

Starting them young: research and project management opportunities for 16 to 19 year olds

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Introduction

Several educational routes have been developed which entail project work with a specific focus on independent learning and research. In this article, we outline some of the options that exist at Level 3, primarily for 16 to 19 year olds (Years 12 and 13) in the UK and internationally. We then conduct a more detailed comparison of two routes: the Extended Project Qualification, and the International Baccalaureate Extended Essay. Many stakeholders may be unaware of the differences in the aims, structure, and scope of these routes. It is important for students and teachers to be conscious of the differences so that they can make informed decisions about what is most suitable for them. End-users such as higher education admissions tutors and employers also need to understand the differences in order to weigh up the experiences and achievements of applicants fairly.

Research and project routes for 16 to 19 year olds

As is the case in many countries, students aged 16 to 19 in the UK are able to choose which subjects they study, and whether the educational route followed is general or vocational in nature, or a combination of the two. Some students carry out independent research and investigative work as part of GCE Advanced (A) level courses, although opportunities vary among subjects. In a recent study of A level teaching, for example, Mehta, Suto, Elliott and Rushton (2011) report that half of A level French and Economics teachers set their students investigation and/or research tasks. In contrast, most A level Mathematics teachers felt that much of their course does not require an independent approach on the part of the students. Opportunities for investigative and research tasks within mainstream vocational courses are also likely to vary. In contrast, other educational routes have been designed solely to offer students the chance to conduct an independent project. These opportunities are often more substantial and specific than those embedded within subject-based courses. Some major examples are outlined below.

Farnborough extended projects

The Sixth Form College, Farnborough, a large state-funded college in the south of England, has run its own scheme of 'extended projects' since 2006. The scheme was devised in the wake of the Tomlinson report (2004) which alleged a lack of opportunity for students to practise effortful study; that is, to engage in deep learning rather than absorbing inert knowledge. Farnborough students are encouraged to go beyond the comfort zones of their A level course material and to investigate any topic of particular interest to them that links at least two of their A level subjects. Students conduct their projects and write up formally structured 5000-word reports

between May of Year 12 and October of Year 13, utilising their free time during their summer holidays.

Farnborough students carry out their projects with the support of an assigned supervisor who is also a teacher at the college. Assessment is internal, taking the form of detailed written comments which use Dweck's (1999) 'two stars and a wish' model to provide formative and instructive feedback. The two stars relate to two points of praise which focus on the project task (rather than on the student him/herself). The wish is a suggestion as to how the work could be extended, taken forward, and improved. Staff at the college have chosen to avoid summative assessment and formal accreditation of the extended projects as qualifications in the belief that this would restrict risk-taking behaviour. Arguably, assigning numerical or alphabetical values to project reports encourages students to play safe and focus on assessment criteria, rather than following their academic interests and instincts.

Extended Project Qualification (EPQ)

A scheme of nationally available project qualifications has evolved from the scheme devised by The Sixth Form College, Farnborough. Project qualifications are now administered by at least five major awarding bodies in the UK (OCR, AQA, Edexcel, Education Development International plc [EDI], the Welsh Joint Education Committee [WJEC], and VTCT¹). They are an option for secondary school students at three different levels: Foundation (Level 1), Higher (Level 2), and Extended (Level 3) (Ofqual, 2011). At Level 3, Extended Project Qualifications (EPQs) can be taken alongside A levels, as well as being a compulsory element in Diplomas. (For further information on Diplomas, see Ertl, Stanley, Huddleston, Stasz, Laczik and Hayward, 2009.) Like Farnborough students, EPQ students explore a personal interest, engaging in cross-curricular study which may take place both inside and outside the classroom. In contrast, however, the topic of the EPQ does not have to be related to anything else that the student is studying, and its outcome does not have to be a traditionally styled piece of academic scholarship. Although many EPQs culminate in a 5000-word dissertation, it is equally acceptable for students to produce a shorter report accompanying an artefact such as a piece of art, furniture, or music.

EPQs are assessed summatively; originally, staff at The Sixth Form College, Farnborough worked closely with the AQA awarding body to develop an initial mark scheme for assessing the projects. Other versions of the mark scheme, grounded in generic descriptive assessment criteria, have since been developed by other awarding bodies. EPQs are intended to engender so-called 21st Century skills such as creativity and imagination, problem-solving skills, independent thinking, cooperation with others, and using people as resources (Department for Education and Skills, 2005), and these skills are the focus of assessment. Students are

¹ VTCT is a specialist awarding body offering vocational qualifications. The acronym is not explained on its website: <http://www.vtct.org.uk/>

rewarded for the process undertaken, rather than for the quality of the outcome of their endeavours.

