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English for Academic Research:

structuring your research paper

2024

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The English for Academic Research: Structuring Your Research Paper textbook has been designed for the students of postgraduate study in Networking and Internet Technologies.

This course is appropriate for students from upper-intermediate to advanced levels who have a specific area of academic or professional interests. It has been developed for use in colleges, and universities, as well as on some specific training programs.

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КИЇВСЬКИЙ НАЦІОНАЛЬНИЙ УНІВЕРСИТЕТ ІМЕНІ ТАРАСА ШЕВЧЕНКА

Олена Степаненко
Ніна Соловей

АНГЛІЙСЬКА ДЛЯ АКАДЕМІЧНИХ ЦІЛЕЙ:

СТРУКТУРА НАУКОВОГО ДОСЛІДЖЕННЯ

B2 – C1

Навчальний посібник

для студентів вищих навчальних закладів III-IV рівнів акредитації

Тернопіль 2024

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English for Academic Research: structuring your research paper охоплює десять тем, які розкривають структуру та особливості написання наукової роботи англійською мовою. Тематичний матеріал супроводжується вправами, які спрямовані на формування і розвиток лексичної та граматичної компетенцій магістрів. Наповнення посібника укладено згідно програми з курсу «Наукова іноземна мова» ОКР «Магістр», а також відповідає вимогам як міжнародних академічних стандартів, так і особистим потребам студентів.

Матеріали можуть бути використані викладачами англійської мови ВНЗ і студентами математичних спеціальностей, які вивчають комп’ютерні науки та інформаційні технології.

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Introduction

In today's academic world, the ability to communicate research findings effectively is more important than ever. However, many students face challenges in understanding the conventions of academic writing and structuring their research papers appropriately. This textbook aims to address these challenges by guiding students through the process of crafting well-organized and coherent research papers.

The book consists of 10 comprehensive units, each focusing on a specific aspect of academic research paper writing. Unit 1 provides an overview of academic writing, highlighting its importance and distinguishing features. Subsequent units delve into the structure of academic research papers, covering essential components such as abstracts, introductions, aims and objectives, methodology, results, discussion, and conclusions.

Throughout the textbook, students will learn key academic vocabulary and phrases commonly used in research papers. The textbook includes tapescripts accompanying listening activities and allowing students to enhance their listening and comprehension skills. Additionally, appendices provide supplementary materials and resources to support students in their academic writing journey.

By the end of this course, students will gain a comprehensive understanding of academic research paper structure and will be equipped with the necessary skills to write clear, concise, and cohesive research papers in English. Whether you are preparing to publish your findings, present at conferences, or simply complete assignments for your courses, this textbook will empower you to communicate your ideas effectively in the academic world.

To get started, you will need to have an intermediate level of English (equivalent to B1+ or B 2 on the Common European Framework of Reference). Whether you are an undergraduate or a postgraduate student, mastering the art of academic writing is crucial for success in your academic journey.

We hope that "English for Academic Research: structuring your research paper" will serve as a valuable resource for students seeking to excel in their academic pursuits. Let's embark on this journey together and unlock the doors to academic success!

Contents

Lead-in

Answer the questions:

1 How would you define academic writing, and how does it differ from other forms of writing?

2 What are some key characteristics or features of academic writing that distinguish it from informal or everyday writing styles?

WHAT IS ACADEMIC WRITING?

Academic writing is a formal style of writing used in universities and scholarly publications. You will encounter it in journal articles and books on academic topics, and you will be expected to write your essays, research papers, and dissertation in academic style. Academic writing follows the same writing process as other types of texts, but it has specific conventions in terms of content, structure and style.

Academic writing is…	Academic writing is not…
Formal and unbiased Clear and precise Focused and well structured Well sourced Correct and consistent	Personal Long-winded Emotive and grandiose

Types of academic writing

Academics mostly write texts intended for publication, such as journal articles, reports, books, and chapters in edited collections. As a student, you may encounter different types of academic assignments during your studies. Some of the most common types are:

1. Essay: A concise and self-contained argument that typically uses sources from a class to respond to a question provided by an instructor.
2. Research paper: A more in-depth study that involves independent research in response to a question chosen by the student.
3. Thesis or dissertation: A final research project undertaken at the end of a degree program. It is usually on a topic of the student's choice, demonstrating their ability to conduct independent research and contribute new knowledge to their field.
4. Research proposal: A plan for a future dissertation or research project. It helps students and researchers clarify their research objectives, methodologies, and expected outcomes before beginning the actual research.
5. Literature review: A critical synthesis of existing research on a topic. It serves to inform the approach of a new piece of research by providing an overview of the current state of knowledge and identifying gaps or areas for further investigation.

6. Lab report: A detailed account of the aims, methods, results, and conclusions of a laboratory experiment.

7. Annotated bibliography: A list of source references accompanied by a short description or evaluation of each source. It is used to provide readers with a summary and critical assessment of the literature relevant to a particular topic or research project.

Different fields of study have different priorities in terms of the writing they produce. For example, in scientific writing, it is crucial to clearly and accurately report methods and results; in the humanities, the focus is on constructing convincing arguments through the use of textual evidence. However, most academic writing shares certain key principles intended to help convey information as effectively as possible.

Whether your goal is to pass your degree, apply to graduate school, or build an academic career, effective writing is an essential skill.

Ex. 1 Read the text and answer the questions.

1 What are the specific conventions of academic writing in terms of content, structure, and style?

2 What are the most common types of academic writing assignments for students?

3 Can you differentiate between an essay and a research paper?

4 What is the purpose of a thesis or dissertation in academic writing?

5 What is the significance of a research proposal in academic writing?

6 What is the purpose of a literature review in academic writing?

7 What are the key components of a lab report?

8 What is an annotated bibliography, and why is it used in academic writing?

9 What are the key principles shared by most academic writing?

10 How does academic writing contribute to the advancement of knowledge and scholarship?

Ex. 2 Match types of academic writing with the definitions.

Type of academic writing	Definition
1 Essay	**a** A write-up of the aims, methods, results, and conclusions of a lab experiment
2 Research paper	**b** An outline of a potential topic and plan for a future dissertation or research project.
3 Thesis/dissertation	**c** A list of source references with a short description or evaluation of each source.
4 Research proposal	**d** A critical synthesis of existing research on a topic, usually written in order to inform the approach of a new piece of research.
5 Literature review	**e** A fairly short, self-contained argument, often using sources from a class in response to a question provided by an instructor.
6 Lab report	**f** The large final research project undertaken at the end of a degree, usually on a dissertation topic of the student's choice.
7 Annotated bibliography	**g** A more in-depth investigation based on independent research, often in response to a question chosen by the student.

Ex. 3 Match the titles to the parts of the article.

1. Clear and precise
2. Correct and consistent
3. Emotive and grandiose
4. Focused and well structured
5. Formal and unbiased
6. Long-winded
7. Personal
8. Well source

The characteristics of academic writing

***A*_____**

Academic writing aims to convey information in an impartial way. The goal is to base arguments on the evidence under consideration, not the author's preconceptions. All claims should be supported with relevant evidence, not just asserted.

To avoid bias, it's important to represent the work of other researchers and the results of your own research fairly and accurately. This means clearly outlining your methodology and being honest about the limitations of your research.

The formal style used in academic writing ensures that research is presented consistently across different texts, so that studies can be objectively assessed and compared with other research.

Because of this, it's important to strike the right tone with your language choices. Avoid informal language, including slang, contractions, clichés, and conversational phrases:

Also, a lot of the findings are a little unreliable. ✖

Moreover, many of the findings are somewhat unreliable.

B_____

It's important to use ***clear and precise language*** to ensure that your reader knows exactly what you mean. This means being as specific as possible and avoiding vague language:

People have been interested in this thing for a long time. ✖

Researchers have been interested in this phenomenon for at least 10 years.

Avoid ***hedging*** your claims with words like "perhaps," as this can give the impression that you lack confidence in your arguments. Reflect on your word choice to ensure it accurately and directly conveys your meaning:

This could perhaps suggest that… ✖

This suggests that…

Specialist language or jargon is common and often necessary in academic writing, which generally targets an audience of other academics in related fields.

However, jargon should be used to make your writing more concise and accurate, not to make it more complicated. A specialist term should be used when:

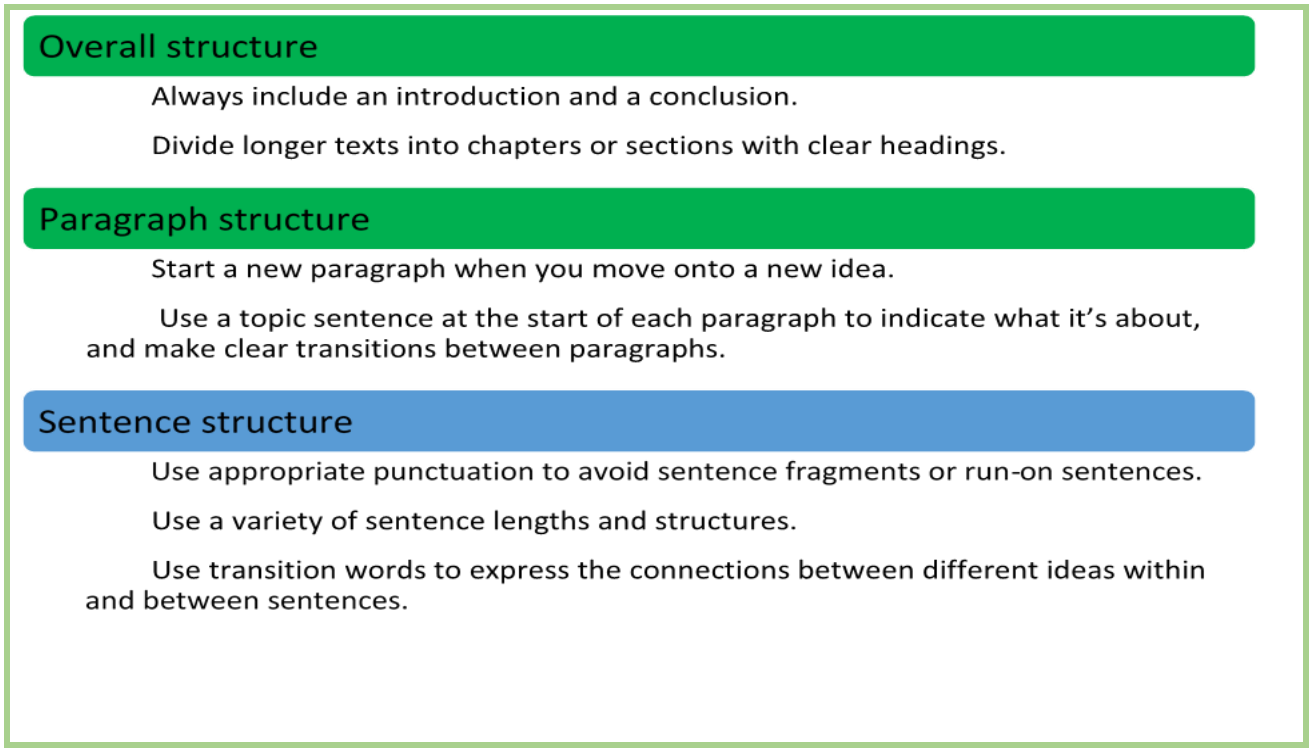
- ➢ It conveys information more precisely than a comparable non-specialist term.
- ➢ Your reader is likely to be familiar with the term.
- ➢ The term is commonly used by other researchers in your field.

The best way to familiarise yourself with the kind of jargon used in your field is to read papers by other researchers and pay attention to their language.

C _____

An academic text is not just a collection of ideas about a topic—it needs to have a clear purpose. Start with a relevant research question or thesis statement, and use it to develop a focused argument. Only include information that is relevant to your overall purpose.

A coherent structure is crucial to organise your ideas. Pay attention to structure at three levels: the structure of the whole text, paragraph structure, and sentence structure.



D_____

Academic writing uses sources to support its claims. Sources are other texts (or media objects like photographs or films) that the author analyzes or uses as evidence. Many of your sources will be written by other academics; academic writing is collaborative and builds on previous research.

It's important to consider which sources are credible and appropriate to use in academic writing. For example, citing Wikipedia is typically discouraged. Don't rely on websites for information; instead, use academic databases and your university library to find credible sources.

You must always cite your sources in academic writing. This means acknowledging whenever you quote or paraphrase someone else's work by including a citation in the text and a reference list at the end.

APA citation example:

In-text citation Elsewhere, it has been argued that the method is "the best currently available" (Smith, 2019, p. 25).

Reference list Smith, J. (2019). Statistical analysis methods (2nd ed.). New York, NY: Norton.

There are many different citation styles with different rules. The most common styles are APA, MLA, and Chicago. Make sure to consistently follow whatever style your institution requires. If you don't cite correctly, you may get in trouble for plagiarism. A good plagiarism checker can help you catch any issues before it is too late.

E _____

As well as following the rules of grammar, punctuation, and citation, it is important to consistently apply stylistic conventions regarding:

- ✓ How to write numbers
- ✓ Introducing abbreviations
- ✓ Using verb tenses in different sections
- ✓ Capitalization of terms and headings
- ✓ Spelling and punctuation differences between UK and US English

In some cases there are several acceptable approaches that you can choose between—the most important thing is to apply the same rules consistently and to carefully proofread your text before you submit.

Academic writing is not…

F_____

Information about the author may come in at some points—for example in the acknowledgements or in a personal reflection—but for the most part the text should focus on the research itself.

Always avoid addressing the reader directly with the second-person pronoun "you." Use the impersonal pronoun "one" or an alternate phrasing instead for generalisations:

As a teacher, you must treat your students fairly. ✖

As a teacher, one must treat one's students fairly.

Teachers must treat their students fairly.

The use of the first-person pronoun "I" used to be similarly discouraged in academic writing, but it is increasingly accepted in many fields. If you're unsure whether to use the first person, pay attention to conventions in your field. When you refer to yourself, it should be for good reason. You can position yourself and describe what you did during the research, but avoid arbitrarily inserting your personal thoughts and feelings:

In my opinion… ✖

I think that… ✖

I like/dislike… ✖

I conducted interviews with… ✖

I argue that… ✖

I hope to achieve… ✖

Academic writing generally tries to avoid being too personal.

G _____

Many students think their writing isn't academic unless it's over-complicated and long-winded. This isn't a good approach—instead, aim to be as concise and direct as possible. If a term can be cut or replaced with a more straightforward one without affecting your meaning, it should be. Avoid redundant phrasings in your text, and try replacing phrasal verbs with their one-word equivalents where possible:

Interest in this phenomenon carried on in the year 2018.

Interest in this phenomenon continued in 2018.

Repetition is a part of academic writing—for example, summarising earlier information in the conclusion—but it's important to avoid unnecessary repetition. Make sure that none of your sentences are repeating a point you've already made in different words.

H _____

An academic text is not the same thing as a literary, journalistic, or marketing text. Though you're still trying to be persuasive, a lot of techniques from these styles are not appropriate in an academic context. Specifically, you should avoid appeals to emotion and inflated claims. The point of academic writing is to clearly communicate ideas, information, and arguments, not to inspire an emotional response. Avoid using emotive or subjective language. Stick to specific, grounded arguments that you can support with evidence, and don't overstate your point.

Ex. 4 Work with a partner. Discuss whether you agree or disagree with the statements. Give examples or reasons to support your answers.

1. Two important adjectives used to describe a dissertation are ``original" and ``substantial." The research performed to support a thesis must be both, and the dissertation must show it to be so. In particular, a dissertation highlights original contributions.

2. The scientific method means starting with a hypothesis and then collecting evidence to support or deny it. Before one can write a dissertation defending a particular thesis, one must collect evidence that supports it. Thus, the most difficult aspect of writing a dissertation consists of organising the evidence and associated discussions into a coherent form.

3. The essence of a dissertation is critical thinking, not experimental data. Analysis and concepts form the heart of the work.

4. A dissertation concentrates on principles: it states the lessons learned, and not merely the facts behind them.

5. In general, every statement in a dissertation must be supported either by a reference to published scientific literature or by original work. Moreover, a dissertation does not repeat the details of critical thinking and analysis found in published sources; it uses the results as fact and refers the reader to the source for further details.

6. Each sentence in a dissertation must be complete and correct in a grammatical sense. Moreover, a dissertation must satisfy the stringent rules of formal grammar (e.g., no contractions, no colloquialisms, no slurs, no undefined technical jargon, no hidden jokes, and no slang, even when such terms or phrases are in common use in the spoken language). Indeed, the writing in a dissertation must be crystal clear. Shades of meaning matter; the terminology and prose must make fine distinctions. The words must convey exactly the meaning intended, nothing more and nothing less.

7. Each statement in a dissertation must be correct and defensible in a logical and scientific sense. Moreover, the discussions in a dissertation must satisfy the most stringent rules of logic applied to mathematics and science.

Ex. 5 Read and discuss the article about a research proposal.

What is a Research Proposal?

When starting your thesis or dissertation process, one of the first requirements is a research proposal or a prospectus. It summarises your intended research by outlining what your research questions are, why they are important to your field
and what knowledge gaps surround your topic. It also outlines your research in terms of your aims, methods and proposed timetable.

What should your proposal contain?

A research proposal is a supporting document that may be required when applying to a research degree. Some universities will specify a word count all students will need to adhere to. You should aim for 1500 to 3500 words (3 to 7 pages). What should your proposal look like? An easy rule of thumb is that your proposal will usually resemble a (much) shorter version of your thesis or dissertation. While of course it won't include the results section, discussion section, or conclusion, it serves as a "mini" version or roadmap for what you eventually seek to write.

1. Title

Your title should indicate clearly what your research question is. It needs to be simple and to the point; if the reader needs to read further into your proposal to understand your question, your working title isn't clear enough.

Directly below your title, state the topic your research question relates to. Whether you include this information at the top of your proposal or insert a dedicated title page is your choice and will come down to personal preference.

2. Abstract

If your research proposal is over 2000 words, consider providing an abstract. Your abstract should summarise your question, why it's important to your field and how you intend to answer it; in other words, explain your research context. Only include crucial information in this section – 250 words should be sufficient to get across your main points.

3. Background & Rationale

First, specify which subject area your research problem falls in. This will help set the context of your study and will help the reader anticipate the direction of your proposed research. Following this, include a literature review. A literature review summarises the existing knowledge, which surrounds your research topic. This should include a discussion of the theories, models and bodies of text, which directly relate to your research problem. As well as discussing the information available, discuss those that aren't. In other words, identify what the current gaps in knowledge are and discuss how this will influence your research. Your aim here is to convince the potential supervisor and funding providers of why your intended research is worth investing time and money into.

Last, discuss the key debates and developments currently at the centre of your research area.

4. Research Aims & Objectives

Identify the aims and objectives of your research. The aims are the problems your project intends to solve; the objectives are the measurable steps and outcomes required to achieve the aim.

In outlining your aims and objectives, you will need to explain why your proposed research is worth exploring. Consider these aspects:

✓ Will your research solve a problem?

✓ Will your research address a current gap in knowledge?

✓ Will your research have any social or practical benefits?

If you fail to address the above questions, it is unlikely they will accept your proposal – all PhD research projects must show originality and value to be considered.

5. Research Design and Methodology

The following structure is recommended when discussing your research design:

Sample/Population – Discuss your sample size, target populations, specimen types etc.

Methods – What research methods have you considered, how did you evaluate them and how did you decide on your chosen one?

Data Collection – How are you going to collect and validate your data? Are there any limitations?

Data Analysis – How are you going to interpret your results and obtain a meaningful conclusion from them?

Ethical Considerations – Are there any potential implications associated with your research approach? How are you going to monitor for these implications and what types of preventive steps will you need to put into place?

6. Timetable

Outline the various stages of your research project and provide an approximate timeline for each stage. This should include key milestones such as your literature review, collecting and analysing data, writing up your thesis and sitting your viva.

7. Bibliography

Plagiarism is taken seriously across all academic levels, but even more so for doctorates. Therefore, ensure you reference the existing literature you have used in writing your PhD proposal. Besides this, try to adopt the same referencing style as the University you're applying to uses.

How can the research best be done?

Ultimately, your proposal should persuade your supervisor or committee that your proposed project is worth pursuing. Strong research kicks off with a solid research question, and dissertations are no exception to this.

Dissertation research questions should be:

- ✓ Focused on a single problem or issue
- ✓ Researchable using primary and/or secondary sources
- ✓ Feasible to answer within the timeframe and practical constraints
- ✓ Specific enough to answer thoroughly
- ✓ Complex enough to develop the answer over the space of a paper or thesis

Project work

Read the text on a research proposal. Choose any thesis proposal from your research area and analyse it. Complete the table. Discuss chosen theses (research) proposals in small groups.

https://www.ut-ie.com/s/samples/m_milosevic.pdf

https://www.ut-ie.com/s/samples/m_green.pdf

https://www.ut-ie.com/s/samples/w_gordon.pdf

https://ukdiss.com/proposal/negative-product-reviews-consumer-purchase-behaviour.php

https://ukdiss.com/proposal/launching-new-generation-hybrid-laptop.php

https://ukdiss.com/proposal/case-study-on-infosys-technologies-ltd.php

https://ukdiss.com/proposal/foundational-forensic-techniques.php

	Yes	No
Structure:		
1 Title		
2 Abstract		
3 Background & Rationale		
4 Research Aims & Objectives		
5 Research Design and Methodology		
6 Timetable		
7 Bibliography		
Dissertation research question:		
1 Focused on a single problem or issue		

2 Researchable using primary and/or secondary sources		
3 Feasible to answer within the timeframe and practical constraints		
4 Specific enough to answer thoroughly		
5 Complex enough to develop the answer over the space of a paper or thesis		

Concept check

1. What is academic writing, and where is it commonly found?
2. What are the most common types of academic writing assignments for students?
3. Can you differentiate between an essay and a research paper?
4. What is the purpose of a thesis or dissertation in academic writing?
5. What is the significance of a research proposal in academic writing?
6. What is the purpose of a literature review in academic writing?
7. What are the key components of a lab report?
8. What is an annotated bibliography, and why is it used in academic writing?
9. What are the key principles shared by most academic writing?
10. What are some strategies for avoiding bias when representing the work of other researchers and the results of your own research?
11. Why is it essential to strike the right tone with language choices in academic writing?
12. What are some examples of informal language to avoid in academic writing? Why should they be avoided?
13. Why is it important to avoid hedging claims in academic writing?
14. What role does specialist language or jargon play in academic writing, and when should it be used?

15. Why is it important for an academic text to have a clear purpose, and how does this contribute to effective writing?
16. What role does a coherent structure play in organising ideas in academic writing?
17. How does academic writing use sources to support claims, and why is this practice important?
18. What criteria should be considered when evaluating the credibility and appropriateness of sources in academic writing?
19. What are some common stylistic conventions in academic writing regarding numbers, abbreviations, verb tenses, capitalization, and spelling?
20. What is the purpose of a dissertation proposal in the research process, and why is it important?
21. How does a dissertation proposal differ from other types of academic writing, such as essays or research papers?
22. What key components should be included in a dissertation proposal, and why are they important?
23. How does the title of a dissertation proposal contribute to its effectiveness, and what characteristics make a strong title?
24. Why is it important to provide background and rationale in a dissertation proposal, and what information should be included in this section?
25. How does the research design and methodology section contribute to the credibility and feasibility of a dissertation proposal?

Unit 2

The Structure of Academic Research

Lead-in

Discuss the following question

Thinking about different academic disciplines, do you believe there are commonalities in the structures of dissertations, or do you think the structure varies significantly across fields? Why might that be the case?

WHAT IS A DISSERTATION? STRUCTURE OF A DISSERTATION

A dissertation is a long-form piece of academic writing based on original research conducted by you. It is usually submitted as the final step in order to finish a PhD program.

Your dissertation is probably the longest piece of writing you've ever completed. It requires solid research, writing, and analysis skills, and it can be intimidating to know where to begin.

Structure of a dissertation

- Title page
- Preface and acknowledgements
- Abstract
- Table of contents
- Optional: List of figures and tables
- Optional: List of abbreviations
- Optional: Glossary
- Introduction
- Literature review
- Optional: Theoretical framework
- Methodology
- Results
- Discussion
- Conclusion
- Reference list
- Optional: Appendices

A thesis is a type of research paper based on your original research. It is usually submitted as the final step of a master's program or a capstone to a bachelor's degree. Writing a thesis can be a daunting experience. Other than a dissertation, it is one of the longest pieces of writing students typically complete. It relies on your ability to conduct research from start to finish: choosing a relevant topic, crafting a proposal, designing your research, collecting data, developing a robust analysis, drawing strong conclusions, and writing concisely.

Thesis vs thesis statement

You may have heard the word thesis as a standalone term or as a component of academic writing called a thesis statement. Keep in mind that these are two very different things.

A thesis statement is a very common component of an essay, particularly in the humanities. It usually comprises 1 or 2 sentences in the introduction of your essay, and should clearly and concisely summarise the central points of your academic essay.

A thesis is a long-form piece of academic writing, often taking more than a full semester to complete. It is generally a degree requirement for Master's programs, and is also sometimes required to complete a bachelor's degree in liberal arts colleges.

Note

Relatedly, you may sometimes hear the terms "thesis" and "dissertation" used interchangeably. It's important to note that their definitions differ significantly depending on your country.

In the US, a dissertation is generally written as a final step toward obtaining a PhD. In other countries (particularly the UK), a dissertation is generally written at the bachelor's or master's level.

How to structure a thesis

The final structure of your thesis depends on a variety of components, such as:

- Your discipline
- Your topic
- Your theoretical approach

Humanities theses are often structured more like a longer-form essay. Just like in an essay, you build an argument to support a central thesis.

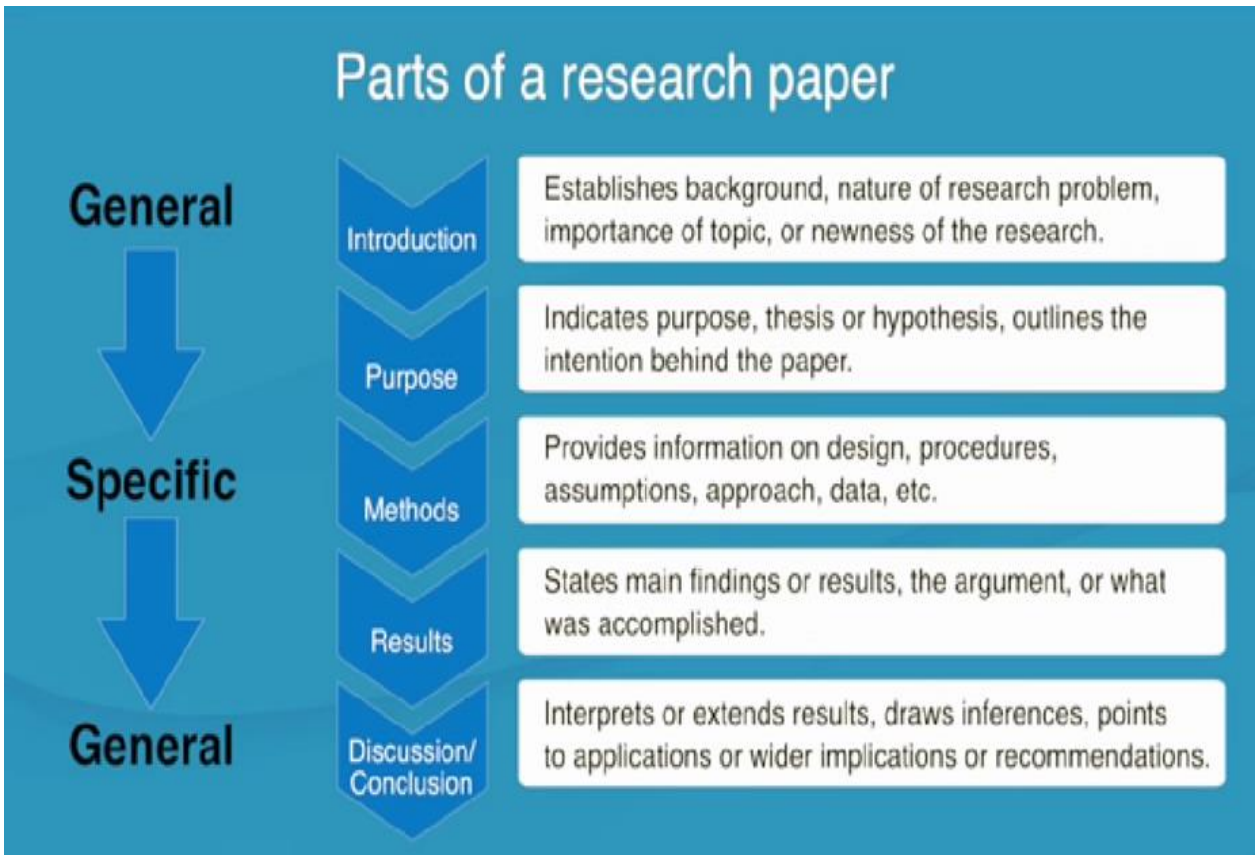
In both hard and social sciences, theses typically include an introduction, literature review, methodology section, results section, discussion section, and conclusion section. These are each presented in their own dedicated section or chapter. In some cases, you might want to add an appendix.

The structure of academic research

It is difficult to make generalisations about how academic research articles and reports should be organised. The norms vary greatly from one field to another. However, the organisation is traditionally represented by the image of an hourglass.

You know the shape: wide at top, narrowing towards the middle to allow only a few grains of sand to fall through at a time, and finally widening out again to hold the built up layers of sand.

The hourglass conceptualises the traditional sections of a paper: the Introduction, Methods, Results and Discussion sections, often referred to by the acronym IMRaD.



The Introduction Section should convince readers of the relevance of the study. It identifies a problem in the real world and narrows down the scope of the research into a specific research question that the study attempts to answer.

The Methods Section traditionally outlines how this research was conducted. With the scope of the research restricted to a manageable focus, the study can be represented by the neck of the hourglass.

The Results Section describes the outcome of the research and, together with the Methods Section, comprises the main body of the research.

The Discussion Section broadens the focus again, relates the study back to the outside world and presents the impact and wider implications of the research.

Ex. 1 Read the text. Match the headings 1-5 with the parts of the research paper A-E. Compare your answers in pairs.

1 Methodology

2 Result

3 Introduction

4 Conclusions

5 Objectives

A_____In the dynamic landscape of real-time data processing, optimising algorithmic efficiency stands as a pivotal challenge. This study aimed to explore the effectiveness of parallel sorting algorithms in enhancing the speed and scalability of data processing systems. The objectives were twofold: first, to implement and benchmark various parallel sorting algorithms in a clustered GPU environment, and second, to analyse the obtained results for performance gains and scalability.

