EXAMINATIONS AND ASSESSMENT CHIEF DIRECTORATE
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2018 NSC CHIEF MARKER'S REPORT

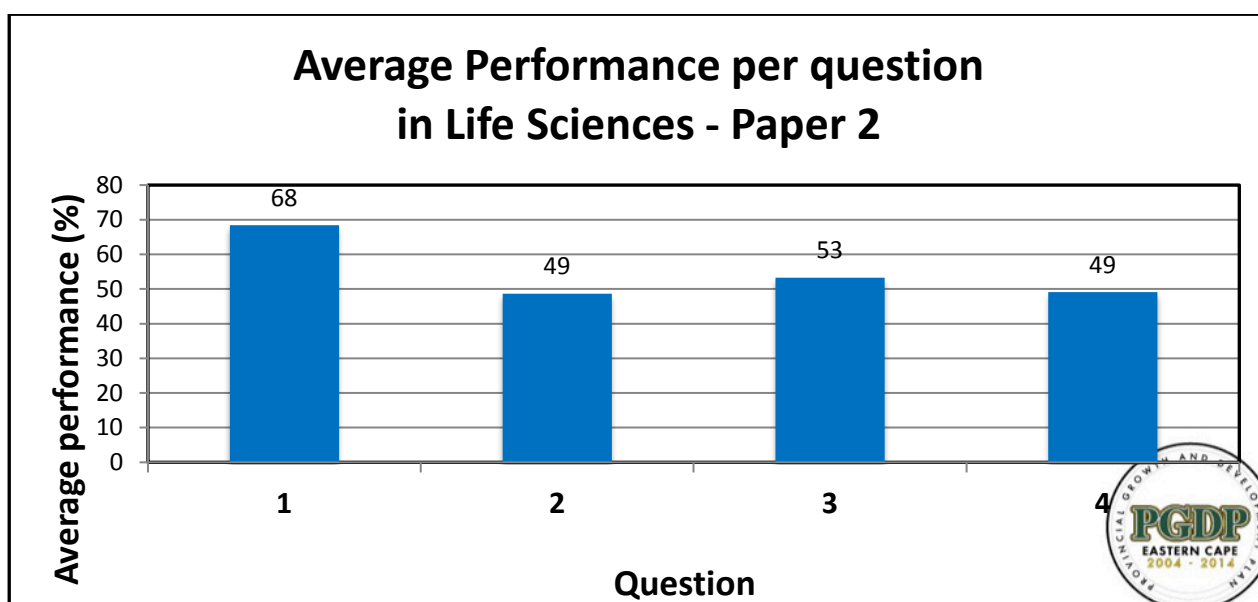| SUBJECT	LIFE SCIENCES	
PAPER	PAPER 2	
DURATION OF PAPER :	2 ½ HOURS	
PROVINCE	EASTERN CAPE	
DATES OF MARKING	01 – 13 DECEMBER 2018	

