

Biology

The extended essay in biology is an opportunity for candidates to apply independent research skills and methodology appropriate to the subject. The subject matter must be biological, must lend itself to investigation through biological research methods, must be at a theoretical level which is suitable for pre-university students and must allow the candidate sufficient room to demonstrate personal initiative and engagement. The report is intended to provide feedback on the performance of candidates and to act as a guide for the supervision of future candidates. As such it is primarily addressed to supervisors, in an effort to highlight those areas where candidates are in need of specific guidance and supervision.

The quality, and to a lesser extent the quantity, of supervision received by a candidate can play a major role in the success of an extended essay. Comments made by the supervisor on the circumstance surrounding the research and level of personal involvement of the candidates can also be of considerable assistance to the examiners.

Range and suitability of the work submitted

Appropriate topics in biology include ecology, genetics, evolution, animal and plant physiology, biochemistry, biotechnology, microbiology, and a wide variety of human biology topics including behaviour, exercise physiology, health, drugs, nutrition and diseases. The most successful research based papers had a small number of clearly defined and easily manipulated independent variables and a quantifiable and easily measured dependent variable. Successful essays often rely on a small amount of simple equipment and can be carried out in the school laboratory or in the local environment.

While literature-based essays per se are not inappropriate, those that rely exclusively on web-based sources run the risk of failing to adequately meet particular criteria (especially the subject specific). These essays are often poorly illustrated and inadequately referenced and show little or no sense of the reliability, or otherwise, of the sources accessed. They tend also to be accumulations of fact with little or no attempt to analyse or critically evaluate.

Choice of topic is crucial to the overall success of the essay and candidates need guidance in selecting an appropriate topic. Inappropriate and or poorly focused topics include ethical, social and religious aspects of biological issues, political and economic aspects of environmental policy, and diagnosis and treatment of disorders and diseases. This is an area where supervisors need to exert more influence. The topic should result from a discussion between the candidate and the supervisor during which a process of identifying, discussing, assessing and narrowing down a suitable area for research is undertaken, and the interest and motivation of the candidate are channeled in an appropriate direction.

Candidate performance against each criterion

General assessment criteria

Criterion A Research question

Essays with a clearly defined, well focused research question tended to be those that were based on experimental work carried out by the candidate. The best essays include a hypothesis or small number of hypotheses which are based on the research question. Good essays will also refer to the research question in the discussion and will establish the extent to which it has been answered in the conclusion. Candidates need guidance on how to avoid inappropriate, poorly focused, or even trivial, research questions. Some reading and preliminary research should take place before the final selection of the research question. Candidates must ensure that the research question is stated “in the early part of the essay” (in the first two pages or so).

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Criterion B Approach to the research question

Most candidates are able to select a broadly suitable research approach. Weaknesses occur in the case of experimentally based essays when the candidate fails to establish suitable experimental controls or fails to elaborate on all of the relevant variables. A weakness in the approach to library-based essays is often the heavy or even exclusive reliance on one type of source (web-based sources or newspaper articles). Few candidates attempt to explain or justify the research approach and in some cases it is evident that the candidate has not been involved in this part of the research process. This is especially evident in cases where the topic is part of a bigger research project with its well established approach. It is helpful and appropriate to give a brief account of preliminary research that was used to arrive at the final approach.

Criterion C Analysis/interpretation

Examiners report a wide range of standards for the criterion, ranging from essays with no analysis to very sophisticated statistical treatments. While candidates should be encouraged to use statistical analysis where appropriate, they must also be selective about the techniques used and should be encouraged to explain and justify their approach. Simply graphing the raw data does not represent data analysis. It is often helpful, if there is a large body of raw data, for this to be included in an appendix and for summary charts and tables to be in the main body of the essay.

Library-based essays often fail to address this criterion well. The exceptions include cases where the candidate analyses published data or attempts to re-evaluate information from a range of sources.

Criterion D Argument/evaluation

In order to build up an effective argument, the candidate must regularly refer back to the research question and/or hypothesis. This helps to make the argument explicit. The candidate must make it clear how the data and information being presented in the essay help to answer the research question. Few candidates take a systematic approach to building up an argument. Weak essays introduce new ideas and arguments, that are not related to either the research question or the data/information presented, at a late stage in the discussion.

Criterion E Conclusion

While few candidates had difficulty writing a conclusion restating the main findings of the research, examiners report that in many cases candidates fail to refer to unresolved questions and new questions that have arisen as a result of the research. In a good conclusion the candidate will refer back to the research question or the hypothesis derived from this and say to what extent the question has been answered or the hypothesis supported.

