the Drawing or Paper Formatting. It tested students' ability to identify particulars included in the title block on A3 drawing sheets. The question was:

Suppose a draftsman is preparing a drawing of a residential building on A3 sheet. Which of the following is not included in the title block?

| A | Method of projection | $B$ | Size of the sheet |
| :--- | :--- | :--- | :--- |
| $C$ | Scale | $D$ | Sheet number |

The correct answer was B, 'Size of the sheet'. The response were chosen by students who were aware of features of the title block, namely scale, projection method, project title, project designer, dimensioning units, notes, date and sheet number. Other students who chose distractors A, B or C lacked knowledge and practical skills in the layout of drawing papers, specifically title block.

Item (v) tested students' knowledge in the topic of Geometrical Figures. The question was:
A pavement block is required to be made from a regular polygon with parallel face. How many pairs of parallel faces a pavemant block will have if a regular hexagon is chosen?

| $A$ | 1 | $B$ | 2 |
| :--- | :--- | :--- | :--- |
| $C$ | 3 | $D$ | 6 |

The correct answer was C, ' 3 '. Students who chose the correct response were aware that a regular hexagon is a closed figure which has six sides and corners, and equal interior angles and equal side length forming three pairs of parallel lines. The majority of those who failed in this item chose distractors A, ' 1 ', and D, ' 6 ', which are the parallel faces formed by a trapezoid and a hexagon, respectively. Other students who chose distractor B ' 2 ' failed in the questions because these are parallel faces formed by a rectangle, square and parallelogram. This implies that the students did not comprehend the plane geometry specifically the regular polygons. As a result they made wrong choices.

Item (vi) was extracted from the topic of Blending of Straight Lines and Curves Students were required to use knowledge of architectural lines to identify the type of line to be used to represent hidden outlines when preparing a drawing of a cylindrical water tank. The question was as follows:

You are required to prepare a drawing of a cylindrical water tank. How will you present hiden outline in a drawing?

| A | By chain thick | B | By dashed thick |
| :--- | :--- | :--- | :--- |
| C | By continuous thin | D | By chain thin double dashed |

The most correct alternative was B, 'By dashed thick'. The students who chose this option were familiar with the various types of lines and their functions.

Other distractors were not correct. Students who chose alternative A, 'By chain thick' were not aware that these lines are used to show the initial outlines before forming or bending. They can also be used to indicate parts or components situated in front of the cutting plane and to give reference to the part shown.

Alternative C, 'By continuous thin', was incorrect because these lines are used as imaginary lines of intersection, a grid, dimension, extension, projection short center, leader reference line, hatching, outlines of the revolved sections, framing of detail and indication of repetitive details. The last alternative D, 'By chain thin double dashes' was an incorrect response because these lines are used to represent outlines of adjacent and extreme positions of movable parts, centroid lines, initial outlines prior to forming and parts situated in front of the cutting plane.

Item (vii) was set from the topic of Pictorial Drawing. Students were required to use their knowledge of the pictorial drawing to identify the type of projection used to view the surrounding area and the building. The question was:

Which projection is used to see the surrounding environment and the building?

| A | Perspective | B | Isometric |
| :--- | :--- | :--- | :--- |
| $C$ | Oblique | $D$ | Auxiliary |

The correct answer was option C, Oblique. Students who were conversant with the techniques of projecting pictorial drawings chose this answer. A few students chose this correct alternative. Most students chose the alternatives randomly A. 'Perspective', B. 'Isometric', and D. 'Auxiliary'. Such students lacked practical knowledge and skills in preparing pictorial drawings.

Item (viii), tested the students knowledge in the topic of Dimensions. The question was:

Which system of placing dimensions will you use when drawing the floor plan of a shop building with doors and windows?
$\begin{array}{llll}\text { A } & \text { Break and aligned } & B & \text { Aligned and directional. } \\ C & \text { Break and unidirectional. } & D & \text { Unidirectional and directional }\end{array}$
The correct alternative was D, 'Unidirectional and directional'. A few of the students were able to answer this item correctly, because they were knowledgeable of the topic of Dimension. The majority of the students who
opted for options A, 'Break and aligned', B, 'Aligned and directional', and C, 'Break and Unidirectional' failed to differentiate the alternatives.