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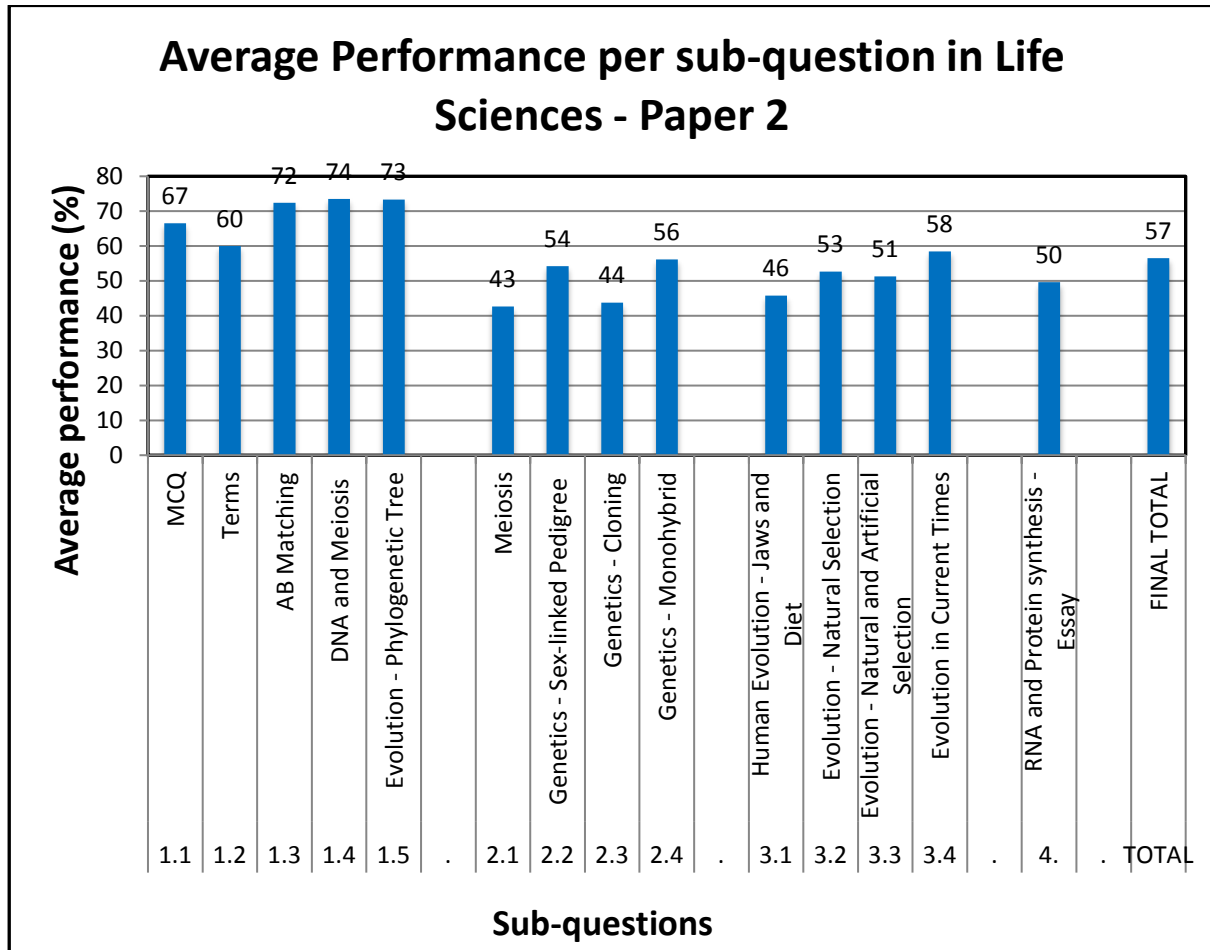
General performance

The general performance of the learners was evaluated from a sample of 100 scripts from the 12 districts according to the new amalgamation. The range of the sampled scripts was distributed as follows:

28 scripts – level 1 to level 2(0 – 59 marks)
36 scripts – level 3 to level 5 (60 – 104 marks)
36 scripts- Level 6 to level 7 (105 to 150 marks)

The graph below depicts the performance of the learners per question and sub question:

Average Performance per question in Life Sciences - Paper 2

Learners have performed better in the question paper as a whole when compared to last year's performance. The average per question ranged from 68% in Question 1 to 49 % in Question 2. The only two questions where learners attained above 50% was in Question 1 and Question 3, which was set on evolution and included natural selection, human evolution and scientific investigation based on evolution in present times.

Average Performance per sub-question in Life Sciences - Paper 2

Sub-question	Value (%)
1.1 MCQ	67
1.2 Terms	60
1.3 AB Matching	72
1.4 DNA and Meiosis	74
1.5 Evolution - Phylogenetic Tree	73
2.1 Meiosis	43
2.2 Genetics - Sex-linked Pedigree	54
2.3 Genetics - Cloning	44
2.4 Genetics - Monohybrid	56
3.1 Human Evolution - Jaws and Diet	46
3.2 Evolution - Natural Selection	53
3.3 Evolution - Natural and Artificial Selection	51
3.4 Evolution in Current Times	58
4. RNA and Protein synthesis - Essay	50
TOTAL FINAL TOTAL	57

Based on the graph above, the most poorly answered questions are 2.1 on Meiosis, 2.3 on Cloning and 3.1 On Human Evolution (Jaws)

SECTION 2: Comment on candidates' performance in individual questions

(It is expected that a comment will be provided for each question on a separate sheet).

