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Project

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Undergraduate study in
Computing and related programmes

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Notes

1. Introduction

CO3320 Project is unlike any other course on your degree. It involves putting what you have learnt in other courses into practice, in a significant endeavour requiring sustained effort, independent thinking and project management skills. It is natural to feel a little apprehensive about the Project at first; most students will have never attempted anything quite like this before. However, year after year, many students find it the most engaging and rewarding part of their degree.

The successful completion of the Project will equip you with many invaluable skills for your future career, whether you plan to work commercially or to pursue academic research. Each year, we see Projects that have clear potential for commercialisation, and others good enough to be published in the academic literature.

The Project is an opportunity for you to identify a topic that interests you, to develop a deep understanding of the topic, and to create something new in that area. It may sound obvious, but it really is the case that the more you put into it, the more you will get out of it.

Because this is the first time that most students will have undertaken something of this nature, we do see various kinds of problems crop up year after year. Problems can occur in every aspect of the Project, from choosing a topic, planning the work, implementing software, testing, analysing data, writing the final report and managing to complete everything on time. This Project guide is designed to help you avoid these common problems, so that you can successfully complete a well designed, well executed, and well written piece of work. Do read through this guide and the prescribed textbook (Dawson, 2009, see p.2) before you start, and also look at some of the additional resources highlighted throughout the guide (these are summarised in Appendix A).

Having read this guide, you will have a good idea of how to go about things, and of what the Examiners will be looking for. With a good grip on that, you can then concentrate on the interesting (and fun!) part of deciding what subject you wish to explore, and identifying specific aims and objectives. Once your Project is properly defined and structured, you should find this course every bit as engaging and rewarding as others have done in previous years.

Learning aims

The Project will enable you to:

- shape the emphasis of your degree study to your interests and needs for the future, through Project topic selection
- develop your ability to work independently on a substantial scale (of an order of magnitude greater than a coursework assignment, and so qualitatively greater in size and complexity)
- demonstrate your originality, creativity and perseverance
- develop an understanding of professional and academic documentation issues; in terms of communication skills, coherence, structure and fitness for purpose
- graduate with a coherent, focused body of written work suitable to show prospective employers or graduate admissions tutors as evidence of ability and achievement in large scale, independent work.

Learning outcomes

On the successful completion of the Project, and through the use of the relevant reading, you should be able to demonstrate:

- the ability to investigate diverse and extensive information sources, to analyse them, and to select from them relevant materials for a specified purpose, with a justification of decisions and choices made
- the ability to make your own decisions (such as design choices) based on analysis of extensive evidence and to give a rational justification based on reasoned argument
- enhanced abilities in analysis, design, implementation, testing, documentation in proportion according to the nature of the Project
- the ability to combine skills and knowledge related to design, human communication, human–computer interaction and information technology
- improved awareness of both technical and non-technical issues, in relation to the Project
- improved time management and ability to work to deadlines, especially with evolving project requirements
- improved skills in the management of unstructured, or complex, project work.

Reading

Essential reading

Dawson, C.W. *Projects in Computing and Information Systems: A Student's Guide.* (Harlow: Addison Wesley, 2009) second edition [ISBN 9780273721314].

Supplementary reading

Cornford, T. and S. Smithson *Project Research in Information Systems: A Student's Guide.* (Basingstoke: Palgrave Macmillan, 2005) second edition [ISBN 9781403934710].

Raimond, P. *Management Projects: Design, Research and Presentation.* (London: Chapman and Hall, 1993) [ISBN 9780412468100].

Rogerson, S. *Project Skills Handbook.* (Bromley: Chartwell-Bratt, 1989) [ISBN 9780862381462].

There are several books on Projects that can be recommended. The most important is Dawson (2009), which is Essential reading, and which you should purchase. Other suggestions are Cornford and Smithson (2005), Raimond (1993), and Rogerson (1989), as listed above under Supplementary reading. Some of these concentrate on projects of different types, so choose ones that are closest to your interests. You will find that these books help clarify the kind of work your Project involves, as well as the methods and reasons for doing it. These books, and others, are included in the References section at the end of this guide, which you should refer to before reading the rest of the guide.

Please note that throughout the guide, there are references to particular sections in these texts, which are Essential or recommended reading. You should make sure that you read or refer to the reading sections listed in the guide, which may or may not be listed as specific Reading activities.

Note that different authors may advise slightly different approaches to some items, such as report content lists or layout. Any directives in this guide take precedence over advice read elsewhere. However, you are free to utilise recommended practice in other texts that you find useful and that is not in conflict with any directives in this guide.

Assessment

Important: the information and advice given here are based on the examination structure used at the time this guide was written. Please note that subject guides may be used for several years. Because of this we strongly advise you to always check both the current *Programme Regulations* for relevant information about the examination, and the virtual learning environment (VLE) where you should be advised of any forthcoming changes. You should also carefully check the rubric/ instructions on the paper you actually sit and follow those instructions.

You will be assessed on your Preliminary Project Report (PPR), Final Project Report and examination. These will demonstrate the quality of your Project in terms of:

- **Content**, consisting of three coherently related parts:
  - **Challenge** (for example, the question to answer, problem to solve or thesis to argue)
  - **Context** (including the background to your work, usually expressed as a literature survey that justifies the methods you use by analysis and comparison of the work of others)
  - **Contribution** (what you did to meet the challenge within your context).

Remember, it is important to check the VLE for:

- up-to-date information on examination and assessment arrangements for this course
- where available, past examination papers and *Examiners' reports* for the course which give advice on how each question might best be answered.

Recommendation on study time

The workload is expected to be the equivalent of **at least 300 hours intense, focused effort.**

1.1. Preface

It is important to make your degree relevant for your future, be it in further academic study or in work. To help in this you have some choice in what you study via the Level 3 options and your Project.

The Project is most important in this regard as it allows you to develop prior learning on the programme to address an interest that relates to your plans for the future. Following a relevant interest will help maximise your motivation and make the Project the most inspiring and enjoyable part of your degree.

While the majority of students attend an institution where supervision of the Project is provided, and this is most helpful, students can, and do, successfully complete the Project alone. If you are studying without a supervisor then be sure to read the advice given in Section 7.1 of this

guide and in Chapter 7 of Dawson (2009), and interpret any suggestions in relation to a supervisor in terms of self-reflection in the learning process.