As can be seen in Table 1, which contains data from the National Pupil Database, the popularity of EPQs has increased rapidly since they first became available nationally in 2007. Most recently, in the summer of 2011, the Joint Qualifications Council reported a further 51% rise in the number of grades issued for EPQs. It should be noted, however, that absolute numbers are small, and the research route is still followed by only a minority of Year 13 students in England.

Table 1: Uptake of the Extended Project Qualification (EPQ)*

Examination session	EPQ Year 13 candidates in England	All Year 13 candidates in England	Percentage of all Year 13 candidates in England taking EPQ in the summer exam session
Summer 2007	17	323,688	0.01%
Summer 2008	919	339,468	0.27%
Summer 2009	3350	365,717	0.92%
Summer 2010	11492	392,176	2.93%

*Data obtained from the National Pupil Database (Department for Education)

Cambridge Pre-U Independent Research Report (IRR)

Another rapidly expanding research route is the Independent Research Report (IRR), a major component of the Cambridge Pre-U Certificate in Global Perspectives and Research (GPR). GPR was developed and is administered by Cambridge International Examinations (CIE), who publish UK and international editions of the syllabus. According to CIE (2011), GPR is taught as two successive one-year courses: in Year 13, the IRR grows seamlessly out of the skills introduced and developed in a Global Perspectives course, which is taught in Year 12. The IRR takes forward the Year 12 Global Perspectives course's emphasis on an interdisciplinary, independent and reflective approach to education, focusing on the need for rigour in the analysis and construction of arguments (CIE, 2008). Its explicit aims are to: prepare students for a way of working in higher education; develop generic and higher order skills of research and analysis; and encourage intellectual curiosity (*ibid*).

IRR students submit a report based on work they have done on self-chosen topics beyond individual subject syllabuses (e.g. A levels or Cambridge Pre-U Principal Subjects). They may choose to: (i) dig deeper in a chosen specialism, (ii) cross subject boundaries with an inter-disciplinary enquiry, or (iii) make a new departure with a study in a non-school subject such as astronomy or anthropology (CIE, 2008). The report must be a single piece of extended writing in the form of a 4500 to 5000-word dissertation or report based on an investigation or field study (*ibid*). Assessment is summative. It focuses on abilities to: design, plan and manage a research project; collect and analyse information; evaluate and make reasoned judgements; and communicate findings and conclusions (*ibid*).

IB Extended Essay

A further research route available to students internationally is the Extended Essay undertaken by students of the International Baccalaureate Organisation's Diploma programme (International Baccalaureate Organisation [IBO], 2011). IB students engage in independent research through an in-depth study of a question relating to one of the subjects they are studying. They write essays of up to 4000 words which are marked summatively and externally (by teachers from other IB schools and colleges). Short concluding interviews are also held with students' supervisors. The Extended Essay is intended to promote 'high-level research

and writing skills, intellectual discovery and creativity' (IBO, 2011). As with the IRR, it enables students to practise the thesis approach to writing that is subsequently needed at many universities, whilst experiencing the excitement of intellectual challenge and discovery. Further details are considered subsequently.

Other research routes

In addition to the better-known routes described previously, award schemes run by national associations and funding bodies provide subject-specific opportunities for 16 to 19 year olds to carry out research and project work. One example is the British Science Association's (2011) scheme of *Crest* awards. The scheme operates at three different levels of secondary education (from 11 to 19 years), and students are rewarded for undertaking individual or team-based project work in science, technology, engineering and mathematics (STEM subjects). At the highest of the three levels, over seventy hours of work are put into projects. The project work may link both into the school or college curriculum and into work experience placements and after-school clubs. Another example is a project undertaken by A level science students at Simon Langton Grammar School for Boys in Canterbury. A *People* award from the Wellcome Trust was used to support collaborative research between the school and the University of Kent. The project entailed students using basic genetic engineering techniques in experiments conducted during lunchtimes and free periods. Ultimately, it fed into research to help to understand the causes of multiple sclerosis (Wellcome Trust, 2008).

Comparison of the EPQ and the IB Extended Essay

The EPQ and the IB Extended Essay are two of the most widely followed research routes. We compared the OCR specification for the EPQ (OCR, 2011) with documentation published to support the Extended Essay (IBO, 2004, 2007). Several different dimensions were considered in the comparison, relating to the two research routes' structures, skills focuses, and assessment approaches.