QUESTION 1
(a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered?
Most learners performed very well in this question and attained an average of 68%. A number of learners managed to score full marks in this question. This was commendable as the various sub questions set in this question addressed different cognitive levels and this showed that the learners are well versed in the various topics of Paper 2. It was evident that the learners are equipped to apply their knowledge not just recall knowledge. A breakdown of learner performance in various sub questions is as follows:

Average mark from the sample of 100 scripts :		
SUB-QUESTION	**TOPIC OR ASPECT TESTED**	**AVERAGE % FROM SAMPLE**
1.1	MCQ	67
1.2	TERMINOLOGY	60
1.3	AB MATCHING	70
1.4	DNA AND MEIOSIS	74
1.5	EVOLUTION- PHYLOGENETIC TREE	73

(b) Why the question was poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.
1.2.1 Genotype and gene pool stated instead of genome.
1.2.6 Medulla oblongata provided as the answer for opening at the base of the skull instead of foramen magnum. Also many learners battled with the spelling of foramen magnum e.g. of answers given forum magnum, foreman magnum

1.2.7 A few learners cannot differentiate between the terms alleles and multiple alleles

1.2.9 Most learners answered sex linked chromosomes instead of gonosomes and some learners simple wrote X and Y instead of providing the term gonosomes. Clear distinction must be made between gonosomes and autosomes

1.4.2 Although learners are taught the human karyotype, quite a few could not provide the correct answer for the number of chromosome pairs found in a normal human somatic cell. they gave the answer as 22 / 46 chromosomes instead of 23 pairs. Some learners also gave the answer as 22 autosomes + 1 gonosome which was not credited as the question required the number of pairs of chromosomes.

1.4.4 Instead of mentioning the organelles where DNA is found in the cell they gave the types of DNA as mitochondrial DNA and Nuclear DNA.
The natural shape of DNA was given as a helix instead of double helix as a result learners were not awarded marks as the RNA also naturally occurs as a twisted structure.

1.5.4 Due to poor comprehension skills and language barrier most learners struggled with the question based on phylogenetic tree. A few could not differentiate between a pedigree diagram and phylogenetic tree. Other candidates simple wrote phylogenetic diagram / evolutionary tree instead of phylogenetic tree and were not credited. It is crucial for teachers to use the correct terminology stated in the CAPS document and examination guidelines when teaching so that learners become used to the correct terminology. Most learners could not link the information provided in the extract with the phylogenetic tree and thus failed to identify the different phyla even though the evolutionary relationships were stated in the extract. This points to poor translation skills.

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

Teachers should emphasize terminology related to each topic and the use of correct spelling. Learners should be reminded of the importance of using correct spelling as if a word is spelt incorrectly it may mean something else in Life Sciences e.g. centromere vs centrosome, chromatid vs chromosome. They must also avoid use of common terminology. English Across the Curriculum should be incorporated in the teaching of terminology. If possible simple diagrams must be used to simplify the understanding of the terminology such as when teaching alleles, a teacher can draw homologous chromosomes and show the position of genes and alleles for certain characteristics. The same diagram can be used to reinforce the understanding of terms such as dominant and recessive alleles as well as homozygous and heterozygous conditions. Teachers should first expose learners to the skill of analyzing a simple phylogenetic diagram and give learners practice in analyzing cladograms/ phylogenetic trees as early as in Grade 10 when they teach History of Life and Classification and in Grade 11 when they do Diversity of plants and animals. Teachers and learners can download the JSDT Solution for Life Sciences APP from Playstore available for Grade 12 and 11 where they can revise questions for section A.