B_____With the exponential growth of data in contemporary applications, the demand for efficient sorting algorithms has become increasingly critical. The introduction addresses the need for accelerated data processing in real-time scenarios, emphasising the role of parallel sorting algorithms in meeting this demand. Key challenges in real-time data processing are outlined, providing the context for the study.

C_____The experimental framework involved the utilisation of NVIDIA GPUs in a clustered environment. Parallel sorting algorithms, including quicksort and mergesort, were implemented using CUDA and OpenCL programming languages. The dataset comprised randomly generated arrays of varying sizes to

simulate diverse real-world scenarios. Benchmarking was conducted to measure processing time, speedup, and scalability under different workloads.

D_____The results demonstrate a notable reduction in processing time when employing parallel quicksort, achieving an average speedup of 3.5x compared to traditional sequential algorithms. Scalability analysis indicates that the parallel approach exhibits optimal performance in scenarios with large datasets. The comparative results showcase the efficiency gains of parallel sorting algorithms, highlighting their potential in real-time data processing applications.

E_____ In conclusion, the study successfully addresses the objectives by implementing and benchmarking parallel sorting algorithms for real-time data processing. The observed speedup and scalability underscore the efficacy of parallel quicksort, offering promising insights for applications demanding rapid and scalable data processing. The findings contribute to the ongoing discourse on algorithmic optimization in the programming field, providing a foundation for further exploration and integration into real-world systems.

Ex. 2 Choose the words and expressions in Ex. 1 that you could use when describing your own research, *e.g. underscore the efficacy*.

Ex. 3 Analyze the use of grammatical tenses in Text A. Answer the questions.

1. Which verb form is used in section A? Why?
2. Why the present perfect is used in section B?
3. Why did the author use the passive voice in section B?
4. Which verb form is used in Methodology section?
5. Which tense would you use for the verbs in parentheses in section D? Why?
6. How are tenses in section E different from section D? Why?

Ex. 4 Write 3-4 sentences about your research using words and expressions you have chosen in Ex. 2. Use appropriate verb forms.

Ex. 5 Identify which section of a research paper 1-8 comes from. Write I (Introduction), M (Materials and methods), R (Results) or D (Discussion) next to them.

1 The discussion delves into the implications of the observed speedup in parallel quicksort, emphasising its potential impact on real-time data processing applications. Additionally, considerations are made regarding the adaptability of the algorithm to different hardware configurations and the trade-offs associated with parallelization.

2 The results reveal a significant reduction in processing time when employing parallel quicksort, with an average speedup of 3.5x compared to traditional sequential algorithms. Further analysis demonstrates that the efficiency gains are most prominent in scenarios with large datasets, showcasing the scalability of the proposed parallel approach.

3 Discussing the fault-tolerant algorithm's performance, the section addresses its applicability in mission-critical systems. The trade-offs between fault tolerance and performance are explored, with an emphasis on how the algorithm's design strikes a balance between system resilience and computational efficiency.

4 The experimental framework employed NVIDIA GPUs in a clustered environment to implement and evaluate parallel sorting algorithms. The programming languages utilised included CUDA and OpenCL, ensuring compatibility with different GPU architectures. The dataset consisted of randomly generated arrays with varying sizes, mimicking real-world scenarios.

5 As the volume of data processed in real-time applications continues to surge, the need for efficient sorting algorithms in parallel computing becomes paramount. This introduction outlines the growing challenges in data processing and sets the stage

for investigating novel approaches to optimize algorithmic efficiency in programming paradigms.

6 To assess the performance of the proposed fault-tolerant algorithm, a simulated distributed computing environment was created. Java was employed for its platform independence, and the algorithm was implemented using the Apache Hadoop framework. The experiment involved injecting faults at different nodes to evaluate the system's ability to recover and maintain data integrity.

7 In the fault-tolerance evaluation, the system demonstrated a remarkable recovery rate of 95% when subjected to simulated node failures. The results highlight the algorithm's resilience in maintaining data consistency even under adverse conditions, making it a promising solution for fault-tolerant distributed systems.

8 In the landscape of distributed systems, the demand for robust fault-tolerant algorithms is ever-increasing. This introduction addresses the critical importance of fault tolerance in distributed programming, laying the foundation for a comprehensive exploration of methodologies to enhance system resilience.

Ex. 6 Watch a video and complete the information.

https://www.youtube.com/watch?v=hxSD8VqgS6o&list=PLjBMY3HggCpCdtW5RKMqE2GEM_hDQyWzD&index=3

1. For _____ research in the sciences or social sciences, this is the most common structure: title page, acknowledgements, abstract, table of contents, list of abbreviations, glossary, introduction, literature review, methodology, results, discussion, conclusion, reference list, and appendices.
2. _____should take up a bigger portion of your dissertation, whereas the methodology, results, and conclusion are usually relatively short.
3. The abstract is _____of your dissertation, normally around 150 to 300 words.
4. You can include a table of contents, so your readers can easily _____your dissertation.

5. _____is where you set up your topic, purpose, and relevance, and tell the reader what to expect in the rest of the dissertation.

6. In the Methodology section, you describe how you conducted your research, allowing your reader to assess its_____.

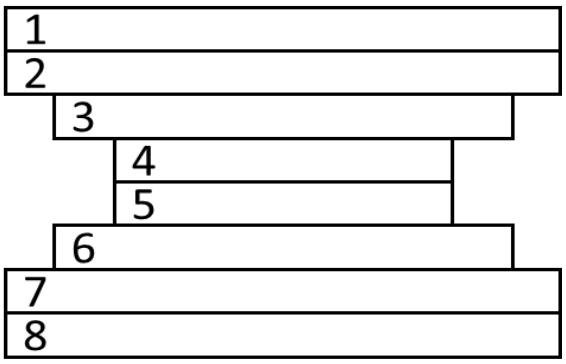
7. Only report results that are _____to your objectives and research questions.

8. In the Discussion, you explore the meaning and _____in relation to your research questions. Here you should _____the results in detail, discussing whether they met your expectations.

9. The dissertation conclusion should _____answer the main research question, leaving the reader with a clear understanding of your central argument.

10. If you want to include any documents that don't fit into the main body, such as surveys, interview transcripts, etc., you can add them as_____.

Ex. 7 Work in pairs and put the headings for the sections of a good research paper in the diagram. Compare your answers with another pair.



a Reference
b Discussion
c Title
d Materials & methods
e Introduction
f Results
g Conclusions
h Abstract

Ex. 8 Match the parts of the research article in ex. 7 with their purposes.

1 It provides a condensed overview of the research study and its outcomes, making it accessible through article databases and typically free for a wide audience.

2 It outlines both specific methodologies and the overall experimental approach by researchers.

3 It offers a clear indication of the article's content, facilitating rapid retrieval from databases for interested readers.

4 It explains research discoveries and often explores their practical applications.

5 It condenses the gathered data, computing totals or trends, along with statistically significant findings.

6 This section outlines the theoretical framework, underscores the importance of the work, articulates a specific research question, and posits a hypothesis for testing.

7 It articulates the consequences and suggestions for future research.

8 It lists the references cited by the author(s) in the research work.

Project Work

Find an article in your own language and an article from an English-medium journal, both related to your research area. Compare the format and structure of both articles and note down the differences, if there are any. Be ready to report your findings in the next class.

Concept check

1. What is the purpose of the introduction in the article?
2. Why is understanding the academic titles and ranking hierarchy crucial for Ph.D. students in the UK?
3. How do UK universities differ in their terminology for academic titles?
4. What are the typical responsibilities of a Ph.D. student in the UK?
5. Describe the role of a PostDoc Research Fellow and how it differs from a Research Assistant.

6. What is the significance of Assistant Lecturer positions, and are they usually permanent or temporary?
7. Explain the primary responsibilities of a Lecturer in a UK university.
8. How does the role of a Senior Lecturer differ from that of a Lecturer?
9. What distinguishes a Reader in terms of academic experience and responsibilities?
10. Why do some universities use the term 'Principle Lecturer' instead of 'Reader'?
11. Describe the qualifications and contributions of a Professor in the UK.
12. What is the significance of the title 'Named Professor,' and how does it differ from a standard Professor role?
13. Explain the role of the Head of Department in a UK university.
14. What responsibilities does a Faculty Dean have in a UK university?
15. Compare academic titles in UK and US universities according to the provided table.
16. What are some additional professor positions mentioned in the article, and what do they entail?
17. Define academic tenure and its purpose in the context of university professors.
18. How does the tenure process differ between the United States and the United Kingdom?
19. What arguments are presented in favor of tenure, and what are the counterarguments?
20. Describe the structure of a dissertation and its significance in academic research.

Lead-in

Discuss the questions.

1. What do you believe is the primary purpose of an abstract in an academic paper?
2. How does an effectively written abstract contribute to the overall value of a research article?
3. What elements do you find most crucial in a well-crafted abstract, and how do these elements impact your understanding of the research presented?

HOW DO YOU WRITE A GOOD ABSTRACT?

The biggest challenge you'll have is getting all the 6 points mentioned above across in your abstract within the limit of 300 words. Your particular university may give some leeway in going a few words over this but it's good practice to keep within this; the art of succinctly getting your information across is an important skill for a researcher to have and one that you'll be called on to use regularly as you write papers for peer review.

Keep It Concise

Every word in the abstract is important so make sure you focus on only the key elements of your research and the main outcomes and significance of your project that you want the reader to know about. You may have come across incidental findings during your research which could be interesting to discuss but this should not happen in the abstract as you simply don't have enough words. Furthermore, make sure everything you talk about in your thesis is actually described in the main thesis.

Make a Unique Point Each Sentence

Keep the sentences short and to the point. Each sentence should give the reader new, useful information about your research so there's no need to write out your project title again. Give yourself one or two sentences to introduce your subject area and set the context for your project. Then another sentence or two to explain the gap in the knowledge; there's no need or expectation for you to include references in the abstract.

Explain Your Research

Some people prefer to write their overarching aim whilst others set out their research questions as they correspond to the structure of their thesis chapters; the approach you use is up to you, as long as the reader can understand what your dissertation or thesis had set out to achieve. Knowing this will help the reader better understand if your results help to answer the research questions or if further work is needed.

Keep It Factual

Keep the content of the abstract factual; that is to say that you should avoid bringing too much or any opinion into it, which inevitably can make the writing seem vague in the points you're trying to get across and even lacking in structure.

Write, Edit and Then Rewrite

Spend suitable time editing your text, and if necessary, completely re-writing it. Show the abstract to others and ask them to explain what they understand about your research – are they able to explain back to you each of the 6 structure points, including why your project was needed, the research questions and results, and the impact it had on your research field? It's important that you're able to convey what

new knowledge you contributed to your field but be mindful when writing your abstract that you don't inadvertently overstate the conclusions, impact and significance of your work.

Abstracts can be divided into two types: *"Informative"* or *"Descriptive"* abstracts. Informative abstracts focus on providing the results of the research and describing the conclusions that can be drawn from these results. In contrast, descriptive abstracts do not supply specific results but rather aim to provide the reader with brief summaries (1-2 sentences) of each of the four sections of the research report (i.e., Introduction, Methods, Results, Discussion).

Informative Abstract

Hypertext is an effective way of organising and presenting data or text for information retrieval. Computer-based hypermedia tools have been successfully employed for training purposes. However, the manufacturing industry still continues to rely heavily on paper versions of technical manuals for trouble shooting, maintenance, and calibration tasks. This thesis compares the effectiveness of a computer-based hypermedia tool against a paper version of the same manual to assist operators in a local manufacturing industry to perform complex maintenance and calibration tasks. [AIMS] The results of the study indicate that l) the performance of the subjects were superior while using the hypertext based manual [RESULTS]; 2) the hypertext system can be used for training even those subjects with minimal computer knowledge [RESULTS]; and 3) hypertext systems can be considered an effective training delivery system [CONCLUSIONS].

Although most abstracts should aim to be informative (i.e., express the main results), this is often not possible in research reports concentrating on theoretical topics. In such cases, writers are more likely to take a descriptive approach.

Descriptive Abstract

Various studies in inspection have demonstrated the usefulness of feedforward and feedback in improving performance. However, these studies have looked at the search and decision making components separately. Hence, it is difficult to draw generalized conclusions on the effects of feedforward and feedback for inspection tasks that have both search and decision making components. In response to this need, this study evaluates the individual and collective effect of feedforward and feedback on an inspection task that has both the search and decision-making components [AIMS]. For this purpose, the study used a computer simulated inspection task generated by the VisIns program. Twenty-four subjects, randomly assigned to various conditions, performed an inspection task wherein the feedforward and the feedback conditions were manipulated between subjects. Defect probability and the number of defects were also manipulated within subjects. Subsequently, the search and decision-making performances were analysed and interpreted [PROCEDURES].

The linguist Ken Hyland (2000) has identified the following five "moves" to describe the structure of research abstracts. Although all five moves rarely occur in a single abstract, the combination of moves and their ordering depends on the exact field of study and type of research.

Introduction or background

Establishes context of the paper and motivates the research

Purpose of the study

Indicates purpose, thesis or hypothesis, outlines the intention behind the paper.

Methodology of the study

Provides information on design, procedures, assumptions, approach, data, etc.

Results

States main findings or results, the argument, or what was accomplished.

Conclusion or recommendation

Interprets or extends results beyond the scope of the paper, draws inferences, points to applications, or wider applications.

INTRODUCTION OR BACKGROUND

By including a brief introduction in their abstract, you can provide readers with enough background information and context to enable them to follow your description of your research. This introductory move can be divided into at least three types of content: Arguing for topic prominence, Making topic generalisations, Defining terms, objects, or processes, and Identifying a gap in current knowledge (Feltrim, 2003).

1. **Arguing for topic prominence**

This type of introductory information is similar to centrality claims in research article introductions. Writers can choose to introduce their topic by emphasising **the relevance, significance**, or **importance** of their topic area to their audience and the real world.

Coverage is a **very important issue** in wireless sensor networks. Current literature defines a point to be covered if it is within the sensing radius of at least one sensor. In this paper, we argue that this is a conservative definition of coverage. This definition implicitly assumes that each sensor makes a decision independent of other sensors in the field. However, sensors can cooperate to make an accurate estimation, even if any single sensor is unable to do so. We then propose a new notion of information coverage and investigate its implications for sensor deployment. Numerical and simulation results show that significant savings in terms of sensor density for complete coverage can be achieved by using our definition of information coverage compared to that by using the existing definition.

2. Making topic generalisations

Another possible strategy for beginning an abstract is to outline what is currently **known** or is **common/standard practice** within the field of study. This information can also include **definitions** of terms, objects, or processes. This strategy mirrors that of the same name used in research article introductions.

IEEE 802.11 MAC based Mobile Ad-hoc Networks (MANETs) **are known to** experience serious unfairness problems, particularly for TCP connections. The unfairness **is caused by** a number of factors and to date, **no solution has completely addressed** all the factors, so that the unfairness is never completely solved. The work presented here identifies the common factors that lead to the unfairness, and from a consideration of these, a novel solution based on carrier sensing is developed, that can completely solve the serious unfairness problem in MANETs. Simulation results are presented which show the effectiveness of our solution.

3. Identifying a gap in current knowledge

Writers often try to justify the relevance of their research by demonstrating that **a "gap"**, **problems**, or **deficiencies** exist in current applications, methods or knowledge. This strategy is identical to that used in MOVE 2: Establishing a Niche in research article introductions.

In the following introduction, the **blue text** describes current models, and **red text** the deficiencies in these models that have motivated the current study.

> The modelling of TCP transfer latency **has received significant attention** in the last decade. Several models **have been proposed** for TCP performance under various conditions. **All the available models predict** TCP performance for a single link. Furthermore, **all models** relate timeouts to packet drops either due to congestion or due to transmission errors. **However**, TCP connections may be running over a multilink connection that aggregates the bandwidth of multiple links into a single logical pipe using the multilink point-to-point protocol (MLPPP). In such aggregate links, packet drops occur if any of the individual links experience a call drop. **None of the available models account for** call drops as a possible source of performance degradation. In this paper, we study the call drop phenomenon under MLPPP and incorporate our results into a method that predicts TCP latency for a long transfer. The performance model is experimentally evaluated by running TCP over MLPPP over multiple Iridium satellite links.

4. Defining terms, objects, or processes

When reporting research that focuses on the development of a new **device** or **software application**, writers may often begin their abstracts by first announcing by name and defining their new creation in terms of its function, purpose, and other important features. This strategy, though more common in computer science, can also be found in other fields of science and technology. (See also Product).

> **A new** project management **tool, Logistix, has been developed** to support project analysts and planners. **Logistix** is a decision support tool that is used to assess and

compare alternative configurations for a collection of projects. **The tool provides** detailed financial features and multiple delivery strategies for each project in the portfolio, while freeing planners to focus upon other factors during the development of preferred configurations of the entire project. This new software has been tested using the London Highway and Transportation Authority as an example. The Authority is responsible for the construction of highways and mass transit systems in London, including construction of a new rail system. Logistix was applied to model the historical financial data of the Agency, including revenues and expenses. The model was found to improve sensitivity analysis of the capital programming variables in a range of municipal projects.

Frequently, the verbs **"present"** and **"introduce"** are used to incorporate the definition into a purpose statement. Notice also how this strategy typically precedes and anticipates an evaluation of the value of the new application (shown below in black).

This paper **proposes** a new algorithm for error-correcting isomorphism detection from a set of model graphs to an unknown input graph. The algorithm, based on a compact representation of the model graphs, uses an off-line preprocessing step to derive an image from the set of model graphs. The main advantage of the proposed image is that common subgraphs of different model graphs need only be represented once, thus reducing the computational effort of matching the common subgraphs for each model graph onto the input graph. Consequently, the new algorithm is only sub linearly dependent on the number of model graphs. Furthermore, the new algorithm can be combined with a future cost estimation method to enhance its run-time performance.

PURPOSE OF THE STUDY

The purpose is the most common function included in abstracts. The four example abstracts above include *purpose statements*:

The work presented here identifies the common factors that lead to the unfairness, and from a consideration of these, a novel solution based on carrier sensing is developed, that can completely solve the serious unfairness problem in MANETs. Simulation results are presented which show the effectiveness of our solution.

In this paper, we argue that this is a conservative definition of coverage.

In this paper, we study the call drop phenomenon under MLPPP and incorporate our results into a method that predicts TCP latency for a long transfer. The performance model is experimentally evaluated by running TCP over MLPPP over multiple Iridium satellite links.

This paper proposes a new algorithm for error-correcting isomorphism detection from a set of model graphs to an unknown input graph.

METHODOLOGY OF THE STUDY

Most abstracts also contain at least a brief mention of the main **procedures**, **criteria or conditions**, or the **materials and equipment** used to create the final 'product' or outcome of the research.

In this paper, we study the call drop phenomenon under MLPPP and incorporate our results into a method that predicts TCP latency for a long transfer. The performance model is experimentally **evaluated by** running TCP over MLPPP over multiple Iridium satellite links.

We investigate the variation of measured multiple-input multiple-output (MIMO) channel capacity for line-of-sight (LOS) Ricean scenarios inside a typical indoor environment for various transmitter-receiver positions at a centre frequency of 2.45 GHz. In order to quantify the effect of LOS component on indoor MIMO performance, an absorber-loaded metal panel **was utilised** to artificially obstruct the LOS path between the transmit and receive antennas. Our results confirm that

MIMO capacity decreases with the increase in the values of the Rician factor. We have also observed that the variation in channel capacity closely follows the corresponding deviations in root mean square (rms) delay spread of the channel.

RESULTS

In engineering, the most important function in the abstract is the results or outcome of the research—its "product". This move often also includes a description of the main **features** or **properties** of the solution or product.

A compact 100-GHz corrugated platelet array antenna **has been developed** based on a corrugated feed design for the background emission anisotropy scanning telescope (BEAST). The antenna **results** in a gain of 20 dB, and a bandwidth across the full range of W-band 75–110 GHz. The sidelobes are down by about -25 dB, a requirement comparable to feed horns used for observation of the cosmic microwave background. The design and fabrication presented in this paper is straightforward and inexpensive. A feature is that because the plates are not permanently bonded, the horn can be disassembled and modified to change its properties.

The development of dual-frequency (14 and 35 GHz), dual-polarisation microstrip antenna arrays **is presented** for the first time on liquid crystal polymer (LCP) multilayer technology. Some of the properties of LCP, such as multilayer (three-dimensional) vertical integration capability, good electrical and mechanical properties, and near-hermetic nature, make this substrate a practical choice for the design of low-cost antenna arrays that can be integrated with remote sensing applications operating in the Ku and millimetre-wave frequency bands. This work illustrates the potential of LCP as a low-cost, “all-package” solution for developing compact, flexible, antenna arrays that can be used in future communication and remote sensing systems.

CONCLUSION OR RECOMMENDATION

Less common to engineering research abstracts is the need to draw conclusions from their findings. When conclusions do occur, they tend to extend the results beyond the scope of the paper. This concluding move can be divided into at least three types of content: Deducing conclusions from results, Evaluating value of the research, and Presenting recommendations (Feltrim, 2003).

1. Deducing conclusions from results

Writers can conclude by **commenting on** and **interpreting** the results, or **deducing** claims from the results.

Analyses of the results **showed** the negative influence of defect standard complexity on both visual search and decision making.

The simulation models **indicate that** the innovations, with the exception of the GFX system, can significantly reduce the time and direct labour costs associated with plumbing or fire protection installation while simultaneously improving worker safety.

Our results **confirm that** MIMO capacity decreases with the increase in the values of the Rician factor.

2. Evaluating efficiency of the research

Writers in engineering often conclude the abstract by evaluating the suitability or efficiency of the "product", or wider potential applications of the studied technology. Important to such evaluation is the use of adjectives expressing a positive evaluation of the study's product.

The simulation results show that our hybrid method approximates the throughput performance of an arbitrary-sized TCP connection with wireless losses **much better** than other proposed models.

This **significantly increases the flexibility** of such FFT-based algorithms for computational electromagnetics.

These results will be **useful** in designing more robust SSA templates through switch redundancy near the feed.

This work illustrates the potential of LCP as a low-cost solution for developing compact, flexible, antenna arrays that **can be used** in future communication and remote sensing systems.

3. Presenting recommendations

In addition to evaluating the outcome/product, the conclusion can also present **recommendations** derived from the study results.

Several strategies are recommended for particular building types, and for three individual case study buildings.
Based on our analysis results, **we make some suggestions for** TCP performance enhancement for overcoming the serious effect from wireless losses.

The study helps recommend design guidelines for the most appropriate type of multimedia to be used in designing web-based asynchronous learning system for different levels of procedural tasks.

Abstract Examples

Perhaps the best way to understand how to write a thesis abstract is to look at examples of what makes a good and bad abstract.

Example of A Bad Abstract

In this project on "The Analysis of the Structural Integrity of 3D Printed Polymers for use in Aircraft", my research looked at how 3D printing of materials can help the aviation industry in the manufacture of planes. Plane parts can be made at a

lower cost using 3D printing and made lighter than traditional components. This project investigated the structural integrity of EBM manufactured components, which could revolutionise the aviation industry.

What Makes This a Bad Abstract

Hopefully you'll have spotted some of the reasons this would be considered a poor abstract, not least because the author used up valuable words by repeating the lengthy title of the project in the abstract.

Working through our checklist of the 6 key points you want to convey to the reader:

1. There has been an attempt to **introduce the research area**, albeit half-way through the abstract but it's not clear if this is a materials science project about 3D printing or is it about aircraft design.
2. There's no explanation about where the **gap in the knowledge** is that this project attempted to address.
3. We can see that this project was focused on the topic of structural integrity of materials in aircraft but the actual research **aims or objectives** haven't been defined.
4. There's no mention at all of what the **author actually did** to investigate structural integrity. For example was this an experimental study involving real aircraft, or something in the lab, computer simulations etc.
5. The author also doesn't tell us a single result of his research, let alone the **key findings**!
6. There's a bold claim in the last sentence of the abstract that this project could revolutionise the aviation industry, and this may well be the case, but based on the abstract alone there is no evidence to support this as it's **not even clear what the author did**.

This is an extreme example but is a good way to illustrate just how unhelpful a poorly written abstract can be. At only 71 words long, it definitely hasn't maximised the

amount of information that could be presented and the what they have presented has lacked clarity and structure.

A final point to note is the use of the EBM acronym, which stands for Electron Beam Melting in the context of 3D printing; this is a niche acronym for the author to assume that the reader would know the meaning of. It's best to avoid acronyms in your abstract all together even if it's something that you might expect most people to know about, unless you specifically define the meaning first.

Example of A Good Abstract

Having seen an example of a bad thesis abstract, now let's look at an example of a good PhD thesis abstract written about the same (fictional) project:

> Additive manufacturing (AM) of titanium alloys has the potential to enable cheaper and lighter components to be produced with customised designs for use in aircraft engines. Whilst the proof-of-concept of these have been promising, the structural integrity of AM engine parts in response to full thrust and temperature variations is not clear.
>
> The primary aim of this project was to determine the fracture modes and mechanisms of AM components designed for use in Boeing 747 engines. To achieve this an explicit finite element (FE) model was developed to simulate the environment and parameters that the engine is exposed to during flight. The FE model was validated using experimental data replicating the environmental parameters in a laboratory setting using ten AM engine components provided by the industry sponsor. The validated FE model was then used to investigate the extent of crack initiation and propagation as the environment parameters were adjusted.
>
> This project was the first to investigate fracture patterns in AM titanium components used in aircraft engines; the key finding was that the presence of

cavities within the structures due to errors in the printing process significantly increased the risk of fracture. Secondly, the simulations showed that cracks formed within AM parts were more likely to worsen and lead to component failure at subzero temperatures when compared to conventionally manufactured parts. This has demonstrated an important safety concern which needs to be addressed before AM parts can be used in commercial aircraft.

What Makes This a Good Abstract

Having read this 'good abstract' you should have a much better understand about what the subject area is about, where the gap in the knowledge was, the aim of the project, the methods that were used, key results and finally the significance of these results. To break these points down further, from this good abstract we now know that:

1. The research area is around additive manufacturing (i.e. 3D printing) of materials for use in aircraft.
2. The gap in knowledge was how these materials would behave structural when used in aircraft engines.
3. The aim was specifically to investigate how the components can fracture.
4. The methods used to investigate this were a combination of computational and lab based experimental modelling.
5. The key findings were the increased risk of fracture of these components due to the way they are manufactured.
6. The significance of these findings were that it showed a potential risk of component failure that could comprise the safety of passengers and crew on the aircraft.

The abstract text has a much clearer flow through these different points in how it's written and has made much better use of the available word count. Acronyms have even been used twice in this good abstract but they were clearly defined the

first time they were introduced in the text so that there was no confusion about their meaning.

The abstract you write for your research paper should succinctly explain to the reader why the work of your research was needed, what you did, what you found and what it means. Most people that come across your thesis, including any future employers, are likely to read only your abstract. Even just for this reason alone, it's so important that you write the best abstract you can; this will not only convey your research effectively but also put you in the best light possible as a researcher.

Ex 1. Read the abstracts and decide whether they are informative or descriptive.

Text A

Communication between humans consists of more than just the verbal component that we all associate with common human interaction. Nonverbal elements are essential parts of full and effective form of communication and conveyance of idea from one individual to another. Nonverbal factors include such things as facial expressions, gestures, body movements, stance, and gaze. These factors are unconsciously and unintentionally present in the communication ritual of humans, and full conveyance of a person's ideas or emotions cannot be realised and transferred to another in absence of these factors. It is only when these nonverbal aspects of communication are represented that human social interaction can occur in its complete form. This holds true for face-to-face interactions as well as when these interactions take place over a virtual collaborative environment via a networked computer system.

This thesis *explores* human social interactions within the context of virtual collaborative work environments. Specifically, this thesis *will examine* the role of gestures in personal expression in human social interaction as it pertains to a collaborative engineering environment where users or the involved parties are

interested in collaborating in a geographically distributed setting to achieve a certain goal in their work process. The significance of social interaction, composed of personal expression and social feedback elements, in a collaborative interaction setting *is discussed*. Gestures, a specific element of nonverbal behavior that plays an integral role in communication that takes place in human interactions, *is explored* in particular. With the aim of enabling a more complete social interaction capability for a user of a collaborative system, a gesture expression prototype *is designed*. The proposed design *will allow* certain gestures to be made at will by the user with the effect of increasing the level of personal expression and social feedback in the virtual collaborative environment.

Text B

Inspection consists of two major components, visual search and decision making. Unlike the popular alternative of automated inspection devices, humans are highly adaptable inspectors and are very good at decision making. However, humans have imperfect memory and are often poor at the visual search component. This work focuses on improving human visual search behaviour in order to improve inspection performance.

Previous methods of improving inspection performance include training and the use of job aids. Also, the attraction of the eyes to a dynamic visual stimulus has been noted in the literature. A method of training a systematic search pattern using these previous findings is proposed using training with a job aid. The job aid consists of a small cursor that traces a systematic search pattern on the item to be inspected.

The effects of training with practice using the job aid were compared to training with practice without the job aid. Quantitative comparisons were made based on the performance measures of inspection time, mean search time, mean stopping time, and defect detection rate and on the process measures of number of fixations,

fixation times, and saccade distances. *None of these measures **showed** a significant difference between the two types of training. Although both training methods significantly improved search performance, none of these measures **showed** a significant difference between the two types of training.*
Suggestions for further research are made such as experimenting on different inspection conditions to see if the job aid does show a significant improvement over the other training method for different tasks.

Text C

This thesis examines quality assurance standards and practices for the development of software systems in a geographically distributed environment. This thesis will also identify the problems that distributed software engineering teams face when collaborating on a project. It will be shown that as a software project becomes distributed, the need to verify the quality of the software process increases. A special focus will also be given to the problems that affected the performance of the Quality Assurance Engineer (QAE) in such an environment. *This study **found** that the team must be kept informed of all the events surrounding quality assurance and one way to do this is by creating a repository, such as a web site, to store all quality assurance work.* Thus, every member will have access to the QAE's work throughout the software development process, potentially increasing the performance of the whole team.

Text D

In the past twenty years, there has been a new wave of global interest in project finance as a tool for financing capital-intensive projects all around the world. The crucial elements in structuring a project finance transaction are: the risk allocation

process, the determination of the best type of ownership structure, and the development of a complete and integrated set of financial and contractual arrangements.

This thesis *examines* the ownership and financing structures in International Project Finance. Selection of the form of business organisation for a project is an important step in project development and depends on a variety of business, legal, accounting, tax and regulatory factors. This thesis *presents* four forms of ownership structure most frequently used for developing a project and highlights the reasons for selecting one of them.

The variety of sources of funds, with a trend towards the increasing development of sophisticated capital market instruments, provides project sponsors with flexibility to select the appropriate structure to finance a project. This thesis *presents* the three types of capital used in project financing and *details* the alternatives for financing a project from its development phase to its operating phase showing that the project financing is a dynamic process.