Because the Project forms such an important part of the degree while allowing a wide range of topics, it has given rise to more queries from students than any other course. These queries arise from uncertainties about both the nature of the work involved as well as the nature of the report that has to be produced. This edition of the Project guide does six things:

1. It answers questions raised by students.
2. It describes, in a chronological fashion, the work required when undertaking a Project.
3. It gives advice on the Project examination, as well as Sample examination questions and comments on how to approach answering them.
4. It provides updated information on the criteria and processes used by the Examiners when marking the Final Project Report (see Section 12).
5. It describes revised requirements and procedures for submitting the Preliminary and Final Project Reports. **In particular, note the new format requirements for the PPR (Section 6.1), the new submission arrangements for the PPR (Section 8.2.1), and the fact that an electronic version of the Final Project Report must now accompany the submitted hard-copy version (Section 8.2.2). The Project Description Form, used in previous years, is no longer required.**
6. It lists various supplementary resources, where you can find additional help and advice.

The Project is unlike other courses. The independence of the work and its requirement for originality will be challenging to all students. Meeting this challenge effectively is what makes the Project so worthwhile.

This guide should be studied carefully. Directions on process are included to help you with approach and structure. There is rarely any need to deviate from the process described in the guide – any deviation should be well justified, should have the agreement of the Project supervisor (if you have one) and should be explained in the Project Report.

The best time to start your Project is soon after your last examination in the preceding year. If you wait a few months until the start of tuition for the next academic year you will have to work harder to make a good start. Also, a Project cannot be hurried as you will need time, outside of direct working hours, for reflection and for ideas to gestate. The earlier you begin your Project, the more likely you are to succeed and to be satisfied with your work.

Good supervision support on the Project is valuable in many ways. For example, a Project supervisor should help you to avoid unsuitable or inappropriate topics, too wide or too narrow a scope, and in offering you advice when work diverges from the plan in form or timing. While no assurance of quality can be given, there is generally a greater likelihood of finding a suitable supervisor if attending an institution that is recognised by the University of London, as detailed in the *Programme Regulations*.

However if you study alone, one benefit is an enhanced opportunity for developing a stronger ability in independent working, which will provide a good test of your powers for self-organisation. We regularly see outstanding Projects submitted by self-study students.

Dawson (2009: preface and Chapters 1 and 2) has some useful additional preliminary reading on Project content. As detailed above, this text is required, Essential reading.

1.2. Purpose of this guide

Passing the Project is essential to gaining honours in any of the BSc degrees in Computing and related subjects. The Project is undertaken at Level 3 and is one full course. It is work that you must do largely under your own direction, in the field of your degree, be it Computing and Information Systems or Creative Computing.

The purpose of this guide is to help you to undertake project work successfully. It offers guidance on the kind of work to do, how to do it and how to report it. It contains advice on presentation and quality standards − this is advice that needs to be taken extremely seriously. It also explains the requirements for documentation. Last but not least, it gives advice on the written examination paper. The Project provides experience in carrying out original work to the standards required of an academic investigation.

The assessment is about originality and quality, not length. Many people write far too much and unnecessary content will not gain credit − it may indeed lose some. You have an extremely limited timescale so you need to make plans to use this time effectively. Many students ask how long their Project Report should be. There is no set answer to this question; essentially, it should communicate all of the important aspects of the work you have undertaken in a clear and concise manner. You may find it helpful to look at some of the best Project Reports from previous years, which are published on the VLE (see Appendix A for details).

The format of the final report is very important. You need to remember that this is an academic piece of work. The work you are reporting is your work and not someone else's. Published sources will be important to you but you must not repeat them word for word; you reference them to support what you want to say.

While the large majority of candidates pass the Project, some do fail and of those many do so for reasons that could easily be overcome. It is important to mention a few things (covered at more length below) to which you should pay special attention. Make sure that any material from other authors is properly referenced for good professional practice and to avoid plagiarism. Make sure that you use language effectively so that you avoid having many words but little content. Even if good work has been done it is important to report and present it appropriately. Interviews must be properly documented in order to receive full credit. English usage must be sound. Treat the Project seriously and remember it is your work alone that is being presented and assessed (not that, for example, of your sources).

Many Projects (and Reports) are far too long and lack purpose. The issue is the quality and presentation of your work. You are not being asked to write a textbook but to conduct a piece of original work for an informed readership. Developing an understanding of what to leave out is as important as coherently presenting what you choose to include.

1.3. How to use this guide

This guide is organised into sections. Each of the earlier sections gives guidance at a particular stage in undertaking your Project work. This guidance should be followed closely. The following sections include advice both on what you should do, and on what you should not do. Some guidance is advisory (such as on choosing a topic); it is there to help, no more and no less. If the way you do your Project is sub-standard then your results will not be reliable or valid. Later sections are to guide you in applying and reporting some of the techniques you may be using.

The guide follows the pattern of:

- Choosing a Project and developing your objectives
- Choosing and documenting your methods
- Uses of the topic literature
- Collecting and documenting your results
- Discussing results and drawing conclusions
- Producing your Report
- Studying for the Project, alone or at an institution
- Research methods
- The role of a supervisor
- The Project examination
- Assessment of the Project Report.

It is suggested, very strongly, that you read the whole Project guide first before approaching each area of immediate concern.

1.4. An approach to working on your Project

The Project is a single large piece of work and can seem daunting at first. The general principle that you have used in writing large programs can help you here, namely ‘divide and conquer’. That is to say you need to find a way of breaking the task into manageable subtasks. The suggestions in this guide on structuring your Project will help here.

Even so, many tasks will run over a prolonged period and, if treated as a single item, you may have trouble measuring progress until your target completion date arrives and the job is found either to be done or not done. Thus **it is important to break your work into small chunks, where each chunk can be finished in a week or at most two**. This can be expressed in terms of the familiar sequence, selection and iteration structures that you have met during your studies (see Figure 1, opposite).

The process emphasises interaction with a supervisor (see Section 10). If you have no supervisor then set aside regular periods for self-review (see Section 7.1).

Work includes at least some of: reading, designing questionnaires or programs, programming, carrying out surveys, writing documents, preparing a presentation. Each of these tasks will be discussed in more detail in the following chapters. Making a sensible decision on what to do (the question to be answered or the problem to be solved) and initial planning are so important that they have been given their own cycle.

