



EXAMINATIONS AND ASSESSMENT CHIEF DIRECTORATE

Home of Examinations and Assessment, Zone 6, Zwelitsha, 5600

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2023 NSC CHIEF MARKER'S REPORT

SUBJECT	LIFE SCIENCES		
QUESTION PAPER	1	2	3
DURATION OF QUESTION PAPER	2½ HOURS		
PROVINCE	EASTERN CAPE		
DATES OF MARKING	04-18 DECEMBER 2022		

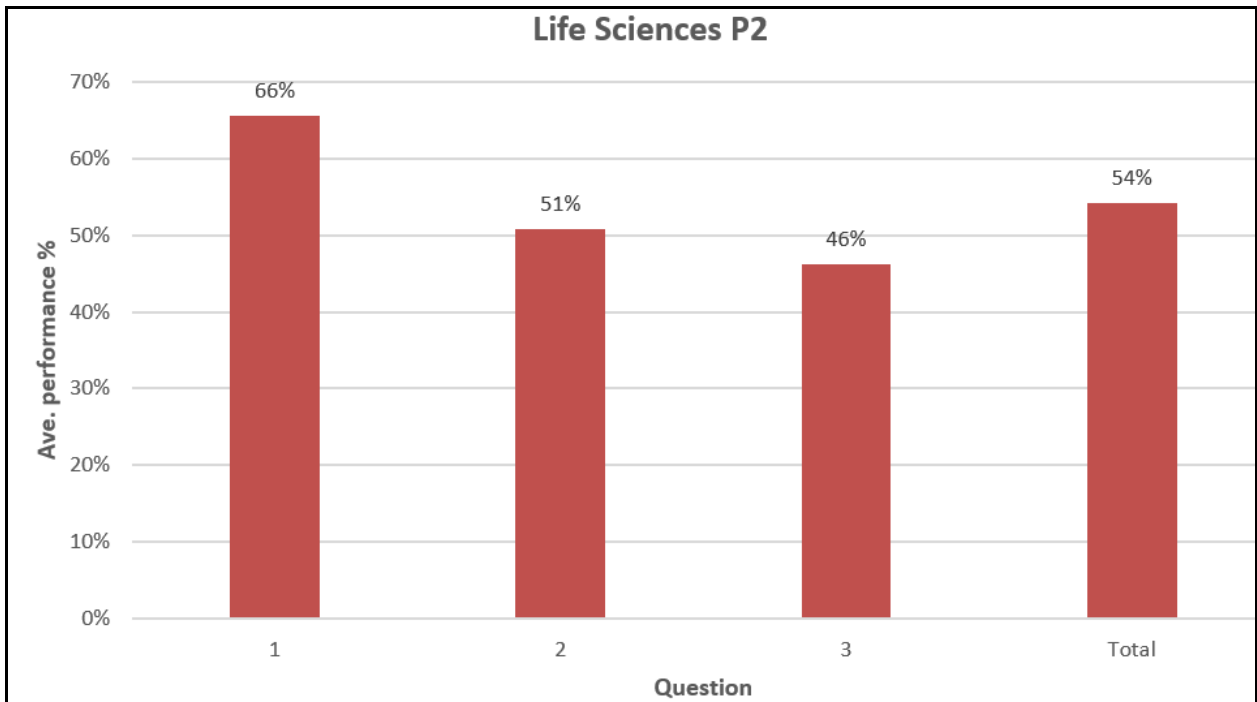
SECTION 1: (General overview of Learners Performance in the question paper as a whole)

The general performance of the learners was evaluated from a sample of 100 scripts from the 12 districts in the province covering the low, mediocre and high performance. Only one script was sampled per centre to allow sampling over a wide range of centres.