The key structural features are summarised in Table 2. It can be seen that the EPQ requires three times as great a time commitment as does the Extended Essay, from both students and supervisors, although it is unknown how much time is actually spent. EPQ outcomes can be comparatively more varied in structure, format, and the topic covered. The Extended Essay, on the other hand, is always linked closely with students' other studies, and its format is prescribed more tightly. Extended Essays may therefore be less diverse, but a more consistent entity for end-users to evaluate.

Table 3 contains details of the knowledge, skills, and understanding that EPQ students and Extended Essay students aim to acquire. The exact wording used in documentation associated with the two research routes (IBO, 2004, 2007; OCR, 2011) is used wherever possible. Some of the skills are presented as so-called '21st Century' skills, and have been defined and grouped in line with the work of a major international collaboration: *Assessment and Teaching of 21st Century Skills* (ATC21S, 2011). Other types of knowledge, skills and understanding are presented lower in the table. It is evident that there is some overlap between the EPQ and Extended Essay: both types of students aim to acquire skills in creativity, critical thinking, communication, research, and personal responsibility. The EPQ differs from the Extended Essay, however, in that greater emphasis is placed on project management, and there is less explicit emphasis on in-depth knowledge and understanding, and on intellectual risk-taking and discovery.

Table 2: Key structural features of the EPQ and the IB Extended Essay

Feature	OCR EPQ	IB Extended Essay
Positioning	Can be a stand-alone linear qualification worth half an A level (20 to 70 UCAS tariff points*), or a component of the Level 3 Diploma.	Compulsory component of the IB Diploma.
Format of student outcome	5000-word dissertation, or other outcome (design, artefact, report, performance) accompanied by a 1500 to 2500-word report. All students must also complete a Project Progression Record, which contains details of all activities undertaken, and the supervisor's comments on them.	<4000-word essay
Topic choice	The student can choose any topic with agreement from his or her supervisor. If the project is part of the Diploma, then the topic should be linked, as appropriate, to the Principal Learning, that is, the subject area being studied.	The student must choose a topic that fits into one of the subjects on the approved Extended Essay list. It is normally within one of the student's six chosen subjects for the IB diploma. The student chooses the topic in cooperation with his or her supervisor.
Language	Always written in English.	Essays on literary topics are written in the student's 'mother tongue'. Students studying a second modern language (e.g. Japanese) may write an essay in this target language, in which case the research topic must be related to the target culture. All other essays (e.g. on scientific topics) are written in English, French or Spanish.
Structure of written outcome	Not specified.	The formal requirements of the final outcome are: <ul style="list-style-type: none"> • Title page • Abstract • Contents page • Introduction • Body (development/methods/ results) • Conclusion • References and bibliography • Appendices
Recommended time requirements	120 Guided Learning Hours (50 hours linked to teaching & 70 hours linked to assessment). NB: this excludes self-directed study time.	Supervisors should spend between 3 and 5 hours with each student, including the time spent on a viva voce. Students should work for 40 hours on their essays.
Main document providing an overview of the research route	<i>The Extended Project Level 3 handbook/specification.</i> Includes sections on: <ul style="list-style-type: none"> • Learning outcomes • Assessment objectives • Assessment criteria, with exemplifications of what the learner will do • Marking criteria • Glossary (2 pages of terms used in the assessment/ marking grids) • Information on key skills, functional skills, and personal learning and thinking skills 	<i>Diploma Programme Extended Essay Guide.</i> Includes sections on: <ul style="list-style-type: none"> • IB learner profile • Aims • Assessment objectives • Details – all essays (including assessment criteria [- OCR EPQ 'marking criteria']) • Details – subject-specific (c. 5 pages on each of 27 subjects, including subject-specific interpretations of assessment criteria)

*UCAS is the Universities and Colleges Admissions Service. For information about UCAS tariff points, see http://wwwucas.com/students/ucas_tariff/

Table 3: Knowledge, skills, and understanding students are aiming to acquire in the EPQ and the IB Extended Essay

