

Biology extended essay

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Grade boundaries

For grade boundary information, please refer to **the Grade boundaries for Diploma programme coordinators** document available on the PRC.

Extended essay

The range and suitability of the work submitted

There was a wide range of work submitted. A lot of original and creative proposals but some were too ambitious. On the other hand, there were few simple or repetitive investigations not recommended for the EE. Microbiology experiments and factors affecting germination and growth of seedlings, were the most common.

The majority of essays were based on a suitably biological topic. Essays which were essentially literature-based, were mostly narratives, where the student's contribution was to assemble the information from sources resulted in poor performance. Most of the ambitious proposals used databases with very few data or old data. Many bibliographic essays had students only describing results without clearly making their own analyses.

Essays based on practical work carried out at the school or a university or other research institution, have been more common in this session. In some cases the EE did not include the supervisor's comment.

Students still have problems with statistical analysis: Excel allows it to be done very easily, but the correct choice of tests, their justification and their interpretation depend on the knowledge of the student. However, in some cases the supervisor may have influenced the choice of tests.

Student performance against each criterion

It seems that there is a better understanding of what is required in each criterion.

Criterion A

In general the RQ was not fully focused as the way to record the dependent variable was not included. Very few cases did not state the RQ on the cover page and sometimes it was not stated in the form of a question. The topics were generally well focused on the research question but in many cases they were introduced in an ineffective way, without clarifying the biological or academic bases to answer the research question. Many research questions were not falsifiable or verifiable. The sources consulted were sufficient (in general) and contributed to the research focus of the essay. Some sources were not purely scientific. It is observed that students are aware of the importance of the selection of appropriate sources compared to previous sessions.

The method selected was appropriate to address the RQ but there were limitations that made the method difficult to be reproduced and in many cases the variables were limited and not fully controlled. Often the methodology was incomplete resulting in a non-replicable experiment. In other cases there was a lack of standardisation and/or a lack of controls.

A common omission was the justification for the selection of the ranges of the independent variables in experimental work and statistical tests chosen. In the bibliographic essays, the selection of the sources used, the criteria used to select the quality ones, the how and why of the selection was not always mentioned. Particularly in this category, it is essential to have a good number of scientific articles and/or databases from recognized sites.

Criterion B

The selection of source material was mostly relevant and appropriate although superficial and limited in many cases. The biological comprehension in general was limited by a superficial discussion with a partial use of sources. Technical terms were not always explained and the use of biological terminology was limited in general. The use of in-text citations has also been better understood. Sometimes only textbooks

were consulted lowering the standard of the essay. There are still many students who do not use sources in the discussion, without a clear relationship with the results obtained, thus lowering their level of understanding.

Criterion C

The majority of the research was appropriate and its application was clearly relevant to the research question. The analysis was in general adequate. Most students carried out appropriate statistical analysis including normality tests, to know if they had to use a parametric or non-parametric statistical test. The discussion and conclusion were in general not supported by sources or without a biological explanation. In some cases, where the student pointed out unresolved issues, there were suggestions as to how these might be further investigated.

Criterion D

In general the structure of the essay was adequate. In some cases the RQ, title of essay or name of the subject were omitted. Some students omitted the word count. Some essays included important information in tables or in the appendix to avoid overpassing the word count. Sometimes there were too many graphs that could have been summarized in a single one. Some essays did not show the raw data and others showed too many tables of raw data that could have been in the appendix.

Criterion E

Most reflections were descriptive and narrative, giving the student an account of the meetings with the supervisor and the outcomes of these. Interim reflections were more analytical with the student solving problems to carry out the method accurately. The viva voce in general reflected the benefits and outcomes of the essay as a personal experience.

Recommendations for the supervision of future students

A supporting letter from an outside institution when the work for the essay is conducted at a university or other institution must be included. There must be evidence that informed consent was obtained from participants in a trial on human subjects.

Photographs to show the work was really performed can be included in the annex, but the source must be included.

The supervisors should discuss with the students each one of the criteria that will be used to evaluate the essays.

The student should clearly and precisely state the topic and the research question, evidencing the variables (independent and dependent) in a well-focused manner. In addition, in the introduction, locate the variables in a local and global context.

The number of individual minimum data in experimental tests and the justification for the selection of the statistical test is necessary.

The supervisor should ensure that IB requirements regarding ethical standards and quality of referenced information are met. Some students still use Wikipedia, Khan Academy, blogs, biology textbooks, encyclopaedias, newspapers, instead of a majority of scientific journals.

There have been a few essays where body fluids of harmful bacteria have been used in their experiments. The reflections (criterion E) is not only a description of their meetings but of the work itself, of the steps and problems encountered and their solutions.

Students should use citations in the introduction, in the body, and in the discussion of the essay, to demonstrate a better understanding of the biological processes involved.

Further comments

Most essays surpass the maximum number of words with lots of tabulated text. This affects presentation (criterion D) and the examiner will only correct up to the limit allowed. This means that a very important part of the essay, usually discussion and/or conclusion will be ignored, affecting criterion C.