The range of the sampled scripts was distributed as follows:

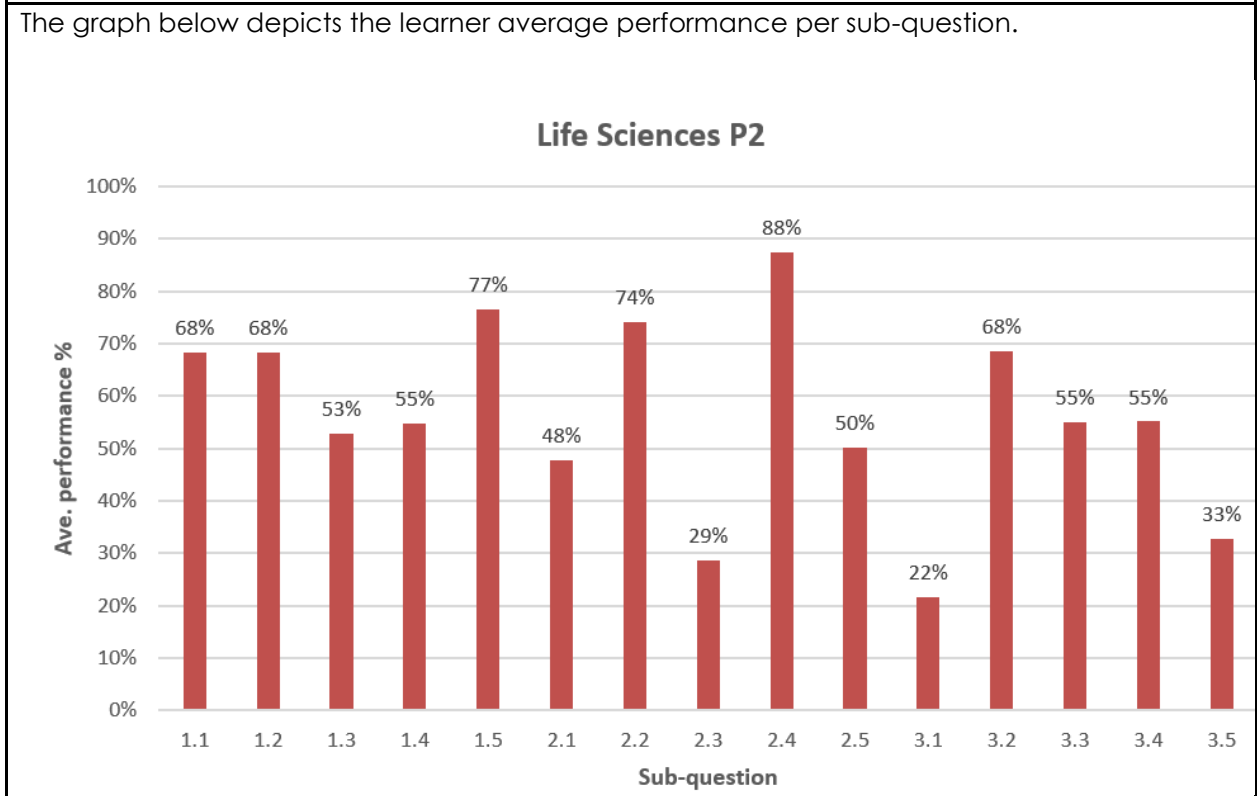
Low Performance (Level 1 - Level 2 i.e., 0-59 marks)	- 30 scripts
Mediocre Performance (Level 3- Level 5 i.e., 60-104 marks)	- 40 scripts
High performance (Level 6 to Level 7 i.e., 105-150 marks)	- 30 scripts

The graph below depicts the average performance of the learners per question and average performance in the paper as a whole:



The overall average performance of the sampled learners has slightly dropped by 1% compared to 2022. The learners performed best in Question 1 which correlates with 2022 performance. The performance in Question 2 was 1% higher than the performance in 2022. In Question 3 which is mainly based on the topic evolution, the performance dropped by 4% when compared to 2022. The drop in performance in the topic of evolution can be attributed to the fact that this topic is taught in the third term and carries a lot of marks in Paper 2 (54 marks). Teachers may have rushed through the content and not sufficiently revised this topic with the learners.

