

SCHOOL OF ELECTRONIC ENGINEERING AND COMPUTER SCIENCE

'HOW TO' RESEARCH GUIDE

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INTRODUCTION

The purpose of this guide is to help you start your background research for your project. This ‘How to’ guide will help with the following:

- Defining research questions
- Searching digital libraries for conference and journals
- Reading and note taking
- Evaluating resources

RESEARCH QUESTIONS

The first step in conducting research is to devise a series of research questions, as these will help you structure the research that will be conducted for your project. Hence, it is important that the research questions should be clear and focused.

HOW TO DEVELOP A GOOD RESEARCH QUESTION

Source: <https://cirt.gcu.edu/research/developmentresources/tutorials/question>

- Researchers should begin by identifying a broader subject of interest that lends itself to investigation. For example, a researcher may be interested in childhood obesity.
- The next step is to do preliminary research on the general topic to find out what research has already been done and what literature already exists. How much research has been done on childhood obesity? What types of studies? Is there a unique area that yet to be investigated or is there a particular question that may be worth replicating? The following video may be helpful in learning how to choose appropriate keywords and search online databases: <https://youtu.be/233DzkmimV4?t=4s>
- Then begin to narrow the topic by asking open-ended "how" and "why" questions. For example, a researcher may want to consider the factors that are contributing to childhood obesity or the success rate of intervention programs. Create a list of potential questions for consideration and choose one that interests you and provides an opportunity for exploration.
- Finally, evaluate the question by using the following list of guidelines:
 - Is the research question one that is of interest to the researcher and potentially to others? Is it a new issue or problem that needs to be solved or is it attempting to shed light on previously researched topic.
 - Is the research question researchable? Consider the available time frame and the required resources. Is the methodology to conduct the research feasible?
 - Is the research question measurable and will the process produce data that can be supported or contradicted?
 - Is the research question too broad or too narrow?

EXAMPLES OF RESEARCH QUESTIONS

Source: <https://cirt.gcu.edu/research/developmentresources/tutorials/question>

<p>Too narrow: What is the childhood obesity rate in Phoenix, AZ?</p> <p>This is too narrow because it can be answered with a simple statistic. Questions that can be answered with a "yes" or a "no" should also typically be avoided.</p>	<p>Less narrow: How does the education level of the parents impact childhood obesity rates in Phoenix, AZ?</p> <p>This question demonstrates the correct amount of specificity and the results would provide the opportunity for an argument to be formed.</p>
<p>Unfocused and too broad: What are the effects of childhood obesity in the United States?</p> <p>This question is so broad that research methodology would be very difficult and the question is too broad to be discussed in a typical research paper.</p>	<p>More focused: How does childhood obesity correlate with academic performance in elementary school children?</p> <p>This question has a very clear focus for which data can be collected, analysed, and discussed.</p>
<p>Too objective: How much time do young children spend doing physical activity per day?</p> <p>This question may allow the researcher to collect data but does not lend itself to collecting data that can be used to create a valid argument because the data is just factual information.</p>	<p>More Subjective: What is the relationship between physical activity levels and childhood obesity?</p> <p>This is a more subjective question that may lead to the formation of an argument based on the results and analysis of the data.</p>
<p>Too simple: How are school systems addressing childhood obesity?</p> <p>This information can be obtained without the need to collect unique data. The question could be answered with a simple online search and does not provide an opportunity for analysis.</p>	<p>More Complex: What are the effects of intervention programs in the elementary schools on the rate of childhood obesity among 3rd - 6th grade students?</p> <p>This question is more complex and requires both investigation and evaluation which will lead the research to form an argument that may be discussed.</p>

DIGITAL LIBRARIES - DATABASES

Digital libraries (databases) are excellent sources of good quality information. Below are a range of databases relevant to Electronic Engineering and Computer Science.

ACM Digital Library

<https://dl.acm.org>

Full-text of every article published by the Association for Computing Machinery.

Tutorial video: https://www.youtube.com/watch?v=Jpr0ODsy_AQ

IEEE Xplore Digital Library

<https://ieeexplore.ieee.org/Xplore/home.jsp>

Full-text collection of all journals and conference proceedings published by the IEEE and IET since 1988 (some earlier material), as well as current IEEE standards and Wiley-IEEE e-books.

Tutorials: <https://ieeexplore.ieee.org/Xplorehelp/#/>

Google Scholar

<https://scholar.google.co.uk>

Tutorial video: <https://www.youtube.com/watch?v=oqnjhjISHFk>

Scopus

Multi-disciplinary database containing the citations and abstracts of peer-reviewed literature. This database lists the number of times a work has been cited in other works and provides direct links to the abstracts of citing works. Access to full-text subscription content where available at QMUL Library via the "library- check full text" button.

Web of Science

Multi-disciplinary database containing the citations and abstracts of peer-reviewed literature. This database lists the number of times a work has been cited in other works and provides direct links to the abstracts of citing works. Access to full-text subscription content where available at QMUL Library via the "library- check full text" button.

If you need help finding information on a specific topic? Email library-sande@qmul.ac.uk to contact the Science and Engineering team at Mile End Library (James Soderman Faculty Liaison Librarian Science and Engineering.)

