



Paper Writing Fundamentals

*Reflections of experienced
associate professor, peer-reviewer
and editor on writing
research papers*

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First published by Motivated Academic Publishing 2021

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First edition

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Preface

“You need to publish your work to build track record and advance in academic career.”

These were the very first words I’ve heard from my supervisor at the beginning of my PhD. No pressure, right? I had no previous experience in publishing in academic journals, let alone writing research papers.

And I was kind of embarrassed by this. Being an introvert I was afraid to admit that in front of my supervisor and colleagues. What did I do then? I typed *“how to publish a research paper”* in Google and started reading. Having spent days trying to figure out what to include in each section, I got overwhelmed and lost my motivation. And it was just the first week of my PhD. Being a practical person, I’ve decided to crack on with the literature review to identify a viable research gap for me to focus on and decided to focus on the writing later – I’d figure it out once I have some data I thought.

A couple of months passed, I developed models, collected data and analysed the results. And you know what? I was back in square one. I had to write the paper. I told myself – *“It doesn’t need to be that difficult. After all, so many people publish their work. Let me try to find a way that works for me.”*

I started by organising my results and discussion in the logical

flow of information, then I described my models and approach to analysis, and only then I wrote my introduction and conclusions.

I was quite proud of what I wrote – after all that was my first paper. That’s why I was so surprised with the volume of comments, corrections and red ink in the draft that I received back from my supervisors. It was like watching Kill Bill again. It took 3–4 review rounds until my supervisors were happy for the paper to be submitted to the journal.

I thought that the worst part is behind me because my supervisors already approved the manuscript. But you probably know that I couldn’t be more wrong. The paper was rejected by peer-reviewers in the first round of review.

This was frustrating but it taught me something. It taught me that the only way to write excellent research papers is through getting as much feedback as possible, learning from this feedback, and continually improving your papers. I learnt that feedback is there to help me grow and improve my writing. I’ve realised the value of the peer-review process and I’ve decided to get the most of it during my PhD.

What was the result? I’ve published a total of 11 journal papers between October 2013 and May 2016, nine papers out of my PhD and two additional papers with my MSc supervisor. These were actually accepted papers in journals with high impact factors, such as Applied Energy or Energy and Environmental Science.

And you know what? I know I would have published even more if I had asked my supervisor for tips and advice from the very beginning of my PhD.

Now I regularly publish my work in and peer-review for prestigious journals in my field. I also hold various editorial roles with Wiley, Frontiers, MDPI, and Oxford University Press. And it’s time for me to give back and support those who are

where I was in 2012 and those who are worried to ask for support.

That's why I've put this eBook together. The *Paper Writing Fundamentals* is a compilation of the most commonly read articles on various aspects of writing papers that I wrote over the past year. You'll find information about writing some of the key sections in the research paper, plagiarism, motivation, writing block and making your work open access.

I trust this eBook will help you improve your writing practice. More importantly, I trust it'll release the pressure and anxiety associated with writing and will help you focus on what's really important - enjoying doing your research and communicating it with your peers.

If you need more support with writing papers, I encourage you to join the [*Paper Writing Masterclass*](#), where I teach everything you need to know about the publication development process, crafting your messages so that your paper appeals to your audience, and how to write each section of the research paper.

In the mean time, happy writing!

Dr Hanak

How to write a research paper?

Reading research papers is the bread and butter of each researcher and academic, regardless of the field of study. And why is this? Well, that's because papers published in academic journals are the primary source of NEW and ORIGINAL knowledge that we, as researchers, use to share our key findings with others.

Before I started my PhD, I knew that academic papers exist and, more or less, knew where to find them. But I had no idea how to write a paper and publish it in a peer-reviewed journal.

My first couple of months as a PhD researchers were really painful. With the pressure to write scientific papers we all experience, my work was initially rejected by the journals, even though I thought the major findings in my work advance my scientific field.

It wasn't until my 2nd year as a PhD student when I got a grasp of academic writing and the publication process, after several rejections and major revisions of my work. But this helped me to appreciate the work that one needs to put into the writing process and paper development process. I don't intend to brag,

but this understanding helped me publish 44 research papers in prestigious journals and achieve an h-index of 22 over the past 5 years. Want to read my research on technologies that enable green energy transition? [Here's my Google Scholar profile.](#)

Today, I want to help those at the very beginning of their academic journey by sharing my reflections on the fundamentals behind writing high-quality scientific papers. Let's get started!

Why is writing a research paper important?

Regardless of the topic of your research project, you must have heard that you should share your findings in the form of research papers. I'm not saying about the peer pressure or the "[publish or perish](#)" culture here. Just genuine need to share your results with others. But do you know what is the significance of a research paper and why we need to write it in the first place?

We write scientific papers to share our findings and new knowledge that we created in our research. By sharing your work in this form, you obtain external validation. A kind of quality stamp. It's because your work has been peer-reviewed by experts in your research field and you've undertaken a revision process to further enhance the quality of your work.

Publishing your work in academic journals is also seen as the "golden" standard in academia. It's usually used as a significant part of your track record when you apply for grants, positions or promotions.

What is the purpose of a research paper?

Although many would have thought that we write papers for the sake of writing papers and academic progression, I still believe the true purpose of each scholarly paper is to advance the understanding of the world we live in and push the boundaries of our knowledge.

Each article must present novel and original research. That's usually different from other types of content, such as white paper or policy briefing paper. That is why I always start writing my papers by specifying a clear purpose of that piece of work. I ask myself my work advances and builds on previous knowledge and how I can clearly demonstrate this in my paper – try this when writing your next paper!

What are the basic parts of a research paper?

Regardless of the research area you work in, there are 5 parts in a research paper. The paper format may differ slightly at different journals and publishers, but by large, each academic research paper will comprise an introduction, methods and materials, results, discussion and conclusion sections.

Each of these sections has a specific purpose and once you understand what to include in each section, writing research papers will become much easier. So what's the purpose of each part? Here's an overview:

- introduction – this section aims to provide the relevant background and rationale for your work, as well as specify its novelty and contribution;
- methods and materials – this section aims to provided

details of your methodological approach to your research and data analysis;

- results – this section aims to present the key results you produced in due course of your research
- discussion – this section aims to share your reflections on your results and benchmark the new knowledge with the previous knowledge, and define any practical application of your work
- conclusion – this section aims to present a concise summary of the main findings of your work

How do you write a research paper?

I encourage you to start writing academic papers as early in your research as possible. Scientific writing is a crucial skill that you need to polish throughout your academic career. So how do you actually write a research paper?

Most of us already possess good writing skills and writing ethics. What does this entail?

I noticed in my work and the work of my students that our papers are much better if we have a clear idea of what each paper is about and what its novelty is. So before you start writing, make sure you clarify these, as it will help you maintain focus.