The graph below depicts the learner average performance per sub-question.



As can be seen from this graph, learners performed best in Question 2.4 which is based on a monohybrid cross involving complete dominance. The next best performed question was Question 1.5 involving interpretation of a protein synthesis diagram. Learners also performed well in Question 2.2 on the description of DNA replication. The most poorly answered questions (i.e. below 50%) are:

- Question 3.1 (22%) based on interpretation of a graph on artificial selection and a comparison of artificial selection and genetic engineering processes.
- Question 2.3 (29%) based on an extract on Mutation of gene
- Question 3.5 (33%) based on Human evolution focusing on skulls and pelvises of different hominids and the concept of transitional species and significance of a change in prognathism
- Question 2.1 (48%) based on Meiosis. The performance was better than 2022 where the learners attained 28%. However, this topic seems to be a consistently challenging topic for learners.

SECTION 2: Comment on candidates' performance in individual questions

QUESTION 1		
(a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered?		
<p>Most learners obtained more than 50% in Question 1. Question 1.5 was well answered by most learners with an average of 77%. Question 1.1 and 1.2 were also fairly answered by most learners attaining an average of 68% in both questions. The performance in Q1.3 dropped significantly from 80% in 2022 to 53% in 2023. Learner performance in the pedigree diagram in Question 1.4 also dropped by 12% when compared to the same type of question in 2022. Some learners are not following instructions. In Question 1.1 i.e. Multiple Choice Question, they write two letters instead of one letter which results in loss of marks as the mark first answer rule does not apply to this question. Sometimes learners give two terms in Question 1.2. as they are not sure of the answer. e.g. complete dominance/ incomplete dominance</p> <p>The table below shows the breakdown of learner performance in sub-questions as follows:</p>		
Average mark from the sample of 100 scripts:		
SUB-QUESTION	TOPIC OR ASPECT TESTED	AVERAGE % FROM SAMPLE
1.1	MCQ	68
1.2	TERMINOLOGY	68
1.3	AB MATCHING	53
1.4	PEDIGREE DIAGRAM	55
1.5	PROTEIN SYNTHESIS	77
(b) Why were the questions poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.		
<p>Question 1.1.2 Only 43% of the sampled learners could give a correct answer for this question. This shows that many learners do not understand the meaning of gene which is a section/segment of DNA that codes for a particular protein.</p> <p>Question 1.1.8 Some learners write the letters (Q, R, S, T) instead of choosing the correct letter from A to D.</p> <p>Question 1.1.9 was based on the scientist who discovered Little foot. Many of the sampled learners (70%) could not give a correct answer to this question. This indicates that either the teachers ignore teaching the history of the discovery of fossils or the learners choose not to learn the history. This is highlighted on page 17 of the examination guide</p> <p>Question 1.2 on terminology- The most common errors are related to spelling or pronunciation which sometimes leads to a change in meaning to something else in life sciences.</p> <p>1.2.1 Locust instead of locus</p> <p>1.2.6 Many learners confuse co-dominance and incomplete dominance</p>		

1.2.8 Some learners gave 'chromatic' network as the answer which was not credited as chromatic means something relating to or produced by colour. This is not the same thing as chromatin.

1.4.4 Many learners gave two correct genotypes instead of three. The questions required that they state all possible genotypes of Vusi and they had to give all three genotypes to get the 2 marks. The average for this question from the sampled learners was 7%.