After having developed a basic framework for structuring an international project finance transaction, this thesis *ends by describing* projects financed on a project-financing basis. These projects *are characterised by* some specific features, such as refinancing prior to project completion or use of capital market financing.

Text E

The civil engineering community is currently moving towards the continuous monitoring of civil structures in order to forecast their unavoidable failure with enough precision. So-called smart technologies seem to be well adapted to this specific task.

For a civil structure, such as a bridge or a dam, a monitoring smart system often includes a set of sensors, whose data is passed onto a controller. The latter analyses the data and outputs commands to a set of actuators that will modify the structure

properties in response to the new sensors' environment. Therefore, the structure can continuously adapt to its surrounding environment.

Artificial neural networks are electronic devices whose structure resembles the structure of the human brain. Such devices can be trained to output desired signals when fed with specific inputs. Consequently, neural networks can theoretically act as controllers in monitoring smart systems.

This thesis first *presents* artificial neural networks in detail, since this topic remains unfamiliar in the civil engineering literature. An entire chapter is also devoted to the training of these artificial neural networks that are likely to be used in civil engineering applications. The thesis then *introduces* the new concept of neurocontrol, i.e. control using neural networks. Finally, a simulation run under MATLAB applies this concept of neurocontrol to a cantilever beam supporting fluctuating loads.

Text F

Web-based asynchronous learning systems have revolutionised the learning environment. However, choosing the appropriate multimedia for the learning modules or system is critical to designing as efficient learning system. In response to this need, a study was conducted to gauge the effectiveness of different multimedia combinations, namely, text; audio and synchronised text; audio, video and synchronised text, for procedural-based tasks to support web based learning for a senior-level Production, Planning and Control Course. The study was conducted over a two week period utilising 24 subjects with 8 assigned to each of the three groups, the text group, the audio and synchronised text group, and the audio, video and synchronised text group. Data was collected on performance, process and subjective measures. Analyses of these learning systems throw new light on the effectiveness of the different multimedia combinations to improve web-based learning of procedural tasks. ***The most salient finding of the study is*** *that user performance is dependent on the type of multimedia combination and the*

type of learning task in terms of complexity. Interestingly, for low difficulty procedural tasks, the choice of multimedia is not critical for either performance or process efficiency. However, when the procedural tasks are complex, a combination of audio, video and synchronised text ***yields the best results*** *both in terms of learning performance and process efficiency measured in terms of amount spent viewing the modules and the module accessing frequency.* ***Another important finding is that*** *an easy-to-use system does not imply an efficient learning system.* Although certain results have been explained using the dual coding theory, the study also points out the inability of this theory to explain all the differences in performance or the lack thereof between the different experimental conditions. The study helps recommend design guidelines for the most appropriate type of multimedia to be used in designing web-based asynchronous learning systems for different levels of procedural tasks.

Text G

An experimental study was conducted to assess the performance of displacement ventilation in high-ceiling facilities found in North America. Such areas include commercial and industrial manufacturing facilities often featuring high internal heat loads and contaminants associated with heat sources. These areas can range from 5 to 20 metres in height. Very little performance data exists for displacement ventilation installations in high-ceiling areas, particularly any which account for the influence of wall temperature. More performance data is needed to support design guidelines for displacement ventilation in such buildings. In this study, several experiments were conducted in a room equipped with both a high ceiling (6.5 metres) and a displacement ventilation system. The performance of the system in the presence of a variety of modelled loads was evaluated by use of strategically placed temperature, tracer gas, and velocity measurements. The modelled loads

consisted of traditional person, computer, and lighting loads found in offices as well as simulators constructed to represent generic welding, engine exhaust and control panel enclosures in a manufacturing environment. Wall, floor, and ceiling temperatures were recorded in these experiments. The resulting data has been used to judge the suitability of displacement ventilation for a building equipped with each process. These experimental results are also used to test existing guidelines for displacement ventilation. *Walls in this high ceiling room* ***were found*** *to have significant impact by generating large plume flows and contributing substantially to the total radiative incident loading to the floor. Experimental results could not justify the use of a constant temperature gradient assumption to estimate the temperature difference between head and foot levels. Plume modelling* ***was found*** *to work well in estimating the room stratification heights. Distance from the supply diffusers* ***was found*** *to have an impact upon air temperature near the floor as well as the temperature difference between the head and foot levels. A five node temperature model* ***was found*** *to work quite well in predicting five key temperature values in this high ceiling space.* A design guideline was proposed for displacement ventilation in high spaces which incorporates the five node temperature model, plume modelling, and the fractional coefficient method. Results of the experimental data are being used to validate a CFD program previously validated for small office and classroom simulations with a ceiling height of 2.4 metres.

Text H

Various studies in inspection have demonstrated the usefulness of feedforward and feedback in improving performance. However these studies have looked at the search and decision making components separately. Hence, it is difficult to draw generalised conclusions on the effects of feedforward and feedback for inspection tasks that have both search and decision making components. In response to this

need, this study evaluates the individual and collective effect of feedforward and feedback on an inspection task that has both the search and decision-making components. For this purpose, the study used a computer simulated inspection task generated by the VisIns program. Twenty-four subjects, randomly assigned to various conditions, performed an inspection task wherein the feedforward and the feedback conditions were manipulated between subjects. Defect probability and the number of defects were also manipulated within subjects. Subsequently, the search and decision making performances were analyzed and interpreted.

Ex. 2 Choose any two abstracts from ex. 1, analyze their structure, and complete the table.

	Text 1	Text 2
1 The abstract is not longer than 300 words.		
2 The abstract contains background information		
3 The abstract contains all the elements		
4 Present tenses are used more than past tenses		
5 Passive forms are frequently used		

Ex. 3 Choose any abstract from ex. 1 and identify the sentences that correspond to the elements of an abstract (a-e).

a background

b purpose of the study

c methodology of the study

d results

e conclusion or recommendation

Language Focus

Stating the purpose

In academic writing, research aims and objectives are commonly expressed with the help of infinitive phrases or clauses.

The aim of this study is/was to determine / to examine / to evaluate ...
To measure / To determine / To compare..... was/were used.
In order to identify / to analyse / to understand ..., we ...
The experiment was conducted (in order) to find out...
The survey was carried out so that we could discover...

 **Ex. 4 Correct the mistakes in the sentences. Use the Language Support box to help you.**

1 For analyze the performance of the algorithm, various test cases were executed.

2 We used the Python programming language in order that we can develop a machine learning model for sentiment analysis.

3 The coding standards were established for provide a consistent style across the development team.

4 To make sure the software is functioning correctly; rigorous testing procedures were implemented by us.

5 The purpose of this code is solving complex mathematical problems, an implementation of a novel algorithm is presented.

6 For improving the software's efficiency, additional functions were added into the existing codebase.

 **Ex. 5 Read the text and decide which statements are True and which are False?**

10 Tips for Cutting Your Word Count

Essays are given specified word counts for a reason. They prevent us from going too far in our research, thereby losing a sustained argument, and they prevent us from keeping our scope too narrow. However, cutting word counts is not always easy. There are some tips on cutting your word count.

1. ***Start sentences with the subject***.

This is both a grammatical point and a content point. Grammatically, the 'subject' is the noun in the sentence that does the verb. Think about what is the most important part of the sentence and structure your sentence by starting with that. Starting sentences with the subject makes your writing clearer because it is obvious who or what the sentence is about.

2. ***Use the active verb.***

Verbs are adaptable. You can take verbs that should suggest action and turn them into passive forms. The passive voice is where you invert the sentence, and make the object the start of the sentence. This is a less concise (and less clear) way of writing, even in this simple example. This can lead to confused sentences where the reader is not sure what is being caused by whom.

However, the passive voice can be used effectively in situations where there is no causality or agency. For example 'In 2011, the people in Northern Japan were struck by a tsunami'. It can also be used to distance oneself from associating responsibility or blame.

3. ***Get rid of adjectives and adverbs.***

The purpose of an essay is to argue a particular point, using objectivity and evidence. The addition of too many adjectives and adverbs can give the impression that the writer is being subjective in their attitude towards the topic. Keeping an objective eye while editing is difficult, but important in academia. Adjectives (words that describe nouns) in academic writing are often used in the place of evidence. Replace them with quantities, data, dates, quotes.

Adverbs (words that describe or modify verbs, adjectives, or other adverbs) in academic writing are often used when a writer wants to intensify their writing. By

packing more information into a concise structure, you can minimise your overall word count.

4. ***Use the shortest form of the word.***

Why say ‘utilise’ if you mean ‘use’? Why say ‘conceptualisation’ if you mean ‘concept’? This may not reduce your word count, but it will make your essay easier for the reader to process. Using a longer form of the word can also be a trap for the unwary, as some words that appear to be longer versions of another word, may actually have a different meaning, for example ‘concept’ ≠ ‘conception’. Use the words you know and keep it simple.

5. ***Use the shortest form of a phrase.***

There are lots of stock phrases that we use to connect sentences, to signpost and to ‘pad out’ our writing. These can often be shortened, for example, you can use ‘However’ in preference to ‘On the other hand’, or ‘how’ in preference to ‘the ways in which’

6. ***Keep your sentences to 25-30 words.***

It is almost impossible to keep control of a sentence that’s over about 40 words, and it’s very hard to follow. You really can’t get lost in a 25 word sentence, as a thinker, a writer or a reader. If you have a tendency to write 50 word sentences, you will find that breaking them into 2 sentences makes your thinking clearer, your writing more effective, and helps your reader to understand your topic.

7. ***Keep your paragraphs to 250-300 words.***

A paragraph is not a whole idea; it is a small step in the overall argument. You should be able to hold the entirety of a paragraph in your mind at once and glance your eye over it in one sweep.

8. ***Don’t refer back.***

In an essay, start each paragraph cleanly. Never link back to previous text. It is a waste of energy and words to start any section with ‘As I discussed in the previous paragraph…’. This kind of writing sends the reader backwards, in thought and possibly literally flicking back through your work if the reference is too vague. You want your writing to move forward, and your reader along with it. This is particularly

important in your conclusion. Your conclusion is your chance to give a summarised discussion that ties the paragraphs together, shaping your overall argument. You do not want to interrupt the flow by telling your reader to refer back to what you have already said.

9. Only explain one idea at a time.

Multitasking in writing is very messy. Ultimately, it is less effective than doing one thing at a time. Academic writing in particular values logical progression, explanation of cause and effect, isolation of individual factors. If you try to discuss too many factors together, they are likely to get confused, or at least become confusing; you will need unnecessary words to explain them, or you will feel the need to tie up too many loose strands, which will negatively affect your structure.

10.Avoid extraneous ideas.

Keep to the single purpose of the writing. Anything else does not belong in this piece. If it has been relegated to a footnote, this is your first sign it is extraneous. When in doubt, check your thesis statement and ask yourself if this piece of information contributes to the argument you set out to achieve.

(From:https://www.adelaide.edu.au/writingcentre/ua/media/3/learningguide-concisewriting.pdf)

Statements:

1. Essays have word counts to help writers stay focused.
2. Starting sentences with the subject makes writing less clear.
3. Adjectives and adverbs should be used carefully in academic writing.
4. Using longer words always makes an essay more sophisticated.
5. It is beneficial to use stock phrases to connect sentences in academic writing.
6. It is easier to follow a 50-word sentence than a 25-word sentence.
7. Each paragraph in an essay should be able to stand alone.
8. It is important to refer back to previous paragraphs in an essay.
9. Multitasking in writing is highly effective.
10. All information in an essay should directly contribute to the main argument.

Ex. 6 Write a draft of your abstract (in 100-120 words). You can use the phrases below as support.

The present study investigates_____

We expected that _____

The method we applied involved _____

The results obtained show that _____

The study provides (strong) evidence that _____

Project Work

Find three articles from your field of study on the internet or use the abstracts from Appendix A. Analyse the article abstracts and complete the table.

	1	2	3
Are all the parts of an abstract included?			
Does the abstract establish the context of the paper and motivate the research?			
Does it indicate purpose, thesis or hypothesis, outline the intention behind the paper?			
Does it provide information on design, procedures, approach, data?			
Does it state main findings or results?			
Does it interpret or extend results beyond the scope of the paper?			
Does it use infinitive phrases or clauses to state the purpose?			

Does the abstract have a clear flow through its different parts?			
Were acronyms (if any) clearly defined the first time they were introduced in the text?			

Concept check

1 Why is keeping the abstract within the word limit crucial for researchers?

2 In what ways does the article suggest researchers can keep their abstracts concise?

3 What role does the abstract play in showcasing the researcher's skill in succinctly conveying information?

4 How does the article guide researchers in explaining the overarching aim or research questions in the abstract?

5 Why is it crucial to keep the content of the abstract factual?

6 What is the suggested approach to editing and rewriting the abstract for clarity and effectiveness?

7 What are the two types of abstracts mentioned in the article, and how do they differ?

8 What is the primary focus of informative abstracts?

9 How do descriptive abstracts differ from informative abstracts in terms of content?

10 According to Ken Hyland, what are the five "moves" that describe the structure of research abstracts?

11 How does the article explain the "Introduction or Background" move in research abstracts?

12 What are the three types of content within the introductory move of an abstract?

13 Explain the purpose of "Arguing for topic prominence" in the introduction of an abstract.

14 How does "Making topic generalisations" contribute to the introductory move in an abstract?

15 What role does "Identifying a gap in current knowledge" play in justifying the relevance of research?

16 How is the strategy of "Defining terms, objects, or processes" used in certain fields like computer science?

17 What information is typically included in the "Methodology of the Study" section of an abstract?

18 In engineering, what is highlighted as the most important function of the abstract?

19 How does the article describe the “Purpose” move in abstracts?

20 What key information is generally mentioned in the methodology section of abstracts?

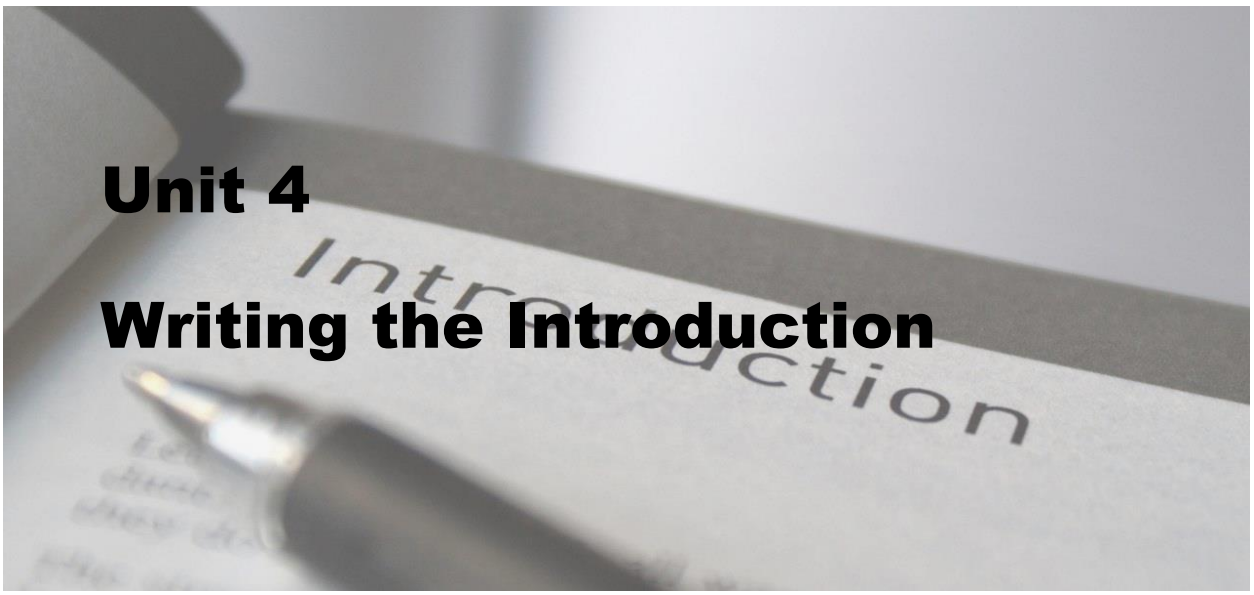
21 Why is the results or outcome of the research considered the most important function in engineering abstracts?

22 Why is the use of adjectives expressing positive evaluation considered important in evaluating the study's product?

23 What is the role of the “Concluding” move in presenting recommendations in an abstract?

24 According to the text, what crucial information should the abstract convey to the reader about the research paper?

25 Considering that many readers may only read the abstract, what impact does the quality of the abstract have on how the research is perceived by future employers and others who come across the thesis?



Lead-in

Discuss the questions.

1. What is the main purpose of the Introduction section?
2. How might the introduction contribute to creating a strong first impression of a research paper?
3. In your opinion, what key elements should be included in an effective introduction to guide the reader into the research work?

HOW TO WRITE THE INTRODUCTION

The Introduction section is important for a number of reasons. Firstly, it allows writers to orient readers to a general topic, explain why research in this area is important, and link the present study to the tradition of research in the area. This background information is intended to convince readers, particularly readers who are not specialists in the area of the research, of the relevance of the study. Since these "non-experts" may include managers, assessors and other "gatekeepers" who read Introduction Sections to monitor the work of research personnel, it is essential that writers are able to explain the reasons why their work is of significance. Secondly, the Introduction gives writers a chance to pinpoint a problem or gap in

knowledge that that the study attempts to address. In this way, writers can offer further evidence that the present work is valuable and necessary.

Finally, writers are able to state explicitly the precise aims of the present study. By doing so, they stake out their own territory, creating a niche for themselves in the highly competitive world of research.

A helpful model for composing an Introduction Section is the CARS ("Creating A Research Space") Model, proposed by John Swales (1990). The CARS Model consists of three moves which can be used by researchers to structure information in Introduction Sections of research articles. Although originally intended to describe engineering articles, the CARS model has since been found to accurately reflect text organisation in a wide range of scientific fields.

The introduction section of a research paper typically consists of several stages that guide the reader into the study. Here are five main stages commonly found in introductions:

Stage 1 Background or Context Establishment:

In this initial stage, the researcher provides background information on the topic, establishing its significance and relevance. This helps readers understand the broader context in which the study is situated.

Stage 2 Problem Statement or Gap Identification:

The introduction then proceeds to identify a specific problem, gap, or limitation in the existing knowledge. It articulates the research question or problem the study aims to address, showcasing the need for further investigation.

Stage 3 Purpose or Objectives Clarification:

Clearly stating the purpose or objectives of the research comes next. This stage outlines what the study intends to achieve, providing a roadmap for readers to understand the goals and expected outcomes.

Stage 4 Review of Related Literature or Research:

A brief literature review follows, summarising key findings from existing research related to the topic. This review helps position the current study within the broader scholarly conversation.

Stage 5 Research Hypothesis or Thesis Statement:

Lastly, the introduction often concludes with the formulation of a research hypothesis or a thesis statement. This presents a concise overview of the researcher's stance and the anticipated contribution to the field.

These stages collectively serve to engage readers, convey the research's significance, and establish a clear foundation for the study that follows.

Ex. 1 Identify the stages of the Introduction section.

Text A

Wireless mobile networks that operate without the need of a fixed infrastructure are widely known as ad hoc networks. Due to recent technology advances, their penetration to markets worldwide has significantly increased over the last years. Ad hoc networks consist of mobile hosts that move randomly in and out of each others communication range.

Text B

As a result, connections between nodes are prone to sudden failures and the graph of the formatted network varies stochastically. It is clear that the aforementioned context encumbers routing. Therefore, the choice of a suitable routing technique is deeply affected.

Text C

Traditional table-driven routing protocols [1] cannot perform efficiently in such an environment [2]. The reason is that they waste the limited system resources to discover routes that are not needed.

Text D

On the other hand, on-demand routing protocols [1], [3], [4] have been proposed as an effective solution to the problem.

Text E

The role of diametrical cup deformation as a factor to unsatisfactory implant performance has not been widely reported. The aim of this thesis was to gain an understanding of the diametrical deformation behaviour of acetabular cups and shells following impaction into the reamed acetabulum. The influence of a range of factors on deformation was investigated to ascertain if cup and shell deformation may be high enough to potentially contribute to early failure and high wear rates in metal-on-metal implants

Ex. 2 Text F is an Introduction to an article whose parts (A-E) are jumbled up. Put the parts into a logical order and then match them with the stages. Compare your answers in pairs.

Text F

1 INTRODUCTION

A_____The rest of the paper is organised as follows. §2 introduces the overall service architecture of WeChat backend as well as workload dynamics that it usually faces. §3 describes the overload scenarios under WeChat's microservice architecture. §4 presents the design of DAGOR overload control and its adoption in WeChat. We conduct experiments in §5 to evaluate DAGOR, review related work in §6, and finally conclude the paper in §7. of the diversity of business logic. Moreover, DAGOR is adaptive.

B_____Overload control aims to mitigate service irresponsiveness when the system is experiencing overload. This is essential for large-scale online applications that needs to enforce 24×7 service availability, despite any unpredictable load surge. Although cloud computing facilitates on-demand provisioning, it still cannot solve the problem of overload—service providers are restricted by the computing resources they can afford from the cloud providers, and therefore cloud providers need overload control for the cloud services they provide. Traditional overload control for simple service architecture presumes a small number of service components with trivial dependencies. For a stand-alone service, overload control is primarily targeted at the operating system, service runtime and applications [2, 24, 29]. For simple multi-tier services, a gateway at the service entry point monitors the load status of the whole system and rejects client requests when necessary to prevent overloading, i.e., loadshedding [5, 7, 23].

C_____While the problem of shedding load inside a network path has been widely studied in literature [8, 10, 15], this paper more focuses on how to build a practical solution of overload control for an operational microservice system. The main contributions of this paper are to (1) present the design of DAGOR, (2) share experiences of operating overload control in the WeChat business system, and (3) demonstrate the capability of DAGOR through experimental evaluation.

D_____However, modern online services become increasingly complex in the architecture and dependency, far beyond what traditional overload control was

designed for. Modern online services usually adopt the service-oriented architecture (SOA) [12], which divides the conventional monolithic service architecture into sub-services connected via network protocols. [….]Overload control for large-scale microservice systems must cope with the complexity and high dynamics of the system, which could be very challenging in real practice. First, all the microservices must be monitored. If any microservice is out of the scope of monitoring, potential overload may emerge at that spot and further ripple through the related upstream microservices. As a consequence, the system may suffer from cascading overload and eventually get hung, leading to high delay of the affected services. Second, it can be problematic to let microservices handle overload independently, due to the complexity of service dependency. Third, overload control needs to adapt to the service changes, workload dynamics and external environments. If each microservice enforces a service-level agreement (SLA) for its upstream services, it would drastically slow down the update progress of this microservice as well as its downstream services, defeating the key advantage of the microservice architecture. Similarly, if the microservices have to exchange tons of messages to manage overload in a cooperative manner, they may not be able to adapt to the load surge, while the overload control messages may get discarded due to system overload and even further deteriorate the system overload.

E_____To address the above challenges, we propose an overload control scheme, called DAGOR, for a large-scale, account-oriented microservice architecture. The overall mechanism of DAGOR works as follows. When a client request arrives at an entry service, it is assigned with a business priority and a user priority such that all its subsequent triggered microservice requests are enforced to be consistently admitted or rejected with respect to the same priorities. Each microservice maintains its own priority thresholds for admitting requests, and monitors its own load status by checking the system-level resource indicator such as the average waiting time of requests in the pending queue. Once overload is detected in a microservice, the microservice adjusts its load shedding thresholds using an adaptive algorithm that attempts to shed half of the load. Meanwhile, the

microservice also informs its immediate upstream microservices about the threshold changes so that client requests can be rejected in the early stage of the microservice pipeline. DAGOR overload control employs only a small set of thresholds and marginal coordination among microservices. Such a lightweight mechanism contributes to the effectiveness and efficiency of overload handling. DAGOR is also service agnostic since it does not require any service-specific information to conduct overload control. For instance, DAGOR has been deployed in the WeChat business system to cater overload control for all microservices, in spite with respect to service changes, workload dynamics and external environments, making it friendly to the fast evolving microservice system.

*(*From *'Overload Control for Scaling WeChat Microservices' by Hao Zhou and et al. SoCC '18 : proceedings of the 2018 Symposium on Cloud Computing : October 11-13, 2018, Carlsbad, CA, USA*)

 **Ex. 3 In Text F underline words and expressions which helped you to identify each stage.**

 **Ex. 4 Watch a video and answer the questions.** https://www.youtube.com/watch?v=h2LAEFbmWWg

Statements:

1. The methodology section of a dissertation is usually longer than the literature review.

2. The abstract of a dissertation is typically around 500-700 words long.

3. Including a glossary in a dissertation is mandatory.

4. The introduction of a dissertation sets up the topic, purpose, and relevance.

5. The discussion section of a dissertation explores the meaning and implications of the results.

6. The reference list in a dissertation should not include any citations from other researchers.

7. Appendices in a dissertation can include documents like surveys and interview transcripts.

Language Focus

A helpful model for composing an Introduction section is the CARS ("Creating A Research Space") Model, proposed by John Swales (1990). The CARS Model consists of three moves which can be used by researchers to structure information in Introduction Sections of research articles. This three-move structure closely reflects a **"situation-problem-solution"** structure in which features of the present situation are first presented, followed by a negative evaluation of this situation, and then a solution, the present research, is introduced to overcome the problem. Although originally intended to describe engineering articles, the CARS model has since been found to accurately reflect text organisation in a wide range of scientific fields.

MOVE 1*: Establishing a Territory*	**MOVE 2*: Establishing a Niche***	**MOVE 3: *Occupying the Niche***
STEP 1: Claiming Centrality STEP 2: Making Topic Generalizations STEP 3: Reviewing Previous Research	STEP 1A: Counter-Claiming STEP 1B: Indicating a Gap STEP 1C: Question-Raising STEP 1D: Continuing a Tradition	STEP 1A: Outlining Purposes STEP 1B: Announcing Present Research STEP 2: Announcing Main Findings STEP 3: Indicating Structure of the Article STEP 4: Evaluation of Findings* * not originally included in Swale's analyze

MOVE 1: Establishing a Territory

In the introduction, writers generally start by trying to define a general "terrain" or "layout" of their research territory. This move can describe the current situation, features and characteristics of that area of study, as well as why it is an important field and who has already been working in it. To find out more about this move, click on the steps in the table above.

MOVE 1 - STEP 1: CLAIMING CENTRALITY

The writer states that the topic of research is useful, relevant, important, or worth investigating since it forms part of a lively, significant or well-established research area. Centrality claims frequently serve as ***topic sentences*** and are therefore usually followed by evidence to support this statement.

*The effect of...**has been studied** extensively in recent years.*

*Of the many..., ...have been **the most** extensively **studied**.*

*The effects of**... have received** considerable **attention***

*Many **investigators** have recently turned to...*

***A** large **body of data** concerning...has been reported.*

*In recent years, there have been many **papers** describing...*

*Recently, there has been wide **interest in**...*

*In recent years, researchers **have become** increasingly **interested in...***

*Knowledge of...has **great** importance **for**...*

*The study of...has become **an** important **aspect** of...*

*The theory that...has led to **the** hope **that**...*

*The relationship between...is **a classic** problem in fluid mechanics.*

***A long-standing** problem has been to obtain more information on...*

The well-known...phenomena...have been favourite topics for analysis both in...

*A central issue **in**...is the validity of...*

MOVE 1 - STEP 2: MAKING TOPIC GENERALISATIONS

These consist of statements concerning the current state of either **knowledge,** consensus concerning **practice** or description of **phenomena**.

The general features of... **are** well known.

Plumage coloration is known **to influence** mate selection in mallards.

An increase of Mallards in eastern North America **has been** well documented.

Trout are believed **to be** relatively immobile.

It is generally accepted that...

There is now much evidence to support the hypothesis that...

A standard procedure for assessing...has been...

Such...methods **are** often **criticized** for...

It is commonly suggested that...

Comparisons of spatially separated populations tend to consist of...

These**...are** often **found**...

...is **a** common finding **in** patients with...

An elaborate **system** of...is found in the...

MOVE 1 - STEP 3: REVIEWING ITEMS OF PREVIOUS RESEARCH

Here, the writer needs to relate **what** has been found (or claimed) with **who** has found it (or claimed it).

Smith (1989) found a clear relationship between...

Smith (1989) argued that...

Smith (1989) concluded that...

It **has been** suggested that...(Smith 1989)

Data have been presented in the literature which show that...(**Smith** 1989)

Observations by **Smith** (1989) suggest that...

MOVE 2: Establishing a Niche

One way that academic writers find a **"niche"** (= reviiri) for their research is by showing that the previous research history is not complete. In other words, that there are aspects of the research field that still require further investigation. The most common way of achieving this is to present **a negative evaluation** of some feature of the research "territory" described in Move 1. This is often signalled by words expressing a **contrast** or **negative evaluation** such as the following.

CONTRAST	QUANTIFIERS	VERBS	ADJECTIVES
however, but, yet, although, despite, nevertheless, unfortunately	few, less, little, no, none, not	fail, ignore, lack, neglect, overlook, question, prevent, hinder, deter, restrict, limit	unsatisfactory, elusive, inconclusive, ineffective, limited, restricted, scarce, uncertain, unclear, unreliable

MOVE 2 - STEP 1A: COUNTER-CLAIMING

This step typically follows Move 1-Step 3 (Reviewing Items Of Previous Research) and is used to introduce an opposing viewpoint or show the weaknesses in previous research.

However, this view **is challenged** by recent data showing...

However, these studies have **failed to** recognize the...

However, recent work in our laboratory suggests that...

...., yet these approaches become increasingly **unreliable** when...

Although these experiments....., they were performed on...and are therefore **suspect**.

MOVE 2 - STEP 1B: INDICATING A GAP (in previous research)

This step typically follows Move 1-Step 2 (Making Topic Generalisations) and indicates an unfilled research **"niche"** or a new way to approach the research problem that the writer intends to pursue.

A considerable amount of research has been... but little **research**...

...has been extensively studied. However, **less attention** has been paid to...

As a result, **no comprehensive theory** appears to exist.

Despite the importance of..., **few researchers** have studied...

Research has tended to focus on...**rather than**...

The only reported study to date of...covered **a limited range** of...

...studies have appeared previously in the literature, but measurements **were restricted to**...

The properties of...**are still not completely understood**.

Evidence on this question is presently **inconclusive**.

MOVE 2 - STEP 1C: RAISING A QUESTION (about previous research)

However, it is not clear whether the use of...can be modified to...

In spite of these early observations, the mechanism...**has remained** unclear.

The question **remains**...?

How much has the seal population actually decreased?

MOVE 2 - STEP 1D: CONTINUING A TRADITION

This step is frequently signaled by causative connectors, such as therefore, hence, consequently or thus, as well as other expressions indicating a need for further research.

These differences need to be analyzed...

Hence, additional studies of...are needed.