Then, write the paper outline, using the generic paper format above. By doing this you'd make sure that you include all relevant information, but also ensure a logical flow of information. Remember, a logical sequence of results and discussion is important to make sure readability of your work.

How do I write a good research paper?

This will definitely vary from area to area, but if I were to give a piece of universal advice that will be broadly applicable on how to write a good research paper, I'd say that all parts of your research article should revolve around and support the novelty and originality of your work. If you structure your manuscript around a single idea reflecting the novelty of your work, the message that you present will make much more impact. This is because your paper will be much easier to understand by your readers and they'll be more likely to use your work.

So regardless if you convert your undergrad or postgrad dissertation into a research paper, or if you're writing research papers as a part of your PhD or postdoc, your work needs to be original and novel to be published in a scholarly journal.

Having said that, I want to emphasise the importance of ethics in publishing. Ensure that you avoid any [plagiarism](#), including accidental plagiarism and mosaic plagiarism, and present work that you and the team of your co-authors contributed to. Also, do not submit your work for consideration to more than one journals at once or do not try to publish the same paper in several different journals.

How to avoid the most common mistakes when writing a research article?

Publishing your research can be a nerve-wracking experience, especially at the very beginning of your academic career. It is because of the pressure that you may experience from your supervisor, peers and even yourself to publish your work in top journals.

Although most of us actively work towards more productive and supportive work environment, the “[publish or perish](#)” culture is still there. A change for the better needs time. I’m sure you’ll play an important role in it. In the meantime, you still need to [disseminate your research](#) to build your academic profile.

As you could read in the ebook that Magda and I put together, [the opportunities to share your research](#) are endless – mostly limited by your imagination. However, publishing your research in the form of a research article is still recognised as the most viable way of sharing your work.

It is mostly because your research will be:

- peer-reviewed by experts in your field before it's published
- associated with a recognised journal in your field, gaining additional quality recognition
- shared with the existing research community, gaining immediate visibility

These are just a few reasons why papers are still perceived as the best outlet for your research. And, of course, the quality of your research articles and the rank of the journals will help you become an internationally recognised expert in your research field.

However, with the pressure to deliver your project on time and [publish high-quality research articles](#) in [prestigious journals](#), small mistakes may creep into your writing. It may result in your paper being rejected. It's something that we all want to avoid – believe me, I know how difficult it's to see your work being rejected.

But what if I told you that there're some common mistakes in writing research articles that are fairly easy to avoid?

Having reviewed more than 150 manuscripts as the peer reviewer at Nature, Elsevier and American Chemical Society, and Editor at Wiley, I observed that there are 7 common mistakes that result in a rejection or a major revision if you're lucky.

I thought I'd share these with you so that you can avoid these common issues, improve the quality of your writing, and get your research articles accepted in top journals!

#1 Literature review is not sufficiently thorough, confusing or outdated

A literature review is a crucial part of a research article. It provides the context for your work and helps the reader understand the state-of-the-art in your research area. It should explicitly specify the rationale for your work.

So what seems to be the most common issues with a literature review?

Well, in my experience, I can tell that the most common issue is that the literature review is too vague. It means that it doesn't include enough detail to give the reader the full picture of the most important ideas and context to the paper. For example, you may only briefly explain the key trends in your research area and refer to a group of papers. It doesn't provide a sufficient level of detail as each of these papers made a different contribution.

It doesn't mean you've got to write extremely long literature reviews in your research papers. Select only the KEY papers that will accurately represent the current state-of-the-art and provide a strong rationale for your research.

Another issue with the literature review is that it's confusing. What it means that it doesn't read well, there's no logical flow of information or even information not relevant to your work. Make sure that you refer to papers that are relevant to your work, support your arguments and ideas, or present relevant counterarguments that you want to tackle in your work.

Last but not least, the fundamental issue with the literature review is that it includes outdated sources. When I was writing my very first literature review for a research article, I was told that one should only use sources from the last 3-5 years. I'd argue that we should rather focus on sources from the last 2-3

years, considering the current pace of development across a broad spectrum of research fields. However, here are some exceptions! If you refer to a concept that was introduced much earlier and not discussed since, or if you want to refer to the origin of a specific idea, then it's OK to use older references.

#2 Unclear rationale and motivation for the research

The literature review in the research article has another, very important role. It provides the reader with a sufficient understanding of the research area to understand the rationale and motivation for your research study.

If the literature review isn't thorough and/or clear enough, then your reader may be confused about why your study is important. And remember the first reader of your work is usually the editor and your peers who review your work. It's up to them to decide whether your research article will be published in the specific journal.

Therefore, to make their life easier and increase your chance of getting published, ask yourself a question "why this research is important" when writing your literature review. Make sure it clearly comes across in your final draft.

#3 Lack of or unclear novelty

This one is a true paper killer to which you need to pay attention when writing your research article. If you don't present the novelty of your research in your research article, then you may be more than certain that your work will be rejected from any respected journal.

The main reason why we publish our academic work is that we

created or enhanced our understanding of specific phenomena, concept or idea. We contributed something new to the existing body of research. And we need to be able to explain it to the others concisely and clearly.

And it can be a difficult thing to do, believe me.

Why? Because you've spent so much time doing your research and analysing your results that the main idea of your work became obvious to you.

We all tend to assume that others see the world and have the same understanding of things as we do. But this is not the case.

To clearly explain the novelty of your work, write it down in 1-3 sentences. Get really down to what is your contribution and state it explicitly in your research article. That's it.

#4 Structure of the paper is confusing

Unless otherwise stated in the guidance for authors, which I strongly advise you to read before you submit your work to any journal, most of the journals follow the same structure and include the 5 common parts:

- Introduction
- Methods and Materials
- Results
- Discussion
- Conclusions

If your manuscript doesn't include any of these sections, your readers will miss the key piece of information that will help them fully understand your work. I know this seems simple, but you'd be surprised how many papers I reviewed that didn't

include proper discussion section.

#5 Methods not explained clearly or sufficiently

A methods and materials section of your paper is crucial for the readers to understand how you did your research.

The main challenge with this section is that it should allow your readers to replicate your work and verify your results. But this isn't always the case, is it? I bet you've read some super confusing papers, and you were asking yourself "how they did this" and "why they did this way" and so on. I get it a lot from my students.

And that's why I want to encourage you to include the full description of the methods and materials you used in your research, in a way that others can replicate your work.

#6 Results are not clearly presented and discussed

As I mentioned above, we write research articles to share new data, results and ideas. One of the key reasons why manuscripts get rejected, or worse published and not cited at all, is that the results are poorly presented and discussed.

The results can be poorly visualised or presented as large, confusing datasets. It means that the research manuscript includes no meaningful discussions of the results, beyond the current state-of-the-art in the specific research area. The discussion may be very vague, stating obvious facts (beware of the word "obvious" in research papers!) and not reflecting on the implications of the results on the current state-of-the-art.