(c) Provide suggestions for improvement in relation to Teaching and Learning

- Training of teachers on the approach on how to teach meiosis, highlighting the events that take place during Meiosis I and II as well the differences between the two divisions.
- Mini workshops on problematic areas in Genetics e.g. interpretation of Pedigree diagrams
- Learners should be provided with examination guidelines before a particular topic is taught. This will give them clear guidance on the terminology to be mastered per sub-topic as well as content they should know and learn for exams.
- In most instances mark allocation indicates the number of facts that must be provided in the answer. However, this is not always the case. Sometimes mark allocation may be less or more than the required items e.g. Question 1.4.4 the learners had to come up with ALL possible genotypes for Vusi. In this case there were three possible genotypes. So those learners who wrote only two genotypes lost the two marks as it was allocated for giving all the three possible genotypes. Similarly, in Question 1.4.6 learners had to come up with a name of one individual for two marks. Again the mark allocation was based on the time spent to get to the answer.
- Teachers must always consult Chief Marker's and Diagnostic reports and apply all the necessary recommendations in their teaching.
- Teachers should extract topic focused questions from previous year's question papers and use these for informal assessment so that learners acquire question interpretation skills and to mitigate against confusing related terminologies.
- Proper feedback should be given by the teacher on any assessment done by the learners.
- Learners must be made aware that they have to know the history of the discovery of fossils of the three genera described on page 17 of the 2021 Examination Guidelines in terms of: The age of each fossil, the fossil sites where they were found and the scientists who discovered them.

(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.

- Subject Advisors should develop teachers that are currently teaching Life Sciences who may not necessarily be qualified in the subject.
- Frequent monitoring of teachers by Subject Advisors and providing timely guidance.
- Teacher Development training workshops on problematic topics.

QUESTION 2

(a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered?

The learner performance in Question 2 was 4% lower than the performance in 2022. Performance in meiosis (Question 2.1) is still a cause for concern, although it has improved from 28% in 2022 to 48% in 2023. Learners are still having a challenge in application questions involving applying information given to describe how a mutation occurs and its effects. Q2.3 based on gene mutation was the second worst performed question in this paper, with learners achieving an average of 29%.

The average performance per sub-question is tabled below:

AVERAGE MARK FROM THE SAMPLE OF 100 SCRIPTS		
SUB-QUESTION	TOPIC OR ASPECT TESTED	AVERAGE % FROM SAMPLE
2.1	MEIOSIS	48
2.2	DNA REPLICATION	78
2.3	EXTRACT ON GENE MUTATION	29
2.4	MONOHYBRID CROSS: COMPLETE DOMINANCE	88
2.5	DIHYBRID CROSS	50

(b) Why the question was poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.

2.1

- Learners are unable to LABEL and EXPLAIN phases of meiosis
- Learners do not know the difference between phases of meiosis and mitosis
- Learners confuse centriole/centrosome with centromere

2.1.1 (b) Many learners referred to 'Springle fibres'

2.1.2 Many learners just wrote Prophase without indicating that it's Prophase I.

2.1.3 Many learners said the 'nucleus/ cell membrane is disappearing' instead of nuclear membrane is disappearing. Learners also gave features that were not unique to the Diagram 1 e.g. there was no credit for stating that the nucleolus has disappeared as this also applies to diagram 2.

2.1.4 Learners lost marks for saying DNA/genetic material is shared instead of saying DNA/genetic material is exchanged.

2.1.5 Some learners incorrectly identified the phase at (a) as Anaphase I and then at (b) gave incorrect reasons for why they identified it as Anaphase and they lost all the 2 marks. Many learners correctly identified the phase as Metaphase I but could not correctly give a complete answer in terms of describing the difference between Metaphase I and Metaphase in mitosis. The key words were left out: Arrangement of chromosomes in pairs at the equator for Metaphase I and arrangement of chromosomes singly at the equator in mitosis. The average for question 2.1.5 (b) was 20%

2.1.6 Most learners answered this question out of context by describing how non-disjunction leads to Down Syndrome and lost all the three marks. They were supposed to apply their knowledge to the given diagram with the starting number of chromosomes being 4. In the response they had to state the number of cells that will be formed at the end of meiosis, the number of chromosomes that will be found in each daughter cell.

