NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY
FACULTY OF SCIENCE AND TECHNOLOGY EDUCATION
DEPARTMENT OF SCIENCE, MATHEMATICS AND TECHNOLOGY EDUCATION

ASSESSMENT IN SCIENCE, MATHEMATICS AND TECHNOLOGY EDUCATION

PST6205

Main Examination Paper	**November/December 2024**

Time Allowed: **3 hours**

Total Marks: **100**

Special Requirements:
1. Statistical Tables
2. Drawing instruments
3. Coloured pens or highlighters

Internal Examiner: **Prof N Phuthi**

External Examiner:

INSTRUCTIONS AND INFORMATION TO CANDIDATES

1. Answer ALL Questions in Section A and any THREE questions in Section B.
2. This Examination Paper consists of 8 printed pages and 20 questions.
3. It is to your best interest to use neat and legible handwriting.

MARK ALLOCATION

	QUESTION NUMBER	ALLOCATED MARKS
Section A	1 – 15	25
Section B	16	25
	17	25
	18	25
	19	25
	20	25

SECTION A

1. Answer all questions in this section.
2. The first 10 questions (20 marks) consist of TWO parts each, the ASSERTION and the REASON. Answer both parts by writing down ONLY the letters corresponding to your chosen answers.

	Assertion	Reason
1.	What is pre-assessment or pre-testing primarily used for? A. To prepare a curriculum B. To assign grades C. To measure learning D. To modify teaching according	A. Pre-assessment is short and simple B. Pre-assessment takes place at the start of a teaching session C. Pre-assessment is done prior to grading learners D. Pre-assessment integrates curricula
2.	The standard normal curve is symmetrical about the: A. Median B. Mode C. Mean D. Standard deviation	A. The mean is more central B. The median covers more scores C. The mode selects the best performance D. The standard deviation is more inclusive
3.	On an aptitude test with a mean of 100 and a standard deviation of 15, Chipo scored 85. What is Chipo's z-score? A. 1 B. 2 C. -2 D. -1	A. Chipo's mark is lower than the mean B. Chipo's mark is one standard deviation below the mean C. Chipo's mark shows that she passed the test D. Chipo's mark is ± 1 standard deviation
4.	Construct validity is: A. How well an instrument compares with a second assessment concurrently done B. When statistical procedures establish the contribution of several contributing factors C. The degree to which an instrument can forecast the outcome D. A logical link between the test instrument and the test objective	A. A test instrument must be valid B. Measurement uses a valid instrument C. Constructs are 'hidden' concepts which require indirect measurement D. Constructs are linked to test objectives
5.	Which of the following best affects test reliability? A. Wording of questions B. Physical settings C. The learner's mood D. All of the above	A. Learners must understand what they are answering B. Learners must be equipped for the test C. Learners must be capable and motivated to write the test D. Learners must study hard
6.	Which of the following is an example of criterion-referenced assessment? A. A test with percentiles as evaluation criteria B. A test based on the criteria of minimum level of learning C. A test with z-scores as evaluation criteria D. A test based on comparing student performance	A. Criterion-referenced assessment addresses attainment of objectives B. Standards for testing are high C. Z-scores include criteria D. Percentiles are

7.	The item difficulty index (F) ranges from 0 to 100%. Which of the following statements is true? A. The higher the value F, the harder the question B. It works when the number of students is low C. The higher the value F, the easier the question. D. It is norm-referenced	A. Item difficulty considers the number getting the item correct B. Item difficulty is a grading process C. All indices range from 0 to 100% or 1 D. Difficulty is the same as standard deviation
8.	Which of the following is a form of technology use in STEM learning and assessment? A. Engineering group discussion and lecture B. O and A Level question papers in physics C. Virtual laboratories and simulation D. Computers, software and mobile phones	A. These are methods of teaching and assessment B. Physics is a STEM subject C. These are examples of technology in teaching and training D. Engineering is a STEM subject
9.	Which is the best reason for invigilating students during examination? A. To catch cheating and dishonest students B. To maintain order and ensure adherence to examination requirements C. To assist students with time management D. To enforce discipline in the examination room	A. Students are prone to misconduct if left unmonitored B. Invigilators must be strict disciplinarians C. Examination regulations must apply to every student fairly D. Students concentrate on the questions and forget to check the time.
10.	Continuous assessment should NOT be implemented: A. To compare and publicly rank students against one another B. To improve the overall teaching-learning process C. To cause undue stress and anxiety among students for their performance D. To monitor and support the holistic development of students	A. Continuous assessment is 'assessment for learning' B. Continuous assessment is 'assessment as learning' C. Continuous assessment is 'assessment of learning' D. Continuous assessment is 'assessment after learning'