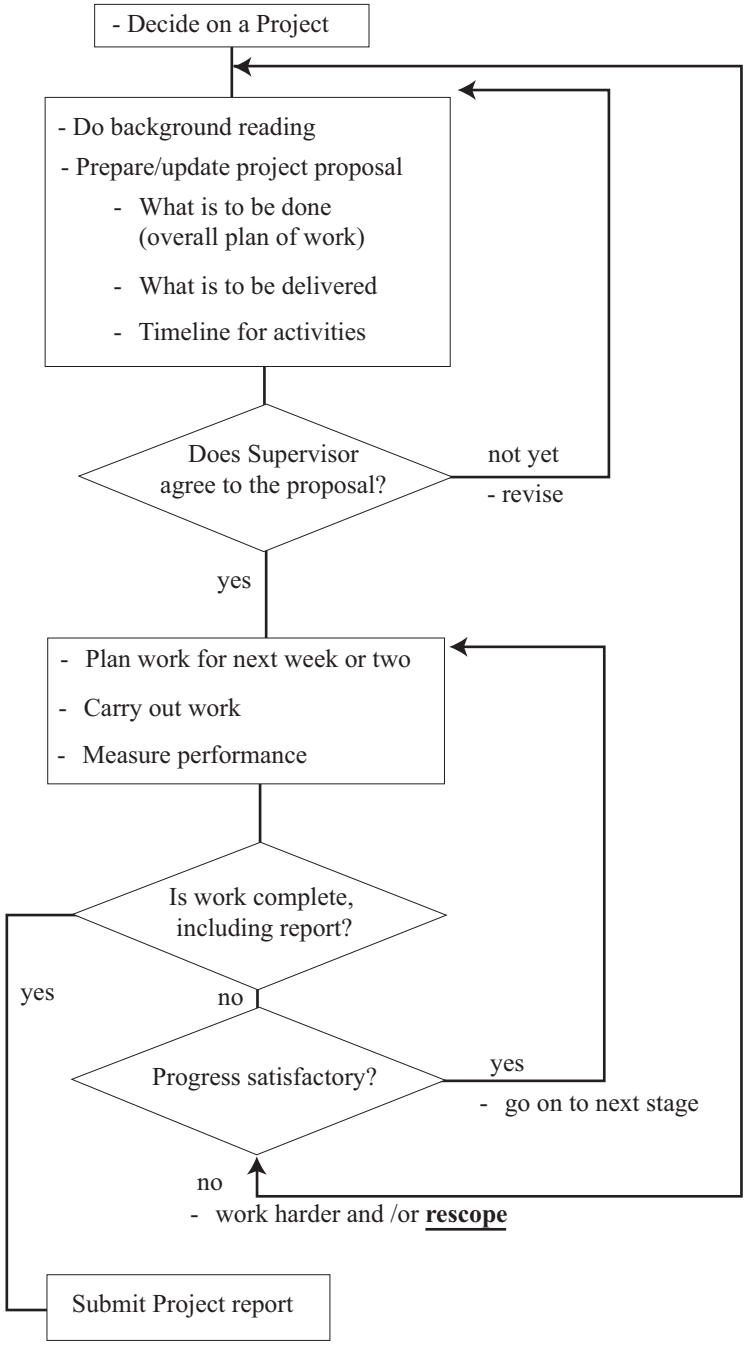

Figure 1: Flowchart of a suggested approach to managing your Project

Note particularly that as well as carrying out the actual work on the Project that you will report, there is a strong emphasis on **planning** and **measuring** within a controlled **timeframe**. These three elements are the key to keeping control of your Project, and a supervisor will check that you do this (see Section 10). Without a competent supervisor you must ensure that you monitor this yourself.

Section 10 includes a list of some 'do's and don'ts' in working with a supervisor, and how to avoid some excuses becoming reasons for failure. If you do not have a supervisor, you have to supervise yourself and you must act with great self-discipline.

Chapter 4 of Dawson (2009) provides very valuable (and much more detailed) further reading on project planning, while Chapters 5–7 discuss how to conduct a project successfully.

1.5. The assessment of the Project

This comprises three elements:

1. The Preliminary Project Report (weighted 10 per cent)
2. The Final Project Report (weighted 65 per cent)
3. The unseen examination (weighted 25 per cent).

To pass the Project course, you must achieve a mark of at least 35 per cent in the examination, a mark of at least 35 per cent in the Final Project Report, and an overall weighted average mark of at least 35 per cent across all three elements (with the weightings as shown above).

The submission deadline for the PPR is specified in the *Programme Regulations* for the session.

Information on what should be included in the PPR and in the Final Project Report is given in Section 6 of this guide, and details of practical matters and deadlines for submitting your Reports can be found in Section 8. Information on the examination is given in Section 11. It is recognised that everything to be done in a Project is not determinable at the start of work and that major aspects of the aims and objectives may change during the Project process. This is one reason for the recommendations given on actively maintaining and updating your Project Plan as the Project progresses (see Section 2.5). For this reason also, it is understood that the PPR may cover rather different ground than the Final Project Report that is submitted several months later. Students should not worry about this. If the Final Project Report diverges from the PPR, then all that is needed is a short account (probably a single paragraph) outlining the differences and how they arose, as part of the Final Project Report introduction.

The information and advice given in the above section are based on the examination structure used at the time this guide was written. You should always check the current *Programme Regulations* for relevant information about the examination. You should also carefully check the rubric/ instructions on the paper you sit and follow those instructions.

2. Choosing a Project

High-quality indicators

Appropriate choice of Project topic, based on preliminary research

Appropriate use of language

Appropriate depth

Common student failings

Vague language

Lack of preliminary research

Lack of depth

A vital first step in choosing a subject for your Project is to understand what makes a good Project, and what kinds of things the Examiners will be looking for in your work.

Ideally, the **Examiners are looking for a Project to address a specific problem, by following the structure of an academic research project**. This involves the following steps:

1. Identifying a specific question (or questions) to be addressed.
2. Justifying why this question is important and situating it within the body of current knowledge on the subject (which will involve a review of relevant literature).
3. Proposing a means of answering that question (which may entail proposing a solution to an identified problem).
4. Performing some sort of experimental data collection relating to the proposed means of answering the question (which may involve developing some software).
5. Analysing the collected data using appropriate analysis techniques.
6. Drawing conclusions from the analysis which relate back to the original research question.

Notice that there is a clear logical structure to these steps, which all hinges on the question(s) identified in Step 1. This structure will dictate what tasks must be performed to complete the Project, and should also suggest an appropriate structure for your Final Project Report.