To make sure your research is properly presented and discussed:

- think outside the box when visualising and analysing your data (check our review of [tools for data visualisation and analytics](#))
- thoroughly analyse your data and present implications of your research
- refer back to the data and ideas from the literature review to provide clear proof of the advancement that you made in your research

#7 Inconsistent conclusions

Conclusions, right after the abstract, is one of the most commonly read part of your research article. It's because the readers are looking for the key outcomes and conclusions presented in the paper before they decide to read the full paper.

The main mistakes I observed in the manuscripts I reviewed, and ones you should avoid in writing the conclusion section, are:

- introduction of new data in the conclusion section
- conclusions not supported with data presented earlier in the manuscript
- too long conclusion section

Although these issues are unlikely to get your paper immediately rejected, you may improve the perception of the reviewers and editors by including only the main outcomes of your work in the conclusion section.

How to write an abstract for a research paper?

Have you heard that an abstract is one of the most important elements of your research paper?

I want you to remind yourself of the time when you search for papers to support your research. Ask yourself the following question – what information you read first?

Yes, that's right – you usually decide whether the research paper is useful for your research based on the title and abstract alone.

Only after the abstract catches your interest, you read the full paper.

You can see the abstract of your research paper as an opportunity to showcase the best aspects of your research and encourage your readers to go through the entire article to find out more.

I know we're usually not taught how to sell and market our work during our PhDs, which is a real shame if you ask me. But it's something you can learn using the [process for developing habits](#) I discussed some time ago.

Essentially the purpose of an abstract is similar to the sales

pitch. The abstract is your opportunity to get your readers hooked and convince them that your work is relevant for them.

A role of an abstract in scientific writing

How to write a good abstract? It's quite a broad topic! But you may wonder why we should talk about it if it's just 100–300 words of your research paper, proposal, conference paper?

So basically abstract is one of the most important elements of your research paper! Why? Well, in my opinion, it's important to write a great abstract as it's a summary of your study that other researchers can read to understand what you did.

However, squeezing all of your fantastic research in about 100–300 words it's quite challenging. So you have to distil the most important messages, methods and results from your research. It shouldn't be an essay. Instead, it should be a very direct message to someone who reads your abstract so that they can easily understand why you did perform this study, what exactly you did and what method you used and what's the implication. Therefore, your abstract needs to answer the main questions of your readers – I'm going to refer to them in the latter part of this article.

The main aim of an abstract is to encourage others to read the full paper or accept your paper for a conference or publication. It helps them understand the key messages in your paper better!

What are researchers looking for in abstracts?

When I read papers or look for papers to support my literature review, I ask myself the following questions.

When I look for a specific piece of information, I first try to

determine whether the specific papers can potentially give me this information. I'm usually trying to understand whether that specific research is relevant to my work or whether I can use some of the methods, results or discussion in this specific paper to support my work. I usually start this by reading abstracts!

When reading your abstract, other researchers will be asking themselves the following questions:

- "Is this research relevant to my work?"
- "How can I use [methods/results/discussion] from this paper in my work?"
- "What new findings and implications this paper presents?"

Reflect on what you do when you search for information. When you read papers, try to understand what information you are looking for. Others are likely looking for similar pieces of information. By reflecting on your journey, you can understand how you should write and what kind of information you should include in the abstracts.

Therefore, when you read the next abstract, I encourage you to write down the questions that come to your mind when you read the abstract. You can use them later when you write your abstract for your research. You'll be able to use those questions to guide you and indicate what's important and what kind of answers you should provide to the readers.

Define a clear message for your research paper

Before you start typing your abstract, it's important to clarify the main message(s) that you want your readers to take away from your research.

Considering your readers, these messages should answer the following questions:

- why is this research important?
- why is this research relevant?
- what are the tools, techniques and methods used?
- what new information do I learn from this research?
- what are the implications of this research?
- how can I use this research to progress with my work?

You get the point. Having done your research, it's important to select only the main information that will directly answer the questions above.

I know it isn't easy to know exactly what the readers will be interested in – after all, each researcher is interested in different aspects of your work.

But as a rule of thumb, you can assume that they'll be interested in the fascinating conclusions and significant implications of your work that may influence the way they do their research.

How to structure your abstract?

Now that you've clarified the messages and selected the information you want to include in your abstract, it's time to structure it.

Unless the journal or conference has a predefined structure for an abstract, you can use the following structure in your writing to make sure you present the most important information about your research paper:

- general background: this part sets the broad context for

your work and informs the reader about the broad background and importance of your work

- specific background: this part narrows down the scope of your work to a specific aspect of your field of study
- research challenge/knowledge gap: this part specifies the problem or challenge that needs to be solved or understood in the specific aspect of your field of study
- proposed solution: this part presents your proposed solution or hypothesis that you've tested in your research paper
- methods: this part concisely informs the readers what approach and tools you used in your work
- results and discussion: this part (most important!) presents the fascinating results from your research and their implication on the specific aspect of your research field

Let me talk about each of these elements in more detail.

You have to start your abstract with the **background and context**. It'll help your reader understand the wider research area and why you do your study. In that element, you answer why this research is important and why it's relevant. For example, [my work focuses on carbon capture](#). Therefore, I usually start my abstracts by including a sentence or two about climate change or the energy sector to provide my readers with the relevant background. Then you need to narrow your abstract down to the specific technology, concept, issues of your particular research area.

Once you established the context and specific challenges in your research area, you need to establish the **research challenge**. You have to clearly articulate the research challenge you set out to address in your research. For example, in my research on carbon capture, the main challenge is that this technology isn't

(yet) economically viable. Therefore, we need to find a way to make it less expensive and easier for the industry to implement.

Once you set out the challenge you'll address in your research paper, you must present your **proposed solution**. You have to clearly present what your paper does. That's why you have to clearly say that "*in this paper, you evaluate [your proposed solution to a specific research problem]*".

Then you present your **methods, key results and** discussion. In terms of methods, if your space is really limited, for example, in the case of short abstracts (<150 words), you may not actually include any description of the method you used in your work, or you may include a very brief mention of it. This is because the results, discussion and implications of your work are the most important aspects you need to include in your abstract. This is because you want to encourage people to read the full paper and inspire them to use your results to support their work.

Remember, the abstract should encourage the reader to read your full research paper. Include only the most relevant information that shows why your research paper is exciting and worth reading.

When you actually write an abstract for the research article?

There are two approaches – either you write a skeleton, a kind of outline, of the abstract first before you actually start writing your article and then it guides you through the article. This will help you to know what messages you should include in your writing.

Another way is to actually write the abstract after you write the full research article. You finish writing your manuscript,

and you leave the abstract at the end. This is the way I prefer. I write the main body of the manuscript, and then I reflect on what I've actually written. I do this to distil the main messages I want to include in the abstract.