Item (ix) was set from the topic of Architectural Draughting and Occupation Information. It tested students' knowledge on classifications of drawing. The question was:

Identify two main classifications of drawing.
A Pictorial and orthographic
B Artist and geometrical
C Artist and technical
D Technical and engineering

The correct response was C , 'Artist and technical'. The majority of the students were able to choose the correct alternative, as they were conversant with graphic representation of an object. Other distractors A, 'Pictorial and orthographic', B, 'Artist and geometrical' and D, 'Technical and engineering' were chosen randomly by students who failed to recall the types of technical drawing.

Item (x) was set from the topic of Perspective drawing. Students were required to apply their knowledge of pictorial projection to identify the type of pictorial drawing one can use to present ideas to the client. The item measured the students' ability to identify use of different pictorial projection. The question was:

Suppose you are required to use pictorial drawing to present ideas to the client. Which drawings is appropriate to use?

| A | Auxiliary view | B | Isometric |
| :--- | :--- | :--- | :--- |
| $C$ | Oblique | $D$ | Perspective |

The correct alternative among the given distractors was D , 'Perspective.' These students were aware that perspective drawings provide the most realistic, and usually the most pleasing and likeness compared with auxiliary, isometric and oblique views. Perspective drawing is a technique that creates the linear illusion of depth because as objects get further away from the viewer they appear to decrease in size at a constant rate. Students who opted for A, B, and C lacked the ability to differentiate drawing views.

### 2.1.2 Question 2: Matching Items

This question was derived from a topic of Lettering. Students were required to match the responsibilities given in List A with their corresponding technical titles in List B by writing a letter of the correct responses in the table provided. The question was as follows:

| List A | List B |
| :---: | :---: |
| (i) Uniformity in width of all strokes is the main distinguishing characteristics. <br> (ii) Difficult to read and draw. <br> (iii) Can be used in both gothic as well as roman. <br> (iv) Thick and thin width strokes and serifs are the main distinguishing features. <br> (v) Interconnected lower case letters are used within the words. | A Roman <br> B Vertical <br> C Gothic <br> D Script <br> E Italics <br> $F$ Texts <br> $G$ Serifs <br> $H$ Inclined |

Statistics show that $490(100 \%)$ students attempted this question. Out of those students, 371 ( $75.5 \%$ ) scored from 0 to 1 mark. Students who scored from 2 to 3 marks were 115 ( $23.5 \%$ ). Moreover, 4 ( $0.8 \%$ ) scored from 4 to 5 marks. Table 2 summarizes the students' performance in this question.

Table 2: The Students' Performance in Question 2

| Scores | Remarks | General Students' Performance |  |  |
| :--- | :--- | :--- | :--- | :---: |
|  |  | Percentage (\%) |  |  |
| $0-1$ | Weak | 371 | 75.7 |  |
| $2-3$ | Average | 115 | 23.5 |  |
| $4-5$ | Good | 4 | 0.8 |  |
|  | Total | $\mathbf{4 9 0}$ | $\mathbf{1 0 0}$ |  |

The analysis of the students' performance in each item is as follows:
In item (i), students were required to match the uniformity in width of all strokes is the main distinguishing characteristics. The correct response was C, 'Gothic'. A fewer students were able to match this item correctly. However, some students matched it with A, Roman. Such students failed to recall Roman letters have ornamental or finishing strokes called serifs at both the top and bottom parts of the letters.

In item (ii), students were required to write the correct response that matched 'Difficult to read and draw'. The correct match was G, 'Serifs'. The majority of the students were not able to match this item correctly. The students' performance in this item was average. However, some of the students matched it with F, 'Text'. Such students failed to recall that 'Text' can be used in both Gothic and Roman.

In item (iii), students were required to identify the correct match of with the statement, 'Can be used both in gothic as well as roman'. The correct response was F, 'Text'. This item was chosen by most of students. The students were able to understand and identify the common styles of lettering involved in drawings.

Item (iv), required students to identify the response which matches correctly with the given statement, 'Thick and thin width strokes and serifs are the main distinguishing features'. The correct response was A, 'Roman'. The score range for this alternative was average, implying that the students mastered the knowledge in the topic of Lettering.