Although the preceding comments have been expressed in terms of an 'academic' research project, the structure is equally valid if your work is focused on a commercial application rather than an academic research question. After all, if you are developing a piece of commercial software that you wish to sell to paying customers, they will certainly want to know what your software does that other applications already on the market cannot do – and they will want to see evidence to back up your claims, which is exactly what the testing, experimental and analysis aspects of the Project are all about.

Projects which merely involve the implementation of a piece of software or website, with no academic question driving the development, will not achieve high marks. They may, however, be deemed sufficient for a pass if they **demonstrate the application of solid software development**

practice. In addition to what you have learnt about software development during your degree, also refer to Chapter 6 of Dawson (2009) for a good summary of what is involved.

Note that even a Project which is, on the face of it, a straightforward software development task, can – and should – be cast as an academic research project if appropriate questions can be addressed (for example, 'Can novel feature X improve some aspect of a business process?', or 'Can novel user interface feature Y improve customer satisfaction of the system?'). The more specific a question that can be framed, and the more specific the means of analysis, the easier it will be to provide a definitive answer in the Project.

Much more extensive guidance on the nature of research, and on choosing a Project, can be found in Chapters 2 and 3 of Dawson (2009). Do make sure that you read these chapters. Additional resources for further help and guidance are listed in Appendix A of this guide.

2.1. Types of subject matter, by programme

In Computing and Information Systems, the first step is to decide whether you want to concentrate on the computer science side of the course or the information systems side or some mixture of the two. Some titles of previous Projects are given in Appendix B, which may help in making the decision. There is not a sharp distinction between these two sides of the course, though the extremes are clear. A Project involving a detailed analysis of algorithms would almost certainly be computer science and one on the impact of ActiveX on the management of text databases would probably be on the information systems side.

The requirements of both sides are identical, the quality standards are identical and the distinction should be more a first step in choosing your direction than a primary point of concern. Provided your topic has relevance to computing, software engineering, business systems or any of the material covered in the taught part of the course there are no subject restrictions. Guidance on Computing-oriented Projects is given in Section 2.1.1, and on Information Systems-oriented Projects in Section 2.1.2.

In the case of Creative Computing, there is a more integrated requirement, as set out in Section 2.1.3 below.

2.1.1. Computing

Some Projects will lead naturally to extensive non-standard data analysis or the writing of significant software to enable implementation and testing of an idea, and so will involve using either a programming language, or a software package such as a database management system, a spreadsheet, or a Computer-Aided Learning/Authoring system.

Such Projects will refer to books and articles and the documentation of the software in use. The main body of the work is the analysis, design, coding and testing done and this will be carried out and documented according to established and explicit principles.

A programming-based Project will be expected to adhere to high standards of design, coding and testing. It is here that you can show what you have learned in your earlier courses about the practice of software development.

If your Project involves the implementation of an application using a software package remember that your contribution will be expected to be substantial. Your chosen application must be non-trivial.

You may want to do a Project that involves only extended library-based research. This is acceptable in principle but the outcome in practice is often disappointing. It requires a much greater amount of reading, and evidence of critical assimilation of information, than the software-based Project. Library-based Projects are reviews − your contribution is your analysis and criticism of previous work. As with all Projects, the Examiners will be looking for the contribution **you** have made to the subject. These Projects are very difficult to do successfully without wide knowledge and experience of the subject. If you have a supervisor be sure to discuss this carefully and take account of the expert's view, especially if you go against it.

2.1.2. Information systems

There are many areas of information systems that are of general academic interest. The subject relates directly to the application of systems ideas and information technology in the real world.

Many good ideas lead to a series of interviews, a questionnaire survey, the analysis of an existing business system to determine impact on the personnel; whether estimated benefits have been achieved; whether performance is satisfactory; whether a new approach or technology is worth pursuing. The more practical your work, the more useful you will find published accounts of methods and cases.

If you are working (or have suitable contacts) you can consider a work-based Project. Normally you will find that the workplace is very demanding and you will need to be very careful in setting and meeting their objectives as well as your own.

Usually you will find it appropriate to define your workplace as the source of information to be discussed in relation to other published sources − giving your Project a wider interest and contributing to general understanding. **Do not attempt to carry out a whole system development**. This kind of Project is unacceptable. If it can be done in the time available it has little or no complexity and little or no general interest. Instead, you may wish to cover a defined subset of the work involved in system development. This kind of Project can be acceptable, but subject to one caveat. Any specific product (often a data flow model or a set of object models) has to be proven to meet quality standards. The submission of evidence that proves the validity of the work is essential, so that it can be properly assessed by the Examiners. Such evidence could, for example, be reports of workshops, the record of exercising prototypes or a survey of user satisfaction. This kind of work is sometimes better specified as an investigation into the effectiveness of workshops, the value of prototyping or the importance of user satisfaction.

Do not commit yourself to doing too much. The assessment will be based on the academic report submitted and the examination. Even in apparently simple cases this may mean that you can only deliver, for example, the cost-benefit analysis, the system specification or the database design in the time available. The deliverables must include documentation of appropriate testing and evaluation of each item.

In general, you will find that devising an investigative or experimental set-up will be much more rewarding (both academically and personally) than taking on the burden of producing part of a complete system.

You will gain credit for producing a system that has significant useful functionality, meets specified requirements, handles errors and is well documented, but not otherwise.

2.1.3. Creative Computing

Any Project in Creative Computing will make reference to, and use, some ideas and approaches from Creative Computing-specific courses.

The deliverables should normally include a substantial visual, audio, or multimedia content. Apart from illustrations and explanations in the written report, this content must also be provided on a CD-ROM, USB stick or other electronic media, included with the printed report, in addition to the software and executables required for any programming-based Project. Before submission, it is recommended that you test that your files open on another system, or that you ask a friend or colleague to open them. **Please note that it is the responsibility of the student to ensure that the media files operate correctly under a standard Windows, Macintosh or Unix/ Linux system**.

As indicated in the assessment criteria set out in the *Programme Regulations,* any Project worthy of a First class mark will have some noteworthy originality, and this is particularly so where enhanced creativity is explicitly an aspect of the programme outcomes.

As for any academic Project, this creative contribution must be set in a context of other work that is reported, to inform and justify the approach taken, and to provide a cultural reference for the motivation and inspiration of the contribution.