But what if you actually write the abstract at the end and activity this will generate new ideas for content you could include in your paper? What to do then? When you write the abstract after you finalize your manuscript, then it's likely that you see some additional pieces of work that you could in your research. It's actually a good idea to think whether you should change the paper itself or whether you actually want to fix the content of the paper, submit it for a conference or to a journal, and then think about how you can expand on your new idea to actually produce an additional piece of work for your research. This will, of course, depend on the "size" of the idea. If it's a small idea that requires little additional work and modifications to your paper, it could be included in this specific paper. But it requires a significant amount of work that will take you weeks or months to complete. In that case, I'd say it's something worth exploring for an additional paper.

How to start writing an abstract?

Once you've written the paper, how do you go about putting the research abstract together? The approach I use is to leave the manuscript for a couple of days. You will be very familiar with your paper, so you may not notice anything exceptional about it. This is because you may think that everyone will understand it in the way you understand it. But if you leave it for a couple of days, you'll be able to clearly see the main messages that come across through your paper. Write down these main messages,

including the main results that are the most fascinating and that you think others will find most exciting. I also encourage you to ask someone else to actually read your paper before submitting it to a journal or for a conference to verify whether your messages come across as you intended.

How to be concise when writing an abstract?

When writing the abstract for your research paper, it may be tempting to use jargon and abbreviations that you've already used throughout your manuscript.

I want you to remember that the readers of your article may not necessarily have the relevant background. They may be just broadly interested in your work and using jargon may make it difficult for them to understand your key messages.

Use neutral language to convey your high-level messages. It might be a good idea to ask someone who isn't directly involved in your work to read the abstract and ask them if they understood it.

As I mentioned above, depending on the journal or conference, you may have only between 150 to 300 words to pitch your research. Use it wisely using the structure above.

Finally, it's [generally accepted](#) that you use past tense to describe what has been already done in your research area, describe your methods and results. You may use present tense to introduce your work and explain the implications of your results.

How to write a literature review?

Writing a literature review can be challenging. I can relate to this! At the very beginning of my academic career, when I didn't know much about writing scholarly articles, I was overwhelmed by the amount of information available in my field of study.

However, as I've started building an understanding of the relevant literature in my field, I've realised how important it is to understand the current state-of-the-art in my research. And it doesn't only apply to writing journal articles. Understanding the key themes and key findings in your research will help you to come up with innovative ideas for your own research. You can later share these ideas with the scientific community in the form of a research article or review article.

I know the literature review process isn't simple. Still, I want to share the process I use to write scientific papers, grant applications or any other relevant piece of academic writing.

By the way, if you're looking for literature review tools or scholarly sources, [check out my other article here](#).

Why do you write a literature review?

The main aim of a literature review is to gain a systematic understanding of the current state-of-the-art. It helps us:

- understand the central themes in our field of study
- understand how our field of study and studied topics changed over time
- understand the challenges, issues, limitations in the current knowledge
- understand the significance of findings from our research
- identify research gaps for our future study
- identify relevant papers and influential theories that have changed our field of study within defined time periods

As you can see, a review of the literature is crucial to generating and justifying new ideas. Regardless of whether you need to write a dissertation literature review or a review for a standalone piece that will undergo a peer-review process, a successful review will have a single focus – to demonstrate your understanding of the current literature and justify your proposed research.

What is a literature review?

Now that you know why we need to perform lit reviews, let's talk about what it actually is.

According to [the University of Edinburgh](#), “A literature review is a piece of academic writing demonstrating knowledge and understanding of the academic literature on a specific topic placed in context. A literature review also includes a critical evaluation of the

material; this is why it is called a literature review rather than a literature report.”

In summary, a literature review is a document presenting a comprehensive discussion of information presented in the key sources in your field of study. At the postgraduate level (Masters & PhD), it's insufficient to present an overview of the current literature.

That's why I want you to place a high emphasis on the specific phrase in this definition – a critical assessment. A literature review isn't merely an overview of what has already been done in your research area. You need to include an in-depth discussion of the validity of that research, questioning the assumptions made to perform that research.

Be brave to identify any limitations, challenges and issues with the current academic sources in your research field.

How to write a literature review?

Step 1: Why do you need to write a literature review?

We often miss this step. Before you even start collecting data for your review, you need to define a clear rationale for it. Why do you need a literature review? Your “why” will define the scope, extent and structure of your lit reviews.

Here are some examples you may encounter in your academic career:

- a literature review to support your papers in academic journals
- a literature review for your PhD/MSc thesis
- a literature review to support your research grant applica-

tion

- a review article to support your research project

Step 2: What type of literature review you need?

Depending on why you need to review the current literature in your field, there are different types of literature review that will be best suited to provide the information you need.

We can distinguish:

- Traditional review – presents a thorough summary, critique and discussion of the current literature. It aims to synthesise the current literature and provide a comprehensive account of research gaps and further direction for research.
- Systematic review – includes a systematic approach (i.e. clearly formulated protocol) to a selection of sources and usually includes a standardised statistical analysis of the literature sources. The review protocol is usually made available. It aims to answer a clearly formulated question.
- Integrative review – similarly to traditional review, it provides a critique of synthesised information for a specific research topic. However, it is structured in a way that supports the development of new frameworks or perspectives.
- Argumentative review – it aims to examine the currently published works to test a specific hypothesis.
- Theoretical review – it aims to provide a comprehensive account of the available information about a specific theory or concept.

Step 3: Identify keywords

Once you identify the type of literature review that fulfil your goals, you'd need to come up with a list of keywords for your literature search.

The simplest approach to identify your keywords is to start reading academic papers relevant to your work and identify the names for:

- theories
- concepts
- frameworks
- methods
- technologies
- processes
- phenomena
- issues

These will help you with finding further studies in your work. Just to give you an example, my work focuses on carbon capture, utilisation and storage. More specifically, I tend to focus on high-temperature technology called calcium looping. So the keywords I would use to find more papers include:

- calcium looping
- carbon capture
- CO₂ capture
- carbon utilisation
- carbon storage
- CO₂ use
- CO₂ utilization

- carbonate looping
- high-temperature CO₂ capture
- ...

As you can see, it's fairly straightforward to come up with relevant keywords! Make sure that you keep a list of keywords for your research updated!

Step 4: Search for relevant sources

Knowing your keywords, it should be easy to identify relevant studies. Have a look at the [list of databases that you can use to find relevant academic literature that I compiled here](#).

Now you need to use your keywords to find relevant studies. Using keywords as they are may lead to a high number of hits, which can be overwhelming. But there are ways to narrow down your search:

- use Boolean operators (i.e. “carbon capture” AND “economic assessment” to find studies that focus on the economics of carbon capture)
- use quotation marks to search specific phrase (i.e. “carbon capture for coal-fired power plants”)
- use filters available in a specific database (i.e. use filter to search only for review papers in a specific time period)

Step 5: Critically appraise and categorise sources

Once you identify the sources you want to include in your review, it's time to categorise and critically appraise them.