READING: NOTE-MAKING (PART I)

The information in this section has been provided by the learning development team.

Writing & Study Guidance

www.learningdevelopment.qmul.ac.uk

There is no specific ‘right’ way to make notes; however, some things are worth thinking about that will help you improve the quality and usefulness of the notes you make when reading. Some of the ways we make notes are also quite unhelpful. Our notes are often too long or too disjointed. They do not contain all the information we need for our essays/exams or they are just large copied blocks of text. This resource will give you some advice on how to develop your note-making.

In this resource, we concentrate on note-making while reading, but many of the techniques and suggestions will also help you when making notes in lectures or seminars.

In conjunction with this resource, you should also take a look at Reading Purposes.



Notice how we use the term note-making and not note-taking. This is because note-making implies doing something active and creative. Note-taking implies doing something passive, without thinking about what you are doing.

WHY ARE YOU MAKING NOTES?

Generally speaking, there are two main reasons why you should make good notes:

1. To keep a record of what you have read so that you can come back to your notes later rather than having to read the paper/book again.
2. To help you process and understand what you have read.

Sometimes when you read, you may only be doing so for reason number 1. This is common when you first start learning a topic and all the information is new to you. Most students will know that this is a good reason for note-making.

Reason number 2 is **very** important, though, to help develop your critical thinking. As your knowledge develops, you should be making more and more notes for Reason 2. Your notes

should not only record information, but record your **thinking** and your ideas. Not many students think about reason number 2 as much as reason number 1.

Below is a list of different ways in which we make notes. Look at each one carefully and say if it helps you (1) to keep a record of what you have read or (2) to help you process and understand it or (3) both?

	1	2	3 (Both)
Writing down what you do not understand.			
Noting key words/terms.			
Making note of the author's argument/idea/theory.			
Writing down the pros and cons of an argument/idea/theory.			
Noting how the text relates to other reading.			
Writing down basic factual information such as names, dates, equations and formulas.			
Writing down what you think about something.			



IMPORTANT ANTI-PLAGIARISM TIP!

Whether you make notes for Reason 1 or for Reason 2, remember to put the surname of the author and the date of your source at the top of your notes. Then for each note you make, just jot down the page number next to it. This will save you ENDLESS time when you are putting in your references and will help you to avoid plagiarism.

HOW TO MAKE NOTES

There are different ways to make notes, so the important thing is to think about what you are trying to achieve – do you need to remember facts and information? Are you trying to understand an argument or theory? Whatever you are trying to achieve, there are some ways of making notes that you may find helpful and some ways that are not so helpful.

Helpful

- Read a passage, paragraph or page first without writing anything. Then try to summarise it in your own words. Imagine that you are explaining it to a friend. This will prevent you from simply copying the text and will test how well you understand what you have just read.
- Write down any questions or thoughts you have about the reading.

- Make a note to yourself when you do not understand something.
- Use abbreviations to quicken your note-making when there are several long and/or technical terms in your reading. But remember what your abbreviations stand for!
- Draw a picture or diagram to represent what you've read – this is particularly helpful when you are revising for exams.

Not Helpful

- Copying out large passages of text.
- Highlighting everything you do not understand or do not think important.
- Forgetting to make a note of page numbers or bibliographical information.

AVOIDING PLAGIARISM

Plagiarism can be committed on purpose (like paying somebody else to write your essay), but usually it is by accident (you simply forget to reference properly). Whether plagiarism is done on purpose or accidentally, it is still plagiarism and there are strict penalties for it.

Good note-making techniques will help you to avoid plagiarising by accident.

To avoid plagiarising, make sure that whenever you copy a string of more than five of another writer's exact words from a book/article/website, you use quotation marks ("....."). Make sure you write down where this quotation was taken from, including which page (if a book, journal or document) and when you wrote down the quotation (if you took it from a website).

Making notes in your own words and not copying text (except quotations or short sentences) will help you to avoid any accidental plagiarism.

Below is an example of how you can take notes.

(https://www.merga.net.au/documents/RP_Johnson_Jones_Thornton_Langrall_Rous_1997.pdf)

Title, author etc	
Questions, comments, ideas, themes that seem to be occurring (basically notes that show what I'm thinking when I'm reading)	Quotations and paraphrasing from the article
<p>Summary of article and how it is useful to me.</p> <p>I think this is the most important section as it's about processing the info and linking it to previous knowledge.</p>	
<p>I add on references to follow up here...</p>	