2.2. Choosing your Project and developing objectives

You should give careful thought to the material in this section in order to make a good start to your Project. There is a useful discussion on developing aims and objectives in Section 3.3 of Dawson (2009).

You may not be sure, at the beginning, what kind of Project to carry out. If you are studying at an institution, your tutors will provide you with some suggestions but do not be afraid to suggest an entirely original idea of your own. The ideal Project is one which:

- interests you
- has not been done before
- enhances your professional and academic standing.

If you do not have ideas of your own, discuss the situation with your supervisor. You should also look at the computer press, or other sources related to your degree subject, where you will find articles on current issues and areas of interest. You should be able to find something that appeals to you.

Whether you have an idea of your own, or whether you have picked up a suggestion, your first task is to determine whether the idea has the potential to meet both your interests and the academic requirements. There are two stages in this process:

1. Develop the idea by thinking the problem through in more detail; one idea usually leads to another and a diagram may help you decide what you need to do, what you do not understand and the kind of place you want to get to.
2. After this preliminary exercise, you are ready to see what has been done before (there is no point repeating work that has been well covered elsewhere). You should also consider what resources are likely to be required for what you have in mind. At this point you should carry out a small scale feasibility study, the product of which will be the specification of your objectives.

The single most important guidance at this stage is to define your Project as a **question to answer**, a **thesis to argue** or a **problem to solve**. Any one of these will lead to a clearer path for useful work than simply specifying a topic. This is because a topic tends to invite just general discussion and a survey of the literature which will tend to limit you to context with little or no contribution.

The suggested alternatives more readily lead to identifying interesting work of your own to do (challenge) as well as helping you see how to carry out the preparatory work (giving context) to justify what you then did (contribution).

A question to answer should need substantial effort to resolve it. For example ‘In what ways can enhanced web presence aid profitability for SMEs?’ is more helpful in leading to what work needs to be done than one that allows just ‘yes’ or ‘no’ as an answer; such as: ‘Does enhanced web presence aid profitability for SMEs?’. In essence, this latter question needs a one-word answer without directly requiring supporting arguments.

A thesis that you put forward and attempt to prove may be more appropriate for some Projects. A thesis in this context means ‘an unproved statement put forward as a premise in an argument’ (*WordNet Online*, 2010). In terms of the previous example, one thesis might be ‘Enhanced web presence aids profitability for SMEs’.

In either case there is a problem to solve that may itself become the Project title, such as ‘The benefits of enhanced web presence for SME profitability: establishing evidence bases and demonstrating their adequacy’.

You will need to show the value of your work in answering your question, in support (or otherwise) of your thesis, or resolving your problem. Often this can be done by setting up some hypotheses (perhaps only one if of sufficient importance) that you can test for appropriateness and significance. An example might be ‘The data gathered shows that there is no statistically significant (at the 5 per cent level) profitability benefit for SMEs from enhanced web presence’. Section 9.5 gives a short introduction to hypothesis testing, but background reading will be needed if you have little existing knowledge of statistics.

Let’s take an example of idea development. Say you have developed an interest in client-server systems. What really interests you in this area? Ignore answers that are regressive, such as ‘it seems important’. It is important but if that is as far as you can go you might as well just read a textbook on the subject.

Perhaps it is an interest in database locking that matters. For example, how does a Database Management System (DBMS) manage to control locks on clients that may be unreliable, where users close down without notifying

the DBMS, where multiple servers are involved, where large amounts of data may have been copied to the client.

Inspiration for Project ideas can often be found in recent conference proceedings. To continue with the example, you could enter a search phrase such as 'Conference DBMS lock reliability 2011 2012' into any search engine.

In the process of developing some more specific ideas, you might find it helpful to draw a diagram like that shown in Figure 2 (these are often known as mind map diagrams − they capture ideas quickly, and informal use is often sufficient). Each of these may provide more than enough material for your Project so you need to investigate further. You locate the appropriate textbooks, spend some time doing internet searches, review the research papers and you soon realise that there is a large body of theory already in existence.

You realise (rightly) that there is no point writing a textbook on the theory but there may be merit in testing how the theory has been applied so you formulate your Project as a question: 'How effectively do server DBMS's manage unreliable clients?' You are now ready for the next stage.

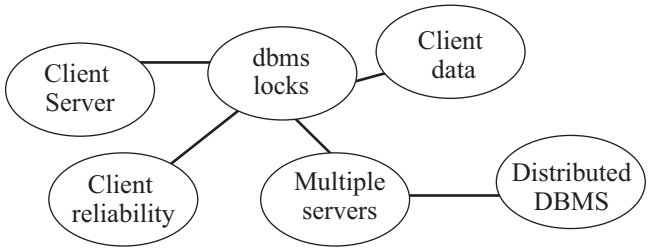

Figure 2: Mind map diagram

You will find that this stage of the work takes a significant amount of effort. Nevertheless, you will find that the clearer you are in what you want to do and why, the more easily you will be able to plan your Project work.

The main problem you are likely to have at the beginning is vagueness. Even when you are relatively certain about the general area you wish to pursue, you may have difficulty in setting out a concrete proposal and a definite plan of work.This is natural at the beginning, but you should move, **within two or three weeks**, to a **definite proposal**. By that stage, you must have a clear idea about what you want to accomplish. Also, if studying at an institution, you may be required to give a short presentation on your proposed Project.

It is common for most proposals to have a wide scope and appear too ambitious initially. You are not expected to try and solve the problems of the universe. A limited objective carried through **systematically and in depth**, impresses the Examiners; one that covers a wide area superficially does not. Set modest goals, and do not attempt more than can be done well. If you have serious doubts, put aside a few days to investigate the feasibility of your Project and your Project plans. If all is well this will enable you to proceed with greater confidence.

Until you have spent enough time doing some substantial work on your Project it is easy to overestimate what can be done in the time available. Often the work takes two or three times the effort that was initially

estimated. One of the benefits of the work process outlined in Section 1.4 is that after only a couple of cycles of planning and measuring progress you will be able to estimate what is possible more accurately. Always leave yourself an ample margin of time to deal with the unexpected.

Summary

1. Decide what question(s) you want to answer.
2. Decide your overall approach to answering the question(s).
3. Formulate exactly what you will produce to give you the answer(s).
4. Determine what previous work has been done that is useful.
5. Decide if the work is feasible in the time available − if not, reduce the scope.
6. Decide if the work is technically feasible: Are the right tools available? What other resources will be required? Do you have access to any data that you will require?
7. Plan the practical element of your work.
8. Produce an outline structure for your Report.
9. Now execute your plans.