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

Workshops must be done for the implementation English Across the Curriculum so that teachers are equipped to teach terminology. Word quiz activities must be organized at the schools so that learning terminology is fun for the learners. ICT integration can also be incorporated to lessons where teachers can design games which test multiple choice questions where learners can go in teams to quickly answer the question and score points. Teachers can visit kahoot.it to create the games.

QUESTION 2

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

The question was poorly answered and the average for the whole question was 49%. There were, however, learners who performed quite well in this question. The marks ranged from 3 to 36 out 0f 40 in the sample of 100 scripts. 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	43
2.2	Sex-Linked Pedigree	54
2.3	Genetics- Cloning	44
2.4	Genetics – Monohybrid	56

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

2.1.1 The question was poorly answered by most learners and the sampled learners attained an average of 28.3%. Most learners were able to identify that non-disjunction occurred but most learners attributed the answer to Anaphase 2 which was not possible in the given example. Instead of explaining that non-disjunction / non-separation of a homologous pair resulted in two chromosomes moving to one pole and none moved to the other pole, learners just repeated the question and mentioned that were two chromosomes in the two cells and none in the other two cells which is already shown in the diagram.

2.1.2 This question was also poorly performed and the sampled learners attained an average of 27.7%. Most learners knew that when Down syndrome occurs one of the gametes will have an extra chromosome at position 21 but failed to identify that Gamete A in this case the sperm is the one with an extra chromosome and when it fertilises a normal ovum it results in a zygote with an

extra chromosome at position 21 or 47 chromosomes. This resulted in learners losing marks for not identifying the number of chromosomes in the gametes

2.1.3 (c) Most learners got the "genetic variation" part correct but learners repeat words that they have memorized, but do not understand how genetic variation gives organisms a better chance of survival. They recite "organisms with favourable characteristics survive" but fail to explain where the favourable characteristics originate.

2.2.2 Some learners failed to explained how individual no5 inherited the disorder. Instead they described the mother's genotype and why she has the disorder without understanding that she has two recessive alleles (X^dX^d), her son will inherit the X^d allele from his mother. Learners wasted time explaining about the father's genotype.

2.3.3 Most learners understood that a somatic cell must be used. The reason they gave for that was "because you want the DNA of the cloned animal" not DNA from a sperm cell fertilizing an egg cell.
2.3.4 Learners performed poorly in this question attaining 22.8%. Some confused cloning with genetic engineering and were referring to stem cells being used. Some lost marks because they only referred to the somatic cell of a donor being removed instead of the 'nucleus' of the somatic cell and that of the ovum being removed.

2.4.3 Most learners did poorly on this question. The average of the sampled learners was 13,7%. Some were writing about Law of Dominance referring to dominant alleles masking the effect of the recessive alleles.

(c)   Provide suggestions for improvement in relation to Teaching and Learning
2.1.1 Use paper to make "chromosome models" to demonstrate the different phases of Meiosis. Non-disjunction can be explained better if learners can see what happens. 2.1.2 Encourage learners to clearly state every fact – do not only mention "extra chromosome" without indicating in gamete A or in the 21st homologous chromosome pair/ zygote with 47 chromosomes 2.1.3 Question linked crossing over and natural selection. Teachers must pay attention to application of natural selection. Learners are taught "Genetic variation ensures survival", but they don't understand how it works and they are able to explain it. 2.3.4 When teaching stem cells and cloning in Grade 10, teachers should spend enough time explaining, ensuring learners understand each concept as well as the difference between them. Teachers must not neglect to teach this section of work again in Grade 12. It needs to be revised! 2.4.3 All of Mendel's Laws should be taught and explained. Emphasize the different laws. Teachers can use genetic crosses to explain and highlight the Law of Dominance and Law of Segregation in a monohybrid cross. In a dihybrid cross when the gametes are being formed the teach must always emphasize the Law of Independent Assortment.

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

The marking guideline was very good, incorporating a lot of possible answers. Learners should be given more opportunities to develop their skill in answering questions where they have to explain something. The genetics cross was assessing their understanding of genetics. It was a fair question and it is clear that teachers do their best when explaining this section of the work. But some learners still used their own letters for the genotype and therefore lost those marks. A number of learners still forget to write P1 and/F1 generation. Care must be taken on the position of meiosis and fertilization. Finally the reading skill of learners must be addressed so that they are able to interpret questions.