Criterion F Abstract

Few candidates pay attention to the requirement for three aspects to an abstract: research question, scope and conclusion. Weak essays have an abstract which is a kind of “justification” for the choice of topic or simply a summary of the introduction. The most difficult aspect of this criterion seems to be dealing adequately with the scope of the research. Few candidates point out how the research was conducted or how the limits of the research were defined. This is particularly noticeable in library-based essays.

Criterion G Formal presentation

The use of word processing and data analysis software has raised the standard of presentation generally to the extent that even weak candidates can produce a well presented essay. There are still a number of problems where candidates need guidance:

- Candidates need to be selective about what they include in the appendix. An appendix should only be part of the essay if it is necessary. Important data should be in the body of the essay.

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- Many candidates do not follow a consistent, standard style for in text referencing. Some candidates are clearly confused about citations, quotations, footnotes, endnotes and bibliographic references and are clearly in need of guidance on this. Most library-based essays are poorly referenced.
- Some essays have no obvious structure. This is often reflected in a table of contents along the lines of “introduction, body, and conclusion”. In other cases candidates use headings in the table of contents which do not appear in the text of the essay.
- Candidates tend not to make good use of supporting illustrative material. On the one hand diagrams and pictures are sometimes copied directly from the sources and included in the essay with no commentary or no attempt to explain or highlight their context. Photographs should be carefully selected and should only be included if they enhance the quality of work.

Criterion H Holistic judgement

A well written comment from the school or external supervisor can help to establish the level of inventiveness and flair displayed by the candidate and can be of great assistance to the examiner in awarding the most appropriate level of achievement for this criterion. As mentioned above, however, many supervisors fail to provide any comment and it is left up to the examiner to try to glean the level of personal engagement of the candidate. It is particularly difficult for candidates who undertake library based research, or experimental research at an outside institution, to demonstrate the attributes included in this criterion and it is therefore particularly important for the supervisors to provide an appropriate comment.

Subject assessment criteria

Candidates who perform their own research (school based, experimental or field study) tend to meet the biological criteria to a high standard. Such candidates are in a better position to demonstrate an understanding of the underlying biological principles, to provide evidence of a personal approach and to be willing (and able) to undertake a critical evaluation of their work.

Criterion J Biological study of living organisms

With the exception of those inappropriate essays mentioned earlier, most essays in this session dealt with biological issues. There is a tendency for biochemical topics to stray into chemical issues and for environmental essays to deal with geographical or even cultural and economic issues at the expense of biology. An ongoing problem relates to essays dealing with diagnosis and treatment of human diseases. These tend to score poorly if the underlying biological phenomena are not dealt with.

Criterion K Use of methods and sources appropriate to biology

Few candidates write about the reliability or appropriateness of the sources they have used. In cases where the work is carried out at a research institution or university, it is often difficult if not impossible for the candidate to provide evidence of a personal approach in the choice and application of research methods and sources used.

Criterion L Analysis of the limitations surrounding the research

This is often by far the weakest criterion. Few candidates attempt to critically evaluate their own work and seem reluctant to scrutinize the work of others. This is a crucial part of the research process and candidates need to learn not to take printed or web based information or data at face value. Candidates need to be shown that pointing out weaknesses in the data or information improves the quality of the research.

Recommendations for the supervision of future candidates

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The amount of time that many supervisors spend with the candidate is insufficient (often less than one hour). Candidates need guidance on several aspects of the writing and research process and this can only be achieved on an ongoing basis. Biology is one of the most popular subject choices for the extended essay and supervisors in many schools may be stretched to meet the needs of their students. However effective supervision is a crucial part of the learning process involved in writing the extended essay. Without effective ongoing supervision the process becomes a chore for the candidate and a fruitless exercise in the end.

The reasons for the need for close and effective supervision have been amply discussed in previous reports. The evidence from this session once again is that those candidates who receive appropriate supervision rarely fail to meet the mechanical aspects of the assessment criteria and are in a better position to do well on the others, while those left to their own devices tend to do poorly.

Candidates are in need of guidance on the following points:

- writing an abstract
- constructing an effective argument
- establishing, refining and using the research question
- referencing the text
- bibliographic entries especially for web based resources
- structuring the essay (headings and sub headings)
- writing a critical evaluation
- incorporating and integrating diagrams and illustrations
- creating effective controls for experiments
- selecting material for inclusion in an appendix.

Candidates should be discouraged from submitting work which has been conducted as part of a research team at a university or research institute for the extended essay unless it can be shown that the candidate has had a sufficient level of input into the research approach and selection of methodology and sources. The supervisors at the outside institution should be apprised of the assessment criteria and be asked to ensure that the candidate will have ample opportunity to work independently. “Outsourcing” the supervision of the extended essay in this manner might seem like an “easy option” but in fact does not meet the spirit or the intent of the extended essay process and puts the candidate at a disadvantage in the assessment process. If the school cannot provide supervision for a school-based research topic in biology then the candidate should chose a different subject.