2.2.1. Unsuitable Projects

Some approaches to Projects that may make the work unsuitable have already been mentioned above.

However, some topics are unsuitable in themselves for any degree in Computing and related subjects, be it Computing and Information Systems or Creative Computing.

Clearly this includes any topic with no computing content at all. Apart from some basis in computing, which may include information systems in Computing and Information Systems, for Creative Computing there must be some aspect of creativity involving computer use. One guide is to consider the extent to which the intended Project involves material or concepts from other courses in the degree programme; if such an involvement or relationship is lacking then there is a high risk that the Project will be unsuitable.

Nevertheless, some topics that have some apparent link to the subject are still considered unsuitable by the Examiners for the degree. Such subjects include implementations of games or other items that have no direct computing relevance apart from the production of a computer program. It may be that some relevance may be present through consideration of human–computer interaction or artificial intelligence issues, but then these should be the focus of the work – the game implementation itself is not the basis on which the work would be assessed.

2.2.2. Benefits of, and problems with, work-based Projects

A work-based Project offers some advantages. One is that you will have some detailed knowledge of the background. This will not only save you some time in Background reading (compared to a student who picks a topic of interest but of which they have no direct knowledge) but may mean that your employer is prepared to allow you to use some of your employment time to work on your Project. Your employer may also provide access to resources that will help you in pursuing your work.

Conversely there are consequent dangers that you may face. One is that your work may lead to reporting of commercially sensitive material in order to be thorough and your employer may object. To counter this, be sure to obtain a permissions letter from your employer at an early stage. This should set out what you may do and report. Include this letter in your Report as an Appendix as it helps to clarify the framework within which you studied. Cross-reference this from the main text as appropriate, such as when setting out the scope of your contribution within a work-based group, or explaining why a particular (work-based) methodology was used.

Another danger that may arise in a work-based Project is that your employer may change their mind about what they want you to do half-way through the Project. A permission letter can help mitigate this danger, by setting out a clear agreement between you and your employer at the start of the Project, detailing exactly what you will deliver, in addition to what you may or may not report.

Another aspect about which you must be especially careful with a work-based Project (although this is true for any Project) is to explicitly identify the parts of the work that are, and those that are not, your own. This is because you may be using a company methodology (ensure it is clear that this is not your product); or results already produced by the company (not derived by you individually as part of the Project), or you may be working as part of a team. In this case, it is important to state explicitly what you did and what others did. This is good professional and academic practice and you will gain credit from the Examiners.

The importance of this last point cannot be emphasised too strongly. If the University of London International Programmes Examiners cannot identify the work that is yours, or have reason to believe that there is too much work to have been done by you alone, you will gain no credit and thus risk failing.

On completion of your Project, you should obtain a sign-off letter from your employer, and include it as an Appendix in your Report. This should include confirmation of work done, a brief evaluation and a statement of acceptance, if appropriate. You need to be clear about the different reporting requirements that may exist for an employer and for the academic report. A report for your employer is likely to be short, containing results and recommendations with a short justification. Your employer can ask for more detail at any time later if interested.

By contrast, the marks you obtain from the Examiners will be for the academic report that you submit. Part of what makes it of academic interest is the context of your work and sufficient detail on methods to enable reproducibility of test results. This enables others to see how your work fits into the wider body of knowledge on the subject and to evaluate its relevance to their own studies.

Thus an academic report will include a substantial literature (and other resource) survey, with detailed analysis to identify elements relevant to (namely, supportive of) your planned line of work. More information on report structure is given in Section 6, and on the literature survey within Section 3.

Only your academic report is submitted to the University of London and so you need to be very clear on the differences between requirements for an academic- and a workplace-oriented report at all stages of working and writing.

Lastly, and related to the earlier points, it is very important to avoid your work being too narrowly focused on company requirements to the point where it has no interest or applicability elsewhere at all. That is, your Report must have some interest other than just to you and your employer in order to have any chance of academic relevance.

2.3. Statement of objectives

High-quality indicators

Sound justification

Specified results

Common student failings

Confusion of company and Project objectives

Failure to define results

Having established the overall aim of your Project, you need to define a set of objectives that you intend to fulfil in order to achieve your aim. Objectives are specific, quantifiable achievements that represent progress towards the overall goal of the Project. They establish the scope, value and planned results of your work. The aims and objectives are also known as terms of reference.

Reading activity

For further discussion on defining aims and objectives for your Project, refer to Section 4.2 of Dawson (2009).

Your aims and objectives will be described in the Introduction section of the Final Project Report. The Introduction should include a justification for doing the work in the first place – that is, a brief explanation of why the aims are important. It should then take your Project aim(s) as a question and explain what will constitute an answer to that question. In doing so, the Introduction should define the results you will produce (the Project's objectives) to answer the question (the aim). What you are doing at this stage is specifying your deliverables.

2.4. Choosing and documenting your methods

High-quality indicators

Clear and complete relation to deliverables

Considering the validity of deliverables

Common student failings

Confusion of development methodology and Project methods

Failure to provide detailed analysis

Failure to discriminate between, and select from, available techniques

You should give careful thought to the material in this section in order to carry out an effective Project. It will also help you to complete the Methods section of the PPR.

When you know what you need to produce, you can then decide the best approaches to get the material you need.

Reading activity

Now refer to Dawson (2009: Section 2.4), which includes a review of research methods.

Dawson classifies these research methods as action research, experiment, case study and survey. Your own Project may use two or more of these classes. You should be aware of the possibilities to help you make more appropriate choices to achieve your particular objectives.

Library work is essential and you should document your search strategy − note that strategies that do not produce useful information should also be reported − see Section 3 below.

If your Project is in any way experimental then you will need to investigate experimental design very carefully. The first point is that you need to be sure, and report the reasons for your belief, that the experiment will produce the required results. The second major point is that experiments need to be controlled so that you and the reader have confidence in the results. These too need to be reported. It is a common failing to report results without sufficient detail of the experimental method and controls. For experiments and surveys that involve human subjects, another common failing is not reporting on what basis the subjects were selected.

Investigative methods themselves need to be defined and Section 9 of this guide gives outline advice. You need to relate your choice of such methods to the objectives, and you need to be discriminating in your choice. Remember to document the details of your choice − textbooks usually give a general view, and you will need to explain how it is appropriate in your particular Project.