It is desirable to carry out surveys of...

It is of interest to compare....

MOVE 3: Occupying the Niche

Here, the writer states how s/he intends to fill the gap, answer the specific question or continue the research tradition that was described in Move 2.

MOVE 3 - STEP 1A: OUTLINING PURPOSES (Why?)

In this step, the writer introduces his/her solution to the problem described in Move 2 by stating the main purpose or aim of the study. Note in the examples below how the **verb tense** used depends on whether the writer is referring to a physical or abstract concept.

PRESENT TENSE:		***PAST TENSE:***
The present tense tends to be used when the aims are described in terms of the written product, now held physically in the reader's hands.		The past tense tends to be used when the aims are described in terms of abstract concepts such as mental enquiry.

(***paper, article, thesis*** → PRESENT tense) The purpose of this paper **is** to... The purpose here **is** to evaluate...		(***study, investigation, experiment*** → PAST tense) The aim of the present study **was** to elucidate... The objective of this research **was** to quantify... **Our purpose was** to describe...

English can (and actually prefers to) take an inanimate agent as the grammatical subject of the sentence.

HUMAN AGENT: In this study, we suggest a 3-step process... In this letter, we propose a ...algorithm. In this paper, we attempt to develop a... In this letter, we provide a novel approach to... In this paper, we describe novel algorithms for... In this paper, we present a system for... In this letter, we analyse the performance of... In this letter, we present an efficient routing protocol that...		**INANIMATE AGENT:** This paper evaluates the effect on... This paper presents data on... This study focuses on a strategy for... The present study tested... This thesis proposes a formal procedure for... This paper introduces a novel architecture for... This research aims to develop a methodology for...

MOVE 3 - STEP 1B: ANNOUNCING PRESENT RESEARCH (How? Where? When?)

This step represents an alternative strategy to that used in Move 3 - Step 1A. Here, the writer describes the aims in terms of the **steps** taken in the study to reach its objectives (i.e., **how** the research sets out to "**accomplish**" the aims).

In this paper, we introduce a novel method to... We use the method of… , in which…. An approximation using a … algorithm similar to that of [6] is used to evaluate …

In this paper, we provide a novel approach to model the dynamic behaviour of …. We first propose the … functions of … regions based on the geometric relationship between… and …. We model the … for a wide variety of situations. The … criterion is then applied to detect the … based on a test statistic, which is a function of the … relationship between … and …. We also demonstrate how to use this technique in … systems to maximize ...

In this paper, we identify the security problems that … face by developing an application in which… would be used in the near future… We identify the threats and vulnerabilities to this application …. This paper details why security mechanisms that are presently used in … environments are inadequate or not appropriate for … designed for this application. We then describe a new security model that serves as a countermeasure to the identified threats.

MOVE 3 - STEP 2: ANNOUNCING MAIN FINDINGS

In this step, the writer considers the results to be the most important aspect of the research and therefore reports these as part of the introduction. Beware, not all disciplines allow this in the Introduction Section!

In this paper, we **argue** that...

Here, we **report** a new method for...

This paper hopes **to show** that...

MOVE 3 - STEP 3: INDICATING ARTICLE STRUCTURE

This step is more commonly found in dissertations and theses than in research articles. However, many disciplines that do not use the IMRD structure, such as engineering, the humanities, and economics, typically require writers to preview how the rest of the article will be organised.

First, the writer introduces the structure with a topic sentence:

We **have organised** the rest of this paper in the following way...

This paper **is structured** as follows...

The remainder of this paper **is divided** into five sections...

Next, the writer has three alternative structures that can be used to describe each **section** (in research articles, reports, and essays) or **chapter** (in theses or dissertations):

Author as actor:

In Section II, **we** describe the framework used to...

In Section IV, **I** present the model used to...

Text as actor:

Section II describes the framework used to...

Section IV presents the model used to...

Content as subject:

In Section II, **the framework** is described that was used to...

In Section IV, **the model** is presented...

MOVE 3 - STEP 4: EVALUATION OF FINDINGS

This step is most often found in research that aims to develop new methods, such as chemistry and engineering. However, in most fields evaluation of the results is left until the Discussion Section. Typically, this step is the opposite of Move 2 in that it requires **positive evaluation** of some aspect of the solution.

*We have developed **a procedure** for detection of the sickle cell mutation that is very rapid and is at least two orders of magnitude **more sensitive** than standard Southern blotting.*

*Numerical results show that **the proposed algorithm** not only enjoys **advantages of low complexity** and ease of implementation but is also able to achieve performance **very close to the optimum achievable bound**.*

Ex. 5 Start writing Stage 1 and 2 of the Introduction to your article. Use the information from this unit.

Ex. 6 Exchange your drafts. Check if your partner has:

• convinced you that the problem is topical
• referred to other researchers in the field
• clearly indicated the gap
• divided the text into paragraphs appropriately
• developed the text logically
• used words and expressions from Moves
• avoided grammar and spelling mistakes.

Give feedback to your partner.

Ex. 7 Redraft your Introduction, taking into account your partner's feedback.

Project Work

On the internet find an article from your area of research. Read the Introduction and identify Stage 3 (the objectives of the study and/or its main findings) and Stage 4 (the positive value of the research). Write out key phrases indicating these stages. Prepare two slides to share in class. Discuss your findings with the whole class.

Concept Check

1. What is the purpose of clearly defined research aims and objectives in a research project?
2. How do research aims differ from research objectives?
3. Why is it important for research aims and objectives to be specific and measurable?
4. Can a research project have multiple aims? Provide an example.
5. How do research aims contribute to the overall significance of a study?
6. In what ways do research objectives guide the researcher's actions during the study?
7. What role does the choice of research verbs play in formulating effective aims and objectives?
8. Explain the difference between broad and narrow research aims with examples.
9. How can SMART criteria be applied to research objectives?
10. What challenges might researchers face in defining clear and concise research aims?
11. Why is it crucial for research aims and objectives to align with the research question?
12. In what stage of the research process are aims and objectives typically formulated?
13. How might interdisciplinary research projects influence the formulation of aims and objectives?
14. Provide an example of how research aims and objectives can evolve during the research process.
15. How do exploratory research aims differ from confirmatory research aims?
16. What impact can unclear or vague research aims have on the overall research project?

17. How might the cultural context influence the formulation of research aims and objectives?
18. Discuss the relationship between hypotheses and research objectives.
19. How do researchers ensure that their aims and objectives are ethically sound?
20. Explain the significance of feasibility considerations in setting research aims and objectives.
21. Can research objectives be revised during the course of a study? Explain why or why not.
22. How do researchers balance the need for precision with the flexibility to adapt aims and objectives?
23. In what ways can collaboration impact the formulation of research aims in team projects?
24. How can researchers ensure that their aims and objectives contribute to the overall research design?
25. Discuss the importance of clear communication when presenting research aims and objectives to diverse audiences.

Lead-in

Discuss the questions.

1. Why do you think clearly defined research aims and objectives are crucial in any research project?
2. Can you provide an example of a research aim and corresponding objectives from a field of study you are interested in?

WHAT ARE AIMS AND OBJECTIVES?

In academic writing, particularly in research papers, the research aims and objectives play a crucial role in defining the purpose and scope of a study. A clear set of aims and objectives not only guides the researcher but also helps the audience understand the intended outcomes of the research. In technical fields, the aims in reports, research articles, and theses are typically expressed with only a limited number of structures and verbs. In addition, a good thesis statement should be clear and not

very long. The essence of any article, report or thesis should be compressed into just one sentence.

Research Aims

A research aim describes the main goal or the overarching purpose of your research project. It acts as a focal point for your research and provides your readers with clarity as to what your study is all about. Because of this, research aims are almost always located within its own subsection under the introduction section of a research document, regardless of whether it's a thesis, a dissertation, or a research paper.

A research aim is usually formulated as a broad statement of the main goal of the research and can range in length from a single sentence to a short paragraph. Although the exact format may vary according to preference, they should all describe why your research is required (i.e. the context), what it is about (the actual aim) and, briefly, how you are going to do it (overview of your objectives).

For example, "*The role of diametrical cup deformation as a factor to unsatisfactory implant performance has not been widely reported. The aim of this thesis was to gain an understanding of the diametrical deformation behaviour of acetabular cups and shells following impaction into the reamed acetabulum. The influence of a range of factors on deformation was investigated to ascertain if cup and shell deformation may be high enough to potentially contribute to early failure and high wear rates in metal-on-metal implants".* Let's say we're conducting a research project in programming focused on optimizing the efficiency of sorting algorithms. The research aim could be formulated as: *"The aim of this research is to enhance the efficiency of sorting algorithms used in data processing to reduce computational time and improve overall system performance."*

Research Objectives

Research objectives, on the other hand, are specific, measurable, and achievable goals that contribute to fulfilling the broader research aim. They break down the aim into smaller, manageable tasks and guide the researcher in the step-by-step process of reaching the ultimate goal. As a result, almost all research objectives take the form

of a numbered list, with each item usually receiving its own chapter in a dissertation or thesis. Continuing with our example, the research objectives could be:

1 To conduct a comprehensive literature review on existing sorting algorithms and their performance metrics.

2 To analyse the strengths and weaknesses of currently used sorting algorithms in specific programming languages.

3 To design and implement modifications to the selected sorting algorithm to enhance its efficiency.

4 To evaluate the performance of the modified algorithm through systematic testing and benchmarking.

5 To compare the results with standard sorting algorithms and identify areas of improvement.

It's worth noting that researchers sometimes use research questions instead of research objectives, or in other cases both. From a high-level perspective, research questions and research objectives make the same statements, but just in different formats.

Each of your research objectives should be SMART:

- **Specific** – is there any ambiguity in the action you are going to undertake, or is it focused and well-defined?
- **Measurable** – how will you measure progress and determine when you have achieved the action?
- **Achievable** – do you have the support, resources and facilities required to carry out the action?
- **Relevant** – is the action essential to the achievement of your research aim?
- **Timebound** – can you realistically complete the action in the available time alongside your other research tasks?

In addition to being SMART, your research objectives should start with a verb that helps communicate your intent.

STRUCTURES

In academic English, there are four structures that you can use to formulate your aims. All of these are listed below along with other synonymous forms.

Passive Verb

"**In this *project**, a novel algorithmic approach is being developed to enhance the efficiency of data encryption methods and evaluate their applicability in securing sensitive information."

***work , research, study, thesis**

Aim (subject)

"**The *aim of** this research is to devise a robust error-handling mechanism to enhance the reliability and stability of distributed systems in cloud computing environments."

* goal, objective, purpose

Aim (verb)

"**The project **aims to implement** a novel encryption algorithm to enhance the security of cloud-based data storage and transmission." **attempts, seeks, tries

Inanimate subject

"**The study** focuses on **the implementation of** an intelligent recommendation system to enhance user experience in e-commerce platforms. The developed system incorporates machine learning algorithms to analyse user preferences and provide personalised product recommendations."

(From https://www.discoverphds.com/advice/doing/research-aims-and-objectives)

 **Ex. 1 Select any article/research paper related to your area of interest and analyse it for compliance with the SMART.**

Language Focus

When writing research aims and objectives, researchers typically use specific grammatical structures to convey the purpose and tasks of the study. Here are common grammatical structures:

Infinitive Verbs:

Example (Research Aim): *"To investigate the efficiency of algorithmic optimization in reducing code complexity."*

Example (Research Objective): *"To compare the runtime performance of two sorting algorithms."*

Gerunds:

Example (Research Aim): *"Exploring the impact of cybersecurity measures on software development."*

Example (Research Objective): *"Assessing the effectiveness of implementing encryption techniques in protecting user data."*

Modal Verbs (Can, Will, Should, etc.):

Example (Research Aim): *"Can blockchain technology enhance the security of distributed systems?"*

Example (Research Objective): *"Will analysing user behaviour patterns improve recommendation algorithms?"*

Action Verbs:

Example (Research Aim): *"Examining the integration of machine learning for predictive maintenance in software systems."*

Example (Research Objective): *"Implementing a neural network to predict system failures based on historical data."*

Quantifiers (All, Some, Every, etc.):

Example (Research Aim): *"Investigating how all team members contribute to collaborative coding projects."*

Example (Research Objective): *"Analysing some factors influencing code review efficiency in distributed teams."*

Adverbs (Effectively, Efficiently, Thoroughly, etc.):

Example (Research Aim): *"To study how blockchain can be applied efficiently in securing IoT devices."*

Example (Research Objective): *"Investigating thoroughly the impact of parallel processing on algorithmic scalability."*

These structures help in clearly defining the goals (aim) and specific tasks (objectives) of the research in a programming context. The choice of grammatical structure depends on the level of specificity and the nature of the action or investigation the researcher intends to undertake.

Table of Research Verbs to Use in Aims and Objectives

Table showing common research verbs which should ideally be used at the start of a research aim or objective. The verbs typically used in statements of aims can be divided into several groups according to their function.

Ex. 2 Complete the missing words.

calculate	construct	assemble	compare	establish
appaise	identify	assess	select	describe

Understanding (Understanding and organising information)	**Applying** (Solving problems using information)	**Analysing** (reaching conclusion from evidence)	**Synthesising** (Breaking down into components)	**Evaluating** (Judging merit)

Review **1)_____** Explore Discover Discuss Summarise **2)_____**	Interpret Apply Demonstrate **3)_____** Determine Estimate **4) _____** Relate	Analyse **5) _____** Inspect Examine Verify **6) _____** Test Arrange	Propose Design Formulate Collect **7) _____** Prepare Undertake **8) _____**	**9)_____** Evaluate Compare **10) _____** Recommend Conclude

Ex. 3 Read the text. Choose the most suitable word for each sentence. The explanation of the words is given. Make the words grammatically correct where it is necessary.

to determine	to estimate	to achieve	to narrow	sophisticate
to investigate	to prove	to measure	to specify	to approach

Mistakes in Writing Research Aims and Objectives

1. Making Your Research Aim Too Broad

Having a research aim too broad becomes very difficult 1)_____ *(to succeed in finishing something or reaching an aim, especially after a lot of work or effort)*. Normally, this occurs when a student develops their research aim before they have a good understanding of what they want to research. Remember that at the end of your project and during your viva defence, you will have 2) _____ *(to show that something is true)* that you have achieved your research aims; if they are too broad, this will be an almost impossible task. In the early stages of your research project, your priority should be 3) _____ *(limit to a small area of interest, activity, or thought)* your study to a 4) _____ *(relating to one thing and not others; particular)* area. A good way to do this is to take the time to study existing literature, question their current 5) _____(a way of considering or doing something), findings and limitations, and consider whether

there are any recurring gaps that could 6) _____ *(to examine something carefully, esp. to discover the truth about it)*.

2. Making Your Research Objectives Too Ambitious

Be realistic about what you can achieve in the time you have available. It is natural to want to set ambitious research objectives that require 7) _____ *(complicated or made with great skill)* data collection and analysis, but only completing this with six months before the end of your PhD registration period is not a worthwhile trade-off.

3. Formulating Repetitive Research Objectives

Each research objective should have its own purpose and distinct 8) _____ *(able to be measured, or large enough to be noticed)* outcome. To this effect, a common mistake is to form research objectives which have large amounts of overlap. This makes it difficult 9) _____ *(to control or influence something directly, or to decide what will happen)* when an objective is truly complete, and also presents challenges in 10) _____(to guess or calculate the cost, size, value, etc. of something) the duration of objectives when creating your project timeline. It also makes it difficult to structure your thesis into unique chapters, making it more challenging for you to write and for your audience to read. Fortunately, this oversight can be easily avoided by using SMART objectives.

Project work

Write a research aim and objectives to a research paper on the area of your interests.

Concept Check

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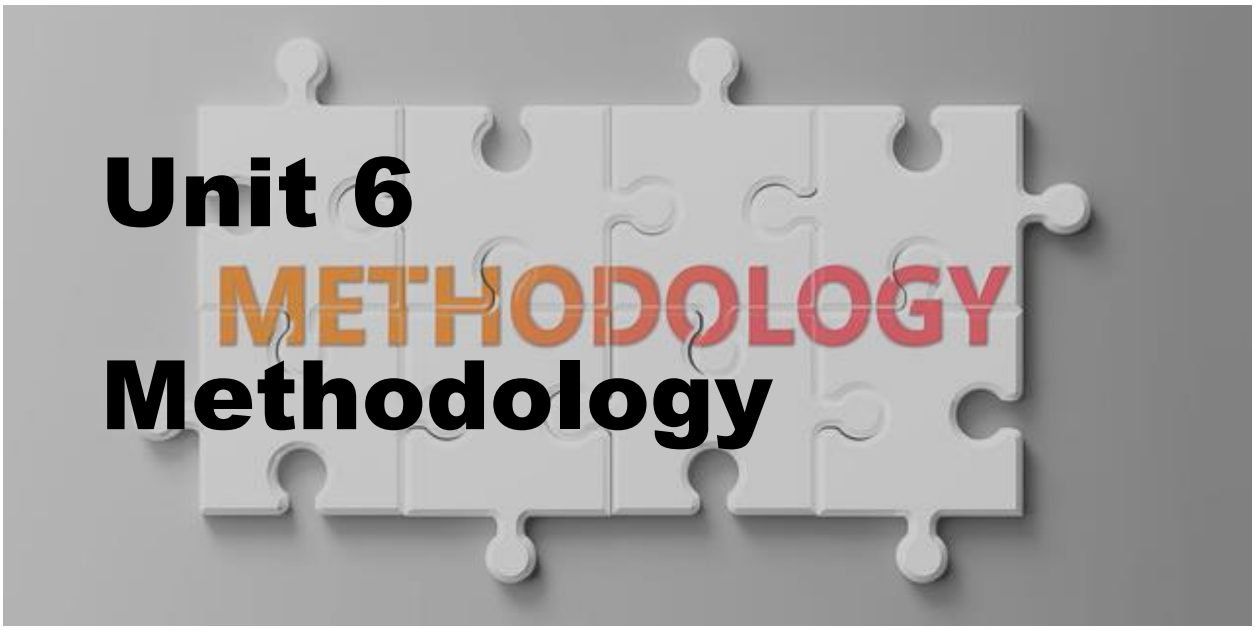


Lead-in

Discuss the following questions.

1 As future researchers, what do you believe is the most critical information that should be included in the method section of a research paper?

2 What challenges do you foresee in ensuring clarity and transparency in describing your research methods?

HOW TO WRITE THE METHODOLOGY SECTION

A key part of your thesis, dissertation, or research paper, the methodology chapter explains what you did and how you did it, allowing readers to evaluate the reliability and validity of your research and your dissertation topic. It should include:

✓ The type of research you conducted

✓ How you collected and analysed your data

✓ Any tools or materials you used in the research

✓ How you mitigated or avoided research biases

✓ Why you chose these methods

Your methods section is your opportunity to share how you conducted your research and why you chose the methods you chose. It's also the place to show that your research was rigorously conducted and can be replicated. It gives your research legitimacy and situates it within your field, and also gives your readers a place to refer to if they have any questions or critiques in other sections.

What is the difference between method and methodology?

Methodology refers to the overarching strategy and rationale of your research project. It involves studying the methods used in your field and the theories or principles behind them, in order to develop an approach that matches your objectives.

Methods are the specific tools and procedures you use to collect and analyse data (for example, experiments, surveys, and statistical tests).

In shorter scientific papers, where the aim is to report the findings of a specific study, you might simply describe what you did in a methods section.

In a longer or more complex research project, such as a thesis or dissertation, you will probably include a methodology section, where you explain your approach to answering the research questions and cite relevant sources to support your choice of methods. To write a research methodology you should take the following steps:

Step 1: Explain your methodological approach
Step 2: Describe your data collection methods
Step 3: Describe your analysis method
Step 4: Evaluate and justify the methodological choices you made

Step 1: Explain your methodological approach

You can start by introducing your overall approach to your research. Start with your "what" question. What research problem or question did you investigate? What type of data did you need to achieve this aim? Depending on your discipline, you can also

start with a discussion of the rationale and assumptions underpinning your methodology. In other words, why did you choose these methods for your study?

Step 2: Describe your data collection methods

Once you have introduced your reader to your methodological approach, you should share full details about your data collection methods. Data collection is a systematic process of gathering observations or measurements. Whether you are performing research for business, governmental or academic purposes, data collection allows you to gain first-hand knowledge and original insights into your research problem.

Data collection is the systematic process by which observations or measurements are gathered in research. It is used in many different contexts by academics, governments, businesses, and other organisations.

While methods and aims may differ between fields, the overall process of data collection remains largely the same. Before you begin collecting data, you need to consider:

- The aim of the research
- The type of data that you will collect
- The methods and procedures you will use to collect, store, and process the data.

Choose your data collection method

Based on the data you want to collect, decide which method is best suited for your research. Experimental research is primarily a quantitative method. Interviews, focus groups, and ethnographies are qualitative methods. Surveys, observations, archival research and secondary data collection can be quantitative or qualitative methods.

Plan your data collection procedures

When you know which method(s) you are using, you need to plan exactly how you will implement them. What procedures will you follow to make accurate observations or measurements of the variables you are interested in? In statistical research, a variable is defined as an attribute of an object of study. Choosing which variables to measure is central to good experimental design. You need to know which types of variables you are working with in order to choose appropriate

statistical tests and interpret the results of your study. You can usually identify the type of variable by asking two questions:

1. What type of data does the variable contain?
2. What part of the experiment does the variable represent?

Conducting surveys or interviews, decide what form the questions will take; if you're conducting an experiment, make decisions about your experimental design (e.g., determine inclusion and exclusion criteria).

Collect the data

Finally, you can implement your chosen methods to measure or observe the variables you are interested in. To ensure that high quality data is recorded in a systematic way, here are some best practices:

- Record all relevant information as and when you obtain data. For example, note down whether or how lab equipment is recalibrated during an experimental study.
- Double-check manual data entry for errors.
- If you collect quantitative data, you can assess the reliability and validity to get an indication of your data quality.

Step 3: Describe your analysis method

Next, you should indicate how you processed and analysed your data. Avoid going into too much detail: you should not start introducing or discussing any of your results at this stage.

Quantitative methods

In quantitative research, your analysis will be based on numbers. In your methods section, you can include:

- How you prepared the data before analyzing it (e.g., checking for missing data, removing outliers, transforming variables)
- Which software you used (e.g., SPSS, Stata or R)
- Which statistical tests you used (e.g., two-tailed t test, simple linear regression)

Qualitative methods

In qualitative research, your analysis will be based on language, images, and observations (often involving some form of textual analysis).

Specific methods might include:

Content analysis: Categorizing and discussing the meaning of words, phrases and sentences

Thematic analysis: Coding and closely examining the data to identify broad themes and patterns

Discourse analysis: Studying communication and meaning in relation to their social context

Mixed methods combine the above two research methods, integrating both qualitative and quantitative approaches into one coherent analytical process.

Step 4: Evaluate and justify the methodological choices you made

Your methodology section should clearly make the case for why you chose the methods you did. This is especially true if you did not take the most standard approach to your topic. In this case, discuss why other methods were not suitable for your objectives, and show how this approach contributes new knowledge or understanding.

In any case, it should be overwhelmingly clear to your reader that you set yourself up for success in terms of your methodology's design. Show how your methods should lead to results that are valid and reliable, while leaving the analysis of the meaning, importance, and relevance of your results for your discussion section.

(From McCombes, S. & George, T. (2023, January 30). What Is a Research Methodology? https://www.scribbr.com/dissertation/methodology/)

Ex. 1 Watch a video and give an outline of the engineering design process.

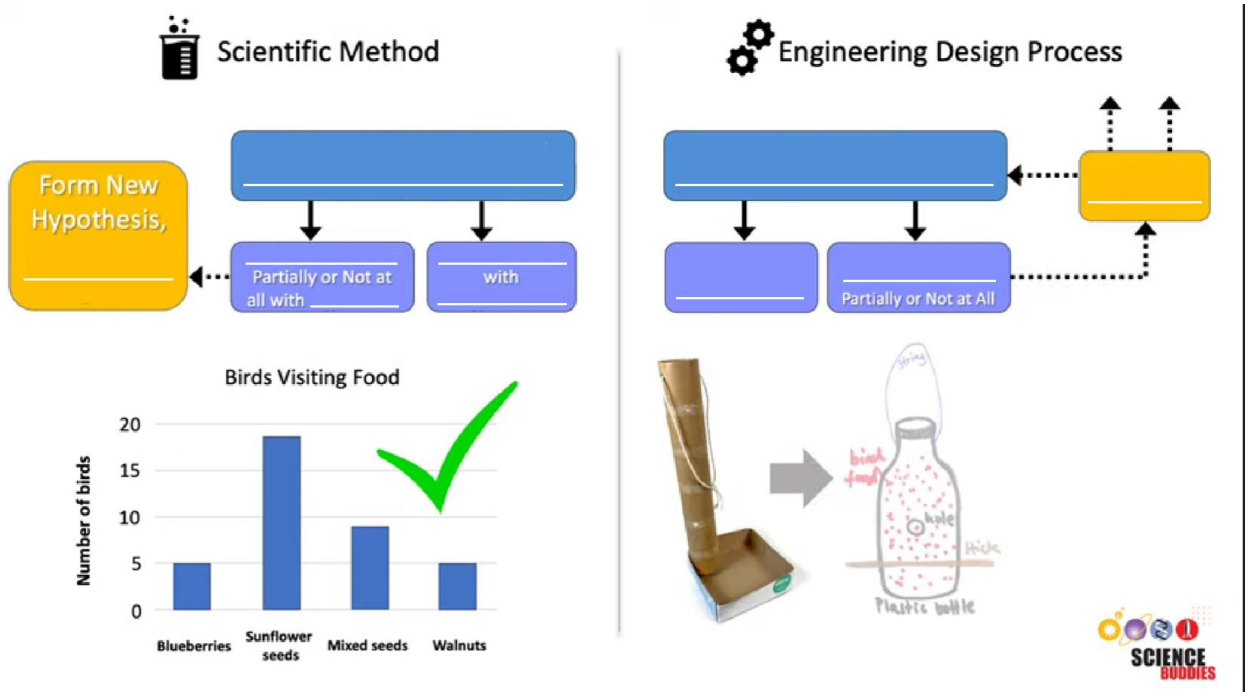
https://www.youtube.com/watch?v=uIV031bnmFA

Answer the questions.

1. When should you use the Scientific Method?
2. Would the Engineering Design Process be a better choice for your research?

Ex. 2 Watch a video from ex. 1 and complete the chart. Use the words and expressions from the box.

Analyse data & draw conclusions results align hypothesis solution iterate meets requirements experiment again test solution



Ex. 3 Read Text 1, which is the part of the Method section in the article "Understanding and Detecting Concurrency Attacks". Answer the questions.

Text 1

3 Quantitative Concurrency Attack Study

We studied concurrency attacks in 10 widely used programs, including 3 servers, 2 browsers, 1 library, and 4 kernel distributions. We added the shared memory concurrency bugs in the prior study [85], and we searched "concurrency bug vulnerability" in CVE and these programs' bug databases. We manually inspected bug reports and removed them if they were false reports or lack a clear description, and we conservatively kept the vulnerable ones caused by multithreading.

Unlike the prior study [85] which counted the number of security consequences in bug reports as the number of concurrency attacks, we counted only each bug's first security consequence. In total we collected 26 concurrency attacks

with three more types of violations than the prior study [85], including HTML integrity violations (§8.4), buffer overflows (§4.3), and DoS attacks (§8.4). We built scripts to successfully exploit 10 attacks in 6 programs if we had source code.

To quantitatively analyze why concurrency attacks are overlooked, we considered data race detectors because they have effectively found concurrency bugs. We selected two popular tools: TSAN [69] for applications and SKI [32] for OS kernels. We ran the two tools on 6 programs that support these tools. We used the programs' common performance benchmarks as workloads. Table 1 shows a study summary

Name	LoC	# Concurrency attacks	# Race reports
Apache	290K	4	715
MySQL	1.5M	2	1123
SSDB	67K	1	12
Chrome	3.4M	3	1715
IE	N/A	1	N/A
Libsafe	3.4K	1	3
Linux	2.8M	8	24641
Darwin	N/A	3	N/A
FreeBSD	680K	2	N/A
Windows	N/A	1	N/A
Total	8.0M	26	28209

Table 1: ***Concurrency attacks study results.*** This table contains both known and previously unknown concurrency attacks we detected. We made 6 out of 10 programs run with race detectors. We built exploit scripts for 10 concurrency attacks in these 6 programs.

1 Which method was used by the researchers?

2 Which materials were examined?

3 How many procedural stages were completed by the authors? Which phrases helped you to identify them?

4 Which elements do you think are always included in the Method section of research articles?

5 Do you find this procedural description clear? Would you be able to replicate this experiment? Why? / Why not?

Ex. 4 Watch a video "How to write a methodology in 4 steps" and complete the information. Use the words from the box.

https://m.youtube.com/watch?v=yplWZs3dqNQ&pp=ygUlSG93IHRvIHdyaXRlIGEgbWV0aG9kb2xvZ3kgaW4gNCBzdGVwcw%3D%3D

⁎focus on ⁎cause-and-effect relationship ⁎explain ⁎describe (2) ⁎evaluate and justify ⁎referencing existing research ⁎the past tense ⁎contributes new knowledge ⁎variables ⁎language ⁎sampling method ⁎convince the reader ⁎statistical software ⁎citing methodological literature ⁎process and analyze ⁎replicated

The methodology chapter is one of the most important parts of your thesis. It allows readers to evaluate the reliability and validity of the research.
In this video, you'll learn how to write a strong methodology in four simple steps. Hi, I'm Jessica from Scribbr, here to help you achieve your academic goals.

Step 1. _____(1) your methodological approach. What was your research problem and what type of data did you need to answer it? Did you aim to describe the characteristics of something, to gain more in-depth understanding of a topic, or to establish a _____(2)? Next, what type of data did you have to collect to achieve that aim? Did you need quantitative data, which is expressed in numbers, or qualitative data, expressed in words? Did you collect primary data by yourself, or use secondary data that was already collected by someone else?

Step 2. _____(3) your methods of data collection. Now you've introduced your overall approach, you can move on to giving full details of the research methods you

used. Here's an idea of what you should include in general. The _____(4) or criteria you used to select participants or sources. The tools, procedures, and material you used to gather data. How you measured your _____(5), especially in quantitative and experimental research, you should give enough detail for it to be _____(6) by another researcher. So let's say we're researching the opinions of a company's customers, and we collected our data through surveys. A paragraph from our methodology chapter might look something like this. The example here describes what type of questions were asked. Where, when, and how the survey was conducted. Here it describes the sampling method used to select participants, the sample size, and the response rate. Also, note that we write the methodology chapter in _____(7), because the research has already been conducted. Don't worry if you're not using surveys, we also have examples on other methods, you can find them in our knowledge-based articles.

