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Abstract

Promoting 21st century skills:
Self-directed Research for Senior Secondary Students

A new senior secondary study in Victoria, Australia – VCE Extended Investigation – provides an opportunity for students to develop, apply and extend knowledge and skills in critical thinking and independent research. Students carry out an individual investigation that focuses on a rigorous research question, thereby developing higher order skills.

Critical thinking is a foundation of the study, requiring students to engage with a range of texts and to apply critical thinking skills. Students learn about types of evidence, strong and weak argument and reasoning, the differences between fact and belief and the kinds of questions that elicit higher order thinking.

They design a research question, apply a research method and procedure, produce a 4,000 word research report and present an oral elaboration and defence of their research.

Students undertake a critical thinking test, and are assessed on their skills of research, the depth of knowledge they acquire in their chosen field of investigation and their ability to communicate findings.

This paper presents the new forms of assessment in the study, in particular the online critical thinking test. It explores the opportunities for learning and the challenges for assessment in a study that contains no prescribed curriculum content.

Key words: critical thinking, independent research, extended investigation.

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PROMOTING 21ST CENTURY SKILLS: SELF-DIRECTED RESEARCH FOR SENIOR SECONDARY STUDENTS

NEW HORIZONS

In Victoria, Australia, a new study within the Victorian Certificate of Education (VCE), VCE Extended Investigation, was piloted successfully in 2013 and has been launched in 2014. The study breaks new ground, particularly in relation to assessment practice in a high stakes environment. It provides a vehicle for independent student learning that is limited only by the student's own horizons and it promotes skills for the 21st century. This paper presents the new forms of assessment in the study and in particular, provides detail about the online critical thinking test.

BACKGROUND

While every VCE study offers a challenging curriculum, there are students who seek to investigate at a deeper level or who have a particular passion for learning in fields of inquiry beyond the scope of their senior secondary studies.

The VCE Extended Investigation has been designed with an innovative assessment regime that creates the opportunity for students to negotiate a more individualised and specialised content for study and that creates a diversity of learning experiences, including the development of critical thinking skills. This study allows students the freedom to roam across a very broad landscape but is contained in terms of what is to be assessed.

21ST CENTURY SKILLS

While the term itself can generate great variety in definitions and interpretations, the 21st century key skills that are widely accepted are:

Critical thinking

Creativity

Problem solving

Communication and collaboration

Learning how to learn.

These skills have always been important. But the rapid development of digital technologies, and the challenges this poses for education systems and students, has projected these skills into high relief. A valid and robust assessment of these skills is able to be conducted in a specified learning context. A senior secondary study that allows students to generate their own topic of research, pursue an individual investigation and communicate their findings in both written and oral forms provides an excellent context for the acquisition of 21st century skills.

VCE EXTENDED INVESTIGATION – OVERVIEW OF THE STUDY

The study comprises two semester length units entitled:

Designing an Extended Investigation

Presenting an Extended Investigation.

Each unit has a set of learning outcomes that detail the knowledge and skills to be demonstrated by the student.

Students carry out an investigation that is generated by and focuses on a rigorous research question. The research question can come from any discipline area but it must not duplicate any current VCE Units 3 and 4 study (Year 12). The investigation may be an extension of an area of curriculum already undertaken by the student or it may be completely independent of any other study in the student's VCE program. Each student enrolled in the study has a unique research question. The student manages their investigation and the teacher acts as mentor and facilitator, as sounding board and critical friend. Students develop their capacity to set out, explore, justify

and defend their research findings in both oral and written forms. They develop understanding of what constitutes both a good research question and an ethical, robust, disciplined and rational approach to interpreting and evaluating evidence to answer the question. They are introduced to a broad classification of research methods and their comparative suitability for the investigation of a particular question. They learn about research ethics, plagiarism and paraphrasing; they explore relevant selected literature; they practise conventions of academic writing including referencing systems and acknowledging sources. They develop project management knowledge and skills and ways of effectively presenting and communicating results.

A feature of the study is the requirement for the student to prepare their investigation for a non-specialist audience.