There are two things you need to consider at this stage.

First, make sure you develop an efficient system to store your data. When reading a paper, write a critical summary and collect all important data that will help you answer the main question(s) for your study.

When I write literature reviews, I always compile summary tables. This helps me to keep all relevant information such as keyword, theme, paper title, authors, critical summary of paper's content, key variables and so on. Also, I use Mendeley to keep track of my references. Want to read some of my review papers? Have a look at my [Google Scholar profile](#).

Second, you need to decide how you'll categorise your work. Broadly speaking, you can categorise the data you collect, and subsequently, structure your review:

- chronologically – chronological method assumes that you'll organise your data from the oldest to the most recent one
- thematically – categorise your data based on common themes in the literature
- methodologically – organise your data by the methodological approach used in the literature sources
- theoretically – organise your data based on the theoretical approach used in the literature sources

Step 6: Outline and write a focused account for selected categories

Now that you've categorised your data, it's finally time to write. If you've reviewed a sufficient amount of academic papers, efficiently organised your data and decided on how you're going to approach your review, the writing should be much easier!

The key here is to have a vision for how your review will look like after you finish. Outlining key sections is crucial to achieving a logical flow of information. You need to know what questions you want to answer in each section.

Once you have an outline, use the data you've collected to write a focused and critical appraisal of the current literature. Make sure that you don't merely overview what has already been published. Think about what challenges are yet to be resolved, what's missing and how this can be resolved.

How to avoid plagiarism in your research?

When writing academic manuscripts, we need to present novel ideas, thoughts and discoveries.

But to ensure that the readers of your work understand what you're talking about, you need to provide them with relevant context and background that presents the current state-of-the-art in your field.

From the discussions I had with you, I've realised that many of you are worried about plagiarism and want to know how to avoid plagiarism in your writing.

I've decided to share some of my thoughts on what you should pay attention to when writing. I trust these will help you to avoid unintentional plagiarism.

Plagiarism definition

Before I start talking about the ways to avoid plagiarism, let's define what plagiarism is.

“Plagiarism is an act of intentional or unintentional copying of someone else’s work and presenting it as your own.” [Oxford Learners Dictionary](#)

The most [common types of plagiarism](#) include:

- direct plagiarism that occurs when you directly copy (i.e. word-for-word) someone else’s work;
- self-plagiarism occurs when you submit and publish the same paper in several different journals;
- mosaic plagiarism occurs when you slightly modify the original sentences and phrases without using quotation marks; and
- accidental plagiarism occurs when you forget to include a reference use wrong quotes or use similar sentences unintentionally.

The last one is rather difficult to avoid, especially when you use jargon relevant to your field. For example, I often use the phrase “carbon capture, utilisation and storage” in my work which will get picked up by any plagiarism tools I use.

Remember, if you’re using tools to check your text for plagiarism (see more on these in the last section), be critical about the results. Use common sense to decide whether you may have plagiarised something.

If you’re not sure, ask your colleague, supervisor or us for advice!

Ways to avoid plagiarism

Now that you know what the definition of plagiarism is and what are different types of plagiarism, let's discuss actions you can take in your academic writing to stay away from plagiarising someone else's work.

Don't copy-paste!

This seems obvious, but it's surprising how many people plagiarise others and their own work. According to [Plagiarism.org](https://plagiarism.org), 40% graduate and undergraduate students "admitted to cheating on written assignments". This is a massive number.

I trust none of you is doing it! After all, research is about being able to critically appraise information in the current literature and use your reflections to present your point of view.

Acknowledge your sources

Efficient [management of your sources](#), i.e. [using tools that can support your literature review](#), is key to successfully avoiding plagiarism.

If you manage your references properly, you'll avoid misquoting or missing relevant citations in your work. As a result, you'll be more organised, keep your references in order, and will never forget to cite the work of others that you use to support your own work.

Paraphrase and quote properly

When writing a literature review or a background section, you need to use other sources. It's implied that you need to refer to them and in some way use the information they provide. To do so, you can either paraphrase or quote that particular source.

You can use paraphrasing when explaining a specific idea, concept or framework from a specific source using your own words. This will include only the most important information that supports your argument. Make sure you refer back to this source!

You can use quotes when you want to use a sentence or a phrase word-for-word in your own work. Make sure such quotation is clearly distinguished with quotation marks and that it's clear where this quotation is coming from.

In academic writing, we tend to paraphrase a lot and use quotes only for definitions or when it's nearly impossible to paraphrase a given passage without changing its meaning.

Check your draft for plagiarism

Last but not least, before you submit your work to a journal or as a part of your PhD, it's crucial to check whether you haven't missed anything.

Your work is likely to be checked by the editors or markers for plagiarism anyway, but it may be too late to avoid rejection.

There are several tools that you can use to check your work, including:

- [Turnitin](#)
- [Grammarly](#)

HOW TO AVOID PLAGIARISM IN YOUR RESEARCH?

- [PlagiarismDetector](#)
- [Dupli Checker](#)
- [Quetext](#)
- [Copyleaks](#)
- [PaperRater](#)
- [PlagScan](#)
- [PlagTracker](#)
- [Plagiarismhunt](#)
- [Plagium](#)

Some of these tools are available free of charge, so why don't you give them a go?

How to overcome writer's block?

Do you enjoy writing?
I noted that many researchers usually consider writing as the least exciting part of doing research, usually dedicating too little time to this important activity in their research project.

After all, you've done your experiments or derived a new mathematical model that helps to solve a specific challenge.

This is truly the most electrifying part of your work, as you've pushed the boundary of knowledge. Well done!

But what's the actual value of your discovery if you don't share it with others?

Although there are many ways to share your research, writing down your research is still the main way to do so.

You usually include "writing time" in the plan of your research project. But once you gather all your research data and sit down to get some writing done, you hit the wall.

The white page of your document scares you, and you don't know where to start. You feel unable to write anything, feel uncomfortable or even sick to put a couple of words together.

You're experiencing writer's block – yes, it happens to researchers too, and it's inevitable.

Definition and causes of writer's block

According to Patricia Huston, writer's block is “[a distinctly uncomfortable inability to write](#)”. But each one of us experiences it differently.

When I experience writer's block, I delay writing at the expense of doing some mathematical modelling or generating [new ideas for research](#). But I only do this if the timeline of my research project allows me to do so. If there's a deadline I need to meet, I apply some of the techniques I discuss in the next section.

Regardless of the plans you've made, you may hit the wall with your writing and experience writer's block in your research project.

Although there can be many reasons that cause writer's block, here are some most common ones:

- looming deadline – instead of getting motivated by the time pressure, you may get overwhelmed by the task you've got to complete;
- incomplete data analysis – you may not have put sufficient time to analyse your data to understand it and draw clear conclusions;
- fear of rejection – you may be worried (sometimes subconsciously) that your work is just not good enough, and you don't want to be criticised;
- perfectionism – you try to get it perfect on the first effort and entering the editing mode rather than writing mode.