Step 3. _____(8) your methods of analysis. In this step, you should describe how you _____(9) the data. Avoid going into too much detail here, so don't start presenting or discussing any of your results. For quantitative methods, we're dealing with numbers. So we might describe the data preparation before analyzing softwares that were used to analyze the data, which statistical methods were used. So here, we've described how we prepared the data, by checking for missing data and outliers. We used the _____(10), SPSS, to analyze the data, and the statistical method used was a pair t-test. For qualitative methods, we're focusing on words. So your analysis will be based on _____(11), images, and interpretations. You might describe how you went about categorizing the responses to identify recurring themes and patterns. We also have an example for qualitative methods. It's in our Knowledge-Based article, you can check it out here.

Step 4. _____(12) your methodological choices. Your methodology should make the case for why you chose these particular methods, especially if you did not take the most standard approach to your topic. Discuss why other methods were not suitable for your objectives, and show how this approach _____(13) or understanding. You

can acknowledge limitations or weaknesses in the approach you chose, but justify why these were outweighed by the strengths.

Now we can step up our game. Here are a few tips to make your methodology chapter even better. _____(14) your objectives and research questions. Show why your methods suit your objectives, and _____(15) that you chose the best possible approach to answering your problem statement and research questions. Establishing your methodology by _____(16) that use similar methods, or _____(17) that supports your choices.

Project Work

1 Read the Method section of an article from your area of study. Find and copy out the information below.

- what was investigated
- which methods were used
- which materials were used
- which steps and procedures were undertaken

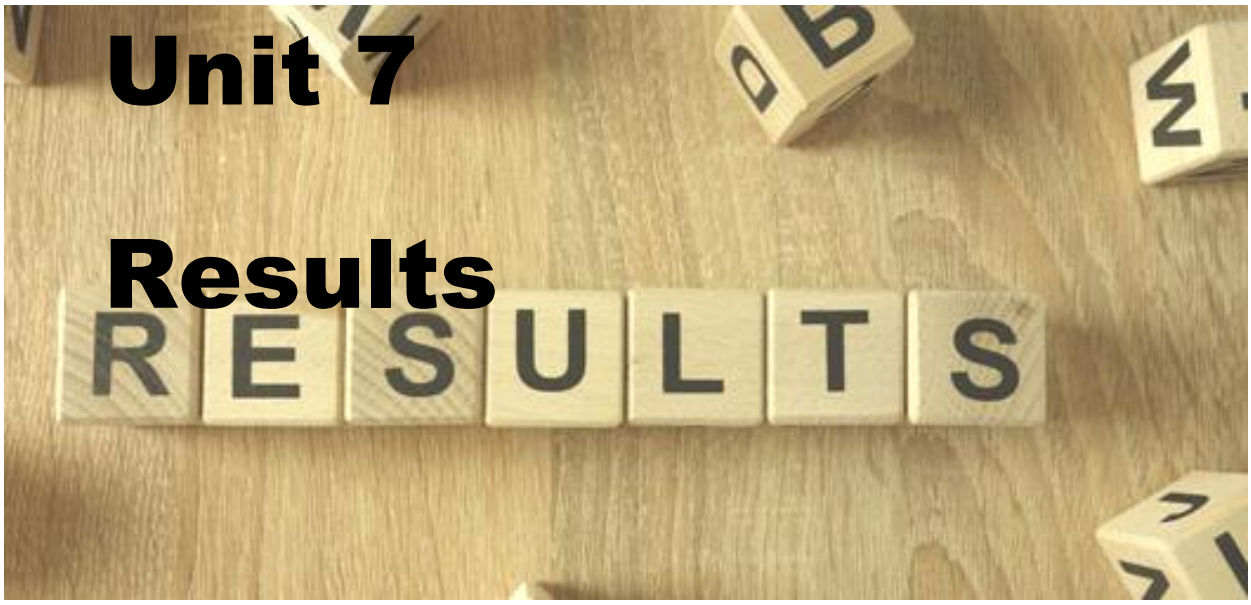
2 Write a draft of the Method section of your article. Self-check it answering the questions below.

Concept Check

1. What is the purpose of the methodology chapter in a thesis or research paper?
2. How does the methodology chapter contribute to the reliability and validity of a research study?
3. What are the key elements that should be included in the methodology chapter?

4. What distinguishes methodology from methods in research writing?
5. How does the methodology chapter situate a research project within its field?
6. Why is it important to demonstrate that research can be replicated in the methodology section?
7. Differentiate between methodology and methods with examples from the given text.
8. Why is the distinction between qualitative and quantitative methods crucial in research?
9. How does the text suggest approaching the "what" question in the methodology section?
10. Explain the role of data collection in gaining insights into a research problem.
11. What considerations should be made before starting the data collection process?
12. How do you choose the appropriate data collection method for a research study?
13. What are some best practices for recording high-quality data systematically?
14. Why is it crucial to avoid discussing results in the analysis method section?
15. In quantitative research, what aspects of data preparation can be included in the methodology?
16. What are some examples of qualitative analysis methods mentioned in the text?
17. How does mixed methods research integrate qualitative and quantitative approaches?
18. What is the significance of evaluating and justifying methodological choices in the methodology section?
19. How does the methodology section contribute to the overall rigor of a research study?
20. What role does the analysis method play in ensuring the validity and reliability of results?
21. In what situations might a researcher deviate from the standard approach and why?

22. What considerations should be made when justifying methodological choices?
23. How can a researcher demonstrate that their chosen methods contribute new knowledge or understanding?
24. What role does the discussion section play in complementing the methodology chapter?
25. Summarize the four steps involved in writing a research methodology as outlined in the text.



Lead-in

Answer the questions:

1 Can you think of any common challenges researchers might face when presenting results in a scientific study?

2 In what ways can visuals such as tables and figures enhance the communication of research findings?

3 Why is it important to provide commentary and interpretation alongside the raw data in the Result section?

HOW TO WRITE THE RESULT SECTION

The Results section is a standard feature of empirical studies, although the actual heading used may vary (“Simulation Results”, “Results and discussion”, “Findings”, "Experimental results"). However, in studies which present the development of a “product” (for example, an algorithm, a strategy, a model, a system, guidelines), the results of the research may be presented in a sequence of sub-sections which reveal the research outcomes step by step interspersed with the methods used to attain them. In these cases, the sub-section headings are typically very study-specific.

Results sections have several characteristic elements. There is often, for example, a general statement which introduces the new section and announces the information which will follow below). Then, of course, the results must be reported. If any information is represented in tables or figures, it is essential that writers tell their readers exactly where these tables or figures are located. Writers also comment on their results. The study's data should be presented in a logical sequence without bias or interpretation. Findings may be reported in written text, tables, graphs, and other illustrations. It is important to include a contextual analysis of the data by tying it back to the research question(s). Only share relevant data and findings that connect with the goal of the study; too much data may overwhelm a reader. An effective results section will present the findings of a study without attempting to analyze or interpret them.

When structuring the results section, it is important that your information is presented in a logical order. First, begin with an introduction to connect the results with the research question(s). This brings the readers' focus back to the purpose of the study after reading the literature review and methods sections of your paper.

Second, present your findings in a structured way (such as thematically or chronologically), bringing the readers' attention to any important, interesting, or significant findings. Be sure to include a combination of text and visuals. Data illustrations should not be used to substitute or replace text, but to enhance the narrative of your findings.

Third, the results section should include a closing paragraph that clearly summarizes the key findings of the study. This paves the way for the discussion section of the research paper, wherein the results are interpreted and put in conversation with existing literature.

Results/Findings Section Dos and Don'ts

● Do write with an academic, impartial, objective tone to increase credibility as a scholar.

● Do provide clear topic sentences that connect your findings to your research question.

● Do take time to establish key findings in connection to your research question.

● Do include any negative findings, as failing to do so would hurt your credibility as a scholar.

● Do include statistical significance tests if applicable.

● Don't attempt to discuss, interpret or analyze your findings within the results section.

● Don't use vague terms or generalizations when presenting your findings, always be specific.

● Don't present raw data that can be summarized or presented visually.

● Don't present the same data multiple times, but decide on one format to best convey it.

● Don't present data that is not relevant to your research question(s).

Answer the questions:

1. How do studies presenting the development of a "product" structure their results, especially when multiple subsections are involved?
2. What is the significance of a general statement at the beginning of the Results Section?
3. Why is it crucial for writers to clearly indicate the location of tables or figures if used in the results?
4. Why is it emphasized that writers should present the study's data in a logical sequence without bias or interpretation?
5. What are the various formats in which findings may be reported in the Results Section?
6. Why is it essential to include a contextual analysis of the data in the Results Section, tying it back to the research question(s)?
7. How can an effective results section balance the presentation of data and findings without overwhelming the reader?
8. What is the role of the introduction in structuring the Results Section, especially in connecting the results with the research question(s)?

9. Why is it recommended to include both text and visuals when presenting findings in the results?
10. What is the purpose of the closing paragraph in the Results Section, and how does it connect with the discussion section of the research paper?

Ex. 1 Read and complete the text with an appropriate form of the words in parentheses.

Visuals, including tables and figures, play a crucial role in effectively communicating research findings. They contribute to a clearer presentation of results in several ways. By providing a concise and clear representation of complex data, visuals make it easier for readers to quickly grasp key findings. Tables and figures help researchers in summarizing large datasets and presenting multiple pieces of information in a compact format, 1)_____ (simple) intricate details. They also facilitate the 2)_____ (compare) of different groups, conditions, or 3)_____ (vary), making trends and patterns more apparent. Well-designed visuals enhance the visual appeal of a research paper or presentation, capturing the reader's attention and maintaining 4)_____ (engage). Additionally, visuals support the narrative in the text by providing evidence for claims and 5)_____ (enforce) main points.

Visual representations of statistical results, such as histograms or scatter plots, make it easier for readers to understand the significance of findings. Figures like line graphs or correlation matrices are 6)_____ (power) tools for communicating relationships between variables, helping readers visualize connections. Furthermore, visuals can illustrate processes or procedures, providing a step-by-step visual guide that complements the written explanation. Maps and spatial visualizations are 7)_____ (value) for presenting geographical or spatial data, offering a comprehensive view of distribution patterns.

Visuals also allow researchers to highlight specific points or results, drawing attention to the most critical aspects of the findings. Well-designed visuals are more 8)_____(memory) than extensive text, enhancing 9)_____ (retain) and

recall. They cater to different learning styles, making information 10)_____ (access) to a broader audience, especially for those who find it easier to comprehend visual information compared to text.

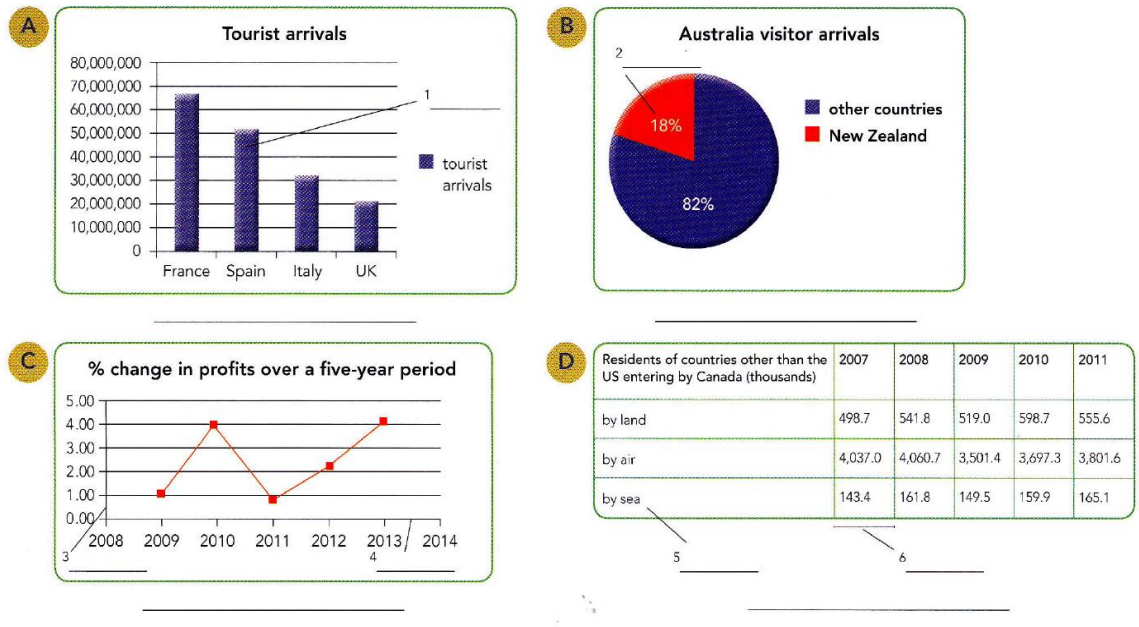
Adhering to standards set by academic journals and conferences for including visuals in research papers enhances the professionalism of the work. In interdisciplinary research, where readers may have diverse backgrounds and expertise, visuals facilitate efficient communication.

Ex. 2 Find the synonyms to the following words in the text above.

1 complicated –
2 importance –
3 intensify –
4 periodical –
5 gradually –
6 support –
7 addition –
8 emphasize –
9 sophisticated –
10 strengthen –

Ex. 3 Look at the four different ways of showing statistics. Label the visuals A-D with the words in the box.

bar chart	line graph	pie chart	table



Ex. 4 Label the features 1-6 in the visuals in Ex. 3 with the words in the box.

bar	column	horizontal axis	row	segment	vertical axis

FACT FILE

A bar chart, also known as a **bar graph**, is used to compare sets of data against the same scale. In visual A the graph is comparing the number of tourist arrivals from different countries on **the horizontal axis**, also called the x-axis. The numbers are shown on the **vertical axis**, or y- axis. This type of graph is useful for comparing different sets of data in a way that is immediately obvious.

A pie chart is a circle (the pie) divided into **segments** (pieces of pie) which represent parts of the whole. In visual B the pie chart shows visitor arrivals to Australia from New Zealand as a percentage (18%) of those from all countries.

A line graph is used to show data changing over a period of time. In visual C the graph shows profits changing over a five-year period, with the years on the **x-axis** and the percentages on the **y-axis**. Line graphs allow smaller or larger changes to be shown by altering the stages on the y-axis.

A table presents information in **rows** and **columns**. The cell where the row and column intersect shows the information that relates to both criteria. In visual D the table shows residents of countries other than the USA entering Canada by land, sea or air over five years. The figures represent the number of people in a given year by one of the methods of travel. Tables are useful to show exact figures.

Language focus

This bar chart ***represents …..***

The pie chart ***shows……***

The red shaded segment ***portrays……***

The line graph ***illustrates …….***

The table gives us a(n) ***breakdown …….***

Ex. 5 Read Text 1 identify the functions (a-d) that results perform in the text. Some sentences may perform more than one function.

a to direct readers to the table where the results can be found

b to explain the particular features of methods used

c to highlight the most important findings

d to comment on the results

Text 1

Results

This section presents the experiment results and answers the research questions introduced in Section1. The data collected to carry out the analysis are available at http://dx.doi.org/10.17811/ ruo_datasets.64866.

RQ2. Is the performance of the software testing students who carry out gamified activities higher than the ones who carry out the mina non-gamified environment? To answer the research question RQ2, we state the null hypothesis of no difference in the performance of the software testing students who carry out gamified activities in comparison with the students who carry them out in a non-gamified environment. To test this hypothesis, we analyze the metrics Effectiveness and Effectiveness Increase. Again, we carried out the Mann–Whitney U test for

independent samples to verify the null hypothesis of median equality with α=0.05, because we cannot assume the normality of the distributions (p-values < 0.001wasobtainedineachKolmogorov–Smirnov test). Table5 shows the results for both metrics, considering the Olympic race and each exercise individually: mean and median for the control and experimental groups, p-value and U obtained by the Mann – Whitney U test. The effect sizes r and η2 are also presented in Table5. For both metrics, the p-value obtained for the Olympic race is smaller than α, soon again, it can be assumed that there is significant difference between the control and experimental groups, although the effect size is small. Moreover, the mean of the Effectiveness, as well as the mean of the Effectiveness Increase, are higher in the experimental group. Therefore, the students in the experimental group achieved better performance and they worked harder in the test improvement activity to increase the effectiveness. The analys is of each individual exercise also reveals that the experimental group performs better: the difference is significant in both metrics in exercises 2 and 3, with small size effect, and the mean of both metrics is higher in the experimental group in all exercises. Despite the benefits of the gamification experience to improve both the Effectiveness and the Effectiveness Increase, we can observe a downward trend, mainly in the last two exercises. Therefore, the null hypothesis is also rejected in favor of the gamification experience when the performance is measured with both Effectiveness and Effectiveness Increase. So, the performance of the students who carried out gamified software testing activities is higher than the ones who carried them out in a non-gamified environment.

Ex. 6 In Text 1 underline phrases and clauses which show that the authors were comparing two different groups. Which of them use comparative forms, which superlative forms and which neither?

Ex. 7 Fill in the gaps in the Language Support box with adjectives and adverbs from Text 1.

Language Support: intensifying

We / Waters (2011) found A comparison showed	slight substantial considerable _____ extreme	differences between ... and ...

Data	contrast(s/ed) differ(s/ed) is/are/was/were	_____ _____ considerably _____ extremely	with ... from ... different from ...

Text 2

The Drill and Test Experiments successfully tested a significant portion of Hypotheses 1 and 2.

Hypothesis 2.1, Delivery methods that use drill and test of separate problem types, will result in poor long-term retention of material, were supported. Hypotheses 1.2 and 1.3, When concepts are reinforced inconsistently, only the most recently introduced concept is remembered, and that ”Cramming” does not improve learning, were supported. Hypothesis 1.5, Problem types that are related to one another become confused on tests, more than unrelated problem types, was not supported in these experiments. The remainder of Hypothesis 2, and Hypothesis 1.1, are tested in Sections 6 and 7. Hypothesis 1.4, Problems types that are related to one another are learned faster than unrelated problem types, was conditionally supported by the results. As was mentioned above, most network learners learned Parts problems far more easily than Usub problems. Because Parts problems are generally acknowledged to be more complex than Usub problems, I expected that they would be harder to recognize than Usub problems.

Ex. 8 Read the Result section of the research paper in Text 3 What are the general trends in the test scores: upward, downward or steady level?

Text 3

Figure 6 shows a fully representative subset of the test scores for the Incremental Learning experiments. The types of midterms and the epoch transition points (5, 35, 140) are shown along the x-axis. The test scores are on the y-axis. As can be seen on the figure, Simple-only midterms very rapidly reached scores of 100%. When Usub problems were introduced (epoch 5), test scores began to fluctuate severely. Scores would go down to, or near, zero, rebound, and then drop again. Over time, although the fluctuation continued, the overall scores increased. In a few cases, midterm scores reached 100%, however the majority of cases peaked at 70-75%. When Parts problems were introduced for the third training period (epoch 35), the pattern of fluctuating scores was accentuated. Midterm scores immediately plummeted, although it is interesting to note that even the downward drop was often not smooth, but marked by brief plateaus and recoveries. Performance continued to deteriorate for longer than in the SU training segment, with scores fluctuating lower and lower. In contrast to the SU midterm scores, SUP midterm scores appeared to tighten in closer and closer to complete failure (for a while nearly all midterms fluctuated well under 20%). Eventually, performance began to improve, with prominent individual differences. Eventually, virtually all midterm scores surpassed the 70% point, averaging 81.9%, with a standard deviation of 8.23.The maximum midterm score was 95.6%, higher than any score reached in a Fully Integrated learning experiment. As evaluated with a t-test, the Incremental Learning final exam scores were higher than those of the Fully Integrated learning.

Ex. 9 Complete the table with underlined words describing in the extract (Text 3).

nouns	verbs	adjectives	adverbs

Ex. 10 Look at the table in Ex. 9. Which words indicate a rapid or sudden change? Which verbs mean "to stop rising or falling"? Which words mean an upward trend?

Ex. 11 Watch a video and answer the questions. **https://www.youtube.com/watch?v=WP4gDG0q63k**

Questions:

1. What should you avoid using in the results section?
   A. Speculative words like "appears" or "implies"
   B. Statistical analysis
   C. Visual elements like graphs and charts
   D. Descriptive statistics
2. When should you write a results section?
   A. After discussing the meaning of the results
   B. Before reporting the results of your study
   C. In the middle of your research process
   D. After writing the introduction
3. In which type of research might you not need a separate results chapter?
   A. Qualitative research
   B. Quantitative research

C. Experimental research

D. Ethnography

4. What should you include in the results section for quantitative research?

A. Relevant quotations

B. Full transcripts of interviews

C. Descriptive statistics and inferential statistics

D. Recurring points of agreement

5. How should you present results that didn't fit with your expectations?

A. Exclude them from the results section

B. Speculate on their meaning

C.Save them for the conclusion section

D. Include them but do not speculate on their meaning

6. What tense should the results section be written in?

A. Present tense

B. Future tense

C. Past tense

D. Conditional tense

7. What should you do if you're unsure about statistical analysis numbers?

A. Exclude them from the results section

B.Find step-by-step articles explaining them

C. Include them without explanation

D. Speculate on their meaning

Project work

Read the Results section of an article from your field of study. Choose any description of the main results with reference to visuals. Identify its functions from the list below. Underline phrases which helped you to identify each element.

- directing the reader to a table or figure
- explaining the particular features of the methods used (optional)
- « highlighting the main findings
- commenting on the results (optional)

Write a draft description of your research results. Exchange your draft with your partner and suggest improvements, if any. Check if your partner:

- has given key information presented in a table or figure
- has directed readers to the appropriate table or figure
- has highlighted the main results
- has written the section in a formal style
- has avoided grammar, vocabulary and spelling mistakes.

Concept check

1. What is the purpose of the Results section in empirical studies?
2. How may the heading of the Results section vary in different research papers?
3. In what type of studies might the Results section be presented in a sequence of sub-sections?
4. What are some characteristic elements of Results sections?
5. Why is it important to inform readers about the location of tables or figures when presenting results?
6. What types of data representations are commonly used in Results sections?
7. How should writers comment on their results in the Results section?
8. Why is it important to include a contextual analysis of the data in the Results section?
9. What is the role of the introduction in structuring the Results section?
10. How should findings be presented in the Results section?
11. What should the closing paragraph of the Results section summarize?

12. What are some dos of writing the Results section?
13. Why is it important to include negative findings in the Results section?
14. When should statistical significance tests be included in the Results section?
15. What are some don'ts of writing the Results section?
16. Why should writers avoid discussing, interpreting, or analyzing their findings in the Results section?
17. How can writers ensure clarity and specificity when presenting findings in the Results section?
18. What should writers avoid presenting in the Results section?
19. Why is it important to decide on one format to present data in the Results section?
20. How can writers ensure that the data presented in the Results section is relevant to their research questions?

Lead-in

Discuss the following questions:

1 What is the purpose of the discussion section in a dissertation? Why is it considered one of the most critical parts of the document?

2 What key elements should be included in the discussion section of a dissertation, and how do they contribute to the overall coherence and persuasiveness of the argument?

HOW TO WRITE THE DISCUSSION SECTION

The discussion section is where you delve into the meaning, importance, and relevance of your results.

It should focus on explaining and evaluating what you found, showing how it relates to your literature review and paper or dissertation topic, and making an argument in support of your overall conclusion. It should not be a second results section.

There are different ways to write this section, but you can focus your writing around these key elements:

Summary: A brief recap of your key results

Interpretations: What do your results mean?

Implications: Why do your results matter?

Limitations: What can't your results tell us?

Recommendations: Avenues for further studies or analyses

What not to include in your discussion section

There are a few common mistakes to avoid when writing the discussion section of your paper.

Don't introduce new results: You should only discuss the data that you have already reported in your results section.

Don't make inflated claims: Avoid overinterpretation and speculation that isn't directly supported by your data.

Don't undermine your research: The discussion of limitations should aim to strengthen your credibility, not emphasize weaknesses or failures.

Let's have a close look at each stage of the Discussion section.

Step 1: Summarize your key findings

Start this section by reiterating your research problem and concisely summarizing your major findings. To speed up the process you can use a summarizer to quickly get an overview of all important findings. Don't just repeat all the data you have already reported—aim for a clear statement of the overall result that directly answers your main research question. This should be no more than one paragraph.

Many students struggle with the differences between a discussion section and a results section. The crux of the matter is that your results sections should present your results, and your discussion section should subjectively evaluate them. Try not to blend elements of these two sections, in order to keep your paper sharp.

Examples: Summarization sentence starters

The results indicate that…

The study demonstrates a correlation between…

This analysis supports the theory that…

The data suggest that…

Step 2: Give your interpretations

The meaning of your results may seem obvious to you, but it's important to spell out their significance for your reader, showing exactly how they answer your research question.

The form of your interpretations will depend on the type of research, but some typical approaches to interpreting the data include:

- *Identifying* correlations, patterns, and relationships among the data
- *Discussing* whether the results met your expectations or supported your hypotheses
- *Contextualizing* your findings within previous research and theory
- *Explaining* unexpected results and evaluating their significance
- *Considering* possible alternative explanations and making an argument for your position

You can organize your discussion around key themes, hypotheses, or research questions, following the same structure as your results section. Alternatively, you can also begin by highlighting the most significant or unexpected results.

Examples: Interpretation sentence starters

In line with the hypothesis…

Contrary to the hypothesized association…

The results contradict the claims of Smith (2022) that…

The results might suggest that x. However, based on the findings of similar studies, a more plausible explanation is y….

Step 3: Discuss the implications

As well as giving your own interpretations, make sure to relate your results back to the scholarly work that you surveyed in the literature review. The discussion should show how your findings fit with existing knowledge, what new insights they contribute, and what consequences they have for theory or practice.

Ask yourself these questions:

Do your results support or challenge existing theories?

If they support existing theories, what new information do they contribute?

If they challenge existing theories, why do you think that is?

Are there any practical implications?

Your overall aim is to show the reader exactly what your research has contributed, and why they should care.

Examples: Implication sentence starters

These results build on existing evidence of…

The results do not fit with the theory that…

The experiment provides a new insight into the relationship between…

These results should be taken into account when considering how to…

The data contribute a clearer understanding of…

While previous research has focused on x, these results demonstrate that y…

Step 4: Acknowledge the limitations

Even the best research has its limitations. Acknowledging these is important to demonstrate your credibility. Limitations are not about listing your errors, but about *providing an accurate picture* of what can and cannot be concluded from your study.

Limitations might be due to your overall research design, specific methodological choices, or unanticipated obstacles that emerged during your research process.

You should only mention limitations that are directly relevant to your research objectives. Then, share how much impact they had on achieving the aims of your research. Here are a few common possibilities:

If your sample size was small or limited to a specific group of people, explain how generalizability is limited.

If you encountered problems when gathering or analyzing data, explain how these influenced the results.

If there are potential confounding variables that you were unable to control, acknowledge the effect these may have had.

After noting the limitations, you can reiterate why the results are nonetheless valid for the purpose of answering your research question.

Examples: **Limitation sentence starters**

The generalizability of the results is limited by…

The reliability of these data is impacted by…

Due to the lack of data on x, the results cannot confirm…

The methodological choices were constrained by…

It is beyond the scope of this study to…

Step 5: Share your recommendations

Based on the discussion of your results, you can make recommendations for practical implementation or further research. Sometimes, the recommendations are saved for the conclusion.

Suggestions for further research can lead directly from the limitations. Don’t just state that more studies should be done—give concrete ideas for how future work can build on areas that your own research was unable to address.

Examples: **Recommendation sentence starters**

Further research is needed to establish…

Future studies should take into account…

Avenues for future research include…

(From https://www.scribbr.com/dissertation/discussion/)

Ex. 1 Read and match the elements of the Discussion section (a-f) with relevant sentences in Text1 (1-9). Not all elements are included in Text 1.

Text 1

5 Discussion

1 The main challenge addressed in this study was to measure and evaluate the impact of gamification on student engagement and performance. To deal with this challenge, we defined the metrics presented in Section 3.5 and analyzed the results obtained in the controlled experiment that was carried out. **2** The results show that, overall, gamification contributes to the improvement of the students' engagement and performance. **3** These findings are in line with those of most works that reported practical gamification experiences in software testing education. Buckley and Clarke (2018), Lőrincz et al. (2021), Sherif et al. (2020) compared the results achieved by gamified and non-gamified groups; Lőrincz et al. (2021), Sherif et al. (2020) reported that the engagement was higher in the gamified one and Buckley and Clarke (2018), Sherif et al. (2020) also stated that the gamified group performed better.These findings align with previous research, as indicated by various studies cited. **4** However, challenges arose in analyzing the consistency of gamification impact and its relationship with motivation. It was observed that while initial engagement and performance were high, they declined over time. **5** The impact of gamification on engagement varied across different exercises, suggesting that the effect may not remain constant throughout the experience.

6 Further, the relationship between gamification and motivation was explored. It was found that extrinsic motivation, driven by gamification benefits, influenced

early engagement. **7** However, intrinsic motivation seemed lacking, particularly in later stages where student participation waned despite nearing the end of the gamified experience. **8** Threats to validity were identified, including internal factors such as professor influence, external factors like student knowledge and skills, construct validity related to metrics, and conclusion validity regarding researcher interpretations. **9** Mitigation strategies were implemented to address these threats, ensuring the reliability and accuracy of the study's conclusions. **10** In particular, while gamification showed initial promise in enhancing engagement and performance, its impact varied over time and seemed more reliant on extrinsic rather than intrinsic motivation. **11** The study underscores the importance of considering both short-term and long-term effects of gamification on student outcomes and highlights avenues for future research to delve deeper into these dynamics.

(Raquel Blanco, Manuel Trinidad, María José Suárez-Cabal, Alejandro Calderón, Mercedes Ruiz, Javier Tuya. Can gamification help in software testing education? Findings from an empirical study. The Journal of Systems & Software. 2023. https://www.sciencedirect.com/science/article/pii/S0164121223000420?via%3Dihub)

a A reference to the main purpose or hypothesis of the study

b A review of the most important findings (whether or not they support the original hypothesis, and whether they agree with the findings of other researchers),

c Possible explanations for/or speculations about findings, often supported by references to relevant literature.

d Limitations of the study that restrict the extent to which the findings can be generalised,

e Implications of the study (generalisations from the results),

f Recommendations for future research and/or practical.

Ex. 2 Work in pairs and compare your answers in ex. 1.

Ex. 3 Find an article from your area of interest, study the Discussion section and answer the questions.

1 How do authors usually order the information in their discussion: from general to specific or from specific to general?

2 Are references to other publications used to support the reported findings or to indicate a gap in them?

3 What is the main difference between the Results section and the Discussion section of an article?

Ex. 4 Read some phrases used to write the Discussion section and write next to them I for implications, L for limitations, E for explanations.