CRITICAL THINKING

The explicit teaching of critical thinking and the application of these skills in individual self-directed learning contexts, promotes the acquisition of 21st century skills. Students engage with a range of texts that require the application of critical thinking skills, in particular the skills associated with questioning and evidence. Students learn about types of evidence, strong and weak argument and reasoning, the differences between fact and belief, and the kinds of questions that elicit higher order thinking. This provides students with the framework for understanding how to undertake an individual investigation and equips them with the skills to interrogate and critically evaluate sources and types of evidence.

ASSESSMENT

The assessment structure of the study is highly specified and serves two purposes. The primary purpose is to determine the student's level of performance through fair, valid and reliable assessment instruments. The second purpose is to ensure that the student's work can be authenticated. The assessment judgements are regulated by a mandated set of criteria on a 10-point marking scale for each component in the two semester units. Of particular note is the use of oral assessments to foster the development of communication skills and which allows students to demonstrate the depth of their learning in an expansive way beyond the bounds of the 4,000 written report. There is no statewide end-of-year examination.

There are three components of scored assessment:
- School-based assessment: 30%
- Critical Thinking Test, externally set and marked: 10%
- Externally-assessed Task: 60% (consisting of the Extended Investigation written report of 4,000 words and an oral presentation in defence of the research findings).

The student maintains an Extended Investigation Journal as a requirement of satisfactory completion of the study. This is an important mechanism of authentication, to document the development of the focus of the investigation and to record data gathering techniques and resources used in the research.

School-based assessment

The elements of student work assessed at the school are:

Designing a research question
Oral progress report
Project management/conducting an investigation.

Prior to lodgement of the research question with the Victorian Curriculum and Assessment Authority (VCAA) for quality assurance purposes, teachers and students use the following criteria to interrogate and evaluate the proposed research question:

- The question is substantial and significant.
- The question is practical, realistic and manageable within the limits that time and resources impose.
- The question aims for critical distance and an impersonal or objective stance.
- The question can be addressed by systematic and sound research methods.
- The student can gain access to appropriate and relevant primary and secondary sources.
- The question and the research methods are likely to produce a useful result.
- The question is clearly and precisely worded.
- The scope of the question is contained and focused.
- The question and method comply with responsible and ethical research guidelines.
- The question will sustain student inquiry over the duration of the study.
- Duplication does not exist with any current VCE study.

External assessment

The Externally-assessed Task has two components: the written report and the oral presentation. The language of both the written report and oral presentation to explain the nature and significance of the investigation must be accessible to an educated adult audience that does not necessarily have specialist knowledge in the area of investigation that is the focus of research.

The Critical Thinking Test is externally set and assessed and undertaken online.

VALIDITY AND RELIABILITY OF ASSESSMENT

The assessment judgements for both school-based and external elements are regulated by a mandated set of criteria for each component of assessment.

The Critical Thinking Test and the Externally-assessed Task are combined to produce the external reference score for moderating the school-based assessments. The Critical Thinking Test may be used also as part of authentication analyses to flag unusual discrepancies across the scored assessments.

Content validity for the assessment relies on the application of clear and well understood, robust criteria that accurately reflect the knowledge and skills specified in the learning outcomes to determine levels of performance. The best test of content validity would be to have assessors who are specialist in the pertinent field of research, as would occur at university level assessments. However to source a range of specialists for participation in both the written and the oral assessments would be extremely difficult. Hence the requirement is that the extended investigation is prepared by the student for a non-specialist audience. This requirement reinforces the importance of communication in the study.

Ensuring integrity of the study

The study contains a number of features to ensure that student work is able to be authenticated.

The Extended Investigation student journal is a requirement for satisfactory completion of the study. The student records all their development work, critical thinking exercises, literature search and reference lists, records of meetings with teachers and mentors and project management documentation. The teacher of the study must sight and sign the journal regularly and be able to track the progress of the student. Like all other VCE studies this study is subject to the annual VCAA audit of school-based assessment and the student journal is an integral part of the audit materials.

The submission to the VCAA of each student's research question guards against breaches of the rules of the study.

The student's oral progress report and final oral defence of the investigation will uncover instances where a student has submitted work that is not their own.

The critical thinking test provides a valid and reliable assessment of the level of achievement of critical thinking knowledge and skills and is compared with all other assessments in the study. Statistical moderation of assessment components of the study identifies anomalous grades and inter-rater reliability analyses flag inconsistent application of assessment criteria.

