2 – Introduction to Computing Projects

MENG311 English V:
Technical Writing Practice I

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Objectives

- What are projects?
- Types of Computing Projects
- **What is research?**
- Ethical clearance for the project
- Stakeholders of the project
- Project Management

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Academic projects

- Academic projects are usually a critical component of your degree course.
- You are not expected to do merely what you are told to do, but you are expected to develop your own thoughts, arguments, ideas and concepts.
- Academic projects should provide evidence of a much deeper understanding of what you are doing.

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What are (computing) projects?

- Projects have a **purpose** being to bring about a beneficial change by making some kind of contribution.
- Projects are broken down into a sequence of **planned** activities that are controlled as the project progresses – they do not simply occur in an *ad hoc* manner, hence the need for project planning and risk management.

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What are (computing) projects?

- In terms of university degree courses, you will *probably* find that
  - courses entitled 'Computer Science' or 'Artificial Intelligence' tend to fall more towards the left-hand side of this scale.
  - 'Software Engineering', 'Computing' and 'E-business' courses probably fall more towards the centre.
  - Courses entitled 'Information Science', 'Information Technology' and 'Information Systems' will fall more towards the right-hand side.

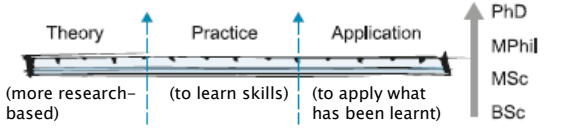

Figure The landscape of computing (adapted from Dawson, 2004)

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Types of Computing Projects

- Development
- Evaluation
- Industry-based
- Problem Solving
- Research-based

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- Development
- Evaluation
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Development

- This category includes the development of, not only software and hardware systems, but also of process models, methods, algorithms, theories, designs
- Examples of software development projects include database systems, multimedia systems, information systems, and web-based systems.
- For software developments you will be required to include requirements documentation, designs, analyses, and fully documented test results along with user manuals or guides.

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- Development
- Evaluation
- Industry-based
- Problem Solving
- Research-based

Evaluation

- This category encompasses all projects that involve some form of evaluation as their main focus.
- For example, such a project might involve comparing several approaches to a particular problem;
  - evaluating two or more programming languages (applied in different contexts or to different problems);
  - analyzing an implementation process within a particular industry;
  - assessing different user interfaces;
  - considering alternative and new technological approaches to a problem;
- Projects in this category may include case studies for evaluating the issue under consideration.

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Industry-based

- Development
- Evaluation
- Industry-based
- Problem Solving
- Research-based

- An industry-based project involves solving a problem within either an organisation or another university department.
- Industry-based projects might be any of the other kinds of projects identified earlier.
- The difference in this case is that you undertake the project for an actual client, which carries with it a number of benefits as well as drawbacks.

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Problem Solving

- Development
- Evaluation
- Industry-based
- Problem Solving
- Research-based

- A problem-solving project can involve
  - developing a new technique to solve a problem,
  - improving the efficiency of existing approaches, or
  - an evaluation of different approaches or theories in different situations.
- It might also involve applying an existing problem-solving technique or theory to a new area.
- In these cases, some form of evaluation would be expected: for example,
  - did your new approach work well or did you discover reasons why it was unsuitable for problems of this nature?
  - Why does one approach or theory work better in some situations than in others?

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Research-based

- Development
- Evaluation
- Industry-based
- Problem Solving
- Research-based

- *A research-based* project involves a thorough investigation of a particular area:
  - improving your understanding of that area,
  - identifying strengths and weaknesses within the field,
  - discussing how the field has evolved, and acknowledging areas suitable for further development and investigation.
- This kind of project will involve some form of literature review.

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What is Research?

- *The good researcher is not 'one who knows the right answers' but 'one who is struggling to find out what the right questions might be!'*

  Phillips and Pugh (2010: 56)

- *Research is a considered activity which aims to make an original contribution to knowledge.*

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What is Research?

- Research is a process of systematic inquiry that entails
  - collection of data;
  - documentation of critical information;
  - analysis and interpretation of that data/information, in accordance with suitable methodologies set by specific professional fields and academic disciplines.
  - E.g. COMP6123 & COMP6299: https://www.ipm.edu.mo/esca/en/master_sbdit.php

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What is Research?

- Research is conducted
  - to evaluate the validity of a hypothesis or an interpretive framework;
  - to assemble a body of substantive knowledge and findings for sharing them in appropriate manners; and
  - to generate questions for further inquiries.

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What is Research?