1 The results do not fit with the theory that…

2 The methodological choices were constrained by…

3 These results should be taken into account when considering how to…

4 This result may be explained by the fact that...

5 The data contribute a clearer understanding of…

6 The reliability of these data is impacted by…

7 The results might suggest that x. However, based on the findings of similar studies, a more plausible explanation is y…

8 Due to the lack of data on x, the results cannot confirm…

9 The experiment provides a new insight into the relationship between…

10 The findings of this study are consistent with those of Brown (2021), who found...

Language focus

Relative Clause

'Defining' relative clauses provide information that defines and restricts the meaning of the word that comes before the clause, and is thus 'essential' for understanding what we are talking about. In contrast to Finnish, defining relative clauses are never punctuated with a comma. In formal definitions, the relative pronouns 'which', 'that' and 'who' are never introduced by a comma, because they are always defining to the meaning and define the class:

A scientist is a person who is expert in an area of science and uses scientific methods in research.

'Non-defining' relative clauses comment or give extra details on the topic, and can thus be omitted from the sentence without losing the main meaning of the sentence. In fact, this is usually the best test of whether you are dealing with a non-defining or defining relative clauses. Non-defining relative clauses must also be 'separated' from the rest of the sentence by punctuation--most commonly by commas. In the examples below, notice how these versions differ in meaning from the 'defining' versions above.

While 'that' can only be used to introduce defining information, 'which' is used to introduce both defining and non-defining information. Some grammarians still, however, insist on limiting 'which' to only non-defining relative clauses.

Ex. 5 Study the information about defining and non-defining relative clauses. Identify the relative clause. Write D for defining relative clause and N for non-defining relative clause. Use the correct punctuation.

1 Artificial Intelligence (AI) is a branch of computer science that focuses on creating systems capable of performing tasks that typically require human intelligence, such as problem-solving, pattern recognition, and natural language understanding.

2 Data mining is a subfield of computer science that involves the extraction of patterns and knowledge from large datasets using various statistical and machine learning techniques, with applications ranging from business intelligence to scientific discovery.

3 The Internet of Things (IoT) is an interconnected network of physical devices embedded with sensors, software, and other technologies enabling them to collect and exchange data facilitating applications ranging from smart homes to industrial automation.

4 Blockchain technology initially developed as the underlying technology of cryptocurrencies like Bitcoin has garnered interest in computer science for its potential to provide secure, decentralized systems for recording transactions and managing digital assets.

5 Computer vision is a field of computer science that enables computers to interpret and analyze visual information from the real world, allowing them to understand images and videos, recognize objects and scenes, and make decisions based on visual input.

6 In recent years, deep learning a subset of machine learning has gained significant attention in computer science due to its ability to automatically learn representations of data through the use of neural networks with many layers.

7 Distributed systems are computer systems composed of multiple interconnected processors or nodes that work together to achieve a common goal, enabling tasks to be divided among different components and executed in parallel, with examples including cloud computing platforms and peer-to-peer networks.

8 Quantum computing an emerging field within computer science explores the use of quantum-mechanical phenomena such as superposition and entanglement to perform computations that are beyond the capabilities of classical computers.

REDUCED RELATIVE CLAUSES

Academic English prefers reduced relative clauses. This relative clause should be reduced to either its past or present participle, or even deleted if the main verb is the verb "to be".

Past participle (-ed)

Full Relative Clause (Passive voice):

Netscape allows administrators to implement programs WHICH ARE BASED on Java.

Reduced Relative Clause (Better):

Netscape allows administrators to implement programs BASED on Java.

Present Participle (-ing)

Full Relative Clause (Active voice):

*This study investigates the factors **WHICH INFLUENCE** the lifetime of telecommunication technology standards.*

Reduced Relative Clause (Better):

*This study investigates the factors **INFLUENCING** the lifetime of telecommunication technology standards.*

DELETION OF VERB "to be"

Relative Clause (verb "to be"):

*The atmospheric aerosols **THAT ARE IN** heavily polluted areas have the potential to accelerate global warming.*

Reduced Relative Clause (Better):

*The atmospheric aerosols **Ø IN** heavily polluted areas have the potential to accelerate global warming.*

STRATEGY FOR AVOIDING ENDING WITH A VERB

End Verb (Bad):

Java is now the programming language WHICH developers in North America USE most.

Reduced Relative Clause (Better):

Java is now the programming language USED most BY developers in North America.

Ex. 6 Study the information about a reduced relative clause. Read the sentences and underline the relative clauses.

1 This model predicted a decrease in UVI adsorption, which was consistent with experimental data.

2 Table 3 shows the instructions distributed to the service personnel for dealing with hazmat waste disposal.

3 We can also infer here that companies which focused on stock management utilised significantly less external finance than A and B type companies.

4 Three new exemptions apply to specific types of equipment that are manually operated.

5 The total amount of infrared radiation which is emitted by the earth's surface is difficult to measure.

6 The temperature of the earth is determined by the amount of incoming solar radiation that reaches and heats its surface.

7 The amount of incoming solar radiation received at the Earth's surface is given by the following equation.

8 It may also be necessary to pay special attention to stakeholders whose influence on the project is likely to increase.

9 This evidence suggests that companies focusing upon cash management routines had fewer sales on cash.

10 Data collected at the retail outlets is then quickly fed back to the warehouse where models are continuously updated.

11 Whilst companies doing the least working capital management were not found to be associated with an interest in firm growth, their counterparts who focused on credit management reported an interest in firm growth.

13 Holden, Smith and Devins highlight a case study on a medium-sized publishing firm based in the UK. With assistance from EU funding, the firm established a learning center equipped with PCs, video conferencing and a tutor. The learning center was set up in order to promote the concept of learning across the full extent of the organization. Whereas in the past, training programs may have been reserved for those higher up the corporate ladder, the approach taken was to promote learning as an organization-wide activity open to all. Indeed, this "opening up" of learning within the company had the greatest effect on those staff working on the shop floor , who soon took to the view that the company was actively interested in their development and prospects. The result? Higher levels of employee motivation and satisfaction.

Language Focus

Transition phrases

Transition phrases are used to make academic texts easier to follow. They highlight connections between different parts of a text. These expressions refer the reader to what was written earlier in the same text.

As was mentioned in the Introduction.....

As described in the previous section.....

As discussed above,....

As explained earlier,....

As stated above,...

In addition to the above,...

Ex. 7 Write five sentences suitable for the Discussion section of your article. Give possible explanations for the results you described in Results section (Unit 7) Use the sentence openers and transition phrases

Ex. 8 Exchange your texts with a partner who works in your area of specialism. Read your partner's text. Suggest any possible limitations of the study. Write two or three sentences using the expressions from the unit.

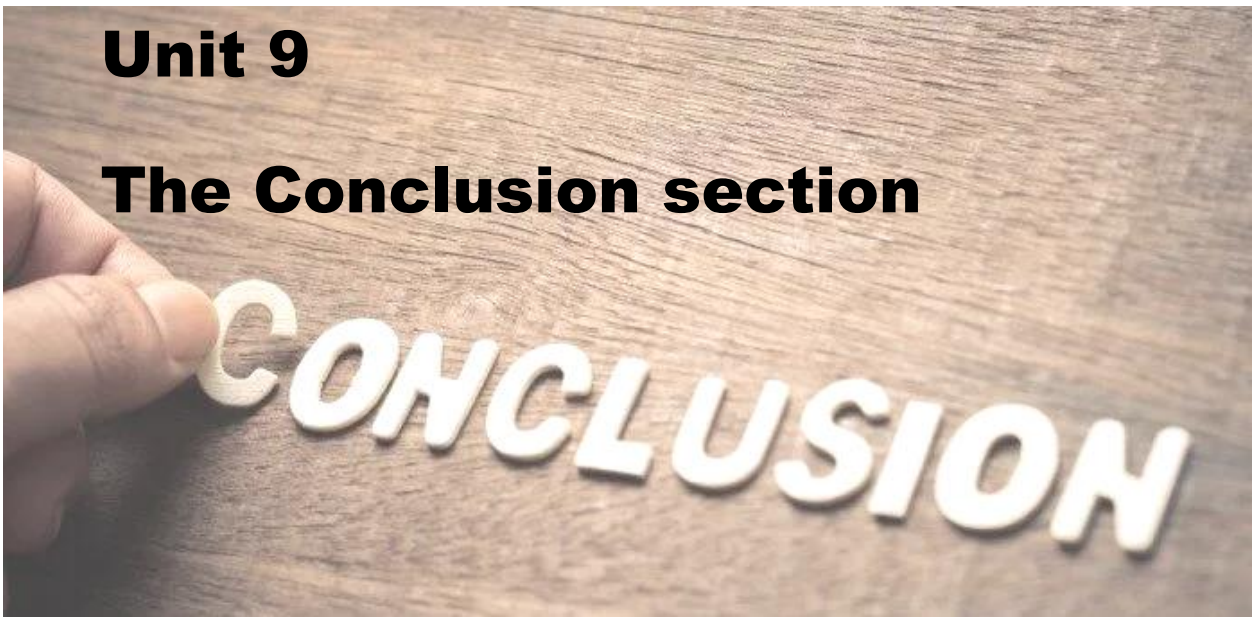
Project work

Find two articles in your research area, one in English, one in your native language. Read the Discussion sections in both. Underline all the examples of sentence openers and transition sentences. Analyse the structure of the Discussion section.

Concept check

1. What is the primary purpose of the discussion section in a research paper?
2. How does the discussion section contribute to the overall structure of a research paper?
3. What key elements should be included in the discussion section?
4. Why is it important to avoid introducing new results in the discussion section?
5. What strategies can be used to effectively summarize the key findings in the discussion section?
6. How can researchers ensure that their interpretations in the discussion section are grounded in the data?
7. What role does the literature review play in shaping the discussion section?

8. Why is it important to discuss the implications of the research findings in the discussion section?
9. What are some common pitfalls to avoid when writing the discussion section?
10. How should limitations be addressed in the discussion section?
11. What considerations should researchers keep in mind when making recommendations in the discussion section?
12. How does the discussion section differ from the results section in a research paper?
13. What strategies can researchers use to effectively organize the discussion section?
14. How does the discussion section contribute to the overall argument or thesis of the research paper?
15. How can researchers ensure that their interpretations in the discussion section align with the research objectives?
16. What are some effective ways to link the discussion section back to the research problem or question?
17. Can you explain the role of critical thinking in the discussion section of a research paper?
18. How can researchers balance objectivity and subjectivity when discussing their findings?
19. What strategies can be employed to engage the reader in the discussion section?
20. Can you provide examples of how to effectively integrate citations and references into the discussion section?
21. What considerations should researchers keep in mind when discussing the practical implications of their findings?
22. How should conflicting or unexpected results be addressed in the discussion section?
23. What role does speculation play in the discussion section, if any?
24. How can researchers ensure that the tone of the discussion section remains appropriate for academic writing?



Lead-in

Work in pairs and choose one or more quotations you like. How it relates / they relate to your own personal and/or professional experience, including expectations, outcomes, disappointments, etc.

- '*Try Again. Fail again. Fail better'*. Samuel Beckett (Irish Writer)
- '*Try not to become a man of success, but rather try to become a man of value'* Albert Einstein
- *'I haven't failed, I've found 10,000 ways that don't work'*. Thomas Alva Edison (American inventor)
- *'I never failed once. It just happened to be a 2000-step process'*. Thomas Alva Edison
- *'The great question is not whether you have failed, but whether you are content with failure'.* (Chinese Proverb, also used by Abraham Lincoln, who lost several elections before he became President of the United States)
- *'There is no such thing as a failed experiment, only experiments with unexpected outcomes'* Richard Buckminster Fuller (American engineer and architect)

HOW TO WRITE THE CONCLUSION SECTION OF THE RESEARCH PAPER

A conclusion is an important part of the paper; it provides closure for the reader while reminding the reader of the contents and importance of the paper. It accomplishes this by stepping back from the specifics in order to view the bigger picture of the document. In other words, it is reminding the reader of the main argument. For most course papers, it is usually one paragraph that simply and succinctly restates the main ideas and arguments, pulling everything together to help clarify the thesis of the paper. A conclusion does not introduce new ideas; instead, it should clarify the intent and importance of the paper. It can also suggest possible future research on the topic. Remember the words of wisdom of Jonathan Shewchuk, professor of computer science at Berkeley: Conclusions should synthesize the results of your paper and separate what is significant from what is not. Ideally, they should add new information and observations that put our results in perspective. Here's a simple test: if somebody reads your conclusions before reading the rest of your paper, will they fully understand them? If the nswer is yes , there's probably something wrong. A good conclusion says things that become significant after the paper has been read. A good conclusion gives perspective to sights that haven't yet been seen at the introduction. A conclusion is about the implications of what the reader has learned. Of course, a conclusion is also an excellent place for conjectures, wish lists, and open problems.

An Easy Checklist for Writing a Conclusion

Is the thesis of the paper accurately restated here (but not repeated verbatim)?

It is important to remind the reader of the thesis of the paper so he is reminded of the argument and solutions you proposed.

Are the main points of the paper addressed and pulled together?

Think of the main points as puzzle pieces, and the conclusion is where they all fit together to create a bigger picture. The reader should walk away with the bigger picture in mind.

Do you remind the reader of the importance of the topic?

Make sure that the paper places its findings in the context of real social change.

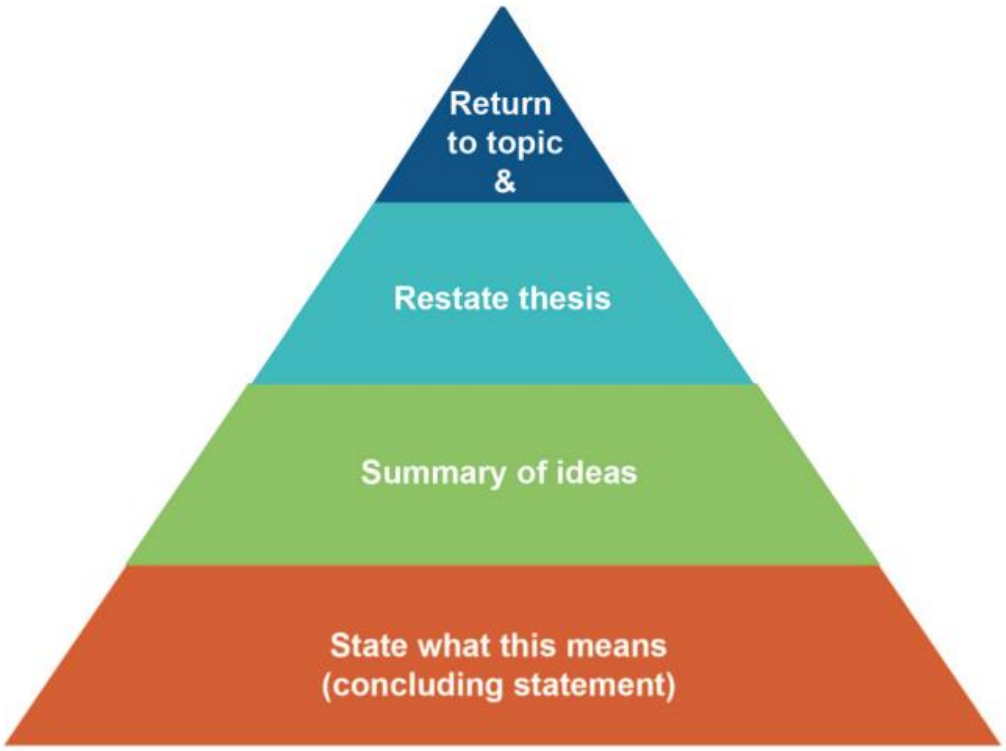
Is there a sense of closure?

Make sure the reader has a distinct sense that the paper has come to an end. It is important to not leave the reader hanging. (You don't want her to have flip-the-page syndrome, where the reader turns the page, expecting the paper to continue. The paper should naturally come to an end.)

Do you avoid presenting new information?

No new ideas should be introduced in the conclusion. It is simply a review of the material that is already present in the paper. The only new idea would be the suggesting of a direction for future research.

Structuring conclusion



Conclusion Dos and Don'ts

DO keep it short and sweet. While there is no hard and fast rule on length, conclusions are typically one paragraph long; however, you may find some that are two or three paragraphs long.

DON'T state the obvious by writing "in conclusion" or "in summary." While these phrases are helpful during oral presentations, context clues should indicate to your reader that they are reading the conclusion of your paper.

DO provide a brief overview of your paper and address whether or not it answers your research questions.

DON'T introduce new information. Instead, your conclusion should restate your main points and provide closure. You may also offer suggestions on how your research can be expanded or improved.

DO mention the limitations of your study and their implications if not already addressed in the discussion section of the paper. Examples of limitations include sample size or composition, participant attrition, study duration, etc. Being transparent about your study's shortcomings is not only ethical--it also helps guide future research; any flaws you've identified can be addressed in the event your study is replicated. All studies have limitations; being up front makes your paper seem credible because you show your understanding of what your study can and cannot say.

Ex. 1 Read Text 1 of a conclusion and identify the main parts of it.

1 return to topic

2 relate thesis

3 summary of ideas

4 state what this means

Text 1

__ (a) Online learning raises more questions than solutions, and the HR professional will bring the necessary human element and organisational perspective to the discussion.

__ (b) Technology has changed the role of the HR professional.

__ (c) The HR professional is needed to ensure that online courses are aligned to organisational goals and individual needs. Software programs cannot adequately implement quality teaching and learning principles, such as assessing a learner's need for practice opportunities, or providing feedback that is relevant to the individual. Consequently, the most successful approaches to using technology have blended self-paced e-learning with traditional face-to-face instruction.

__ (d) Given its complexities and limitations, it is not foreseeable that the computer will entirely replace the human element in the design, delivery and evaluation of training.

Ex. 2 Put the sentences in Text 1 (a-d) in the order you think the authors originally wrote them. What language helps you to do this?

Ex. 3 Read statements 1-8 about the Conclusions section of the research paper. Write T if the statements are true or F if they are false. Compare your answers in pairs.

1 This section is mandatory as part of the article's structure.

2 Within it, the author has the opportunity to provide suggestions for future research.

3 Prioritizing the validity of findings is considered a good approach.

4 This represents the final opportunity to incorporate any forgotten arguments.

5 It is imperative to include a statement regarding the research findings' contribution to knowledge within the relevant field.

6 It ought to incorporate supporting evidence to illustrate the researcher's primary findings.

7 It is recommended to highlight the practical implications of the study in this section.

8 It should present evidence to demonstrate the significance of your findings.

Language Focus

The first thing is to show how your work *could / could not* be applied in another area.

Our findings could be applied quite reliably in other engineering contexts without a significant degradation in performance.

These findings could be exploited in any situation where predictions of outcomes are needed.

Our results could be applied with caution to other devices that …

However, it remains to be further clarified whether our findings could be applied to …

Further studies are needed to determine whether these findings could be applied to components other than those used for …

Suggest future work

a) **will refers to your own planned work**

One area of future work will be to represent these relationships explicitly …

Future work will mainly cover the development of additional features for the software, such as …

Future work will involve the application of the proposed algorithm to data from

b) **should refers to work that you believe could be addressed by the general community**

Future work should give priority to the formation of X...

Future work should benefit greatly by using data on …

c) **making a recommendation**

to recommend (suggest, propose) + that + someone or something + should (optional) + infinitive (without to) + something

We suggest that policy makers should give stakeholders a greater role in …

We suggest that policy makers give stakeholders a greater role in …

We suggest that the manager give stakeholders a greater role in …

We recommend that stakeholders should be given a great role in …

We recommend that stakeholders be given a greater role in …

Ex. 4 Read and analyze Text 2 - the final part of the article on "Representation of NURBS surfaces by Controlled Iterated Functions System automata". Which statements in ex. 3 are true of this Conclusions section?

Text 2

In the research paper, we have shown that NURBS curves and tensor- surfaces can be represented with a Controlled Iterated Function System (CIFS). As most of CAGD-systems are NURBS-based, adding these new surfaces to the CIFS-model is an important progress to a transition from usual CAGD-engineering to a CIFS-modeling. We have shown the associated automaton is finite, and composed of limited number of stationary states. Furthermore, we have provided two methods: the first one generates CIFS-automata that correspond to NURBS of any degree and the second one explains how to trans- pose tensor-product from curves to automata. Once NURBS tensor-surfaces defined as CIFS automata, many in the reactions between them and object that are already defined in the formalism (fractals, subdivision surfaces...) become possible or easier. The main issue NURBS have to face is the management of extraordinary vertices that are usually unavoidable in CAGD- engineering. Sederberg et al. [19] and Müller et al. [20] proposed another solution which is Non-Uniform Rational Subdivision Sur- faces but have been restricted to low-degree (quadratic or cubic) surfaces. Thereafter, Cashman et al. [21] found a way to generalize [19] to high-degree surfaces but only for odd degree. For this purpose, we need to manage non-tensor NURBS sur-faces. Corresponding CIFS-automata should handle the evolution of both knot-vectors (which are no longer limited to two "orthogonal"ones)and the topology of the mesh. For quadratic and cubic cases, the shape (states and transitions) of automata seems to be at the cross of this paper for the non-uniformity and [10] for the management of extraordinary vertices. Coefficients of matrices associated with transitions should be deduced from [19] . Even if low-degree cases may be quite direct to integrate, a real issue will take place with higher degree. This comes from the fact that the neighborhood of vertices needed to compute a piece of surface is composed of a central vertex (for quadratic case) or a central face (for cubic case) and a unique ring of vertices that sur- rounds it. This ring is composed of vertices that share a face with the central vertex or a vertex of the central face. In these cases, the possibilities of irregularities are very limited and can be all listed. For

higher degree, the patch owns several nested rings; thus the possibilities of irregularities are subject to combinatorial explosion. The solution proposed by Cashman et al. [21] for any odd-degree should be closely studied to find a solution to fill this gap.
(Lucas Morlet et al. (2019)Representation of NURBS surfaces by Controlled Iterated Functions System automata https://www.sciencedirect.com/science/article/pii/S2590148619300068)

Ex. 5 Work in pairs. What is the main focus of Text 2? Write out the phrases that express it.

Ex. 6 Read Text 3 on "The Acquisition of Intellectual Expertise: A Computational Model". Which sentence signals the need for further research?

Text 3

In this proposal I have shown results supporting the following two hypotheses: 1) An artificial neural network can be used as a model to investigate how people learn under different training scenarios 2) Different delivery methods result in different overall performance. These results provide new insight into how humans learn complex cognitive tasks. In my Proposed work I intend to test a third hypothesis: 3) Different delivery methods will result in different internal conceptual representations and conceptual development. The results reported in this study, and the proposed dissertation work, will contribute to many fields. For computer science, and artificial intelligence in particular, this research expands the body of existing computational models of human learning and provides a new example of modeling higher-order cognition. We have discovered that priming an ANN can produce higher performance than inputting all the types of data randomly. This discovery can lead to re-evaluating the training design of existing computational models in which performance and efficiency are the primary goals. The results reported in this study have also given cognitive science new understanding of how conceptual development takes place in different types of learning. Educators now have additional evidence that structured, integrated delivery methods are better for learners than oversimplification and isolation of learning tasks. In addition, this work encourages educators and cognitive scientists to focus on analyzing problem examples, to see what their underlying structure contributes to learner categorization and subsequent problem solving.

(Lisa C. Kaczmarczyk, Risto Miikkulainen (2015). The Acquisition of Intellectual Expertise:
A Computational Model
https://nn.cs.utexas.edu/downloads/papers/kaczmarczykcogsci04.pdf

Project work

Develop your Discussion and Conclusion sections. Write 4 -5 sentences describing the limitations of your research and the need for further study.

Exchange your drafts. Read your partner's text and make a list of questions about

• his/her main purpose or hypothesis

• the most important findings

• their interpretation of the results

• the limitations of their study

• the recommendations for future research

• the practical applications of their study.

Work in pairs. Ask and answer the questions.

Concept Check

1. What is the purpose of a conclusion in a paper?
2. How does a conclusion provide closure for the reader?
3. Why is it important for a conclusion to remind the reader of the contents and importance of the paper?

4. What does it mean for a conclusion to "step back from the specifics"?
5. How does a conclusion help clarify the thesis of the paper?
6. Can a conclusion introduce new ideas? Why or why not?
7. What are some potential elements that a conclusion can include?
8. According to Jonathan Shewchuk, what should conclusions aim to do?
9. How can a conclusion add new information and observations to the paper's results?
10. What test can be used to determine if a conclusion effectively summarizes the paper's content?
11. How does a good conclusion differ from the introduction of a paper?
12. What role do conjectures, wish lists, and open problems play in a conclusion?
13. What are some key points to consider when structuring a conclusion?
14. Why is it important to avoid stating "in conclusion" or "in summary" in a conclusion?
15. How can a conclusion provide a brief overview of the paper's main points?
16. What is the significance of restating the thesis in a conclusion?
17. How can a conclusion address whether or not the paper answers its research questions?
18. What should a conclusion focus on, rather than introducing new information?
19. Why is it important to mention the limitations of a study in the conclusion?
20. How can being transparent about study limitations enhance the credibility of a paper?
21. How long is a typical conclusion in terms of paragraph count?
22. What purpose does the checklist serve for writing a conclusion?
23. Why should a conclusion emphasize the importance of the topic?
24. How does a conclusion provide a sense of closure for the reader?
25. Can a conclusion suggest directions for future research? Why or why not?

Unit 10

Academic titles and ranking hierarchy

Lead-in

Discuss the following quotations:

- If you can't explain it simply, you don't understand it well enough.
- To raise new questions, new possibilities, to regard old problems from a new angle, requires creative imagination and marks real advance in science.
- Look deep into nature, and then you will understand everything better.
- Education is what remains after one has forgotten what one has learned in school.
- Most people say that it is the intellect which makes a great scientist. They are wrong: it is character.

(By Albert Einstein)

ACADEMIC TITLES AND RANKING HIERARCHY OF THE UNIVERSITIES

Understanding the academic titles and ranking hierarchy of UK universities is fundamental if you want a smooth start to your PhD. It is important to note that not all UK universities follow the same terminology for academic titles. This is

especially the case among Russell Group universities such as the London School of Economics (LSE) and University College London (UCL). Despite this, they still resemble their more traditional titles, so it is still possible to distinguish the position and academic rank of a member of staff.

PhD Student

A PhD student is a postgraduate who is actively undertaking a research degree with a recognized institution. The length of their studies depends on both their discipline and whether they are enrolled in a full or part-time program. Usually, a PhD student will spend three to four years completing their degree. During this time, they will undertake original research, produce a thesis and defend their work during an interview known as a 'viva'. Besides this, they may also attend seminars and conferences, deliver presentations to their industry and collaborate with external institutions. Upon successfully completing their doctorate, the individual will carry the title of Doctor (denoted by the initials 'Dr'). This is true for all individuals regardless of which discipline their research relates to. It's worth noting that although a PhD is the most common doctoral degree, doctorate students could be anyone undertaking a DPhil, DBA, DProf, EdD, EngD, MD etc.

PostDoc Research Fellow/Research Assistant

A PostDoc Research Fellow or Research Assistant is a postgraduate doctorate holder working in research. Whilst both positions undertake similar work, a PostDoc Research Fellow typically has greater independence and responsibilities. This means they can influence the overall direction of the research, and whilst a Research Assistant can do so as well it will be to a lesser extent.

Assistant Lecturer

An Assistant Lecturer is the most junior teaching position regarding the overall ranking of academic titles. They are usually only temporary positions, such as an individual covering for another lecturer during a period of absence. Some Assistant Lecturers will be PhD students on Graduate Teaching Assistantships (GTAs). GTAs are programs which, alongside their studies, require a doctoral student to assist in the learning of undergraduate students. This will typically involve leading tutorials,

marking coursework and hosting laboratory sessions. Besides this, they may also support lectures if their knowledge and relevant experience allow for it.

Lecturer

A Lecturer is also considered a junior academic staff member. Their primary responsibilities are on meeting the educational needs of students. As such, their most common duty is to teach but may also extend to undertaking research and minor administrative tasks. Most lecturers will be PhD holders and so would be referred to as 'Dr'. However, this isn't always the case with some individuals who haven't undertaken a doctorate but still possess extensive experience and knowledge to teach. Although these individuals are few, they are more common in non-STEM fields.

Senior Lecturer

The responsibilities of a Senior Lecturer extend further than that of a normal Lecturer, with the addition of leading and supervising research and greater administrative tasks.

Reader

A Reader is an academic individual with both senior-level experience and an international reputation for their academic or research contributions. In terms of hierarchy, they are more distinguished than Senior Lecturers, largely because of their international presence, but below Professors due to not having yet contributed as a substantial amount. Interestingly, universities established after 1992 use the title 'Principle Lecturer' in place of Reader. Other than the terminology, the titles refer to the same position. Note: Some universities adopt the academic title 'Associate Professor' instead of Senior Lecturer.

Professor

A professor is the highest academic title and denotes an individual at the top of their respective field. This individual would have made significant scholarly contributions to their field. In EU countries such as Germany and France, a faculty member has to sit and pass a review before they can become a Professor. This review is undertaken by a panel of highly experienced academic professionals and requires the individual

to produce a document outlining their contributions to their field before they can even be considered. In the UK, a different approach is taken. Rather than being appointed by an independent review, it instead comes down to the university's discretion whether they should be upgraded to a full professorship. However, nearly all UK universities mirror a very similar review process, with some universities also utilizing independent panel members to ensure fair professoriate decisions are made. According to the Higher Education Statistics Agency (HESA), approximately one in ten academic teaching staff members is a Professor.

Named Professor

A Named Professor is a Professor who has the honour of sitting in a 'chair'. A 'chair' is a position named after an individual who made significant achievements in their field, and in some cases, dates back to individuals in the 16th century. Being a Named Professor is a prestigious professorship reserved for academics who have made achievements beyond that of a typical Professor role. Some universities, such as the University of Sheffield, adopt the academic title 'Honorary Professor' instead of Named Professor.

Head of Department

The Head of Department provides academic leadership to the department and is responsible for ensuring it upholds its high standards. The key activities of a Head of Department will differ depending on the breadth of its discipline and number of staff. However, their responsibilities will include ensuring the development of students, maintaining department-wide communication and overseeing research opportunities, financial management and overall quality assurance etc.