21st Century skills* mentioned explicitly in aims and in statements of intention and opportunities	OCR EPQ	IB Extended Essay
1. Creativity and innovation	Creativity Innovation (initiative and enterprise)	Creativity
2. Critical thinking, problem-solving, decision-making	Critical thinking Problem-solving Decision-making	Critical thinking (including constructing reasoned arguments)
3. Learning to learn, metacognition	Develop and improve own learning and performance	Not mentioned
4. Communication	Communication (including presentation skills)	Communication (including high level writing skills)
5. Collaboration (teamwork)	Project may be a defined task within a collaborative group project	Not mentioned
6. Information literacy (includes research on sources, evidence, biases, etc.)	Understand and use research skills	Research (including a concern with interpreting and evaluating evidence)
7. ICT literacy	Where appropriate, e-confidence - applying new technologies	Not mentioned
8. Citizenship – local and global	Not mentioned	Not mentioned
9. Life and career	Use learning experiences to support personal aspirations for further study and/or career development	Not mentioned
10. Personal and social responsibility – including cultural awareness and competence	Responsibility either for an individual task or for a defined task within a group project	Personal responsibility for own independent learning
Other knowledge, skills, and understanding also mentioned in aims and in statements of intention and opportunities	<ul style="list-style-type: none"> • Project management • Design, planning, research, analysis, synthesis, and evaluation • Development as critical, reflective and independent learners • 'Learners will have the opportunity to apply and develop their personal learning and thinking skills (PLTS), the functional skills of English, mathematics and information and communication technology (ICT) and key skills' 	<ul style="list-style-type: none"> • Engagement in a systematic process of independent research appropriate to the subject • Excitement of intellectual discovery • Intellectual risk-taking and reflection • Open-mindedness, balance and fairness • In-depth knowledge and understanding

*as defined and grouped by a major international collaboration: *Assessment and Teaching of 21st Century Skills* (ATC21S); see <http://atc21s.org>.

Key aspects of the assessment approaches of the two research routes are collated in Table 4. Perhaps the most striking difference between them is that EPQ assessment focuses *exclusively* on the process of undertaking a project. In contrast, Extended Essay assessment takes account of the outcome of the research process, as well as the process *per se*. EPQ assessment is internal, emphasising evaluation, review, and critical work, whereas the Extended Essay assessment emphasises argument and analysis and focuses to a greater extent on academic writing skills.

Table 4: Assessment approaches of the EPQ and the IB Extended Essay

Aspect of assessment	OCR EPQ	IB Extended Essay
Assessors	Following within-centre standardisation (in centres with multiple entries), the project is marked by the student's own supervisor. A sample of work from each school/college is moderated externally by OCR-appointed moderators.	Completion of the written essay should be followed by a short, concluding interview, or <i>viva voce</i> (10-15 minutes), with the supervisor. The essay is marked externally by IBO-appointed examiners.
Marks awarded	A total score is obtained on a scale of 0 to 60. The stand-alone qualification is graded as A*–E. For Diploma students, the grade is translated into a points score. The overall Diploma grade is calculated by adding this to the point score for the student's Principal Learning.	A total score is obtained on a scale of 0 to 36. This is used to determine the band (A, B, C, D, or E) in which the essay is placed. This band, in conjunction with the band awarded for the Theory Of Knowledge (TOK) component, determines the number of IB Diploma points (0 to 3) awarded for these two requirements.
Focus (content/process)	The focus of the assessment is on the process the learner has gone through to achieve and evaluate their final outcome rather than the outcome itself.	Emphasis is placed on the research process and its formal outcomes.
Objectives	<ul style="list-style-type: none"> • Manage • Use resources • Develop & realise • Review & communicate 	<ul style="list-style-type: none"> • Plan & pursue a research project • Formulate research question • Gather & interpret • Structure argument • Present • Use terminology & language • Apply analytical & evaluative skills
Assessment terms mentioned most frequently in main documentation	• <i>Evaluation, review, and critical</i>	• <i>Argument and analysis</i>
Judgement of student work against assessment criteria	Best fit approach entailing holistic judgement	Best fit 'bottom up' approach entailing holistic judgement

Discussion

In recent years, research and project management has become an important component of education for many 16 to 19 year olds. The increasing interest is unsurprising, given the high levels of competition for jobs and university places that currently exist, which place pressure on

applicants to distinguish themselves from their competitors. Key questions for educationalists and policy-makers relate to whether, and the extent to which, research projects conducted outside of mainstream vocational and general courses such as A levels should be influencing university admissions tutors and employers. These are important concerns, given the diverse opportunities and resources available to different student groups nationally and internationally. Although project grades (where they exist) are not always part of formal conditional offers for university places, which tend to relate to A levels and similar courses, research projects can be described in application forms and discussed in interviews. In this way, some applicants can use their project work to demonstrate their commitment and enthusiasm for a particular subject or for education in general. Whilst problems relating to inequality of opportunities affect an educational context far broader than the one considered here, the variation in research and project work among 16 to 19 year olds could be considered an important example of how the problem shows no signs of abating.