As stated in wiki:

- **Research** is "*creative and systematic work undertaken to increase the stock of knowledge*"
- It involves the collection, organization, and analysis of information to increase understanding of a topic or issue.
- A research project may be an expansion on past work in the field.
- Research projects can be used to develop further knowledge on a topic, or for education.

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Research

- Research is defined by the Higher Education Funding Council for England (HECFE) as '*original investigation undertaken in order to gain knowledge and understanding' (RAE, 2008).*
- *Three key terms are original, gain and knowledge and understanding.*

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Originality

- Quite simply, *originality is doing something that has not been done* before.
- You can be original in two ways.
  - First, you can be original in the way you do things – for example, doing something someone has done before but using a different technique or approach.
  - Second, you can be original by producing or developing something that has not been produced before.

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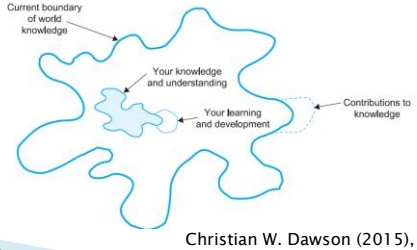
Gain

- 'Gain' from research should actually lead to a *contribution to knowledge.*
- Research should add to world knowledge so that it is accessible to all and not just yourself.



Christian W. Dawson (2015), Figure 2.1 from page 17

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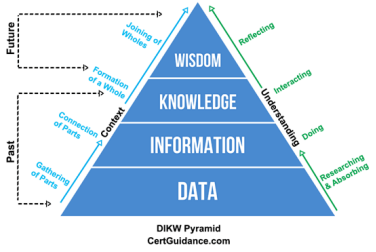
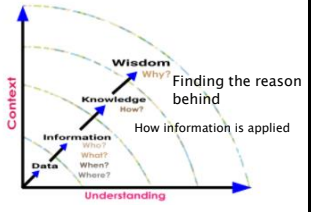
DIKW Model

- The DIKW pyramid is a hierarchical format of Data, Information, Knowledge, and Wisdom.
- This model explains a functional structure between these four components of hierarchy.

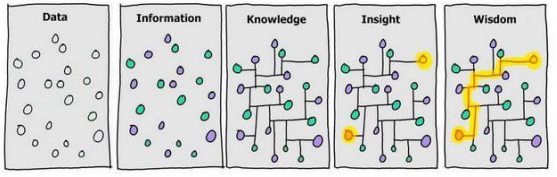




https://www.certguidance.com/explaining-dikw-hierarchy/

A different view of the DIK(I)W Pyramid

This example also introduces the '**Insight**' concept, sometimes known as '**Intelligence**'. It's a sporadic manifestation of Wisdom. Insight is what connects Knowledge and Wisdom.



https://towardsdatascience.com/rootstrap-dikw-model-32cef9ae6dfb

Knowledge and Understanding

- **Information** represents data that have been processed in order to provide you with some insight into their meaning.
  - Converting your rainfall data into information may lead to graphs summarizing monthly totals, charts presenting seasonal fluctuations and tables summarising average daily rainfall at different sites. In these formats the data have some meaning and you now have some insight into what these data represent.
- **Knowledge** is your higher level understanding of things. Whereas information provides you with an idea of the 'what' (i.e., what is happening in the real world), knowledge represents your understanding of the 'why'.
  - While your information about rainfall provided you with an overview of **what** was happening to weather over a period of time, knowledge represents your understanding of **why** rainfall might have changed during this period. For example, your knowledge would be your understanding of why rainfall had increased in a particular part of the country since 1900.

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Knowledge and Understanding

- **Wisdom.** Wisdom represents your ability to put your knowledge into practice.
  - It represents your ability to apply your skills and experiences to create new knowledge and adapt to different situations.
  - With reference to the rainfall data example, wisdom would represent your ability to predict likely changes to rainfall and climate in the future or enable you to understand why rain falls at particular levels in entirely different parts of the world.

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Knowledge and Understanding

- Collecting data and information on their own is termed as 'intelligence-gathering'.
  - These data are used to answer the 'what' questions – i.e., what is happening in the world, what don't we know and what can we find out?
- Research, however, must go beyond merely gathering data and describing what you see.
  - It must make a contribution to **knowledge.** It looks for 'explanations, relationships, comparisons, predictions, generalisations and theories'.
  - Research thus addresses the 'why' questions – why do things happen the way they do? Why is the situation the way it is? And so on.