Faculty Dean

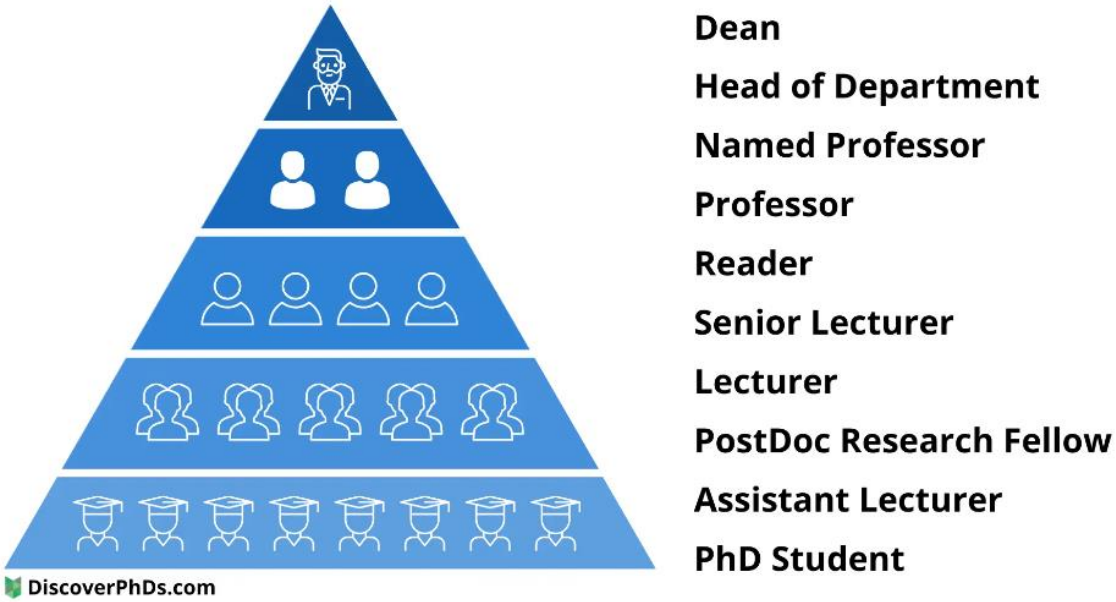
A Dean is in charge of the academic administration of a collection of related university departments known as a faculty.

There are many responsibilities to being a Dean, including:

- Representing all permanent staff members of the faculty.
- Undertaking strategic planning for the faculty's direction and growth.
- Participating in internal review panels for staff title promotions.

- Lead research initiatives and facilitating faculty collaborations.

Academic Titles and Ranks in UK Universities



UK vs US Academic Titles

Table comparing academic titles in UK and US universities.

United Kingdom	**United States**
Undergraduate	Undergraduate
Postgraduate	Graduate
Postdoc	Postdoc
Lecturer	Assistant Professor
Senior Lecturer / Reader	Associate Professor
Professor	Full Professor

Other (not as common) Professor Positions

Although not as common, a few universities also make use of the following titles:

Visiting Professor – A Visiting Professor is a professor who teaches on a short-term basis at one university, but officially belongs to another university.

Professor Emeritus – A Professor Emeritus is an academic title in the UK given to retired professors who have made distinguished contributions to their field. Professors who are given this title usually continue to work with their university voluntarily.

Research Professor – A Research Professor is a full professor who specializes in research. Although they may teach from time to time, they will usually have very little 'formal' teaching responsibilities.

Adjunct Professor – An Adjunct Professor is a professor who primarily focuses on teaching and has a non-permanent contract. They are typically non-tenured faculty positions and form most of the academic positions in US Higher Education Institutions.

 **Ex. 1 Read and complete the text with the words from the box. Use the explanation given in the parentheses.**

assessment, differ, controversial, portfolio, misconduct, disputed, permanent, probation, excellence, responsibilities, challenging the work, appointment, legal rights, determine, evaluation, being granted, explicitly, replacements, compete, arguments, promotion, to carry out, application

What Does Tenure Mean?

Tenure is a term used to describe a ***1)*****_____***(lasting for a long time or forever)*** job position given to a university professor. Tenure gives a professor a number of institutional and ***2)*****_____***(allowed by the law)*** rights which provide them with 'academic freedom'. These academic freedoms can ***3)*****_____***(to be not like something or someone else, either physically or in another way)*** between universities but mainly center around allowing them ***4)*****_____***(to perform or complete a job or activity)*** any academic research, regardless of whether it may be in unpopular topics, surround ***5)*****_____***(causing disagreement or discussion)*

theories or involve ***6)_____*** *(difficult, in a way that tests your ability or determination)* of others, without fear of losing their job. Having tenure as an academic staff member, which is also called being in a tenure track ***7)_____*** *(the act of officially choosing someone for a job, or the job itself)*, typically means you can only be dismissed for grave ***8)_____*** *(unacceptable or bad behaviour by someone in a position of authority or responsibility)*. This is why most see tenure as a job for life.

Tenure in United States

While tenure is by far most commonly adopted in the US, not all American universities adopt it as part of their higher education policies. For those that do, their staff members are expected to work in a period of ***9)_____*** *(a period of time at the start of a new job when you are watched and tested to see if you are suitable for the job)* for six to seven years before sitting a review to ***10)_____*** *(to make a strong decision)* whether they should be awarded a tenure track professorship. Within these six to seven years, professors will be expected to develop a ***11)_____*** *(a particular collection of articles or papers that represent a person's work)* of published research papers, have acquired funding grants and have demonstrated administrative and teaching excellence.

After their probationary period, the professor will undergo an intense external review process; similar to how a UK university lecturer is assessed when being considered for ***12)_____*** *(the act of raising someone to a higher or more important position or rank)* to an associate professor. The head of a department will recommend a tenure review to the faculty dean, who will then appoint a committee to undertake the review. The committee will gather information from the candidate, such as their CV, publication record and teaching portfolio, and from senior professors, such as a letter of review or short ***13)_____*** *(the process of judging something's quality, importance, or value)* report. A decision is then made based on this information, and if the candidate is successful, they will be granted a tenured position within the faculty. However, if the ***14)_____*** *(an official request for something, usually in writing)* process is unsuccessful, the faculty member's contract

won't be renewed and they'll need to look for employment elsewhere. Although a tenure decision can be ***15)*** _____*(an argument or disagreement, especially an official one),* in reality, this very rarely happens.

It's interesting to note that each university weighs the tenure process ***16)***_____*(the process of testing, and making a judgment about, someone's knowledge, ability, skills, etc.)* criteria's slightly differently. For example, smaller universities typically place more merit on teaching ability, whereas larger universities usually place a higher value of success on research ***17)***_____*(the quality of being excellent)* and your ability to increase the university's reputation.

Tenure in United Kingdom

The tenure track system used to form part of the higher education policies in the UK, however, it was removed in the late '80s. Nowadays, UK universities adopt temporary and permanent contracts which come with their own ***18)***_____*(something that it is your job or duty to deal with)* and level of academic freedom and job security. While it may not be ***19)***_____*(in a way that is clear and exact)* stated, any academic staff member on a permanent contract, whether they're a lecturer, professor or reader etc., will be regarded as in an open-ended position, giving them academic freedom to research and teach as they see fit.

Besides academic freedom, one of the main ***20)***_____*(the process of explaining these reasons)* for tenure is the job security it provides is necessary for attracting high-quality individuals into higher education. Because universities can't ***21)***_____*(to try to be more successful than someone or something else)* with the private sector in terms of pay, they need to offer alternative benefits if they hope to have a chance of competing with private companies, given they'll all be recruiting from the same talent pool.

Interestingly, job security also works both ways in academic settings. As well as the professor ***22)***_____*(to give or allow someone something, usually in an official way)* stability, the university will be given the stability in the form of an individual capable of securing grants, leading research and publishing papers within a highly specialized field. Finding ***23)***_____*(the process of replacing something with*

something else) with the same knowledge, experience and specialization is extremely difficult, and as a result, the grants and research projects the individual was securing typically leave with them.

Ex. 2 Work in small groups and discuss whether you agree or disagree with the statement "Tenure provides job security and academic freedom for university professors." Provide reasons to support your opinion, share it with the class.

Ex. 3 Read the text and answer the questions. Discuss the advice on how to prepare for the PhD Viva.

5 Tips for Preparing for Your PhD Viva

You've just passed a massive milestone: writing and submitting your PhD thesis. This has been the culmination of at least three years of work and is definitely a cause for celebration. But the journey's not fully over just yet – you still have the viva to pass. In the UK the viva usually lasts a few hours and involves a detailed discussion of your thesis with two expert examiners; your primary supervisor may or may not sit in this. Expect the viva to be tough – you'll need to be able to defend your PhD thesis and respond to questions designed to probe your understanding of your subject. But if you prepare for it well, you're likely to come out of it having had an enjoyable experience discussing your work with people genuinely interested in your project.

Here are some tips to help you prepare for the day.

1. Know Your Thesis

You should expect your examiners to have spent a considerable about of time going through your PhD thesis and the content of it will be fresh in their mind; make sure it's fresh in yours too. Yes, you're the one that's written it but, if you've planned well, you may have written some of your chapter content quite a while ago. Equally,

I would definitely recommend checking to see if any new papers in your field have been published since writing your chapters and submitting your thesis.

2. Know Your Examiners

Your examiners will be experts in their fields, and at least one (if not both) will be experts in the same field of your research. Make sure you look up papers they've published and think about how they fit in with your work. It's likely that some of their line of questioning in the viva will be based around their contributions to the research area.

3. Think of Possible Questions

It's a good idea to spend time with your supervisor to think of possible questions the examiners may ask you. In particular, can you predict the tough questions that might come your way and how you might best answer them? Are there any areas within your work that you would consider as limitations for your studies and that you should be prepared to acknowledge? Some preparation here and even a mock interview will go a long way in making the actual thing feel easier.

4. Bring a Copy of Your Thesis

Make sure you have your own printed copy of your PhD thesis that you bring along with you to the viva. Make notes and highlight pages and sections within it that you especially want to bring attention to. You might also find it useful to print separate larger copies of key results (e.g. graphs or figures) that you think would be useful to discuss. Some props that help explain concepts (if relevant) can also be a brilliant way to guide the discussions to areas you're most comfortable with.

5. Focus on Your Strengths

Try to view the viva as an opportunity to showcase the new knowledge you have added to your field of research. Focus on the positives that have come out of your work; all projects will have some areas of weakness but there's no need to highlight these to your examiners unless directly asked about them. Coming into your viva with one or two papers published (if possible) is a great positive – it'll give you confidence that your work has already stood up to peer-review and is a very good way to present your contributions to research.

(From https://www.discoverphds.com/blog/preparing-for-phd-viva)

1. How can candidates effectively refresh their understanding of their thesis content before the viva?
2. What steps can candidates take to familiarize themselves with the research contributions of their examiners?
3. In what ways can candidates anticipate and prepare for challenging questions during the viva?
4. Why is it important for candidates to bring a printed copy of their thesis to the viva?
5. How can candidates use props, such as graphs or figures, to enhance their discussion during the viva?
6. What are some strategies candidates can use to focus on showcasing their strengths during the viva?
7. Can you explain the significance of having published papers before the viva in terms of presenting research contributions?
8. How might candidates leverage their supervisor's expertise to prepare for the viva?
9. What are some potential limitations candidates should be prepared to discuss during the viva?
10. How can candidates ensure they maintain confidence and composure during the viva discussion?

Ex. 4 Read and discuss the text. Decide if the statements are True or False.

PhD Imposter Syndrome

Many students in the postgraduate world, particularly at the PhD level, suffer from impostor syndrome, or the feeling of being incompetent. Despite its prevalence, this psychological condition is frequently misunderstood. So, exactly what is impostor

syndrome? Is it a constraint? Or is it just a normal part of life that everyone goes through? And how do you deal with this feeling if it affects you?

What is Imposter Syndrome, and what triggers it?

If you're a PhD student, you're probably aware of the dangers of impostor syndrome. It can cause you to withdraw from social circles, avoid tasks, or frequently change your point of focus. It can even slow your progress.

Impostor Syndrome is a psychological condition that occurs when a person believes he or she is not good enough and must prove their worth to others. This syndrome is common among people who have accomplished something significant, especially if they do so early in life.

It is common to feel as if you have failed if you do not succeed on the first try. If you've ever experienced this syndrome, you know how difficult it is to overcome.

Techniques to deal with PhD Imposter Syndrome

Imposter syndrome is a psychological reaction to high-pressure situations. PhDs are often characterised by intellectual complexity, lofty expectations, and little separation between professional and personal life. While it can be difficult to deal with at times, it is worthwhile to investigate techniques to deal with imposter syndrome in order to keep it from limiting your progress. If you're stressed out about not being able to meet the standards you've set for yourself, try incorporating the following.

First, recognise that you are not alone in your feelings. Rather than denying the sensation, try to separate it from reality by learning to identify the sources of your imposter feelings. Being objective about your own achievements and accomplishments is the most effective way to address imposter feelings. To achieve this, ask for feedback from others, whether it be your supervisor or your fellow researchers.

Second, try to manage your expectations of yourself as well as any negative self-talk. If you believe you are incapable of completing your PhD, you will be less confident in your ability to tackle it. Remember that you were chosen for this PhD

based on your academic achievements. Identify your specific accomplishments and write them down or post them somewhere visible. When you have doubts or lack confidence, look at them. The more you remind yourself of your accomplishments, the better you will be able to combat impostor syndrome symptoms.

Third, try to focus on the tasks that you need to complete and set short-term goals. Don't worry about what others think of you and what you've done. Instead, concentrate on what you need to do and what you want to accomplish. Learn how to manage your time and energy effectively so that you can work efficiently. Keep a journal and write down your thoughts and feelings. If you're feeling anxious or having a hard time focusing, you may need to take a break or switch things up by concentrating on the next task at hand.

Fourth, discuss your feelings with your peers and PhD supervisor. It can be beneficial to speak with someone who has gone through a similar experience as you. They can give you advice, help you understand what you're going through, and show you that you're not alone.

Realise no one is perfect

Regardless of whether you're just starting your PhD programme or are already a few years into one, it's not uncommon to experience feelings of worthlessness. But keep in mind that no one is perfect, and research is littered with dead ends and failed experiments. Knowing your limits is critical for your mental health and self-esteem. Most challenges can be overcome by perseverance, seeking support from others, and learning from their experiences.

The future depends on your work, and nothing is ever perfect.

(From: https://www.discoverphds.com/blog/phd-impostor-syndrome)

Statements:

1. Impostor syndrome is only experienced by undergraduate students.
2. Impostor syndrome can cause individuals to withdraw from social circles.
3. Impostor syndrome is a psychological condition where a person believes they are not competent.

4. Impostor syndrome is common among people who have not accomplished anything significant.

5. Seeking feedback from others can help in addressing feelings of impostor syndrome.

6. It is not important to manage your expectations or negative self-talk when dealing with impostor syndrome.

7. Keeping a journal and writing down thoughts and feelings is not a helpful technique for managing impostor syndrome.

8. Discussing feelings with peers and supervisors is not recommended when dealing with impostor syndrome.

9. It is uncommon to experience feelings of worthlessness during a PhD program.

10. Research is always perfect and without any challenges.

Concept check

1 Why is it important to understand the academic titles and ranking hierarchy of UK universities?

2 What is the primary responsibility of a Lecturer in academia?

3 How does the role of a Senior Lecturer differ from that of a Lecturer?

4 What distinguishes a Reader from a Senior Lecturer?

5 What are the responsibilities of a Professor in academia?

6 What is the significance of being a Named Professor in academia?

7 Compare UK and US academic titles.

8 What are some alternative professor positions in addition to the standard professorship?

9 What is tenure, and what does it provide to university professors?

10 How does the tenure process differ between the United States and the United Kingdom?

11 What criteria are typically considered during the tenure review process?

12 Why is academic tenure considered necessary for attracting high-quality individuals into higher education?

13 What challenges do universities face when trying to compete with the private sector in terms of attracting talent?

14 How might the departure of a professor impact the grants and research projects of a university?

15 What is impostor syndrome, and how does it affect PhD students?

16 What are some common symptoms of impostor syndrome among PhD students?

17 How does impostor syndrome manifest in the academic and personal lives of individuals?

18 What are some techniques for dealing with PhD impostor syndrome?

19 Why is it important for PhD students to recognize that they are not alone in their feelings of impostor syndrome?

20 How can managing expectations and negative self-talk help combat impostor syndrome?

21 Why is setting short-term goals and focusing on specific tasks important for overcoming impostor syndrome?

22 How can journaling help PhD students manage impostor syndrome symptoms?

23 What role can discussing feelings with peers and supervisors play in addressing impostor syndrome?

24 What is the significance of realizing that no one is perfect in the context of dealing with PhD impostor syndrome?

Academic vocabulary

A

abstract n a summary of the contents of a book, article, or speech

acknowledge v accept or admit the existence or truth of something

address v to give attention to or deal with a matter or problem

advance v to go or move something forward, or to develop or improve something

applied adj relating to a subject of study, especially a science, that has a practical use

apply v to use something for example, a law in a particular situation

apply for phr v to request something, usually officially, especially in writing or sending a form

approximately adj more or less, not exactly

assess v to judge or decide the amount, value, quality or importance of something

associated (with) adj be connected to

assume v to think that something is likely to be true, although you have no proof

assumption n something that you think is true without having any proof

attempt v to try to do something, especially something difficult

axis n a line or a graph used to show a position of a point

B

background n the conditions that existed before a particular event happened, and that help to explain why it happened

bar chart n a mathematical picture in which different amounts are represented by thin vertical or horizontal rectangles that have the same width but different heights or lengths

body n a large amount of something

C

call for papers phr an announcement inviting people to send a proposal (= a written suggestion) for a talk that they would like to give at a conference (= a large, formal event at which people meet to discuss a particular topic) or for a scientific report that they would like to be included in a book or magazine

case study n a detailed account giving information about the development of a person, group, or thing, especially in order to show general principles

claim v to say that something is true or is a fact, although you cannot prove it

clarification n an explanation or more details that makes something clear or easier to understand

collaborate v to work with someone else for a specific purpose

combine (with) v 1. to exist together, or to join together to make a single thing or group; 2. to do two activities at the same time

concise adj giving a lot of information clearly in a few words

conclusion n the opinion you have after considering all the information about something

conduct v to organise and perform a particular activity, e.g. an experiment

consistent adj always behaving or happening

contribute v to give something in order to provide or achieve something together with other people

correlation n a connection or relationship between two or more facts, numbers, etc.

correspond v to match or be similar of equal

credibility n the fact that something can be believed or trusted

criterion (plural: criteria) n a standard by which you judge, decide about or deal with something

critical adj of the greatest importance to the way things might happen

crucial adj extremely important or necessary

cutting edge adj very modern and with all the newest features

D

data n information from research or a survey

deadline n a time or day by which something must be done

decline v to become less, worse or lower than before

define v to explain and describe the meaning and exact limits of something

degree n a course of study at a college or university, or the qualification given to a student who has done this course, e,g, BA, MA, PhD, etc.

demonstrate v to show or prove that something exists or is true

digital pointer n an object you use to point at something that is using an electronic system that changes images into signals in the form of numbers before it stores them or sends them

dimension n a measurement of something in a particular direction, especially its height, length, or width

discipline n a particular area of study, especially a subject studied at a college or university

dissemination n spreading or giving out to a lot of people, e.g. dissemination of research results

E

e-conference n e conference held online

editor/editorial board n a person/people who is in charge of a newspaper, magazine, etc. and decides what will be published in it

educational platform

e-learning

emphasise v to make something clearer

empirical adj based on what is experienced or seen, rather than on theory

enhance v to improve the quality, amount or strength of something

enrol v to put yourself or someone else onto the official list of members of a course, college or group

equal opportunity n the principle of treating all people the same, and not being influenced by a person's sex, race, religion, etc.

escalate v to become greater or more serious

ethics n a system of accepted beliefs that control behaviour, e.g. *research ethics*

evaluation (critical evaluation) n process of judging or calculating the quality, importance, amount, or value of something

evidence n facts, information, documents, etc. that give reason to believe that something is true

executive summary n a short text that gives the most important facts or ideas contained in a longer document such as a report, study, or plan

explore v to search and discover about something

express an opinion give one's opinion on something

extensive adj covering a large area, having a great range

F

facilities *pl n* the buildings, equipment and services provided for a particular purpose

feasibility n whether something can be made, done, or achieved, or is reasonable

feedback n information or statements of opinion about something, such as a new product, that can tell you if it is successful or liked

finding n a piece of information that is discovered during an official examination of a problem, situation, or object

forum n a situation or meeting in which people can talk about a problem or matter especially of public interest

foster v to encourage the development or growth of ideas or feelings

footnote n a note printed at the bottom of a page that gives extra information about something that has been written on that page

funding n money given by a government or organization for an event or activity

G

guidelines for authors information intended to advise people on how something should be done or what something should be

grant n an amount of money given especially by the government to a person or organization for a special purpose

H

histogram n a mathematical picture that uses vertical columns of different heights to show ranges of weight, height, time, etc. or frequencies (= how many times something happens). A histogram does not usually have spaces between the columns

host organization a place or organization that provides the space and other necessary things for a special event

hypothesis n an idea or explanation for something that is based on known facts but has not yet been proved

I

identify v to recognize a problem, need, fact, etc. and to show that it exists

illustrate v to show the meaning or truth of something more clearly, especially by giving examples

impact n a powerful effect that something, especially something new, has on a situation or person

implication n an occasion when you seem to suggest something without saying it directly

implement v to put a plan or system into operation

increase v to (make something) become larger in amount or size

indicate v to show, point, or make clear in another way

interaction n an occasion when two or more people or things communicate with or react to each other

interdisciplinary adj involving two or more different subjects or areas of knowledge

interrelated adj connected in such a way that each thing has an effect on the others

invest v to put money, effort, time, etc. into something to make a profit or get an advantage

investigation (= research) n the act of examining something

carefully, esp. to discover the truth about it

J

journal n a magazine, newspaper, or website containing news and information about a particular industry or profession

K

kernel n the most important part of something, although it might not always be easy to find

keynote speaker n the person who gives the keynote address at a large meeting

L

launch v to begin something such as a plan or introduce something new such as a product

limitations (of research) n if someone or something has limitations, that person or thing is not as good as they or it could be

line graph n a drawing that uses lines to show how different pieces of information are related to each other

M

make an impact on/in phr have a powerful effect on a situation or person

make predictions phr to make a statement about what you think will happen in the future

meet expectations phr satisfy standards or hopes

multidisciplinary adj involving different subjects of study in one activity

manuscript n the original copy of a book or article before it is printed

N

Named Professor a professor who has the honour of sitting in a 'chair', a position named after an individual who made significant achievements in their field

O

objective n something that you aim to do or achieve

object (of research) n a thing or a phenomenon that is researched

OSS open source software

outcome n a result or effect of an action, situation

overview n a short description of something that provides general information about it, but no details

P

panel n a small group of people chosen to give advice, make a decision, or publicly discuss their opinions as entertainment, e.g. a panel session

peer review n a system in which people you work with report on your performance so that you and

your managers know areas that you need to improve, or an occasion when this happens

peer-reviewed article/journal having been read and checked by another scientist or expert working in the same

persistent adj lasting for a long time or difficult to get rid of

pie chart n a way of showing information about how a total amount is divided up, consisting of a circle that is divided from its centre into several parts

plenary n a meeting at which all the members of a group or organization are present, especially at a conference

predict v to say what you think will happen in the future

prediction n when you say what you think will happen in the future

project development n the process of creating a project

proof-reading n the process of finding and correcting mistakes in text before it is printed or put online

proposal n a suggestion, sometimes a written one

propose v to offer or suggest a possible plan or action for other people to consider

Q

qualitative adj relating to the quality of an experience or situation rather than to facts that can be measured

quantitative adj related to information that can be shown in numbers and amounts

query n a question, often expressing doubt about something or looking for an answer from an authority

questionnaire n a list of questions that several people are asked so that information can be collected about something

quote v to repeat the words that someone else has said or written

R

rationale n the reasons or intentions that cause a particular set of beliefs or actions

reference n a writer or a book, article, etc. that is mentioned in a piece of writing, showing you where particular information was found

replicate (an experiment) v to make or do something again in exactly the same way

revise/revision to change or correct something, esp. a piece of writing

research gap n a lack in research that means something is not complete

review v a piece of writing that describes the main facts in a piece of academic research (= detailed

study of a subject) that you have read, and gives your opinion of it

S

sample n a small amount of a substance that a doctor or scientist collects in order to examine it

scatter plot n a graph with points representing amounts or numbers on it, often with a line joining the points

scope n the range of a subject covered by a book, programme, discussion, class, etc.

scientist n an expert who studies or works in one of the natural sciences

school n a college or university or the time that a student spends there

scholar n a person who studies a subject in great detail, especially at a university

scholarship n an amount of money given by a school, college, university, or other organization to pay for the studies of a person with great ability but little money

session n a period of time or a meeting when a particular activity takes place

speculation n the activity of guessing possible answers to a question without having enough information to be certain

state v to officially say or write something

statement n something that someone says or writes officially, or an action done to express an opinion

state-of-the-art adj very modern and using the most recent ideas and methods

strand n a continuous element, e.g. in a project

submit v to give or offer something for a decision to be made by others

submission n the act of giving something for a decision to be made by others, or a document formally given in this way

survey n an examination of opinions, behaviour, etc., made by asking people questions

sustained adj 1. continuing for a long time 2. determined

T

technique n a way of doing an activity which needs skills

tenure n the right to remain permanently in a job, especially as a teacher at a university

trait n a particular characteristic that can produce a particular type of behaviour

trend n the general direction of changes or developments

U

utterance n to express your ideas or feelings in spoken word

V

validity n the quality of being based on truth or reason, or of being able to be accepted

variable n a number, amount, or situation that can change

variation n a change in amount or level

venue n the place where a public event or meeting happens

virtual learning environment n a system for learning and teaching using the internet and special software

visual n something such as a picture, photograph, or piece of film used to give a particular effect or to explain something

viva n a spoken exam for a university qualification

W

webinar n an occasion when a group of people go on the internet at the same time to study and discuss something

workshop n a meeting of people to discuss and/or perform practical work in a subject or activity

Tapescripts

Unit 2 The structure of Academic Research

Your dissertation is probably the longest piece of writing you've ever done, and it can be intimidating to know where to start. This video will help you work out exactly what to include and where to include it.

Dissertations can take many different forms. You might include different chapters or use different headings depending on the type of research you're doing. But for empirical research in the sciences or social sciences, this is the most common structure: title page, acknowledgements, abstract, table of contents, list of abbreviations, glossary, introduction, literature review, methodology, results, discussion, conclusion, reference list, and appendices.

How long should each section be?

This is a really common question, although it really depends on the type of research you do. Here's a rough idea of the proportions. Generally speaking, the literature review and discussion should take up a bigger portion of your dissertation, whereas the methodology, results, and conclusion are usually relatively short.

Now let's go through each section. The very first page of your document contains your dissertation's title, your name, department, institution, degree program, and submission date.

The Acknowledgement page is where you thank everyone who helped you, like your supervisors. The Acknowledgements are then followed by an abstract. The abstract is a short summary of your dissertation, normally around 150 to 300 words.

You can include a table of contents, so your readers can easily navigate through your dissertation. If your dissertation contains a lot of figures, tables, or abbreviations, you can also include lists of these to make them easily findable. But this is often optional. Same goes for glossary. It's optional. But if you've used a lot of highly specialized terms that will not be familiar to your reader, it might be a good idea to include one.

Now we've arrived at the most important part, the text of your dissertation itself. The Introduction is where you set up your topic, purpose, and relevance, and tell the reader what to expect in the rest of the dissertation.

In your literature review, you don't just summarize existing studies, but develop a coherent structure and argument that leads to a clear basis or justification for your own research.

In the Methodology section, you describe how you conducted your research, allowing your reader to assess its reliability and validity.

Next, you report the results of your research. Only report results that are relevant to your objectives and research questions. Pay attention. If you're doing qualitative research, this section might be woven together with discussion.

In the Discussion, you explore the meaning and implications of your results in relation to your research questions. Here you should interpret the results in detail, discussing whether they met your expectations. If any of the results were unexpected, offer explanations for why this might be.

The dissertation conclusion should concisely answer the main research question, leaving the reader with a clear understanding of your central argument.

If you want to include any documents that don't fit into the main body, such as surveys, interview transcripts, etc., you can add them as appendices.

Now before you go, here's a tip to kickstart your dissertation. Create a Word document. Insert the headings of each section. Write down and bullet points what you want to write in each section. This way, you will have a clear view of what you need to write.

Unit 4

Ex. 4 How to Write a Dissertation Introduction

The introduction is the first chapter of your thesis, so it's essential to draw the reader in with a strong introduction. Set the stage for research with a clear focus, purpose, and direction. The introduction should include these five things. Topic and context.

Focus and scope. Relevance and importance. Questions and objectives. Overview of the structure. I'll go through them one by one, so stay tuned!

Hi, I'm Jessica from Scribbr, here to help you achieve your academic goals. Before you start, although the introduction comes at the beginning of your dissertation, it doesn't have to be the first thing you write. In fact, it's often the very last part to be completed, once you have a clear idea of the text you're introducing.

Begin by introducing your topic and giving any necessary background information. It's important to place the topic in context, showing why the topic is timely or important. For example, our topic is young people's attitudes to climate change, and the context could be a relevant news item.

After a brief introduction to your general area of interest, narrow your focus and state the scope of your research. For example, what time period does your research cover? What demographics or communities are you researching? In our example here, we're focusing specifically on British teenagers' engagement with climate policy.

It's essential to show your motivation for doing this research. How it relates to existing work on this topic, and what new insights will it contribute? So does it contribute to a theoretical problem or help solve a practical problem? Give a brief overview of the current state of research, citing the most relevant literature, and indicating how your research will address a gap or problem in the field. In the example here, we address a relevant current issue, build on existing literature, and address the gap in the literature. We emphasize the importance of our research in contributing to a better understanding of the topic.

Now moving on to questions and objectives. This is probably the most important part of your introduction. It sets up the expectation of the rest of your dissertation.

You should always clearly state the central aim of your research. For example, your research question could be, how do high school students engage with the UK government's policies on climate change? Your objectives could be, to conduct qualitative research to gain in-depth insight into students' knowledge, perceptions, and actions in relation to climate policy. If your research involves testing hypotheses, you can formulate them along with a conceptual framework here. You can watch this video on how to formulate a good research question.

End with a concise overview of your dissertation structure and summarizing each chapter to clearly show how it contributes to your central aims. One or two sentences should usually be enough to describe the content of each chapter. For an unconventional structure, you might need more space to make it clear how everything fits together.

When your introduction checks off all of the five elements we just covered, congrats, you have a strong introduction. Make sure to drop a like and share with your friends if you find this video helpful. I'll see you in the next video.

Unit 6 Ex. 1 The engineering design process.

The scientific method or the engineering design process. How do we know which one to choose? We will offer some general guidelines at the end of this video, but first we'll use a real world example to compare both.

Let's imagine that we want to watch birds in our backyard to learn more about them. There are already a few that come to our yard, but we would like to attract more by feeding them. How should we approach this project? Should we use the scientific method or the engineering design process?

Let's go step by step and compare how we could use these two approaches for our project about feeding birds. As we go through the steps, you will notice that there are similarities and differences between the scientific method and the engineering design process.