THE CRITICAL THINKING TEST

As part of the Extended Investigation students undertake an online test of 70 minutes duration that assesses a sampling of the following generic reasoning skills.

Key knowledge

- elements, features and terminology of critical thinking
- concepts of opinion, evidence and truth
- uses of analogy and metaphor
- use of anecdote as evidence
- characteristics of strong and weak reasoning
- distinction between inductive and deductive reasoning
- techniques to construct arguments and techniques to analyse and evaluate the soundness and validity of arguments
- socio-cultural influences in argument
- methods for organising and analysing ideas and information
- ways of summarising readings and research materials.

Key skills

- explain the elements and characteristics of effective critical thinking
- examine the purpose, characteristics and contribution of research and inquiring questions to critical thinking practice
- select and apply techniques to construct arguments
- analyse and evaluate arguments, viewpoints and evidence
- organise and analyse ideas and information.

The critical thinking test is based on a view about critical thinking that shapes the kind of items used. There are many definitions of critical thinking.[1] Some are very general and treat critical thinking as any kind of good thinking. Some approaches to critical thinking have quite narrowly focused on logical and syllogistic reasoning. This test is based on the following quite specific definition of critical thinking.

> *Critical thinking is process of evaluating evidence and argument to make decisions. Problem solving is distinguished from critical thinking in that problem solving is a process of determining one or a number of correct solutions. Critical thinking takes place where there is uncertainty, and no true or correct answer to a question or solution to a problem can be, or has yet been determined.*
>
> *Critical thinking involves the ability to:*
> 1. *understand arguments*
>   - *What is this view?*
>   - *What is this argument doing?*
> 2. *analyse approaches and strategies in arguments*
>   - *How is this view developed?*
>   - *How is this argument supported or justified?*
> 3. *evaluate the logic, validity and plausibility of arguments*
>   - *How strong or convincing is this? Why?*

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[1] McCurry, D. (2013)Teaching Critical Thinking, Queensland College of Teachers Research Digest, Number 9

- *Do you agree with this? Why?*

This definition distinguishes critical thinking from other kinds of thinking such as problem solving. As well as understanding arguments, this definition emphasises analysis and evaluation. It is concerned with approaches and strategy in argument, and it is not concerned with persuasion or rhetoric as such. According to this definition, critical thinking is focused on the evaluation of the logic, validity and plausibility of arguments and evidence. This definition reflects some standard definitions of 'higher-order thinking'. Below the rather high level of abstraction of this definition, the approach to critical thinking in this test is best understood as a process of dialectical reasoning or debate.

The test of 2013 involved the following topics and response formats.

EI CT test example items 2013				
Section	Item	Topic	Response format	Score
1	1	Moral obligation	drag and drop	3
	2–5	New flag	multiple-choice	4
	6–10	Protection	multiple-choice	5
2	11–12	Sustainability	short written answer	4
	13–14	Graffiti	short written answer	4
3	15–16	Home schooling	short written answer	2
	17–18		longer written answer	8
				30

Section 1 Closed argument mapping and closed ProCon Questions

The first section of the test was focused on the notion of arguments for and against a proposition. These questions are developed from a ProCon analysis in which the test writers identify an issue that can be envisaged as a matter for debate, such as the topics of moral obligations, a new Australian flag, and protection or free trade. A set of pro and con statements about the proposition for debate are developed, and attempts are made to rebut each pro or con statement.

Such a ProCon analysis is the basis of the first 'drag and drop' items in the test. In these items candidates have to identify where a statement would best fit in a ProCon table. The statements offered for consideration are difficult to classify when they do not explicitly declare a position on the proposition, and candidates have to envisage a way in which the statement would be turned into an argument for or against the proposition. It is as though the candidates have to imagine the possibilities for plausible argument (both for and against) a proposition.

ProCon analysis is also the basis of what has come to be called 'the debate style items' that make up the remainder of the closed items in the test. These items identify a proposition for debate, and ask candidates to classify statements according to the following answer key.

For each of questions 2 to 5 you are to choose the alternative (A–D) that most appropriately describes the relationship of the statement to the proposition of the debate.