The differences among research routes highlighted in this article indicate the breadth of skills being nurtured in young people. Positive experiences of all routes are easy to find, and no single one can be said to meet all needs. Whilst some students may be striving to develop specialist academic research skills and deepen their subject knowledge beyond A level, others may be focused on acquiring the generic skills and capabilities considered most desirable by many employers (Confederation of British Industry, 2007). It is important that admissions tutors, employers, and other end-users understand some of the differences in approach, focus and project magnitude, so that they can evaluate and compare applicants' accomplishments meaningfully. Furthermore, this will aid them in clarifying what they prefer future applicants, teachers, and course developers to devote time to. Stakeholder engagement of this kind is critical in ensuring that young people are sufficiently prepared for the challenges of higher education and professional life.

Finally, it is worth reflecting on the value of conducting summative assessments of student projects. The variety of assessment provision described in this article reflects the diversity of views on this issue held among highly experienced educationalists. On the one hand, because the EPQ and IB Extended Essay are assessed summatively, they can constitute or contribute to formal qualifications. Accreditation of the EPQ by the national regulator (Ofqual, 2011) has ensured that schools and colleges across the country have the financial means to offer it to their students. Furthermore, grades may provide extrinsic motivation for some students, and teachers who lack the skills or experiences needed to set up their own project schemes can obtain support and advice from awarding bodies. On the other hand, the case for encouraging academic risk-taking through formative assessment, or even non-assessment, is also powerful. An appreciation of the intrinsic value and intellectual satisfaction of undertaking a project is arguably something to be nurtured more actively among young people.

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NEW TECHNOLOGIES

An investigation into the impact of screen design on computer-based assessments

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Introduction

Many authors put validity at the heart of assessment (Kane, 2006; Popham, 2000) and emphasise the importance of validity in evaluating new forms of assessment. For example,

The arguments... regarding traditional and alternative forms of assessment need to give primacy to evolving conceptions of validity if, in the long run, they are to contribute to the fundamental purpose of measurement - the improvement of instruction and learning.
(Linn et al., 1991, p.20)

Arguments have also been put forward demonstrating the role of computer-based assessment (CBA) in both enhancing and reducing the validity of test scores. Ridgway and McCusker (2003) highlight benefits of CBA in improving the validity of assessing problem-solving skills, whilst Clarke et al. (2000) identify the detriment to validity from dependence on multiple choice items. Throughout the history of CBA, there has been discussion regarding the validity aspects of its implementation (Huff and Sireci, 2001; Russell, Goldberg, and O'Connor, 2003).

Educational measurement theory emphasises construct validity in evaluating test outcomes (Messick, 1989). Construct validity is defined as "the qualities a test measures, determined by the degree to which certain explanatory concepts or constructs account for performance on the test" (Messick, 1989, p.16).

Construct validity can be affected by 'construct-irrelevant variance'; it occurs when the test contains excess variance that is irrelevant to the

interpreted construct. For example, a demanding reading stimulus in a science assessment may cause a variance in test scores (related to reading ability) that is irrelevant to the construct being assessed (science).

Some aspects of construct-irrelevant variance have been explored in the CBA literature. A number of studies indicate that students with a good prior knowledge of ICT performed better on computer-based tests (Clariana and Wallace, 2002; Russell et al., 2003; Warschauer, 2004). Construct-irrelevant variance can be introduced by poor item design (McKenna, 2001; Sireci and Zenisky, 2006); screen size and resolution (Bridgeman, Lennon, and Jackenthal, 2003); and the effect of scrolling (Ricketts and Wilks, 2002). These studies indicate that aspects of the screen environment or the method of student interaction may be related to sources of construct-irrelevant variance in CBA. Additional research has investigated how the layout of paper-based formats may affect item performance (Crisp and Sweiry, 2006) and how screen design affects how website users access information (Helander, Landauer, and Prabhu, 1997). However, there is no research on how item format¹ may affect performance by students on a computer-based test. This article reports on part of a study that investigated the impact of item format on the difficulty of test items. The following research question was investigated:

What are the effects of changing the item format on measures of item difficulty of a computer-based test item?

¹ 'Item format' is the term used in this article to cover the layout of text, buttons and images on the computer screen, along with the method of interaction used with these screen elements.