In item (v), students were required to write the correct match of the statement 'Interconnected lower case letters are used within the words which is the word, 'Italic', the correct response E, The performance in this item was poor, as most students responded incorrectly, likely because they did not master the topic.

### 2.2 SECTION B: SHORT ANSWER QUESTIONS

### 2.2.1 Question 3: Orthographic Projection

This question had parts (a) and (b). In part (a), students were required, with the aid of drawing, to describe two common methods applied in drawing the pictorial projection of cylindrical objects. In part (b), they had to draw, to a scale of 1:50, a third angle projection of the tank in the figure provided. The question is designed to assess students' knowledge of pictorial and orthographic projections.


The question was attempted by all 490 (100\%) students, out of which 427 ( $86.7 \%$ ) scored from 0 to 4 marks, $58(11.9 \%)$ scored from 4.5 to 9.5 marks and $7(1.4 \%)$ scored from 10 to 15 marks. Figure 2 presents the students' scores in Question 3.


Figure 2: The Students' Performance in Question 3
Figure 2 indicates that the general performance of the students in this item was poor as 86.7 percent of the students scored below 4.5 marks. The analysis shows that the majority of the students who scored low marks could not demonstrate sufficient knowledge and skills in drawing views in the orthographic and isometric projection.

In part (a), the students failed to demonstrate an understanding of the topic. They lacked knowledge and skills in both, mentioning the two common methods applied in drawing pictorial projection of cylindrical objects and describing them. In addition, they failed to give suitable examples for each case; as well as to project the cylindrical object into drawing for both two methods differently. Some of students were able to mention the methods, i.e. (i) ordinate method and (ii) compass method. However, other students could not understand the concepts of the two methods. Hence, they failed to project. Some students drew the same object asked in the question paper. Some failed to distinguish between the compass and ordinate methods, which made them score low marks.

In part (b), the students' performance was weak because of their failure to comprehend the requirement of the question. For instance, some students were not able to draw the plan views, front views and side elevations of the given cylindrical object.

The students were not aware that the third angle projection as the 3 D object to be projected is placed in the third quadrant and is positioned behind the vertical plane and below the horizontal plane. Moreover, some students had little information about the use of scales and application of hidden lines. The majority of the students who scored zero marks lacked basic knowledge of the concepts tested. Extract 1.1 provides a sample of incorrect responses from one of the students.

3, (a) With the aid of drawing, describe two common methods applied in drawing pictorial projection of cylindrical objects.
(i)



Extract 1.1: A sample of the students' incorrect responses to Question 3
Extract 1.1 is a response from a student who could not understand concepts of the two methods applied in drawing pictorial projection of cylindrical objects as a result he/she mentioned and described the types of orthographic projection in part (a) and drew a third angle orthographic projection with a wrong positioning of the views in part (b).

On the contrary, students who scored average marks (4.5 to 9.5) were able to draw the required drawings but skipped some procedures in the process of attempting the question. For instance, in part (a), students in this category were able to mention but failed to describe the two methods applied in drawing the pictorial projection of cylindrical objects. In part (b), the students were able to
draw an orthographic view without showing construction lines projected in relation to the front, plan and end elevations. The missing of some dimensions was also one of the reasons for scoring average marks.

Nevertheless, 1.4 percent of the students scored from 10 to 15 marks. Such students managed to identify the three views of the cylinder and used an appropriate scale of $1: 2$ to draw its orthographic. The students in this category mastered the concept of the orthographic projections. Extract 1.2 illustrates a correct response from one of the students who attempted the question well.


Extract 1.2: A sample of the students' correct responses to Question 3
Extract 1.2 is a response from a student who managed to provide relevant responses to the question.

### 2.2.2 Question 4: Scales

The question intended to assess the students' knowledge on uses, interpretation and application of architectural drawing scales. The question had two parts, (a) and (b). In part, (a) students were required, with examples, to explain three types of scales used in architectural draughting. In part (b), they were required to to determine the sizes of the rectangle drawn on paper using the scale of 1:100.