The numbered statement:

A is most likely part of the argument <u>for</u> the topic.

B is most likely part of the argument <u>against</u> the topic.

C could possibly be part the argument <u>for or against</u> the topic.

D   is <u>not relevant</u> to either the argument for or against the topic.

As in the drag and drop items, candidates have to recognise the way a statement might be turned into an argument for or against the proposition. They have to envisage elaborating the statement to see what it implies or assumes about the proposition. There are additional difficulties in these debate style items in that candidates have to recognise that some statements can be used to argue both for and against a proposition, and that other statements are irrelevant to the proposition for debate.

The Graded Questions

Section 1 is analytical rather than evaluative. Candidates are not asked whether they agree or disagree with statements about the proposition. They are asked to envisage a way in which the statement might be or can be turned into an argument about the proposition. In Section 3 – Argument Assessment this analytical thinking is extended into evaluation of views and arguments. In Section 3 arguments or sets of arguments (home schooling) about a proposition are presented, and candidates are asked to analyse and evaluate the strengths or weaknesses of those arguments.

As with the other statements in the test, the statements in Section 3 are more or less reasonable and plausible. The phrasing of the statements is neutral, and the emphasis is on judgements (that is arguments) about the logic, validity and plausibility of arguments, claims and evidence. As well as analysis of arguments, Section 3 of the test could ask candidates to present the argument they think is most powerful and decisive about a proposition.

Assessing questions 11 to 18 is a grading exercise in that assessors make judgements about the quality of what candidates say rather than deciding whether candidates' responses are correct, partially correct or incorrect. Assessors make case-by-case decisions about the quality of what candidates say rather than applying a decision rule about what is a good, a fair or a poor answer.

The outlined answers offered to questions 11 to 16 below (in brackets) are likely or plausible answers. There is reason for thinking these answers are reasonable and would be easiest to justify, but it is expected that some candidates will offer different answers, and these answers have to be judged on their merits.

In all of the graded questions, the reasons or explanations offered by candidates are to be assessed on their merits. Some general comments are offered on how marks might be distributed in the mark allocation tables, but these are not definite rules. They offer possible reasons why a score might be given. Markers have to make a judgement about the quality of the reasons and explanations candidates offer or are implicit in the answers of candidates.

This assessment is a process of grading rather than partial credit scoring. No attempt is made in most cases to break the grading into separate score points. Assessors distribute marks on the basis of a judgement about strength or weakness of a response rather than allocating marks for separate points.

A note on writing

It should be noted that the test is not a literacy assessment. How candidates express themselves is not assessed as such. Poor answers may be well written in this test, and good answers may be poorly written. While it is likely that the two will be quite closely correlated in most cases, there may be cases where they are not well correlated, and it is always the quality of thought and explanation that is to be assessed.

Section 2 – Critical Research Questions

Section 2 tests the skills used in designing a research project. It reflects the issues

considered in the evaluation of research questions, and the criteria for the assessment of research questions in the Extended Investigation.

Candidates are given five questions about an issue (sustainability, graffiti) and they are asked to classify and evaluate these questions. The judgements involved in answering these questions could involve consideration of the following.

Is the question/s

- clearly and precisely worded?
- substantial and significant?
- practical, realistic and manageable?
- likely to produce a useful result?

Can the question/s

- allow a critical distance and an impersonal or objective stance?
- be addressed by data collected with systematic and sound research methods?

Do the question/s and methods comply with responsible and ethical research guidelines?

Scoring the questions in this section is a matter of judgement rather than a matter of right or wrong, truth or falsehood. The marks for these questions were allocated on the following basis.

Score 2	Sensible and reasonable justification
Score 1	partial or rudimentary justification
Score 0	little or no justification

Below each of the research questions offered for consideration by the candidates there is a brief comment (in brackets) that is expected to be the easiest or most plausible case to make in response to that question. These are not the only responses that may be judged to be 'sensible and reasonable justification'.

Below are 5 possible research questions (A to E) about graffiti.