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An example

- **Data**: It's raining
- **Information**: The temperature dropped 5 degrees, the humidity went up by 5% in one hour and then it started raining at 3 pm.
- **Knowledge**: A quick increase in the humidity, accompanied by a temperature drop caused by lower pressure areas, will likely make the atmosphere unable to hold the moisture and rain.
- **Wisdom**: Based on the observations and maths model, we can predict why and when it will rain in the future, and we can do it so fast and systematically that it won't require a lot of analysis.
  We already have an understanding of all the interactions that happen between evaporation, air currents, temperature gradients, changes, and raining.

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Good Research

Phillips and Pugh (2005: 48–49) identify three characteristics of good research:

- **Open minds. You should work with an 'open system of thought'. Be open minded** to the questions posed. 'Conventional wisdom and accepted doctrine. . . may turn out to be inadequate'.
- **Critical analysis. Examine data critically.**
  Are these figures correct?
  Have they been affected in some way?
  What do these data *really mean?*
  Are alternative data available?
  Can these data be interpreted differently?

- **Generalisations. It** concerns whether findings of one particular study can be applied to unexamined subjects and contexts. Generalisations stem from your own wisdom and evolve from your deductive reasoning.

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Ethical issues

- In terms of undertaking your research, it should be conducted with integrity and honesty.
  - Respect other people's work and don't plagiarise.
  - Respect copyright and other forms of intellectual property.
  - Be open to sharing your ideas and results and take any criticisms objectively.
  - Have you undertaken your experiments accurately?
  - Have you been careful to avoid errors?
  - Have you used appropriate methods throughout?
  - Have you been honest with people you work with – your client/users, supervisor and colleagues?

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Ethical issues

- When you have completed your project and are writing your report or a research article, there are still a number of ethical issues you should consider.
  - Are you, for example, being honest about your results?
  - Are you choosing to leave certain results out because they do not conform to your hypothesis?
  - Are you presenting your results objectively and clearly?
  - Have you fabricated any results?
- Although these issues are important, ethical issues are of paramount importance when dealing with participants in your project.

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Ethical clearance for the project

- Research integrity embodies a range of good research practice and conduct which can include intellectual honesty, accuracy, fairness, intellectual property, and protection of human and animal subjects involved in the conduct of research.
- If you are planning on involving others in your project in any way – conducting a survey, developing a system for a vulnerable group (requiring interaction and feedback from them), undertaking action research (working with people), developing a database to store personal data, or working on medical systems – you may well need to obtain **ethical clearance for the project** from your department, university or some other external agency beforehand.
- The goal is to determine whether the proposed research poses inappropriate risks to either the subjects or the researchers.

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Ethical issues: dealing with participants

- Areas covered include
  - recruitment of participants;
    - selection criteria – will these be unbiased and lead to a reasonable cross-section of participants?
    - what consent will be required from participants to take part (or their parents/ carers/guardians)?
    - will there be any financial incentive or otherwise to take part (which may affect the objectivity of the results)?
    - will participants be able to withdraw at any stage (this should be allowed)?
  - confidentiality and security of data;
    - data should only be used for the specific purpose for which it was gathered in the first place;
    - individuals have the right to access data held about them;
    - data may not be disclosed to third parties without permission of the individual;
    - if personal data are kept, these data must be appropriately protected;
    - personal data should be kept for no longer than necessary.
  - risks and responsibilities.

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Stakeholders

- Stakeholders are any individuals who are involved with your project.
- The most important person in your project is ***you. You are responsible for the overall completion of your project,*** meeting milestones, achieving objectives, satisfying users, satisfying the examiners, and so forth.
- The other stakeholders in your project are your *supervisor*(s), your *user*(s), your *client*(s), your *examiner*(s), etc.

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Stakeholders – Supervisor

- It is that person's role to encourage you as you move along in your project.
- Your supervisor are also there to ensure you are moving in the right direction.
- The supervisor will have an eye on the route you are taking.
- Read the COMP321 Instruction Guide on responsibilities.

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Stakeholders –Client and User

- If your project involves the development of a software system or case studies, you will probably be working with a client and/or a user.
- It is important to realise the distinction between these two stakeholders.
- A client is usually the project's sponsor – the one who has requested the system be developed or study undertaken.
- The user, on the other hand, will be the one who eventually uses the system or the results of the project.
- Sometimes the client and the user are one and the same

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Stakeholders – Examiners

- The number and type of examiners you will encounter on your course will largely depend on the level of project you are undertaking.
- At MPI, for example, your supervisor and the assessor will be marking your project.

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Stakeholders – Tester or Evaluator

- If you are developing a software system as part of your project, you will need to test and evaluate this system at some point.
- It would be wrong to complete all the testing and evaluation on your own, and so others will be involved.
- These people can range from your client, who has requested the software, the user(s) who will actually use the software.