11. The following are desirable elements in learning and choice of education goals.

      i)   a more diverse range of assessment types
      ii)   easy gathering feedback on students during learning
      iii)   a more diverse collection of universities for study
      iv)   easy collection and analysis of student data
      v)   parents' and guardians' views on universities

Which of the above are best achieved by the use of digital technology in assessment of learning?
    A. i and ii only
    B. i, ii, and v
    C. ii, iii, and iv
    D. i, ii, and iv

12. Which of the following is a conceptual criticism for traditional paper-based models of assessment in the present era of digitalisation?

    A. Heavy reliance on standardised tests and grading
    B. Repetition of digital technology methodologies
    C. Heavy reliance on the need for teachers
    D. Use of classrooms and laboratories for learning

13. What is the purpose of a "table or grid of specifications" in assessment design?

    A. To analyse student demographics and tailor assessments accordingly
    B. To ensure alignment between learning objectives, content, and assessment items
    C. To provide a detailed rubric for grading student performance on assessments
    D. To establish a timeline for administering and evaluating assessments

14. One requirement for assessing essay and long answer questions is to:

    A. Disregard grammatical errors and omissions
    B. Allocate equal marks for each valid point or task
    C. Use a well-written and clear rubric
    D. Assess only what was taught

15. Study the table below and answer the question:

Concepts In Assessment	Explanation
i. Content validity	(a) concept mapping
ii. Item difficulty	(b) self-assessment
iii. evaluating own skills and knowledge	(c) coverage of learning matter

Which of the following pairs show correct matching?
    A. (i, a) and (ii, b)
    B. (iii, b) and (ii, c)
    C. (ii, a) and (i, c)
    D. (i, c) and (iii, b)

SECTION B

1. Answer any THREE questions in this section.
2. All questions carry equal marks.
3. Begin each question on a fresh page and keep all parts of the same question together.

Question 16

Read the passage below and answer the questions that follow.

> Although the use of digital technologies in assessment offers a range of benefits over traditional paper-based assessment from increased convenience and accessibility to improved security and increased engagement – it is essential to note that digital technologies are not a replacement for conventional assessment methods. Digital technologies, such as online assessments, computer-based assessments, and mobile assessments, may have limitations in terms of security, accessibility, and reliability. For instance, internet connectivity issues or technical problems with hardware or software may negatively impact the assessment experience. Also, digital assessments may introduce new biases and fairness concerns that need to be addressed. For example, certain populations may be disadvantaged due to differences in technology access and/or familiarity with digital platforms. (O. Olunirola; Digital Technologies for Assessments)

(a) Identify the three (3) types of digital technologies mentioned in the passage, briefly define them and give one example of each. [6]

(b) Give a suitable title or heading for this passage, giving two reasons for your choice. (4)

(c) Expound fully on the statement 'digital technologies are not a replacement for conventional assessment methods'. Give clear explanations of the author's arguments, and whether you agree or disagree with the author. [15]