A	How does graffiti differ from other kinds of art? (descriptive, analytical)
B	Is real graffiti art generally admired and respected? (a fairly broad question)
C	Do street art programs reduce graffiti in a neighbourhood? (concrete, significant)
D	Who is the best graffiti artist? (interpretation and opinion)
E	When does graffiti become street art? (analytical and philosophical)

Question 13   (2 marks)

Of research questions (A to E), research question …… would be best described as a matter of **personal preference** or **opinion** because……

(D (or E?) is the most subjective. A judgement will depend on all kinds of personal attitudes and values. The question assumes that graffiti is art and is valuable. A matter of analysis and argument at best. Does not seem to envisage any data collection.)

Question 14   (2 marks)

Of research questions (A to E), research question …… is most likely to produce a **definite** or **concrete** answer because……

(C is focused and would involve gathering data about a program.

B could be surveyed, but it is a little less concrete and significant than C?)

Section 3 Argument Assessment

In Section 3 candidates have to analyse the characteristics of arguments, compare sets of arguments about an issue, and decide which argument is strongest and which is weakest. Questions 15 and 16 have more plausible answers, but if some other reasoning is offered or implied for an unexpected response, it is judged on its merits.

Question 15   (1 mark)

Whose rights are given priority in the **For** case?

   (The rights of the parents.)

Question 16   (1 mark)

Whose rights are given priority in the **Against** case?

   (The rights of the child.)

While there are no clear or expected answers to questions 17 and 18, in general terms the marks are distributed on the following basis.

Score 4	The best answers will be • based on accurate description and understanding of the argument • analytical rather than mere opinion • reasonable • concerned to explain rather than assert • not concerned to present a view as such There may be many reasons why candidates may find one or other argument least or most persuasive. The issue is the degree to which they explain and justify their judgement. They are directed to nominate specific arguments. There is no penalty if they deal with the cases in general, but again it is the quality of the explanation and justification that is to be judged. There should be no advantage to dealing with a whole case rather than one argument.
Score 3	quite accurate and thorough
Score 2	fairly accurate only asserts opinions
Score 1	weak and gestural assertive with little support

Section 3 Argument Assessment:
In some school systems parents can arrange to educate their own children under certain conditions. Some educators have argued that home schooling is not satisfactory, and that young people should have to go to a school outside the family.

Compare and contrast the following arguments **For** and **Against** home schooling. Each argument is labelled with a letter.

Home schooling is an acceptable substitute for going to school.	
The case **For** home schooling	The case **Against** home schooling
a. Home schooling aims to create a special world for children and to exclude damaging influences from the wider world. b. There may be good reasons to be dissatisfied with available schools. It may be reasonable to choose to home school rather than send a child to a poor school. c. Some young people have a terrible time and do not thrive in school, while home schooling can be personal and adjusted to the needs of the individual. d. Home schooling is not the easy way out for parents. It expresses a deep concern and commitment to children. e. If they can do it satisfactorily and within certain requirements, parents have a right to educate their children at home.	f. Society has a right to require that children attend school and be educated. We would not accept parents deciding not to educate their children. g. Those who want to home school their children may be extremists or fanatics whose aim is to isolate and indoctrinate their children. h. Children have a right to an education, and that education cannot be restricted to the world view of their parents. i. Even professional level home schooling cannot offer young people the important social experiences that going to a school offers. j. The government ensures the quality of schools so that it can reasonably require all young people to attend them.

Question 17 **(4 marks)**

Of arguments (a-j), argument …… is the **least** persuasive and convincing because……

Analyse the arguments presented rather than offering your own opinion about the argument.

Question 18 **(4 marks)**

Of arguments (a-j), argument …… is the **most** persuasive and convincing because……

Analyse the arguments presented rather than offering your own opinion about the argument.

The test of 2014

The CT test is evolving. The first version of the test was 40% closed questions that were scored automatically. The other 60% of the test was doubled marked. The test of 2014 has only a few closed questions.

The performance of the candidates on the test has been satisfactory to date, although there is some reason for concern about the low correlation of the closed questions with other assessments in the study. The emphasis on closed questions has been reduced significantly for 2014.

It is hoped that the CT test has a clear structure that can be taught and learned, but the generic and unseen nature of the topics analysed means that the emphasis of test preparation will be on skills rather than issues. It is hoped that the structure of the CT test requires and encourages the kind of flexible analytical thinking skills needed for dealing with the flood of information and argument we are subject to in the 21st century.