How to overcome writer's block in a research project?

Writer's block can get your work stuck for a while and, unfortunately, I don't think there's a silver bullet that we could all apply.

Each case of writer's stuck is different. Therefore, you may want to try different ideas to overcome writer's block and unstuck your research project.

However, I'm happy to share some of the ideas and activities that have helped me overcome writer's block in a research project.

Plan your document

this may seem like an obvious one, but setting out the content framework or outline for your document will help you focus on what's important in each section. Break your work down. You'll also not need to think about what to write next when actually writing.

Read journals

Reading publications related to your work may spark the inspiration you need to start writing your piece. This is something you need to do in your research project anyway, so try to make the most of it. Make sure you read something of high quality – you may start with [Science](#), Nature or [Energy and Environmental Science](#)!

Freewrite and hammer through

Try to start writing your thoughts as they come to your mind, don't think or evaluate what you've just written – keep on writing and enjoy. Just keep writing about anything that can get you out of writer's block in no time.

Change your environment

You may try to write in a different room in your apartment, a balcony, or even a park nearby. Changing your environment can do marvels to your creativity and productivity. (P.S. I write this article from my sofa rather than the desk where I usually do most of my writing.)

Exercise and get some fresh air

Going out for a short but intensive walk can get your blood pumping, even if it's just a couple of minutes. It'll take the mind of your writing and will let your subconsciousness do its work. Once you're back, sit to your writing straight away.

Turn off distractions

Seriously, do you need your phone on 24/7? Switch off anything that can distract you, especially if you [work from home](#). Unfortunately, [we cannot multitask efficiently](#), so try to make most of your writing time by creating an environment that supports focus and motivation.

Reward yourself

We all like to be rewarded for our work. If there's anything that you enjoy the most, like a night out with friends or shopping, let yourself have it only after you finish your document.

Get creative and write about your hobby

Brainstorming and creative work can be a great remedy for writer's block. The same applies to writing about your hobby or things that you care about. Since Magda and I launched [Motivated Academic](#), I found myself much more productive in writing research proposals and papers.

How to make your research open access?

Once you immerse in [writing academic papers](#) and get some of your papers through the peer-review process, you'll realise that there are several options for you to enable others to access publication that you crafted. By the way, here's my article on [how you can avoid key mistakes in academic writing](#).

Some of these options are paid, some are free, but the underlying idea of publishing in an open-access peer-reviewed journal is to share your research with a wide academic community. After all, we publish our work for others to learn what we did and found out, as well as to disseminate the new knowledge produced in high-quality research.

There is a strong open access movement that promotes making your research as widely available as possible. And I strongly support this. We're not producing our cutting-edge research for the publishers to benefit. We're producing it to advance our knowledge and make our life better!

When I engage with early career researchers and PhDs, I noted

that open access is not very well understood across academic disciplines. Unfortunately, this lack of understanding makes those with little experience in academic publishing vulnerable to predatory journals or journals that don't care about quality or ethical issues.

In this article, I want to encourage you to make your research papers and review papers as widely available as possible. It doesn't matter if you're in social sciences, health sciences, behavioural sciences, medicine sustainable development, energy science or engineering, or climate research areas. Making your original articles openly accessible will help other researchers, professionals and policymakers in your field find and use your work!

What is open access?

As already explained in the name, open access journals make your high-quality research openly available to all at no cost to the reader.

According to openaccess.nl *“a publication is defined ‘open access’ when there are no financial, legal or technical barriers to accessing it – that is to say when anyone can read, download, copy, distribute, print, search for and search within the information, or use it in education or in any other way within the legal agreements.”*

The most important benefits of publishing in OA journals is that your work is more visible and easier to reuse by others.

The disadvantage? Most OA journals charge the article processing charges (APC) that can reach a couple of thousands of dollars/euro/pounds for the top journals in your field. This is usually paid by the author's institution through grants or agreements with publishers.

That's where the open access publishing is broken, gets challenging and disadvantageous for those in developing countries.

But don't worry! Even if you or your institution cannot afford to pay APC, there are other open access options that you can consider to make your research widely available!

How do you make your cutting-edge research open access?

Before you select the journal to share your high-quality research in, it's always good to explore what open-access licence that specific journal offer and whether this fits your requirements.

Why?

Not all journals are open access. A large fraction of journals is still charging subscription or a one-off fee for access. This means that if someone what's to access your research, they need to purchase access to your article or specific journal issue.

Therefore, it is important to consider whether the journal you want to publish in offers the open access option.

Once you establish a list of journals that make your research OA, it's important to consider what type of OA they offer. Broadly speaking, there are 4 different open access models that are often represented with different colours - hence the rainbow in the title!

Gold Open Access Journals

These journals make online access to your research via the publisher platform under the Creative Commons (CC) license.

These can be either full open access journals, which publish only OA papers, or hybrid journals. The latter publishes both

subscription-based and OA papers.

When it comes to fees, the Gold OA route may attract an article processing charge. This is more likely in the hybrid journal, although the full open-access journal may also involve this charge.

Green Open Access Journals

In my view, this is an underutilised route to making your research open access.

What is green open access? It's simple. You publish your research in a hybrid peer-reviewed journal or subscription journal at no cost (i.e. your work will be published behind the paywall and not everyone can access articles in that journal).

And for most of the researchers, that's the end of the publication process.

But that's not the end!

To make your paper Green Open Access, you can share your postprint, aka. author accepted copy, via subject repository or institutional repository.

You would need to include the reference to where your paper was first published, but I don't think this is a major issue. Make sure you check the open-access policies of the specific publishers.

Also, self-archiving by authors is permitted under green OA. This means you can also share your work via communities and your website, as long as you acknowledge the original publication.

Bronze Open Access Journals

This route to open access is quite controversial. What do I mean by this? Let me explain.

If you select to publish in the bronze open access journal, then your article will be available for others to read on the publisher website, usually free of charge.

This is a good thing!

What's the catch then?

The issue is that the bronze OA journals do not assign an open-access license to your review or research paper. This means that your work cannot be reshared or reused in a similar way as gold open access publications.

Diamond and platinum open access

This is the ultimate route to open access! Your paper is made open access for free to you, as an author, and to anyone who wants to read your work. There are no APCs or subscription costs. It involves similar open access licences as the gold OA.

Diamond Open Access Journals are usually funded via libraries, institutions, societies or any other external source.

Where to find open access journals?

Now that you know different types of OA journals, how do you find them? That's where the [Directory of Open Access Journals](#) comes in. DOAJ is a search engine that helps you find open access journals and papers. It allows you to select a filter the results by area, APC, language etc.