Question 17

Figure Q16 is a model showing steps in planning for outcomes-based assessment.
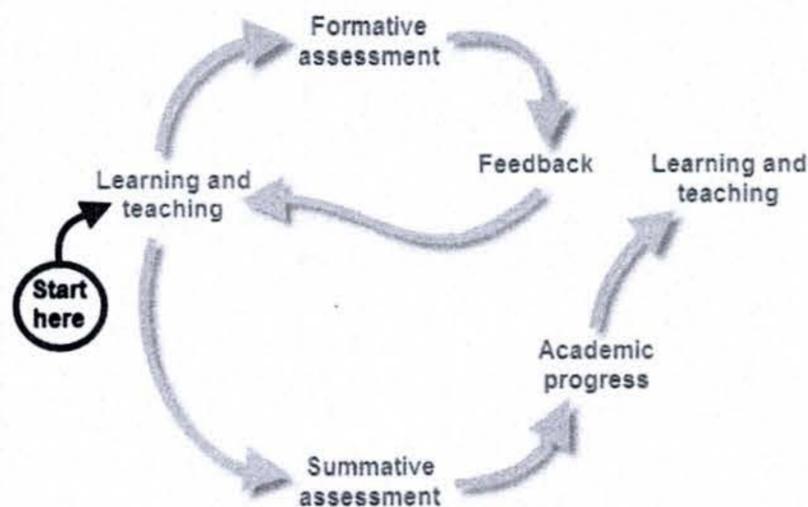

Fig Q16: Planning for outcomes-based assessment (Source: Terry Johnson Consulting)

(a) Examine the 'start' and the your perceived 'end' of the model. What does this say about the goals of all assessment in teaching and learning? [10]

(b) Use the model to discuss your personal understanding of 'formative' and 'summative' assessment, and say how you apply this understanding. [10]

(c) How would you improve or modify the model to suit your needs and perceptions? [5]

Question 18

Study the information in Table 1 and answer the questions that follow.

TABLE 1: Test item analysis data - Multiple Choice questions

Student	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	TSS	R
					QUESTIONS/ITEMS							
Siza	1	1	1	1	1	0	1	1	1	0	8	
Joy	0	1	1	0	1	1	0	0	0	0	4	
Thom	1	0	0	1	0	1	1	1	1	0	6	
Ronet	1	1	1	1	1	0	1	1	1	1	9	
Rach	0	0	0	0	1	1	0	1	0	1	4	
Faith	1	1	1	1	1	0	1	1	1	1	9	
Bula	1	1	1	1	1	0	1	1	1	0	8	
Vela	1	1	1	1	1	1	1	1	1	0	9	
Nomie	0	0	1	0	1	1	0	0	0	0	3	
Blake	1	0	1	1	1	0	1	1	1	0	7	
Vee	1	1	0	1	0	0	0	1	1	1	6	
Sonnie	1	0	0	0	1	1	0	1	0	0	4	
TQS	9	7	8	8	10	6	7	10	8	4	77	

p											
q											

Key

Q	Question number	
1	Correct	
0	Wrong answer	
TSS	Total Student score	
TQS	Total Question score	
R	Student Rank	
p	Proportion of student getting the question correct	
q	Proportion of student getting the question wrong	

(a) Complete the R column of the data   [2]

(b) Calculate the difficulty index and the discrimination index for Q3, Q6, and Q10. Use your answers to evaluate the quality of these three questions, stating whether they should be removed, revised or retained.   [15]

(c) Create a table to compare between test-retest and parallel forms reliability   [8]

Question 19

Below is an abstract of a research carried out in a developing, upper middle income country

There have been significant advances in science and technology in recent years. Subsequently, all countries need qualified people who can take on the challenges of life and compete in the international arena. This has led countries to adopt new approaches to education. Science, technology, engineering and mathematics (STEM) education is one of the latest examples of those approaches. This study investigated science teachers' views on assessment and evaluation methods in STEM education. The study adopted a phenomenology design. The sample consisted of 22 science teachers from both public and private schools in different provinces in Turkey in the 2021-2022 academic year. All participants were experienced teachers in STEM education. Data were collected using a semi-structured interview questionnaire developed by the researchers. The study had two significant results. First, participants used process- and outcome-oriented methods to evaluate STEM education. Second, they made some errors and faced some challenges in evaluating STEM education. However, those errors and challenges were of teacher or education system origin. Therefore, schools should provide teachers with in-service training on assessment and evaluation methods in STEM education, and educators should develop different measurement tools to help teachers make fewer errors and overcome the challenges they face in evaluating STEM education.