QUESTION 3

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

Average mark from the sample of 100 scripts:

SUB-QUESTION	TOPIC OR ASPECT TESTED	AVERAGE % FROM SAMPLE
3.1	Human Evolution – Jaws and diet	46
3.2	Evolution – Natural Selection	53
3.3	Evolution- Natural and Artificial Selection	51
3.4	Evolution- Current Times	58

The average for the whole question was 53%. All learners attempted all the sub-questions scoring between 1 and 37 marks. The question was fairly answered and this was indicative of the fact that the learners were taught evolution and also the format and style of the questions did not deviate from much from the previous years although the questions were new. The learners who had revised previous year question papers and were given ample opportunities to practise application type questions were able to tackle the question with ease. However, quite a few learners displayed that they knew the content but could not apply it to the given context.

(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 Instead of learners giving the observable differences in the jaw of the chimpanzee and *Homo sapiens,* they were giving prognathous jaw which relates to facial features and was not observable in the given diagram and therefore no marks were awarded for that feature. Some learners even gave differences between the pelvis of the chimpanzee and *Homo sapiens* which shows lack of comprehension skills and making reference to the given diagram.

3.1.2 The significance of the changes in the skull that occurred during human evolution must be emphasized. Learners put more focus on dentition in terms of structure and did not focus on diet. Quite a few learners had the notion that a large jaw corresponds to a large amount of food consumed instead of mentioning the that the diet comprised of raw and hard food.

3.1.3 (a) This question was answered poorly by most learners showing lack of understanding of the term transitional species. As a result, in 3.1.3 (b) they struggled to provide the structural features to support *Australopithecus* as a transitional species between the chimpanzee and *Homo sapiens*. They compared different features, for example, teeth in one species and jaw shape in the other species as opposed to looking at one feature in all the three species e.g. looking at the shape of the palate in *Australopithecus* and comparing it to that of the chimpanzee and *Homo sapiens*. This shows lack of diagram interpretation skills which is one of the skills required in order to master Life Sciences.

3.2 Although most learners managed to get a minimum of 2 marks some of the learners were very confused identifying variation as existing in all snakes (both coral and kingsnakes) instead of concentrating on the variation within one species i.e. kingsnakes. Also quite a few learners gave a general account of natural selection and failed to apply it to the context provided in the question. Some misinterpreted the question and thought that it was based on camouflage even though no reference was made to the habitat in the question as a result they identified dull colour of kingsnakes as the favourable characteristic. Surprisingly a few learners gave an account of speciation by geographic isolation which had nothing to do with this question.

3.3.2 Most learners could not calculate the percentage increase, surprisingly so as this was included in the Diagnostic and Chief Marker's Report of 2017.

3.3.3 Most learners cannot differentiate between natural selection and artificial selection and some learners still cannot draw a table and ensure that the features on each column correlate and cannot write about one feature on the left column and a different feature in the right column.

3.4 The performance in the scientific investigation question has improved from last year. Most learners were able to answer question 3.4.1 and 3.4.2 although a few learners swapped the independent and dependent variables around. This clearly shows that these learners did not refer to the aim of the investigation to determine the two variables. Some learners gave incomplete answers such 'Herbicide' instead of 'Type of herbicide' and 'time' instead of 'time it takes to develop resistance to herbicide' by so doing changing the sense of the answer. For example, just saying 'herbicide' one could be referring to the amount/ concentration of herbicide not necessarily the type of herbicide, hence no credit was given for just saying herbicide.

3.4.4. (a) and (b) were poorly answered with learners achieving 27% and 10.5 % respectively. In 3.44. (a) Learners were asked to describe how scientists would determine weed resistance to herbicides and it was clear that the skill of designing an investigation is not well developed even though a simple explanation was required. It was also clear that learners do not understand the concept of resistance to herbicides as an example of evolution in current times as some learners thought weeds resistant to herbicides are those that are killed by the herbicides.