A total of $490(100 \%)$ students attempted the question. The analysis of the students' performance shows that $224(45.7 \%)$ students scored from 0 to 4 marks, 189 ( $38.6 \%$ ) scored from 4.5 to 9.5 marks, whereas 77 ( $15.7 \%$ ) students scored from 10 to 15 marks. Figure 3 summarizes the students' performance in this question.


Figure 3: The Students' Performance in Question 4
Figure 3 illustrates that the general performance of the students in this question was average, as 54 percent of the students scored 4.5 and above marks. The majority of the students who scored average and above marks were able to explain, to some extent, the type of the scale used in architecture draughting but failed to give examples in part (a). They were also able to calculate the drawing length from a scale given and partially constructed a rectangle to the required scale.

Furthermore, students who scored full marks perfectly explained, with examples, the type of scale used in architectural draughting in part (a), interpreted the given
scales and converted the actual dimensions to drawing dimensions. In addition, they drew the rectangle to the required scale. Such students had an adequate knowledge of architectural drawings scale. Extract 2.1 presents a sample of such correct responses.

The process of drawing objects like tables, chairs or buildings on a small piece of paper is only possible when a scale is used.
(a) With examples, explain three types of scales used in architectural draughting.
(i)
 with Ir el womisan as: 11

$\qquad$


 He drawing she of
(iii) Enlarged scale used to.....ndarg................................. ...to bey seen dearly e. eg. 2:1 50:

(b) Consider a rectangle that represents the actual size of the floor plan of a certain classroom sized $20,000 \mathrm{~mm} \times 30,000 \mathrm{~mm}$.
(i) Determine the sizes of the rectangle drawn on a paper using a scale of 1:100.



Extract 2.1: A sample of the students' correct responses to Question 4
Extract 2.1 is a sample of response by a student who explained the types of scale used in architectural draughting and gave an example in each item in part (a). The student was also able to calculate the drawing length of the rectangle from the given scale and draw the figure as required in part (b) of the question.

Despite the average performance by most students, 45.5 percent of the students performed poorly. The majority of the students who scored low marks misinterpreted the requirements of the question in part (a). They also mixed up the scale used in architectural draughting with scales used in engineering drawing. Engineering drawing scale include plain, diagonal, comparative, vernier and scale of chords. These students could not interpret the given scales because they failed to convert the given actual dimensions to drawing dimensions in part (b) (i) but partially were able to draw the rectangle in part (b) (ii). Hence they scored some marks. Further analysis done on the students' responses show that those students who scored 0 mark, provided irreverent answers in the all parts of question.

There are a number of factors, which might have contributed to the failure of the students in this question. The factors include the lack of drawing skills and
inadequate mastery of the topic of architectural scales. Extract 2.2 provides a sample of the students' incorrect responses to this question.
4. The process of drawing objects like tables, chairs or buildings on a small piece of paper is only possible when a scale is used.
(a) With examples, explain three types of scales used in architectural draughting.
(i) Flown scale

$\qquad$
$\qquad$


$\qquad$
$\qquad$
(iii) Comparator scale
-....ran!, cohen calaulateon Full y ley of an object
$\qquad$
$\qquad$
$\qquad$
(b) Consider a rectangle that represents the actual size of the floor plan of a certain classroom sized $20,000 \mathrm{~mm} \times 30,000 \mathrm{~mm}$.
(i) Determine the sizes of the rectangle drawn on a paper using a scale of 1:100.



Extract 2.2: A sample of the students' incorrect responses to Question 4
Extract 2.2 shows a sample of the incorrect responses from a student who wrote the types of engineering drawing in part (a) and wrongly interpreted the given scale and failed to calculate the drawing scale in part (b) (i). $\mathrm{He} /$ she also failed to follow the given instruction; hence he/she drew the given rectangle in part (b) (ii).

### 2.2.3 Question 5: Geometrical Figures.

This question had two parts: (a) and (b). The students were required to use their knowledge of geometrical figures to respond to this question. Students were required, in part (a), to enumerate four procedures that one should follow in drawing hexagon inscribed in a circle of any given diameter with the help of a drawing. In part (b) by using a scale of 1:1, they were required to draw the pentagon when the diameter of a circle equals to 80 mm .