Make sure you check the scope, readership and other metrics

of the journal before you submit it.

Are open access journals reputable?

As with any journal, there are a couple of things you need to do to check the quality of the journal before you submit your awesome science.

Make sure that you submit your work to a peer-reviewed journal and check how long the peer-review process takes. If the journal promises you to do the review within 1-2 weeks, this looks rather suspicious and you should steer off such journals.

Also, check whether the journal is listed in DOAJ, ideal with DOAJ seal.

Finally, try to stick to recognised and reputable publishers. Remember to put priority on quality for your paper and the journal itself! I receive several requests to submit manuscripts to some random publishers a day. Reputable publishers won't do this unless they launch a new journal or have a special issue.

How to avoid predatory journals?

As an early career researcher, you may feel pressure to publish your work. And that's understandable. We need to publish our research in scholarly journals that use the peer-review process to ensure the high quality of your research. Your academic progression at your university may also depend on [your track record of publications in academic journals](#).

However, if you don't have sufficient support or are encouraged to publish as much as possible, you may feel under significant pressure to cut corners.

I'm not saying that you'll do this.

But there'll be people who'll get excited when they receive an email from an unfamiliar journal asking them to submit their research. I know it seems that someone has recognised your work. But remember, credible journals WILL NOT ASK YOU TO SUBMIT YOUR WORK unless they have a special issue or the publisher launch a new peer-reviewed journal.

I'm also not saying that publishing in Q3/Q4 journals by impact factor is something that we shouldn't do. After all,

we cannot judge that a specific title is a low-quality journal solely based on its impact factor. As long as you publish in legitimate journals that respect the peer-review process, gather a relevant audience and are published by a reputable publisher, your research should achieve the impact it deserves.

However, under some circumstances, people will put quantity over quality. If you read my previous blog, [you should always put QUALITY over quantity](#).

I decided to write this article because I'm high worried about the quality of publishing in science and the integrity of the scientific community.

When engaging with you via several Facebook groups, I noticed many people offering to get your research published in the "peer-reviewed" journals in a couple of days. Sadly, people try to use predatory publishing to take advantage of researchers who strive to share their research.

Here's what you need to know about the common characteristics of predatory journals.

What are predatory journals?

Predatory publishing is an exploitative and unethical practice that charges you the article processing charges (APC) to make your research open access without the rigorous peer-review process that you would expect from legitimate journals.

A great explanation of how predatory-open access journal differs from the reputable journal was given by Grudniewicz et al. (2019) in [Nature](#). Here it is:

"Predatory journals and publishers are entities that prioritize self-interest at the expense of scholarship

and are characterized by false or misleading information, deviation from best editorial and publication practices, a lack of transparency, and/or the use of aggressive and indiscriminate solicitation practices.”

What are the common characteristics of predatory journals?

Luckily for us, there are several common characteristics that we can use to identify deceptive journals and avoid publishing in them.

One of the most common ways to check whether the journal is predatory is to check [Jeffrey Beall's list of potential predatory open-access publishers](#).

This page gives you a list of publishers and standalone journals that meet Beall's criteria for poor journal standards and practices. And remember, journal impact reports are not the only way to check the journal quality!

Building on Beall's work, Eriksson and Helgesson have come up with a list of 25 characteristics that may indicate that the journal deviates from the gold standard of scholarly publishing.

For your benefit, you can read [their full work here](#). I just quote the key characteristics of a predatory journal. When you benchmark the journal against this list, remember that the more you can tick off, the more likely it is that the journal is predatory.

If you don't have time to read through the entire list below, these characteristics can be broadly divided into 4 categories:

- false or misleading information, including fake impact factors, wrong email address or fake editor
- deviation from gold publishing standards, including fake peer review or lack of peer review

- lack of transparency, including information on author fees, instructions for authors, no citation metrics
- aggressive solicitation, including repeated predatory publishing emails (i.e. unsolicited emails) that ask you to submit your work urgently

The criteria set out by [Eriksson and Helgesson](#) are:

1. *“The publisher is not a member of any recognized professional organisation committed to best publishing practices (like COPE or EASE)*
2. *The journal is not indexed in well-established electronic databases (like Medline or Web of Science)*
3. *The publisher claims to be a “leading publisher” even though it just got started*
4. *The journal and the publisher are unfamiliar to you and all your colleagues*
5. *The papers of the journal are of poor research quality, and may not be academic at all (for instance allowing for obvious pseudo-science)*
6. *There are fundamental errors in the titles and abstracts, or frequent and repeated typographical or factual errors throughout the published papers*
7. *The journal website is not professional*
8. *The journal website does not present an editorial board or gives insufficient detail on names and affiliations*
9. *The journal website does not reveal the journal’s editorial office location or uses an incorrect address*
10. *The publishing schedule is not clearly stated*
11. *The journal title claims a national affiliation that does not match its location (such as” American Journal of ...” while being located on another continent) or includes ”international”*

- in its title while having a single-country editorial board*
12. *The journal mimics another journal title or the website of said journal*
 13. *The journal provides an impact factor in spite of the fact that the journal is new (which means that the impact cannot yet be calculated)*
 14. *The journal claims an unrealistically high impact based on spurious alternative impact factors (such as 7 for a bioethics journal, which is far beyond the top notation)*
 15. *The journal website posts non-related or non-academic advertisements*
 16. *The publisher of the journal has released an overwhelmingly large suite of new journals at one occasion or during a very short period of time*
 17. *The editor in chief of the journal is editor in chief also for other journals with widely different focus*
 18. *The journal includes articles (very far) outside its stated scope*
 19. *The journal sends you an unsolicited invitation to submit an article for publication, while making it blatantly clear that the editor has absolutely no idea about your field of expertise*
 20. *Emails from the journal editor are written in poor language, include exaggerated flattering (everyone is a leading profile in the field), and make contradictory claims (such as “You have to respond within 48 h” while later on saying “You may submit your manuscript whenever you find convenient”)*
 21. *The journal charges a submission or handling fee, instead of a publication fee (which means that you have to pay even if the paper is not accepted for publication)*
 22. *The types of submission/publication fees and what they amount to are not clearly stated on the journal’s website*
 23. *The journal gives unrealistic promises regarding the speed of*

the peer review process (hinting that the journal's peer review process is minimal or non-existent)—or boasts an equally unrealistic track-record

24. *The journal does not describe copyright agreements clearly or demands the copyright of the paper while claiming to be an open access journal*
25. *The journal displays no strategies for how to handle misconduct, conflicts-of-interests, or secure the archiving of articles when no longer in operation”*

If you notice any of these predatory practices, please check whether you're not dealing with predatory journals.

Why should predatory journals be avoided?

We all want to publish our work in high-quality journals. This helps us to build a strong track record and recognition for our research.