(a) Suggest a suitable title for the research project. [3]
(b) Make comparisons and similarities between assessment and evaluation. [5]
(c) Propose a research question and 3 sub-questions for the research. [5]
(d) Critique the design and the methodology used in this research project. [10]
(e) Suggest three (3) key words in the research. [2]

QUESTION 20

Figure Q20 represents one version of the normal distribution curve describing a standardised population parameter such as the scores of students on a national examination.
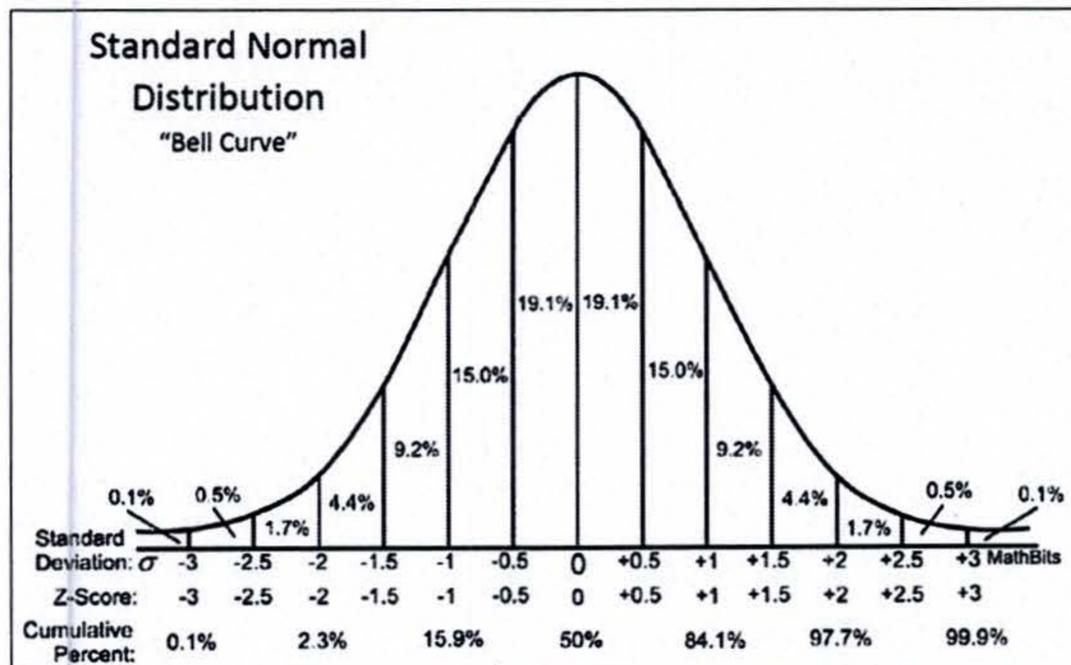

Figure Q2 Standard normal curve

(a) What percentages of the population lie:
    i.   between $z = -2$ and $z = 1.5$ [2]
    ii.   between minus infinity and $z = 2.5$ [2]
    iii. below 1.5 standard deviations   [2]

(b) If the examination had a mean score of 77 and a standard deviation of 11, re-draw a simple sketch of the above diagram, and on it, insert and label accurately the positions of the scores between ±2.5 standard deviations. [8]

(c) A university has to decide which students to admit into their medical degree programme from those who have applied in a particular year. All shortlisted applicants have excellent A Level passes. The university board of administrators and faculty members go on to interview candidates in order to gather information about each student regarding the likelihood they will be successful at the university medical school. The board uses a standardized checklist, including asking candidates about their career goals, study habits, and personality.
Outline the main considerations the board should make to reach the most accurate decision on which candidates to select? [11]

END OF EXAMINATION PAPER