A total of 490 ( $100 \%$ ) students attempted the item. Out of which, 270 (55.1\%) scored from 0 to 4 marks, 155 ( $31.6 \%$ ) scored from 4.5 to 9.5 marks and 65 $(13.3 \%)$ students scored from 10 to 15 marks. Figure 4 summarizes the overall performance of the students to the question.


Figure 4: The Students' Performance in Question 5
Figure 4 indicates that the general performance of the students in this question was average as 44.9 percent of the students scored 4.5 and above marks. The majority of the students who scored in the range of an average and above were able to write and follow procedures. Hence they drew the hexagon inscribed in a circle of any given diameter in part (a). They also drew the pentagon when given the diameter of the circle in part (b). The variation observed in the students' scores depended on individual presentation skills, especially in the use of scale, the degree of neatness and the ability to differentiate the use of different types of lines in the drawing. Extract 3.1 illustrates a good response from one of the students who attempted the question.
 .exampl e.....e. have use..... 38 mm
(ii) With .....the ...... same ....radius ..........mark .......the point ...along. the sircumperence .... which . . will . be ...point.... A:
(iii) Then ... with ......the fame. radius.........................................................cumperence .upto...rich ....point .... A. ...and mark. them....points $B, C, D$, E and F:
(iv) Join ...... you given ..... points ..... A
(b) Using a scale of 1:1, draw the pentagon when the diameter of a circle equals to 80 mm .


Extract 3.1: A sample of the students' correct responses to Question 5
Extract 3.1 is a sample of responses from a script of the student who managed to draw the hexagon inscribed in a circle of any given diameter in part (a). They
also drew the pentagon when given the diameter of the circle in part (b). Hence she/he was able to score full marks.

Despite the average performance by most of the students, 53.77 percent of the students performed poorly. Most of such students who provided irrelevant responses in all parts of the question, probably due to insufficient practical knowledge and skills in drawing, failure to follow procedures and incomprehension of concepts related to the construction of geometrical features. Extract 3.2 provides a sample of the students' incorrect responses in this question.
5. (a) With the help of a drawing, enumerate four procedures you will follow in drawing hexagon inscribed in a circle of any given diameter.
procedures.

(i) Draw a line a $A B$ with any length example 2 cm . ii) Daw a perpendicular line at $90^{\circ}$ by using. length $A B$ provided (iii) Stand at intersecting arcs you used to obtain $90^{\circ}$ and draw acircle. iv) By using $A B$ length, mark your points and join them to obtain hexagon.


Extract 3.2: A sample of the students' incorrect responses to Question 5
Extract 3.2 shows a sample of the incorrect responses from one of the students who failed to draw the hexagon by using the given information in part (a), contrarily, he/she drew a pentagon with unequal side in part (b).

### 2.3 SECTION C: STRUCTURED QUESTIONS

### 2.3.1 Question 6: Pictorial Drawing

In this question, students were required to, use scale of $1: 1$, (a) to draw the missing end elevation, (b) to draw the object in isometric projection. The question stated as follows:
The figure below is a plan and front elevation of a certain wooden object in the drawing office. In order to give a carpenter for making it, two views are required to be added. Using a scale of 1:1, draw:
(a) The missing end elevation.
(b) The object in isometric projection.


PLAN


FRONT VIEW

A total of $490(100 \%)$ students attempted the question, out of which, 369 ( $75.3 \%$ ) scored from 0 to 5.5 marks. The number of students who scored from 6 to 12.5 marks were $103(21 \%)$, whereas 18 ( $3.7 \%$ ) scored from 13 to 20 marks. Figure 5 presents the students' performance in this question.


Figure 5: The Students' Performance in Question 6
Figure 5 indicates that the general performance of the students in this question was poor, as 75.3 percent of the students scored below average. Further analysis
shows that the majority of the students who scored below average had insufficient skills in drawing views in the orthographic projection.

In part (a), the students failed to locate views in the first angle projection. Principally, in the first angle projection, the object's right hand side should be projected only if we observe the object from its right hand side. Further, the impression will fall to the left hand side of front view; the similar is applied to the other side, whereby the right hand side view is placed on the left side of the front view of the object.