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Computing Projects – Project Management

Responsibilities of Students

- As a student you should:
  - Discuss with your supervisor what kind of guidance you find most useful, and what your possible preferences might be with respect to the working routines
  - Plan and discuss with your supervisor the topic of the project and the timetable, including a schedule of meetings where appropriate feedback can be given
  - Maintain progress according to the agreed schedule, and continuously report your progress to the supervisor
  - Keep systematic records of work completed
  - Make sure to submit written material to your supervisor in time to allow for discussion and comments before proceeding to the next stage of the project
  - Discuss with your supervisor (taking into account any input from the supervisor) the preparation of the report

Responsibilities of Students (2)

- Write up and submit the report within the time limit
- Address and respond to criticism, guidance, and suggestions given by the supervisor, which may include undertaking any study required by the supervisor, e.g. directed reading or applying a statistical test to analyse your data
- Be informed about and respect any regulations and considerations, legal as well as ethical, that are relevant for the project
- Drive the project forward and initiate discussions
- Inform your supervisor of any problems or difficulties, technical as well as non-technical, e.g. any personal circumstances which prevent you from working on your project
- Take pride in and responsibility for your work; prioritise and organise your work in such a way that it represents your best efforts.

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Important Items

- Meetings with Supervisors
- Time Planning
  - work plan
    1. *Work breakdown*
    2. *Time estimates*
    3. *Milestone identification*
    4. *Activity sequencing*
    5. *Scheduling*
  - gantt chart

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Project initiation

- In large industrial projects, initiation can be a major task.
- It might involve a launch workshop, where stakeholders are introduced, the project plan discussed and work assigned.
- You will want to set up an initial meeting with your supervisor and establish your relationship and rules of engagement (how often you will meet, how you will communicate, what sort of things you can ask of them and so forth).
- If you are undertaking a project for a client, you will want to meet with them and establish your ground rules early (similar to your first meeting with your supervisor, but perhaps contact and access to them might be more critical).
- If you are working on a group project, you will want to establish the team structure (leader, secretary, etc.), communication links, meetings, etc.
- It is also a good idea to put together a project folder.

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Project Control

- *time*,
- *resources and money (which are used to develop the project's product);*
- *and two attributes* of the project's product; *scope and quality.*

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Project Control – Project Management

- Project management will often involve deciding how to trade each of the five project elements off against one another as your project progresses.
- For example, you could reduce the scope of your project in order to improve its quality.
- Conversely, you may decide to expand the scope of your project (for example, by increasing the functionality of a program you are developing) at the expense of some quality (by introducing more bugs).
- Time is always limited so you will often find yourself trying to trade it with other elements – for instance, saving time by reducing quality and/or scope, particularly towards the end of your project

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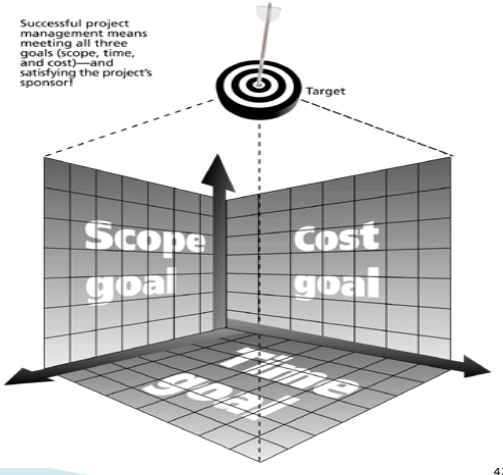
The Triple Constraint of Project Management

Successful project management means meeting all three goals (scope, time, and cost) – and satisfying the project's sponsor!



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Problems

- Motivation – move to another task
- Personal problems – talk to someone
- Hardware failure – backup data
- Data availability – another source, alternative data
- Time Management
  1. **Decide what you want to do.**
  2. **Analyse what you are currently doing.**
  3. **Change what you are doing to achieve your aims.**
- Procrastination means that you put off until tomorrow what you can do or should be doing today. – have someone to check your progress

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Project Closure

- In your computing project this will represent the completion of your project, writing up your report, perhaps preparing for a final presentation or oral examination, completing any programs and associated documentation and finally handing everything in.

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References

- Christian W. Dawson (2015), Projects in Computing and Information Systems, A Student's Guide, Third Edition, Pearson Education Limited.
- Phillips and Pugh (2005), How to Get a PhD: A Handbook for Students and Their Supervisors, Fourth Edition, Open University Press.

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