2.2. Although learners performed well in this question attaining 78%, some learners are confusing it with transcription. This is probably due to DNA replication process not being published in the 2021 exam guidelines like the other processes (it was in the 2017 exam guidelines). Many learners are saying free nitrogenous bases in the nucleoplasm which is incorrect as it is the nucleotides that are freely found in the nucleoplasm. Learners must note that nucleotides are the monomers of nucleic acids and are made up of three parts: nitrogenous base, sugar portion and a phosphate. Many learners are writing that the end product of DNA replication is two identical DNA strands instead of two identical DNA molecules. This is incorrect as the strands in each DNA are not identical but are complementary to each other. It is the two DNA molecules formed that are identical to the original DNA molecule.

2.3.1 Most learners quoted the base triplets given in the extract without linking it to the presence of thymine, a nitrogenous base unique to DNA.

2.3.3 Most learners refer to autosomes as 'body chromosomes' which is incorrect as all chromosomes are body chromosomes including the gonosomes as they are all found in the body. Some learners referred to autosomes as non-sex linked chromosomes, also incorrect. We talk about sex-linked when we refer to alleles carried on the sex-chromosomes. Learners were supposed to define: what an allele is – a form of a gene, what does being autosomal mean – found on chromosomes in position 1-22/ non-sex chromosomes; dominant – always expressed in the phenotype/ masks the recessive allele in the heterozygous state. Combining three definitions in one posed a challenge to many learners.

2.3.4. (a) The average performance in this question was 34%. Most learners saw the word 'warfarin resistance' and immediately thought this was a case of evolution of in present times. The question was answered without any reference to the preceding table of codons and amino acids that was given. Consequently, they lost all the 5 marks for this question. Most of the learners who referred to the table managed to get the full 5 marks for the question. A few learners wrote a general account of how a mutation occurs without any reference to the codons and amino acids. At the most they obtained 1 mark for saying a different protein will be formed.

2.3.4 (b) This question was poorly answered with learners obtaining a 9% average. Many learners did not describe the mutation as being harmful but gave examples of harmful effects

2.4 Although it is the most well answered question some learners lost marks for including heterozygous or homozygous (which indicates the genotype) when writing the phenotype. Some learners are using normal/ affected when writing the phenotype. They are supposed to refer to the condition given in the question. A few learners cannot write the correct format for a genetic cross e.g. some write fertilization in line with the formation of gametes.

2.5 Overall the question was answered moderately well (50% average)

2.5.1 (a) A few learners are writing genotypes with mixed characteristics. Instead of BBDD they write BDBD and lose marks. Some leave gaps between the letters which is not allowed e.g.
BB DD

2.5.1 (b) learners lost two marks if they wrote more than one answer even if the first answer was correct. They were asked to give the phenotypes of the F1-generation and there was one correct answer which was white and round fruit for all the offspring of the F1-generation.

(c) Provide suggestions for improvement in relation to Teaching and Learning

- Teachers should use and refer to the examination guidelines and Chief Markers and Diagnostic reports.
- Teachers should use pictures or diagrams showing the learners distinct differences e.g. centromere and centriole.
- Teachers should write the correct spelling of terminology on the board and not rely on just saying out or dictating the words to the learners.
- Learners must be taught to stick to the requirements of the question and not give more information than is required as sometimes the mark first answer rule does not apply to some questions.

- Learners must be exposed to the meaning of action verbs used in questions. The explanations of these action verbs is included in Abridged Section 4 Caps implemented in 2020 in Grade 10 & 11 and in 2021 in Grade 12.

(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.

- Information sharing meeting where markers share with non-markers and Chief Markers reports are mediated for uniform understanding.
- Rework the examination guidelines and include the description of DNA replication process
- Copies of examination guidelines to be given to learners.