In part (b), the students' poor performance was due to the lack of knowledge and practical skills in pictorial projections. Moreover, the students failed to conceptualize the angle of projection and the scale given in order to accommodate the requirements of the question. Extract 4.1 provides a sample of the students' poor responses in this question.


Extract 4.1: A sample of the students' incorrect responses to Question 6

Extract 4.1 shows the incorrect responses from a student who had insufficient knowledge and skills in concepts tested from the topic of Orthographic and Pictorial Projections.

Contrarily some students performed averagely because they managed to provide the correct answer but failed to exhaust all the procedures applied when attempting the question. For instance, in part (a) one of the students was able to draw orthographic view to find the missing elevation with missing construction lines related to the front, plan and end views. The lack of the dimension awareness was among the reasons for scoring average marks. In part (b), the students were able to draw an isometric view but failed to use the correct scale.

Nevertheless, 3.7 percent of the students scored from 13 to 20 marks. Such students were able to draw all the three views correctly and applied the correct position of front, top and side views. They were also able to draw an isometric drawing of the wooden object. Extract 4.2 illustrates the correct responses from one of the students who attempted the question.


Extract 4.2: A sample of the students' correct responses to Question 6
Extract 4.2 shows a drawing from the student script who managed to draw the orthographic views correctly. He/she demonstrated a good mastery of practical drawing skills by providing relevant views in correct positions and visibility.

### 2.3.2 Question 7: Orthographic Projection

In this question, students were required to draw an elevation and an oblique view. The question stated as follows:

The figure is the sketch of the $U$-shape of wooden block which is to be prepared as a teaching material to the kindergarten school. In order to make it, the orthographic views were supposed to be prepared. Using a scale of 1:1, draw:
(a) The front elevation, end elevation and plan elevation as indicated by the respective arrow $Y$.
(b) Oblique cabinet.


This question was attempted by 490 ( $100 \%$ ) students. Out of those students, 324 ( $66.1 \%$ ) scored from 0 to 5.5 marks. The number of students who scored from 6 to 12.5 marks were 148 ( $30.2 \%$ ) and only $15(3.7 \%)$ scored from 13 to 20 marks. Figure 6 summarizes the students' performance in this question.


Figure 6: The Students' Performance in Question 7

Generally, the performance of the students in this question was average, because 33.9 percent scored 6 and above marks, as illustrated in Figure 6. Such students managed to demonstrate skills in interpreting the given information. They appropriately drew the required orthographic and oblique view. The variation in their marks was caused by the differences in the quality of finishing, the number of labeling, dimensioning and neatness of drawings. Extract 5.1 shows a sample of good responses from one of the students in this category.


Extract 5.1: A sample of the students' correct responses to Question 7
Extract 5.1 is a response from a student who managed to draw in part (a), the front elevation, end elevation and plan elevation as indicated by the respective arrow. He/she also drew an oblique cabinet drawing in part (b).

The analysis reveals that 61.1 percent of the students performed poorly. In part (a), such students failed to demonstrate understanding of the properties of the orthographic projection in case of position views. They also failed to distinguish or mixed up the position of views in both method. In first angle, orthographic projection the plan comes below the front elevation. The view of the object as observed from the left side is drawn to the right of front elevation while in the third angle orthographic projection, the plan comes above the front elevation and the left hand side view is drawn to the left side of the front elevation.

In part (b), the students' poor performance was due to their inability to understand the requirement of the question. For instance, some students drew a wooden block in full size while in oblique cabinet half of their true length should shorten the receding lines. On the other hand, some students failed to recall that in the oblique projection, the front view of the object is drawn to the correct size, and its side surfaces are drawn at an angle to give a pictorial appearance.

Further analysis shows that the students who scored 0 marks failed to draw the required orthographic and oblique views. The complete failure is an indicator that the students were completely unaware of the concept of the orthographic and oblique. Extract 5.2 shows a sample of incorrect responses from one of the students in this category.



Extract 5.2: A sample of the students' incorrect responses to Question 7
Extract 5.2 shows a sample of incorrect responses from a student who did not adhere to the principles of orthographic and oblique projection. Hence she/he failed to draw an orthographic and oblique views in accordance to the given information.