You should follow requirements rigorously and plan for the documentation and analysis of your findings. On matters of interviews, surveys and observation, you will find many authoritative sources. It is a common failing to investigate unselectively without regard to the outcomes. When a series of interviews has been undertaken there should be a report of each interview and a document that analyses the interviews as a set; when workplace observation has taken place it is necessary to report the circumstances, why they were chosen as well as the resulting analysis of the findings.

When you have worked out how you are going to achieve your results it is often useful to get a second opinion. You will find that your supervisor will ask you many questions relating to your proposed methods and their validity.

It is almost certain that documenting the choice and application of your methods will be a substantial part of your Final Report (see Section 3 below). In some cases, such as those that involve surveys, it can be the largest section of the Report. If you are using a commercial or previously published methodology, do not repeat the general principles (but give full citations) − concentrate on your interpretation and method of use.

2.5. Planning aids for executing your Project

If you have a supervisor then they will comment on your planning. You are strongly recommended to find a suitable supervisor if at all possible. If you have no supervisor then read Section 7 with particular care. In any case, read Section 10 for its planning advice.

One of the most useful planning aids is the Project Plan, the original version of which is submitted as part of the PPR. The final version of your Project Plan must be included as an Appendix in your Final Project Report. It will help the Examiners to see what you intended and may help them in marking your Report more sympathetically.

Perhaps most importantly, on a day-to-day basis, you should use the Project Plan as an evolving planning document, updating an electronic copy frequently in the light of results you obtain and of progress reviews (whether with your supervisor or alone). Specify things to do in the next week, two weeks, month, and so on, so that you can **measure** your progress and rescope if necessary (for example, if you get behind with deadlines) at an early stage while you have time to recover. As time goes by, your planning (meeting deadlines) will get better and you will be able to plan the remainder of your work with more confidence. Near deadlines are important in this. If you have only distant deadlines (for example, it is November and the next deadline is end February) then only at that later time will any failure to be on target emerge, and then it may be too late to recover effectively by rescoping to include adequate realisable objectives. Dates set in the Production Schedule section of the plan should reflect achievements in the Key Milestones section.

Reading activity

For further reading on Project planning and risk management, in addition to Sections 7 and 10 of this guide, see Chapter 4 of Dawson (2009). Also have a look at his useful comments and advice on time management with respect to the Project (Dawson, 2009: Section 7.3).

3. Uses of the topic literature in your Project

High-quality indicators

Clarity of search criteria to permit follow-up

Depth of insight in analysis and comparison of sources

Clarity of expression and relevant narrative in survey

Clear and complete relation to deliverables

Common student failings

Lack of a clear narrative

Lack of explicit information about search strategy and criteria

Lack of an analysis to link what is reported with what is contributed in later results

Reading activity

The Essential reading to accompany this section is Dawson (2009: Chapter 5).

3.1. Introduction

In order to give value to your work academically, you need to place it in an appropriate context. Providing a context for your problem and justifying your approach to its solution is generally achieved by examining and analysing what others have done, as reported in some form of publication − the subject literature. Thus searching and evaluating literature sources will be at the heart of providing a context for your work, and writing a review of the relevant literature will be a vital part of your Project Report.

Taken together, the literature search, evaluation and survey contribute to several aspects of your Project, with weighting depending on your Project topic and objectives. These aspects include the Terms of Reference, Methods, and in some cases, the Results. For example, if you have a clear idea of a specified system or subsystem to implement, review of the literature will help identify possible approaches and algorithms, comparison providing justification of choices made for the Project.

Usually the Literature review will be a distinct chapter of your Report. Its location and extent will depend on the nature of your Project. As indicated above, for many candidates it will provide the background to a rationale for the choice of method or methods to be used. In the – often more challenging – case of a Project that is library-based (but see, for examples, provisos in Section 2.1.1) then the Literature review will become the main part of the Report, with the evaluation extending to detailed analysis to enable a contribution, in the form of well-argued conclusions, to be made.

In general, a Project Report with little or no literature survey will provide too little context and justification of any work done to enable a pass.

Forms of literature, reference lists and citations are covered elsewhere (Sections 6.3–6.5) and, with information sources for literature, in Dawson (2009: Sections 5.2–5.3).

As emphasised in Dawson (2009: Section 5.2) the literature survey process does not consist of a fixed number of steps but rather a cycle of search definition, search execution, evaluation and writing, in turn leading to reflection that enables a refined definition for an enhanced search. This structure should be familiar through its similarity to evolutionary prototyping in software engineering, albeit that this is for an expanding product while the literature survey, as it expands, also converges on a core focal point − giving context to the problem to be solved or question to be answered.

3.2. Literature search

In general terms, an important aspect of academic work is to explain what you do well enough to enable other workers to reproduce the results you report, enabling your claims to be verified as mentioned in Section 6.2e. This principle of accurate explanation applies to the literature search. For example in internet searches, report the date of the search (as results vary with time) as well as the search engine used and precise details of search criteria (see also Section 6.2e).

As an undergraduate you have limited time to search for relevant literature and are not likely to find all that the Examiners know and consider important. The Examiners understand your time restrictions and will make due allowance for limitations in what you find, provided you tell them explicitly what you did. Thus the Examiners are interested in how you looked for the information that you did find − and it is good academic practice to report this in any case. Showing an intelligent approach to your searching is something for which they can give credit. They will certainly look for you to have been ‘systematic’ (Dawson 2009: Section 5.3.1).

Dawson also emphasises the need for materials used to be published, and ‘recognised’. In this regard he warns against the use of unreferenced materials such as blogs and other personal work found on the internet.

However, in the context of this course, we would allow limited use of such personal materials as long as they are publicly available – for example, with a web reference. The vital proviso is that you must critique rigorously as to quality. Even company sales materials may be relevant but with a strong warning to be aware of the possible deficiencies. As Dawson remarks, refereed work will have been checked for its value and hence absence of gross defects − it has ascertained provenance. By contrast, personal expressions of opinion on the internet, sales literature and other such materials will often be making a point in a biased manner, perhaps intentionally ignoring well-known information that modifies or invalidates claims made.