QUESTION 3**(a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered?**

This question was well attempted by most learners. The question was balanced with lower and higher order questions. Some learners struggled with questions that need interpretation and application.

Performing learners answered all the questions well some attaining 49/50 marks. However, weaker learners struggle to understand the different action verbs e.g. list, name, explain, discuss. The average for the whole question was 46% and this is 4% lower than the average performance in this question in 2022. The range of marks from the sampled learners was from 2 to 49 marks out of 50.

The average performance per sub-question is shown in the table below:

AVERAGE MARK FROM THE SAMPLE OF 100 SCRIPTS		
SUB-QUESTION	TOPIC OR ASPECT TESTED	AVERAGE % FROM SAMPLE
3.1	EXTRACT ON ARTIFICIAL SELECTION	22
3.2	DARWIN'S THEORY OF EVOLUTION BY NATURAL SELECTION	62
3.3	SCIENTIFIC INVESTIGATION : RELATIONSHIP BETWEEN HEAD HEIGHT AND BITE FORCE IN LIZARDS	55
3.4	HUMAN EVOLUTION:TIMELINE OF DIFFERENT HOMINDS AND DEVELOPMENT OF TOOLS	55
3.5	HUMAN EVOLUTION: SKULLS & PELVISES OF DIFFERENT HOMINIDS – TRANSITIONAL SPECIES & SIGNIFICANCE OF CHANGE IN PROGYNATHISM FROM A.sediba to <i>H.Sapiens</i>	33

(b) Why the question was poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.

3.1.1 Many learners lacked the skill of using the information from the graph to determine the desired characteristic selected by the farmer which is high protein content. Instead they generalized their description of artificial selection not linking it to the high protein content. Some learners wrote the farmer bred the mealie plants with low protein with those that have high protein which showed that they did not know what was the desired characteristic. Majority of learner who managed to identify the desired characteristic left out the part which talks about how many times the selective breeding was done and only obtained two out of the three marks. The average for this question from the sample of 100 learners was 20%

3.1.3 The majority of learners could not do this calculation. Many calculated the percentage increase and difference which resulted in loss of two marks for this question. The average for this question from the sample of 100 learners was 4%.

3.1.3 Learners struggled to describe how the process of artificial selection differed from genetic engineering. Many were just indicating that genetic engineering involves manipulation of genes without indicating how the manipulation is done i.e. a gene coding for the desired characteristic is inserted into an organism. Only 11% of the sampled learners managed to get two marks for the question.

3.2. This was a level A question requiring a description of Darwin's theory of evolution by natural selection. Many learners could give the description as it is given in the examination guidelines. Most learners wrote there is variation between species or in organisms of the same species instead of variation amongst offspring/ organisms in a population. Many learners wrote about organisms with desirable or undesirable characteristics instead of favourable and unfavourable characteristics. This resulted in loss of marks if the learners used desirable or undesirable in their description. Most learners used the example of the maize plant from Question 3.1 although 3.2 was an independent question.

3.3 A scientific investigation question – there was a 13% improvement in the performance of the sampled learners in this type of question compared to 2022.

3.3.1 (a) & (b) Although 63% of the learners managed to correctly identify independent variable, some learners could not identify the independent variable. Some copied directly from the aim of the investigation and wrote 'the relationship between the height of the head and the bite force'. Some wrote effect of the height of head.

3.3.2 Some learners could not correctly extract the factors kept constant from the procedure of the investigation. Some wrote same characteristics instead of similar characteristics, same age instead of reproductive age, same environmental conditions instead of each species was kept in environmental conditions similar to their habitat.

3.3.3 Many learners merely said the investigation was repeated and lost a mark as the investigation was not repeated. It was one investigation but the measurements of the bite force were taken 5 times and the average of those 5 readings was calculated. Just mentioning that an average was calculated was not credited. The learners needed to link their answer to what was done during the investigation to ensure reliability.