Students' Thinking and Writing in the Context of Probability

Written Communication, Vol 15.2, April 1998, pp.203-229

Todd M Johnson, Graham A Jones, Carol A Thornton, Cynthia W Langrall, Amy Rous

	<p>P203-4 //Summary of research into the benefits of mathematical writing. Lots here that I could read through.</p> <p>204 'the extent to which writing experiences in mathematics influence students' writing patterns has not been widely reported. Our study addressed this need by examining students' <i>transactional writing</i> (Britton, 1970), that is, writing in which the students provided their teacher with descriptions, justifications, and interpretations of their solutions to mathematical problems.'</p> <p>Aim is basically what do they write, does it change their maths, does it change their writing; and are writing and maths knowledge linked?</p> <p>204 Study looks at 5th grade students doing probability. The aims of the research are to identify the characteristics of students' transactional writing; whether changes in probability thinking result from teaching students writing to learn; whether changes in writing also follow; and is there a relationship between probability thinking and writing levels?</p> <p>205 Two theoretical frameworks: cognitive one that describes elementary schools students' probability thinking (Jones, Langrall, Thornton, & Mogill, 1997); and one adapted from Shepard (1993) that describes levels of students' mathematical writing in relation to specific phases of conceptual learning.</p> <p>//The cognitive framework basically just has levels of thinking from subjective (level 1) to mathematical (level 4). So, what's the probability of getting a red ball of gum from the machine? 'I like yellow' (Level 1), 'Red, because the chance of red is 6/9' (level 4).</p> <p>//The writing framework goes from 1-4 (recording, summarising, generalising, relating, with relating the most sophisticated.)</p> <p>I'm sure I could unpack my thinking a bit around the Probability Writing Programme, even if it's just to acknowledge that it's quite difficult to know what it included from the description. I haven't because I'm not sure it's the focus of why I am reading this. Or maybe this is entirely the point?</p> <p>209 //Of the 24 students, 8 were examined. Most showed improvements in both probability and writing after the Probability Writing Programme (10 x 45 minute sessions over 2 months). Description of programme.</p> <p>210 //There were probability and writing assessment activities at the start and at the end. A bit about the process.</p> <p>214 (The effects of the programme: qualitative analysis) 'Two patterns were identified: (a) students demonstrated growth in mathematical writing as they interacted with their teacher through their journals, and (b) students' growth in mathematical writing was enhanced when there existed a complementary relationship between their writing symbols and their mathematical symbols.'</p>
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	<p>//Looks at two students (Boris and Marion) and their progress. It's attributed to the interactions with the teacher through the medium of the journals. (See below for how this could be relevant to QMUL)</p> <p>218 Some students did develop both writing and mathematical thinking (and the two were linked) but other students did not. For example, one student, Steffi was already very good at probability thinking but was reluctant to explain each step in writing.</p>
	<p>Although I didn't go into the specifics of summarising how the Probability Writing Programme was taught, it's interesting that most of it was through feedback in the students' journals. The feedback was of three kinds: (p210) '(a) those that encouraged the students to amplify, explain or complete their responses (e.g. "I do not understand your drawing. Explain it to me"), (b) those that posed an extension question or problem (e.g., "What would be her chance of guessing correctly if the locker combination had 4 numbers instead of 3?"), and (c) those that gave an overall assessment of their work (e.g., "I like your work.... It's well organised and very clear.").' The teacher marked their work every weekend. Interesting in regards to feedback practices in maths in relation to writing. The key thing about the journals is that they have dialogue. The teacher wrote questions and then the students would respond, and sometimes redo parts of the task. So the idea of a feedback loop was more successfully closed.</p>

J Britton (1970) Language and Learning. London. Allen lane. – seems to be the foundation text behind literacy across the curriculum

EVALUATING RESOURCES

When evaluating sources, you should consider the following criteria:

Currency: the timeliness of the information

- When was the information published or posted?
- Has the information been revised or updated?
- Is the information current or out-of-date for your topic?
- Are the links functional?

Relevance: the importance of the information for your needs

- Does the information relate to your topic or answer your question?
- Who is the intended audience?
- Is the information at an appropriate level (i.e. not too elementary or advanced for your needs)?
- Have you looked at a variety of sources before determining this is one you will use?
- Would you be comfortable using this source for a research paper?

Authority: the source of the information

- Who is the author/publisher/source/sponsor?
- Are the author's credentials or organizational affiliations given?
- What are the author's credentials or organizational affiliations given?
- What are the author's qualifications to write on the topic?
- Is there contact information, such as a publisher or e-mail address?
- Does the URL reveal anything about the author or source? Examples:
 - .com (commercial),
 - .edu (educational),

- .gov (U.S. government),
- .org (nonprofit organization),
- or .net (network)

Accuracy: the reliability, truthfulness, and correctness of the content

- Where does the information come from?
- Is the information supported by evidence?
- Has the information been reviewed or refereed?
- Can you verify any of the information in another source or from personal knowledge?
- Does the language or tone seem biased and free of emotion?
- Are there spelling, grammar, or other typographical errors?

Purpose: the reason the information exists

- What is the purpose of the information? to inform? teach? sell? entertain? persuade?
- Do the authors/sponsors make their intentions or purpose clear?
- Is the information fact? opinion? propaganda?
- Does the point of view appear objective and impartial?
- Are there political, ideological, cultural, religious, institutional, or personal biases?

After evaluating this source, do you think you will use it for your paper? Why or why not? If you are not sure, explain why.

USEFUL RESOURCES

Write reports in Science and Engineering (WRiSE)

<http://learningcentre.usyd.edu.au/wrise/>

Writing in engineering (iWrite)

<http://iwrite.sydney.edu.au/iwrite.html>