Nonetheless, much good material can be found on the internet, including up-to-date information on the research of many individual academics. Evidence for the soundness of this can be deduced from the URL, such as if it indicates the computer science department pages of an established university. For example, URLs for UK universities all terminate with ‘.ac.uk’, preceded by an identifier for the university or university college, such as ‘lon’ or ‘london’ for the University of London and ‘gold’ or ‘goldsmiths’ for Goldsmiths University of London. Thus the Department of Computing at Goldsmiths is at: www.goldsmiths.ac.uk/computing/

3.2.1. Recording references as they are found

Reading activity

Dawson (2009: Section 5.3.5) mentions the value of making a note of the reference for any material you read. We extend the recommendation of Dawson (2009: Section 5.4) − to 'use a computer to do this'.

From the beginning, for each publication you read, make a habit of filing a record of the full reference (in standard form) and at the least some key words or phrases relating to it. This has more than one advantage. One is that later on you may find some other material on the same topic; remember you have seen something similar and wish to compare it with what you read earlier (for example, to evaluate the opinions of the two authors critically). With your electronic record you can simply search for the relevant key phrase to identify the source and hence speed up your comparison. By contrast, if you have no record and you cannot recall the details of the first source, you may spend a long time repeating internet searches or searching through piles of printouts, perhaps never to find the important comparison. Second, your electronic record is the basis of your reference list and also provides stubs (topic headings) for expansion into the text for your literature survey. That is, when you start writing parts of the Report at an early stage, this will help you avoid being overwhelmed by the amount of writing needed (as often happens when writing the body of the Report is left until late on in the Project process).

In selecting literature to read, consult with your supervisor if you have one. Whether or not you have a supervisor, do follow the advice in Dawson (2009: Section 5.5), to help you decide if an item is worth reading in full, by considering timeliness, author reputation, and reading the abstract and other summary sections.

Use the 'tips for performing a literature search' (Dawson, 2009: Section 5.3.5) as a checklist to help you keep control of the process.

3.3. The Literature review

A crucial point discussed by Dawson (2009: Section 5.6) on one purpose of carrying out the Literature review is **to avoid repeating the work of others** (the other quoted points relate to positive benefits already noted). Lack of care in this and in referencing can all too readily lead to a justifiable charge of plagiarism.

In the same section, Dawson also warns that you should avoid padding with irrelevant material just because it was among the things you looked at. Your Literature review should only discuss work which is of demonstrable relevance to your Project. Avoid the common mistake of writing a large Literature review which includes material of a very general nature of no specific relevance to your topic, or specific material on topics which are far away from your Project subject. **There is no prize for writing an overly-long review; the Examiners are looking for a concise summary of just the work that is of specific relevance to what you plan to do**. In the reference list also avoid listing items that you have not read and referred to in your Report and ensure everything you do refer to in your Report is in the reference list. A sprawling 'bibliography' that is not referenced, and may just be a hit list from a web search, is of no value and is inappropriate.

Dawson also warns against writing a ‘review’ that is simply a sequence of entries describing each item you have read. This has little value, in particular as there is little intellectual input and none on the vital aspect of comparing and contrasting what different authors have to say so as to inform and justify decisions taken. For the same reasons, you should avoid writing a review that is essentially a tutorial. To help show good practice, Dawson (2009: pp.107–08) provides an example of a review section as well as a commentary on its features. You will have already developed some skills in comparative writing through assignments for earlier courses, but it is worth paying attention to developing your skills to write the best Literature review that you can.

3.4. Evaluation of the literature

You should read Section 5.5 of Dawson (2009) for some good advice here. In particular, note that evaluation involves critical reading in the positive sense of including looking for good ideas that can help you. For example, if looking for methods or algorithms to use, you will read about various possibilities and decide which is most appropriate for your application or problem. You need to explain the basis for your judgements as part of your evaluation. Dawson lists a number of points you should take into consideration when judging the quality of the work you are assessing, and these are quite general.

You will need to address the specifics of your own problem as well. As a simple illustration, consider a familiar problem of sorting records on a given key. Here there is a readily available and extensive literature that you should use to guide you in a choice of methods according to the number of records, the dataset size, and the likely properties of the data prior to sorting. That is, some sorting methods perform well on average over many datasets but have very poor behaviour on data with particular properties, such as when initially in reverse order, or partly so. If you know some features of your source data, such as being in random key order or having sorted sub-sequences of records, then you can optimise your choice and justify it.

Often the decision basis will not be so clear cut, such as when choosing a method for the design of a business process, where constraints may be unclear or may be very uncertain for a novel business area.

Overall what you should demonstrate are intelligence and depth of thought ‘beyond mere description’ (Blaxter et al., cited in Dawson (2009: p.104)), and take into account the other facets of evaluation listed from Blaxter, ‘relates different writings’, ‘[do] not take...at face value’, and be aware of ‘research writing as a contested terrain’.

You must show that you are joining that contest intelligently and with sound justification for what you claim or decide.

3.5. Developing your methods

Having read and evaluated a substantial body of literature related to your area of interest you will have been able to identify a challenge (a problem to solve or a question to answer) that is appropriate in scale and difficulty to address in the Project.

Further, having read Dawson and others on approaches to investigative, experimental and other work, you will have learned much about the methods for carrying out such work, especially in relation to what you plan for your own Project. Thus you are ready to select, with appropriate

justification recorded in your Project Report, appropriate methods to meet your Project challenge and begin to provide some appropriate contribution.

What you select and how you proceed will depend on your individual plan. For example, if your Project involves a system design and/or some software development you will know what development process (waterfall, evolutionary prototyping, etc.) is appropriate for your problem type, and be able to justify its choice.

As another example, if your Project involves a questionnaire survey as part of data gathering, for subsequent analysis, you will have learned, or know where to learn, about questionnaire design, prototyping and redesign. In this case you will also have learned, or be learning, about identifying the target population for your questionnaire, how to select an appropriate (unbiased) sample for questionnaire circulation, and how to account for, or discuss, possible biases that may arise from the questionnaire fraction returned not being representative of the sample chosen.

Where your study generates data (e.g. from execution of software on datasets or from questionnaire returns) you will have learned, or be learning, about appropriate methods for analysis. For example, in the case of questionnaires, your prototyping will have ensured that you have a concise set of non-overlapping questions that cover the information you need to gather to enable analysis (such as the interrelation of effects in different questions). As another example, if your results follow from implementing and executing some algorithms that you wish to analyse for efficiency, you will understand how to investigate the effects of different forms of input (such as the degree of pre-ordering or randomness in data for sorting or database searching) in relation to what is known already in the literature and how to enable appropriate comparison with it.