3.3.7 Many learners struggled to present their response to this question. Many were referring to species C as having a strong or larger bite force instead of saying strongest bite force or larger bite force than species A and B. For the second part of the answer learners merely repeated

what was in the question and said to eat tough fibrous plants when the focus was on having the strongest bite force in order to break down/ crush/bite/chew the tough fibrous plant material.

3.4.2 Learners came up with different ways of calculating the period in which the *A. afarensis* and *A. africanus* co-existed and some of the calculations were accepted as additional answers provided they were done looking at the period of co-existence. The answer had to be in my (i.e. 0,5my) and some learners left their answer in years (i.e. 500 000 years) and led to a loss of a mark. For example, $1\ 800\ 000 - 1\ 300\ 000 = 500\ 000$ no mark was awarded as the period indicated by the learner is outside of the period where *A. afarensis* and *A. africanus* co-existed and the answer was in years not in my.

3.4.6 Learners needed to explain that an INCREASE in brain size, leads to HIGHER/MORE intelligence to be able to make COMPLEX/ ADVANCED tools. Most learners merely wrote large brain indicates intelligence and assisted in the development of tools and lost two marks for not indicating more intelligence and complex tools.

3.5.3 Learners could not describe what a transitional species is even though this was highlighted on page 180 of 2022 Life Sciences Diagnostic Report. "Teachers must teach the concept that a *transitional fossil* displays the intermediate phenotype between a predecessor (which comes before it) and the current organisms of which it is part OR that it has the intermediate phenotype of those organisms that it is currently part of and a descendant (which comes after it). This knowledge should then be applied to information given in the source-based question."

3.5.5 Learners could not explain the reasons, giving both dimensions of the pelvis why *A. sediba* is a transitional species. Some just wrote it is narrow and short without comparing to pelvis B and C. The average for this question from the 100 sampled learners was 10,5%

3.5.6 Many learners could not explain the significance of a change of prognathism from *A. sediba* to *H. sapiens*. Most learners did a comparison of features of *A. sediba* and *H. sapiens* including many features not related to the question e.g. position of the foramen magnum, brain size, pelvis. The average for this question was 32 % as only a few learners managed to relate the non-prognathous jaw of *H. sapiens* to a having a small jaw and teeth due to change of diet to soft cooked food.

(c) Provide suggestions for improvement in relation to Teaching and Learning

- Learners do not read with comprehension. Teachers should provide more activities with extracts to practice reading skills. Train learners to read questions with understanding, underlining key words/phrases as they read. More activities with extracts should be provided to allow ample opportunity to practice reading.
- Application of language across the curriculum for learners to understand concepts better.
- Teachers are revising Question 1 type of questions with learners neglecting the application questions found in Question 2 and 3.
- Teachers must consult examination guidelines and prepare adequately for lesson preparation. Each learner must be provided with their own exam guidelines at the beginning of Grade 12.
- Teachers must pay attention to the previous Diagnostic and Chief Markers reports so that mistakes and misconceptions repeated year in year out. The issue of a transitional species was addressed in the 2022 diagnostic report.
- When assessing processes such as natural selection, give learners a question where they have to give the general account and another question where they have to apply natural

selection to a given example.

- Emphasis should be placed on the following:
 - Terminology
 - Definitions
 - Scientific investigations (determining variables)
- Consolidate work after a concept by doing informal assessment with learners.
- Learners must be taught how to respond to action verbs used in Life Sciences questions e.g. Explain – requires a cause and effect response.

(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.

- Learners struggle to differentiate between concepts. It is evident that many learners have only heard certain terms and never seen them (phonetic spelling)
- Focus on terms and definitions
- Do regular informal assessments with a variety of questions
- Guide learners on how to use given information, or how to study a diagram and answer questions based on the diagram.
- Extract questions from past papers to expose learners to exam-type questions pitched at different cognitive levels and levels of difficulty and not only rely on textbook activities.