The challenge is that the true peer-review process at prestigious journals tends to take time. Legitimate publishers take the ethical standards seriously and ask 2–5 experts in your field to evaluate your manuscript before the editor decides whether to accept your work for publication.

So why predatory journals exist? Well, such questionable journals offer you a chance to publish your work in a couple of days or weeks rather than months or years.

It's tempting, therefore, to submit to such journals, especially if you're close to the end of your research programme and still need to publish your work.

But here's why you should avoid publishing in predatory journals:

- your work WILL NOT be peer-reviewed, so the potential quality issues will not be corrected
- you WILL BE CHARGED author fees, regardless of whether your work is published
- your work WILL NOT BE INDEXED and, therefore, other researchers will not be able to access it and cite it
- your work WILL NOT achieve the impact it deserves
- your work CAN BE STOLEN and published by other researchers in a more prestigious journal

How to verify a publisher and avoid predatory journals?

Here's the academic publishing rule 101. Journals offered by legitimate publishers will not ask you to urgently send your work and promise rapid peer review to publish it in a couple of days or weeks. Be suspicious when you get an invitation from an unknown journal.

How do you identify publishers and journals to share your high-quality research in and avoid getting caught by a predatory publisher?

When selecting a suitable journal for your research, check whether it is indexed in standard databases, such as Scopus and Web of Science.

If you want to publish in the open-access journal, it's good to check the Directory of Open Access Journals. Be careful though as work by [Grudniewicz et al. \(2019\)](#) indicated that some journals in DOAJ can be published by predatory publishers (although a very small fraction). If in doubt, check [Beall's list](#) and the [list of hijacked journals](#).

How many articles should you publish during your PhD?

From the early stage of your research career, you are told that you need to publish your work in peer-reviewed journals.

You may even feel the pressure to publish, especially towards the end of your PhD degree, because of the [“publish or perish” culture](#) that may influence your productivity. As a result, you may be tempted to publish your work in any journal that will publish your work, regardless of its international standing and recognition.

If you’re fairly fresh to the entire publishing process, you may be wondering how many publications you should publish during PhD? Or even what journals you should consider publishing your work in?

I’ve been there and asked these questions myself! I never could get a definitive answer from my peers and supervisors – most of the answers I got emphasised the need to publish high-quality work in prestigious journals.

And I fully agree with this. You should always place quality

over quantity in your research project.

But as an academic, I am curious whether this is the case.

For example, one question that kept coming to my mind was whether there a correlation between quality and quantity or between quantity and impact?

Let me answer some of these questions for you.

What does the research say about quality over quantity?

As I mentioned above, your publications should be of a high quality advance our understanding of the world. It would be best if you also aimed to inspire other researchers with your new insights and enable them to build on your work.

Yes, quality is of paramount importance in academic publishing.

Although the common view is to place quality over quantity, the analysis by [Sandström and van den Besselaar](#), who evaluated the importance of quantity (productivity) and the production of highly cited papers show that quantity also is an important factor to academic impact. Their work considered a database comprising 48,000 researchers, their publications recorded in Web-of-Science between 2008 and 2011 and citations up to 2014.

Their work has indicated that “*the share of top cited papers increases with output*”.

Quality over quantity? Research by [Sandström and van den Besselaar](#) revealed the correlation between the average number of top cited papers by field as a function of productivity class (here defined as the number of published papers)

Interestingly, they also indicated that:

“the 6.3% most productive researchers in [considered] population are responsible for 37% of all papers and for 53% of the top 1% cited papers.”

So why producing more papers in your PhD may lead to higher quality; hence higher recognition? Here are some ideas that may explain this correlation:

- the more you write, the more ideas you generate – when you write more and embed writing in your daily schedule, you tend to come up with ideas that are related to your work. This is because while being regularly exposed to your research, you can come up with additional questions or ideas that need to be addressed;

- the more you write, the easier it gets to express your ideas
- this is simple. If you practice writing journal papers, you'll gradually become better and better. You'll know exactly what to include in your paper and how to structure it. What data to present and how to discuss it. As a result, you'll become more productive and spend less time writing, more time doing research. That's why I published 11 articles in highly prestigious journals during my PhD!

- the more you publish, the more visible your work is – this relies on the assumption that your work is of high quality and is more likely to come up in the search results. In this vein, your research is more likely to be noticed by your peers, attract more citations and result in higher recognition.

I know it is tempting to publish as much as possible, especially given the results above. But if you place quality over quantity in your research project, you'll build strong academic integrity

and substantial recognition among peers.

How many articles should you publish during your PhD?

This is the most common question I get from PhDs who just started their degrees. And I appreciate this question – after all, we all need [clear goals to be productive and motivated](#).

What is the ultimate answer to this question, considering the above discussion on a correlation between quality and quantity?

Always place quality over quantity in your research project. As a result, you'll become the recognised and respected expert in your research area.

What is the right balance between quality and quantity?

Well, this will really depend on the subject area you are in, the methods and frameworks you apply in your PhD, your drive to publish and much more.

This seems like a very ambiguous answer, isn't it?

Because it is.

Some universities may have specific guidelines on the minimum number of publications you need to produce during your PhD, before you can even present your PhD thesis to your committee. Other universities have unofficial or even no expectations regarding a specific number of publications out of your PhD research.

This just adds to [the uncertainty of the academic environment](#).

Yet, some rules of thumb can help you plan your research project (I share with PhD researchers in my research team too!).

Besides introduction, literature review, methodology and conclusion chapters, most of the PhD theses comprise around 3–6 research chapters. These chapters present the key outcomes

out of your PhD.

Therefore, if you consider that each research chapter presents a novel idea and innovative results, you should be in place to publish each chapter as a research paper.

Following this reasoning, you should be able to publish at least 3–4 high-quality research papers (i.e. Q1 journals) out of your PhD work.

It doesn't sound that scary, does it?

Regardless of how many articles you publish during PhD, make sure you place quality over quantity!

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- **organise your paper** using an appropriate structure
- tailor the content of your paper to meet the requirements of editors and reviewers
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About the Author

Dr Dawid Hanak is our Academic Coach who is passionate about research dissemination. He is here to share his extensive expertise in writing and editing research articles and support you to get your work published.

Why should you learn from him? Well, Dawid has published his award-winning research in more than 44 articles in prestigious peer-reviewed journals. [His work was cited more than 1,232 times and he has an h-index of 22.](#) He has more than 10 research papers under review at the moment. He has **peer-reviewed for key scientific and engineering journals**, such as Nature Communications. Dawid is also **a research-active senior academic in the UK, TEDx speaker, and associate editor with Wiley, Frontiers**, and a guest editor with MDPI. He is also an editorial board member at the Oxford University Press.

Dawid is also passionate about innovation in teaching. He was awarded the **Best Lecturer Award 2020 by students at his university**. His teaching practice is always assessed as excellent. Because of his dedication to supporting his students, many of them won the best thesis awards during their postgraduate

studies.

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