When using the scientific method, the goal is to understand something about the natural world and gain knowledge by asking a question and experimenting to find the answer. In our bird watching example, the question might be, which food will attract the most birds to my yard?

When using the engineering design process, the goal is to solve a problem by building or improving a product or process. It starts by defining the problem. For our bird watching example, the problem statement might be, I need a bird feeder that attracts more birds to my yard because I want to watch them and learn more about them.

The second step for both the scientific method and the engineering design process is to do background research. In our scientific method example, we might research what different types of foods birds eat or what other scientists have found out about birds' food preferences. In our engineering design process example, our research might focus on finding out how other engineers have approached building a bird feeder, what challenges they have encountered or what types of bird feeders already exist and what types of birds use them.

The next step when using the scientific method is to make a hypothesis or educated guess about how we think our question will be answered by our experiment. In our bird watching project, maybe our background research revealed that birds enjoy sweet foods. We might hypothesize that if we put blueberries, sunflower seeds, a seed mix and walnuts outside, then more birds will come to the blueberries than the other foods because they are sweet and juicy.

When using the engineering design process, we won't make a hypothesis. Instead, the next step is to specify the criteria or requirements for our product or solution. When building a bird feeder for example, we would need to make it big enough and sturdy enough to hold a certain amount of bird food, it should be weatherproof, safe for the birds, keep away squirrels and be relatively inexpensive and easy to build.

When following the scientific method, we will test our hypothesis by designing and carrying out an experiment. To do this, we first need to identify the variables of the experiment. Then we come up with an experimental procedure that will allow us to collect data about the birds food preferences. For example, we could put out several identical containers that each contain a different type of food and then collect data about the number of birds that visit each container or record how quickly the food in each container empties.

When following the engineering design process, we won't do the same kind of experiment. Instead, we continue brainstorming solutions to our problem, evaluating the different solutions and choosing the best one to try first. For our project, this means we would brainstorm different bird feeder designs and decide which one we will build first.

In the scientific method, we need to actively ask is the procedure working as we experiment and collect data? If the experiment is not working, we will need to troubleshoot the procedure and restart the experiment.

For example, we might find that other animals besides birds eat the food we put out, which means that we will have to rethink our procedure and then redo the experiment. The goal of conducting the experiment is to collect enough data to confidently determine if our hypothesis is being supported or not.

In the engineering design process, after deciding which bird feeder design we want to try first, the next step is developing and building a prototype. This means we use our previous sketches or drawings of the bird feeder we want to build, choose the materials for each part of the design, and then build our first bird feeder prototype. We know we might need to make changes later. Our prototype is just an initial build that will let us begin testing our product.

In the scientific method, after we finish our procedure and have collected our data, we review and analyze the data. This includes making graphs and evaluating if the collected data is complete, of good enough quality, and is valid. If our data is sufficient, we can then draw conclusions about whether or not our data supports our hypothesis. Sometimes the data leads to more questions, and the process starts again with a slightly different question and a new hypothesis.

The next step in the engineering design process is testing our prototype, which involves measuring the prototype's performance, as well as evaluating it against our design criteria. For our bird feeder, this means we could observe how well birds interact with our prototype and keep track of metrics like how many birds visit the feeder, how many eat from the feeder, whether squirrels get to the food, and whether any parts of the bird feeder get damaged. If we find that our prototype does not fulfill all of the criteria, we start a new cycle of brainstorming, improving on our bird feeder design, building, and testing our new prototype. This type of iteration continues until the design meets all requirements. Iteration is common in engineering.

The last step for both processes is communicating our findings. Sharing our results allows others to use the information we uncovered to continue to discover more about feeding backyard birds and building the best bird feeder. Now that we have completed our bird project, we find that we ended up with two different outcomes based on how we approached the project. By using the scientific method, we

understand which food is best to attract the most birds, and by using the engineering design process, we designed a good bird feeder for our yard.

You might notice that in our example project, the engineering design process and the scientific method are complementary. Although the outcomes are different for each process, together they lead to more birds that we can observe and enjoy. There are many other problems or projects where science and engineering can be combined. When you are not sure which process to use for a project, follow these general guidelines. If you ask, why does this happen? Or what would happen if... you need to follow the scientific method. If you ask, can I build something that... or can I build a better something? You need to follow the engineering design process. Thanks for watching, and happy creating and experimenting!

Unit 6 Ex. 4 "How to write a methodology in 4 steps"

The methodology chapter is one of the most important parts of your thesis. It allows readers to evaluate the reliability and validity of the research. In this video, you'll learn how to write a strong methodology in four simple steps. Hi, I'm Jessica from Scribbr, here to help you achieve your academic goals.

Step 1. Explain your methodological approach. What was your research problem and what type of data did you need to answer it? Did you aim to describe the characteristics of something, to gain more in-depth understanding of a topic, or to establish a cause-and-effect relationship? Next, what type of data did you have to collect to achieve that aim? Did you need quantitative data, which is expressed in numbers, or qualitative data, expressed in words? Did you collect primary data by yourself, or use secondary data that was already collected by someone else?

Step 2. Describe your methods of data collection. Now you've introduced your overall approach, you can move on to giving full details of the research methods you used. Here's an idea of what you should include in general. The sampling method or

criteria you used to select participants or sources. The tools, procedures, and material you used to gather data. How you measured your variables, especially in quantitative and experimental research, you should give enough detail for it to be replicated by another researcher.

So let's say we're researching the opinions of a company's customers, and we collected our data through surveys. A paragraph from our methodology chapter might look something like this. The example here describes what type of questions were asked. Where, when, and how the survey was conducted. Here it describes the sampling method used to select participants, the sample size, and the response rate. Also, note that we write the methodology chapter in the past tense, because the research has already been conducted. Don't worry if you're not using surveys, we also have examples on other methods, you can find them in our knowledge-based articles.

Step 3. Describe your methods of analysis. In this step, you should describe how you process and analyze the data. Avoid going into too much detail here, so don't start presenting or discussing any of your results. For quantitative methods, we're dealing with numbers. So we might describe the data preparation before analyzing, softwares that were used to analyze the data, which statistical methods were used. So here, we've described how we prepared the data, by checking for missing data and outliers. We used the statistical software, SPSS, to analyze the data, and the statistical method used was a pair t-test. For qualitative methods, we're focusing on words. So your analysis will be based on language, images, and interpretations. You might describe how you went about categorizing the responses to identify recurring themes and patterns. We also have an example for qualitative methods. It's in our Knowledge-Based article, you can check it out here.

Step 4. Evaluate and justify your methodological choices. Your methodology should make the case for why you chose these particular methods, especially if you did not

take the most standard approach to your topic. Discuss why other methods were not suitable for your objectives, and show how this approach contributes new knowledge or understanding. You can acknowledge limitations or weaknesses in the approach you chose, but justify why these were outweighed by the strengths. Now we can step up our game. Here are a few tips to make your methodology chapter even better. Focus on your objectives and research questions. Show why your methods suit your objectives, and convince the reader that you chose the best possible approach to answering your problem statement and research questions. Establishing your methodology by referencing existing research that use similar methods, or citing methodological literature that supports your choices. You can use Scribbr's free citation generators to create MLA or APA citations. Click here. If you encountered any difficulties in collecting or analyzing data, explain how you dealt with them. Show how you minimized the impact of any unexpected obstacles.

Step 5. Now you're fully equipped to write your research methodology. Check out our article for more examples. Before you go, make sure to drop a like and subscribe to Scribbr. I'll see you in the next one.

Unit 7 Ex.11. How to write a Dissertation Result Section

The results section is where you objectively report the main findings of your research. It can be easy to confuse with the discussion. Want to know how to write a clear results section? Then stay tuned! Hi, I'm Jessica from Scribbr, here to help you achieve your academic goals.

In the results chapter, you should report your findings concisely and objectively in a logical order. Present only brief observations in relation to each question, hypothesis, or theme. That means you should not yet speculate on the meaning of the results or give an overall answer to your main research question. Avoid subjective words like appears or implies. These are more suitable for the discussion section, where you will interpret the results in detail and draw out their implications.

So when do you write a results section? In most cases, if you're doing empirical research, it's important to report the results of your study before you start discussing their meaning. This gives the reader a clear idea of exactly what you found and keeps the data itself separate from your interpretation of it. In some types of qualitative research, such as ethnography, you might not need a separate results chapter, as the results of the study are often woven together with the discussion.

For quantitative research, you'll usually be dealing with statistical results. You can structure these results around your research question or hypotheses. For each question or hypothesis, present the following. A reminder of the type of analysis you used. For example, a two-sample t-test or simple linear regression. A concise summary of each result, including relevant descriptive statistics like means and standard deviations and inferential statistics like t-scores, degrees of freedom and p-values. These numbers are often placed in parentheses. Not sure what these numbers mean? You can find numerous step-by-step articles explaining statistical analysis in Scribbr's knowledge base. Just click here. And a brief statement of how the result relates to the question or whether the hypothesis was supported. Make sure to include all relevant results, both positive and negative. If you have results that didn't fit with your expectation, include these two, but do not speculate on their meaning or consequences. This should be safe for the discussion or conclusion.

In quantitative research, it's helpful to include visual elements such as graphs, charts and tables. But only if they accurately reflect the results and add value for the reader. In qualitative research, the results might not all be directly related to specific hypotheses. In this case, you can structure your results section around key themes or topics that emerge from the analysis of the data. For each theme, make general observations about what the data showed and present relevant quotations. For example, you might mention recurring points of agreement or disagreement, patterns and trends, and individual responses that were particularly significant to your

research question. Further information, such as full transcripts of your interviews, can be included in an appendix.

As you can see from the examples earlier, the results section is written in the past tense. Make sure to keep this in mind. Now that the results section is clear, the next step is to write your discussion. We've also covered this. I'll see you in this video then.

Appendices

Appendix A

Text 1

Abstract

Just like bugs in single-threaded programs can lead to vulnerabilities, bugs in multithreaded programs can also lead to concurrency attacks. Unfortunately, there is little quantitative
data on how well existing tools can detect these attacks. This paper presents the first quantitative study on concurrency attacks and their implications on tools. Our study on 10 widely used programs reveals 26 concurrency attacks with broad threats (e.g., OS privilege escalation), and we built scripts to successfully exploit 10 attacks. Our study further reveals that, only extremely small portions of inputs and thread interleavings (or schedules) can trigger these attacks, and existing concurrency bug detectors work poorly because they lack help to identify the vulnerable inputs and schedules. Our key insight is that the reports in existing detectors have implied moderate hints on what inputs and schedules will likely lead to attacks and what will not (e.g., benign bug reports). With this insight, this paper presents a new directed concurrency attack detection approach and its implementation, OWL. It extracts hints from the reports with static analysis, augments existing detectors by pruning out the benign inputs and schedules, and then directs detectors and its own runtime vulnerability verifiers to work on the remaining, likely vulnerable inputs and schedules. Evaluation shows that OWL reduced 94.3% reports caused by benign inputs or schedules and detected 7 known concurrency attacks. OWL also detected 3 previously unknown concurrency attacks, including a use-after-free attack in SSDB confirmed as CVE-2016-1000324, an integer overflow, HTML integrity violation in Apache and three new MySQL data races confirmed with bug ID 84064, 84122, 84241. All OWL source code, exploit scripts, and results are available at https://github.com/ruigulala/ConAnalysis.

(Rui Gu, Bo Gan, Jason Zhao, Yi Ning, Heming Cui, and Junfeng Yang. (2023). Understanding and Detecting Concurrency Attacks. https://www.cs.columbia.edu/~junfeng/papers/owl-dsn18.pdf)

Text 2

Abstract

Intellectual expertise is knowledge and ability that a person has that allows them to solve extremely complex problems. It is important to understand how people become experts so that we can improve educational strategies, and help learners achieve their full academic potential. Unfortunately, the process of acquiring intellectual expertise is not well understood. The goal of this research is to build

and test a computational theory of this process. My approach is to train artificial neural networks (ANNs) as a model of expert human learning. ANNs address many of the difficulties found in trying to study expertise in humans; they have already been successful in modeling other types of human learning. In completed work, I have built a first version of the model and used it to confirm two hypotheses: (1) An artificial neural network can be used as a model to investigate how people learn under different training scenarios. (2) Different methods for delivering the training material result in different final performance, and best performance is achieved by incrementally increasing the complexity of the material. I propose to complete the dissertation by testing a third hypothesis: Different delivery methods result in different internal conceptual representations and conceptual development, which in turn is responsible for the different performance. The results suggest that psychological learning theory should be considered when designing instructional strategies. My research has shown that, in contrast with symbolic models of cognition, connectionist models are able to model the human learning process, and provide practical insights into how people should be trained.

(Lisa C. Kaczmarczyk (2004). The Acquisition of Intellectual Expertise: A Computational Model. https://escholarship.org/content/qt9726w4q1/qt9726w4q1_noSplash_881a347fac2428a144eb6a6d26d2944b.pdf?t=op2mvt)

Text 3

Abstract

Hands deserve particular attention in virtual reality (VR) applications because they represent our primary means for interacting with the environment. Although marker-based motion capture works adequately for full body tracking, it is less reliable for small body parts such as hands and fingers which are often occluded when captured optically, thus leading VR professionals to rely on additional systems (e.g. inertial trackers). We present a machine learning pipeline to track hands and fingers using solely a motion capture system based on cameras and active markers. Our finger animation is performed by a predictive model based on neural networks trained on a movements dataset acquired from several subjects with a complementary capture system. We employ a two-stage pipeline that first resolves occlusions and then recovers all joint transformations. We show that our method compares favorably to inverse kinematics by inferring automatically the constraints from the data, provides a natural reconstruction of postures, and handles occlusions better than three proposed baselines.

(Dario Pavllo, Mathias Delahaye, Thibault Porssut, Bruno Herbelin, Ronan Boulic (2019) Real-time neural network prediction for handling two-hands mutual occlusions
https://www.sciencedirect.com/science/article/pii/S2590148619300111)

Text 4

Abstract

Dynamic program analysis frameworks greatly improve software quality as they enable a wide range of powerful analysis tools (e.g., reliability, profiling, and logging) at runtime. However, because existing frameworks run only one actual execution for each software application, the execution is fully or partially coupled with an analysis tool in order to transfer execution states (e.g., accessed memory and thread interleavings) to the analysis tool, easily causing a prohibitive slowdown for the execution. To reduce the portions of execution states that require transfer, many frameworks require significantly carving analysis tools as well as the frameworks themselves. Thus, these frameworks significantly trade off transparency with analysis tools and allow only one type of tools to run within one execution. This paper presents REPFRAME, an efficient and transparent framework that fully decouples execution and analysis by constructing multiple equivalent executions. To do so, REPFRAME leverages a recent faulttolerant technique: transparent state machine replication, which runs the same software application on a set of machines (or replicas), and ensures that all replicas see the same sequence of inputs and process these inputs with the same efficient thread interleavings automatically. In addition, this paper discusses potential directions in which REPFRAME can further strengthen existing analyses. Evaluation shows that REPFRAME is easyto run two asynchronous analysis tools together and hasreasonable overhead.

(Heming Cui, Rui Gu, Cheng Liu, and Junfeng Yang (2015). REPFRAME: An Efficient and Transparent Framework for Dynamic Program Analysis. APSys '15: Proceedings of the 6th Asia-Pacific Workshop on Systems. 13. P. 1–9 https://www.cs.columbia.edu/~ruigu/papers/repframe-apsys15.pdf)

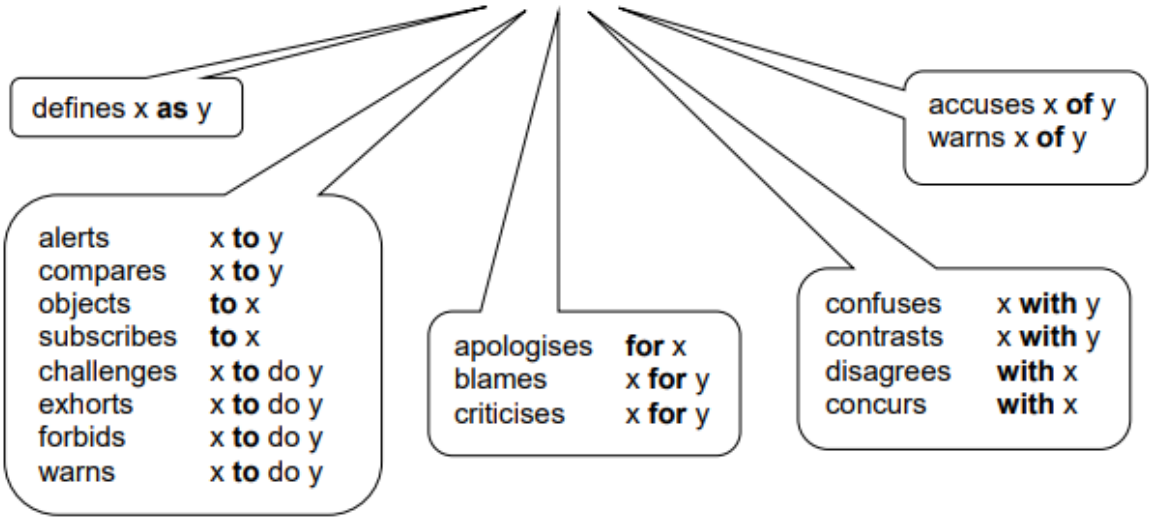
Appendix B

Function and strength of reporting verbs

Some verbs are weaker in their function, while others are strong. Some verbs are followed by a preposition (e.g. as, to, for, with, of), while others are followed by a noun or 'that'. In addition, some verbs can fit more than one category e.g. warns can be used to disagree with, emphasise or examine an idea. It is important you understand and know how to use the verb correctly before placing it in a sentence, and that you use past or present tense as appropriate.

	weaker position	neutral position	stronger position
addition		adds	
advice		advises	
agreement	admits, concedes	accepts, acknowledges, agrees, concurs, confirms, recognises	applauds, congratulates, extols, praises, supports
argument and persuasion	apologises	assures, encourages, interprets, justifies, reasons	alerts, argues, boasts, contends, convinces, emphasises, exhorts, forbids, insists, proves, promises, persuades, threatens, warns
believing	guesses, hopes, imagines	believes, claims, declares, expresses, feels, holds, knows, maintains, professes, subscribes to, thinks	asserts, guarantees, insists, upholds
conclusion		concludes, discovers, finds, infers, realises	
disagreement and questioning	doubts, questions	challenges, debates, disagrees, questions, requests, wonders	accuses, attacks, complains, contradicts, criticises, denies, discards, disclaims, discounts, dismisses, disputes, disregards, negates, objects to, opposes, refutes, rejects
discussion	comments	discusses, explores	reasons
emphasis			accentuates, emphasises, highlights, stresses, underscores, warns
evaluation and examination		analyses, appraises, assesses, compares considers, contrasts, critiques, evaluates, examines, investigates, understands	blames, complains, ignores, scrutinises, warns
explanation		articulates, clarifies, explains	
presentation	confuses	comments, defines, describes, estimates, forgets, identifies, illustrates, implies, informs, instructs, lists, mentions, notes, observes, outlines, points out, presents, remarks, reminds, reports, restates, reveals, shows, states, studies, tells, uses	announces, promises
suggestion	alleges, intimates, speculates	advises, advocates, hypothesises, posits, postulates, proposes, suggests, theorises	asserts, recommends, urges

Verbs followed by a preposition



Verbs followed by a noun or –ing form

analyses, applauds, appraises, assesses, attacks, considers, contradicts, critiques, debates, describes, discards, disclaims, discounts, discusses, dismisses, disregards, evaluates, examines, explores, expresses, extols, forbids, highlights, identifies, ignores, illustrates, investigates, justifies, lists, opposes, outlines, praises, presents, questions, refutes, rejects, restates, scrutinises, studies, supports, underscores, uses, validates, verifies

Verbs followed by 'that'

accepts, acknowledges, adds, admits, advises, advocates, agrees, alerts, alleges, announces, argues, articulates, asserts, assures, believes, boasts, claims, clarifies, comments, complains, concedes, concludes, confirms, feels, finds, forgets, guarantees, guesses, hopes, hypothesises, imagines, implies, indicates, infers informs, insists, justifies, knows, maintains, notes, observes, persuades, points out, posits, postulates, promises, proposes, proves, questions, realises, reasons, reasons, recognises, recommends, remarks, reminds, reports, reveals, shows, speculates, states, stresses, suggests, suspects, tells, theorises, thinks, understands, urges, warns

Appendix C

Complex sentences can be very useful when you want to introduce a contrast, a result, and cause and effect. Here's a list of words that introduce dependent clauses:

after although as because before even if	that though unless until when whenever where

even though if in order that once provided that rather than since	whereas wherever whether while why so that than

(http://www.chompchomp.com/terms/subordinateclause.htm)

Appendix D

Readers need to follow the connection between your ideas. Cohesive devices help explain and connect those complex ideas in your writing. Use cohesive devices to add information, present opposing ideas, and come to conclusions.

List of cohesive devices:

time
Before, meanwhile, later, soon, at last, earlier, thereafter, afterward, by that time, from then on, first, second, third, next, now, presently, shortly, immediately, finally, at this time, thereafter, formerly, previously, at this point, during, before, after
to compare
Likewise, similarly, once again, once more, like, likewise, by comparison, similar to
to contrast
But, yet, however, although, whereas, though, even so, nonetheless, still, on the other hand, on the contrary, besides, conversely, in contrast, instead, nevertheless, regardless, whereas, while, yet, although, despite, unlike
to conclude
As a result, consequently, therefore, hence, for this reason, in summary, in other words, on the whole, thus, in conclusion, hence, ultimately, finally
to add
Again, also, and, and then, besides, equally, further(more), in addition (to...), indeed, next, in fact, moreover, too, what is more, finally, additionally, further
to contradict
However, whereas, while, still, alternatively, nevertheless, on the other hand, instead, inspite of, in contrast, even though
to give an example
For example, for instance, to illustrate, such as, specifically, to demonstrate

Achieving Flow

- Use the old before new rule to achieve flow in your writing. Put 'old' information in the beginning of your sentence, and 'new' information at the end.
- Begin sentences with information familiar to your reader.
- To you, everything is familiar, since you have worked out your ideas on the topic. Try to begin sentences with only information that is familiar to your reader.

Pronouns: Your Friend and Enemy

- Sometimes, the pronoun and what it refers to is clear, and this helps you avoid repetition in your writing.
- Other times, the reference is unclear, because there are too many nouns to choose from.
- Try to avoid beginning sentences with the word "It." "It" is the most vague of the pronouns, and can refer to nearly anything at all.
- More often, use a concrete noun (such as 'empire', 'the author,' or 'industry,' instead of 'it') to improve clarity.
- A pronoun, like 'it' or 'this' cannot just refer to the entire previous sentence. Pronouns like 'it' or 'this' only refer to one particular noun. Make sure the noun it refers to is clear, or restate the noun.

KEYS

Unit 1

ex1.

1 Academic writing follows the same writing process as other types of texts but has specific conventions in terms of content, structure, and style. These conventions ensure clarity, coherence, and credibility in academic discourse.

2 The most common types of academic writing assignments for students include essays, research papers, theses/dissertations, research proposals, literature reviews, lab reports, and annotated bibliographies.

3 An essay is a fairly short, self-contained argument, often using sources from a class in response to a question provided by an instructor. A research paper, on the other hand, is a more in-depth investigation based on independent research, often in response to a question chosen by the student.

4 A thesis or dissertation is the large final research project undertaken at the end of a degree. It is usually on a dissertation topic of the student's choice and demonstrates their ability to conduct independent research and contribute new knowledge to their field.

5 A research proposal outlines a potential topic and plan for a future dissertation or research project. It helps students and researchers clarify their research objectives, methodologies, and expected outcomes before embarking on the actual research.

6 A literature review is a critical synthesis of existing research on a topic. It is typically written to inform the approach of a new piece of research by providing an overview of the current state of knowledge and identifying gaps or areas for further investigation.

7 A lab report typically includes the aims, methods, results, and conclusions of a laboratory experiment. It provides a detailed account of the experimental procedure, findings, and their implications.

8 An annotated bibliography is a list of source references accompanied by a short description or evaluation of each source. It is used to provide readers with a summary and critical assessment of the literature relevant to a particular topic or research project.

9 Most academic writing shares key principles aimed at conveying information effectively. These principles include clarity, coherence, precision, objectivity, and adherence to academic conventions.

10 Academic writing contributes to the advancement of knowledge and scholarship by disseminating research findings, fostering critical inquiry and debate, and

building upon existing knowledge within various fields of study. It enables researchers to communicate their ideas, theories, and discoveries to a wider audience and engage in scholarly dialogue.

ex2 1e; 2g; 3f; 4b; 5d; 6a; 7c

ex 3 A 5; B 1; C 4; D 8; E 2; F 7; G 6; H 3

Unit 2

ex1: 5A 3B 1C 2D 4 E

ex.5 : 1D 2R 3D 4M 5I 6M 7R 8I

ex6 : 1 empirical; 2. the literature review and discussion; 3. a short summary; 4. navigate through; 5. the introduction; 6. reliability and validity; 7. relevant; 8. implications of your results / interpret ; 9. concisely; 10. appendices.

ex7: ex.1 1c 2h 3e 4d 5f 6b 7g 8a

ex 8: ex.2 1h 2d 3c 4b 5f 6e 7g 8a

Unit 3

ex4 : 1 To analyze the performance of the algorithm, various test cases were executed.

2 We used the Python programming language in order to develop a machine-learning model for sentiment analysis.

3 The coding standards were established to ensure a consistent style across the development team.

4 To ensure the software is functioning correctly, rigorous testing procedures were implemented.

5 The purpose of this code is to solve complex mathematical problems, and it presents an implementation of a novel algorithm.

6 To improve the software's efficiency, additional functions were added to the existing codebase.

Ex. 5: 1. True

2. False - Starting sentences with the subject makes writing clearer.

3. True

4. False - Using longer words does not always make an essay more sophisticated.

5. False - Stock phrases should be avoided to improve writing quality.

6. False - It is easier to follow a 25-word sentence than a 50-word sentence.

7. True

8. False - It is a waste of energy and words to refer back to previous text.

9. False - Multitasking in writing is messy and less effective.

10. True

Unit 4

ex 1 : 1 A 2B 2C 4D 3E

ex 2 1B 2D 3E 4C 5A

ex. 4 : 1. False - The literature review and discussion are usually longer than the methodology section.

2. False - The abstract is a short summary, around 150-300 words long.
3. False - The glossary is optional in a dissertation.
4. True
5. True
6. False - The reference list should include citations from other researchers.
7. True

Unit 5

ex 2: 1 identify; 2 describe; 3 establish 4 calculate 5 compare 6 select 7 construct 8 assemble 9 appraise 10 assess

ex 3: 1 to achieve 2 to prove 3 to narrow 4 specific 5 approaches 6 be investigated 7 sophisticated 8 measurable 9 to determine 10 estimating

Unit 6

ex4 : 1. Explain 2. cause-and-effect relationship 3. Describe 4. sampling method 5. Variables 6. Replicated 7. the past tense 8. Describe 9. process and analyze 10. statistical software 11. Language 12. evaluate and justify 13. contributes new knowledge 14. focus on 15. convince the reader 16. referencing existing research 17. citing methodological literature

Unit 7

ex 1: 1 simplifying; 2 comparison; 3 variables; 4 engagement; 5 reinforcing; 6 powerful; 7 invaluable; 8 memorable; 9 retention; 10 accessible

ex 2 :1 complex 2 significance 3 enhance,4 journal, 5 step-by-step, 6 facilitate 7 complement 8 highlight 9 intricate 10 reinforce

ex 4 Answers: 1 bar 2 segment 3 vertical axis 4 horizontal axis 5 row 6 column

ex. 11 : 1. A 2. B 3. D 4. C 5. D 6. C 7. B

Unit 8

ex 4 : 1I 2 L 3I 4E 5I 6 L 7 E 8 L 9 I 10 E

ex 5 : 1D 2D 3N 4N 5D 6N 7D 8N

3 …, enabling them to collect and exchange data,…
4 …, initially developed as the underlying technology of cryptocurrencies like Bitcoin,…
6 …., a subset of machine learning,…
8 .., an emerging field within computer science,…

ex 6 : 1 This model predicted a decrease in UVI adsorption, which was consistent with experimental data.
2 Table 3 shows the instructions distributed to the service personnel for dealing with hazmat waste disposal.
3 We can also infer here that companies which focused on stock management utilised significantly less external finance than A and B type companies.
4 Three new exemptions apply to specific types of equipment that are manually operated.
5 The total amount of infrared radiation which is emitted by the earth's surface is difficult to measure.
6 The temperature of the earth is determined by the amount of incoming solar radiation that reaches and heats its surface.
7 The amount of incoming solar radiation received at the Earth's surface is given by the following equation.
8 It may also be necessary to pay special attention to stakeholders whose influence on the project is likely to increase.
9 This evidence suggests that companies focusing upon cash management routines had fewer sales on cash.
10 Data collected at the retail outlets is then quickly fed back to the warehouse where models are continuously updated.
11 Whilst companies doing the least working capital management were not found to be associated with an interest in firm growth, their counterparts who focused on credit management reported an interest in firm growth.
12 Holden, Smith and Devins highlight a case study on a medium-sized publishing firm based in the UK. With assistance from EU funding, the firm established a learning center equipped with PCs, video conferencing and a tutor. The learning center was set up in order to promote the concept of learning across the full extent of the organization. Whereas in the past, training programs may have been reserved for those higher up the corporate ladder, the approach taken was to promote learning as an organization-wide activity open to all. Indeed, this

"opening up" of learning within the company had the greatest effect on those staff working on the shop floor , who soon took to the view that the company was actively interested in their development and prospects. The result? Higher levels of employee motivation and satisfaction.

Unit 9

ex 1: 1b 2 d 3c 4c

ex 3: 1 T 2 T 3 F 4 F 5 T 6 T 7 T 8T

Unit 10

ex.1 : 1. permanent 2. legal rights 3. Differ 4. to carry out 5. Controversial 6. challenging the work 7. appointment 8. misconduct 9. probation 10. determine 11. portfolio 12. promotion 13. evaluation 14. application 15. disputed 16. assessment 17. excellence 18. responsibilities 19. explicitly 20. arguments 21. compete 22. being granted 23. replacements

ex. 4 :

1. False - Impostor syndrome is also prevalent among postgraduate students, particularly at the PhD level.
2. True
3. True
4. False - Impostor syndrome is common among people who have accomplished something significant.
5. True
6. False - It is important to manage expectations and negative self-talk.
7. False - Keeping a journal and writing down thoughts and feelings is a helpful technique for managing impostor syndrome.
8. False - Discussing feelings with peers and supervisors is recommended when dealing with impostor syndrome.
9. False - It is not uncommon to experience feelings of worthlessness during a PhD program.
10. False - Research is not always perfect and without challenges.

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