### 3.0 ANALYSIS OF THE STUDENTS' PERFORMANCE IN DIFFERENT TOPICS

Architectural Draughting subject in FTNA for the year 2022 had 7 questions drawn from 13 topics as per Form One and Form Two syllabuses. The analysis of the performance reveals that the students' performance in question 1 was good, given that $74.7 \%$ of the students passed. Question 1 was set from the following topics: Architectural Draughting and Occupation Information; Instruments Equipment and Materials; Layout of the Drawing or Paper Formatting; Blending of Straight Line and Curves; Geometrical Figures; Scales; Auxiliary Views, Dimension and Perspective Drawing. The good performance in these topics is attributed to the ability of the students in utilizing knowledge acquired in different topics to identify correct answers among the given alternatives.

The topics in which the students performed averagely were Scales (54.3\%) and Geometrical Figures ( $44.9 \%$ ), tested in questions 4 and 5 respectively. The average
performance shows that the students had insufficient drawing skills that would enable them to perform above average in the topics.

The students performed poorly in topics of Pictorial Projection (24.7\%), Lettering (24.3\%) and Orthographic projection (23.6\%) tested in questions 2, 3, 6 and 7. The analysis shows that the inability of the students to identify the requirements of questions, misinterpretation of question requirements and irrelevant application of the acquired knowledge and skills led to poor performance in the mentioned topics.

### 4.0 CONCLUSION

The analysis of the students' performance was done in all questions which were assessed in Architectural Draughting paper in 2022 . Generally, the performance of the students in Architectural Draughting was average, as only $30.6 \%$ of the students were able to score pass the mark and above.

The average performance of the students was attributed by incapability to interpret correctly the requirements of the questions asked, inability to attempt questions; insufficient and inadequate knowledge and skills acquired in the tested topics including the lack of practical drawing skills in the topics of Lettering, Pictorial and Orthographic Projections. The poor command of English language was also a factor in the outcome.

The students' performance in questions 1 was good while the performance of students in questions 4,5 and 7 was average. The poorly performed questions were 2,3 and 6 .

The analysis conclude that drawing equipment, instruments, materials and more involvement in drawing practical works are required to improve the prospective students' performance. This will help them acquire logical and technical understanding of the subject matter.

### 5.0 RECOMMENDATIONS

Based on the shortcomings observed in the analysis, it is recommended that:
(a) School administrators and subject teachers should promote learning by doing. This involves ensuring the availability of learning and teaching facilities. The Practice will foster the acquisition of knowledge and competence by students. As a result, their performance will improve at both the school and national level.
(b) Teachers should provide regular exercises, tests and immediate feedback to students on how they can identify the requirements of questions and presentation of their responses.
(c) Teachers should make students practise on drawing classrooms and various sources of technical drawing skills to improve their competence. This can be possible if they ensure easy access of internet, relevant books, and study tours.
(d) Students should be encouraged to search and read relevant materials such as books or websites in order to widen their knowledge. This will help them to grasp relevant and modern concepts and theories applied in the construction industry.
(e) Teachers should foster more competence based questions during the syllabus implementation and encourage the participatory mode of learning (student centered learning).
(f) Students should be encouraged to read instructions on the question papers so that they can attempt questions according to their requirements.

Appendix:
Analysis of the Students' Performance in Different topics

| S/N | Topic | Question Number | Percentage of <br> Students who <br> Scored 30\% <br> or above | Remarks |
| :--- | :--- | :--- | :--- | :--- |
| 1 | Architectural Draughting <br> and Occupation <br> Information; Instruments, <br> Equipment and Materials; <br> Layout of the Drawing or <br> Paper to Formatting; <br> Blending of Straight Lines <br> and Curves; Geometrical <br> Figures; Pictorial <br> Drawing; Dimensions; <br> Auxiliary Views and <br> Perspective Drawing. | (Multems) | 73.8 | Good |
| 2 | Scales | Were |  |  |
| 3 | Geometrical Figures | 5 | 54.3 | Average |
| 4 | Pictorial Drawing | 6 | 44.9 | Average |
| 5 | Lettering | 24.7 | Weak |  |
| 6 | Orthographic Projection | 3 and 7 | 23.6 | Weak |