In 3.4.4 (b) Most learners displayed lack of understanding of validity of an investigation and applying it to the given example. Whenever learners list factors that must be kept constant to ensure validity they must be able to explain the impact of that factor on the results

3.4.5 Most learners were able to draw the graph, however they lost marks for labeling of axes, in particular the Y-axis which was incompletely labelled either missing the unit (years) or just written as 'time' and also the scale on the X-axis which includes the width of the bars and the spaces between the bars.

(c)   Provide suggestions for improvement in relation to Teaching and Learning
Teachers need to give learners more data response questions to practice and should include at least one of these types of questions in each test. Newspaper articles or internet websites such as Science Daily have good resource material that could be used to train our learners on comprehension skills. More emphasis needs to be put on scientific investigation. The teachers must use the handbook on practical investigation for Grade 10, 11 and 12 and subject advisors must mediate the practical activities. Teachers must extract scientific investigation question from past question papers and categorise them per topic and incorporate them in their teaching. Learners must be exposed to at least two scientific investigation question in each topic. Each learner must be provided with this resource material. Informal tasks must include a variety of question types ranging from lower to high cognitive levels (application, interpretation and analysis of data). The teaching method of teachers must be versatile and not stress mere memorizing of content without proper understanding of the concepts and processes. Teachers must use past

question papers as their question bank in their teaching. **The concept of transitional species should be emphasized in Grade 10 when learners are taught History of Life, where the *Archeopteryx* is a transitional fossil between reptiles and birds.**

(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 must conduct workshops and train all teachers teaching Grade 10 to 12 on how to incorporate Scientific Investigation in their lessons rather than to shelve it as an assessment activity. Resourcing of schools with equipment for conducting Life Sciences experiments should be prioritised.

QUESTION 4
(a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered?
This question was poorly answered by most learners attaining an average of 49%. However, there are centres that have shown very good performance and most learners attempted the question.

Average mark from the sample of 100 :		
SUB-QUESTION	TOPIC OR ASPECT TESTED	AVERAGE % FROM SAMPLE
	RNA and Protein Synthesis essay	50

(b) Why the question was poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.
Learners described the whole process of transcription. They discussed protein synthesis in general without focusing directly on the involvement of the different types of RNA in protein synthesis. This showed that the learners lack the skill of extracting core knowledge relevant to the question, they merely write everything they know about the question and this led to many learners losing the mark for relevance when awarding the synthesis mark. The learners' responses also displayed lack of planning in terms of structuring their essay, for

instance when discussing RNA structure the plan should have included general structure of RNA, then structure of messenger RNA and transfer RNA. This would have guided them on the second part of the essay to focus only on the involvement of the different types of RNA in protein synthesis instead of narrating the whole process. A number of learners compared DNA and RNA which also lead to them losing marks for relevance. They confused codons and anticodons. Some learners wrote key words instead of writing sentences. Learners also lost marks for logic where they muddled the involvement of the different types of RNA in protein synthesis for example they would start talking about translation and then transcription. Some learners linked the different types of RNA with incorrect processes.

(c)	Provide suggestions for improvement in relation to Teaching and Learning
Learners should be trained on how to answer essay questions. Teachers need to make use of examination guidelines more often when teaching so as to know exactly what facts to focus on. When teaching the process such as protein synthesis teachers must try and make the role of each type of RNA in the process clear to the learners so as to make it easy for the learners to answer any application question based on that process. Learners must write in full sentences not in bullet points, as this often results in losing sense of the sentence. They should be guided on how to breakdown the question into the different subtitles and identify what is being asked. They should be taught to write each sub-topic as a separate paragraph and stick to the sub-topic within that paragraph to obtain the mark for logic and relevance.	

(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 need to communicate with teachers how an essay should be laid out and how marks are allocated for synthesis. Teachers should be given a dummy essay to mark so that they are exposed to how an essay is marked. In each topic, teachers need to identify possible essays and give these to learners as informal tasks to give learners more practice in essay writing.	