

Keys to Research Productivity

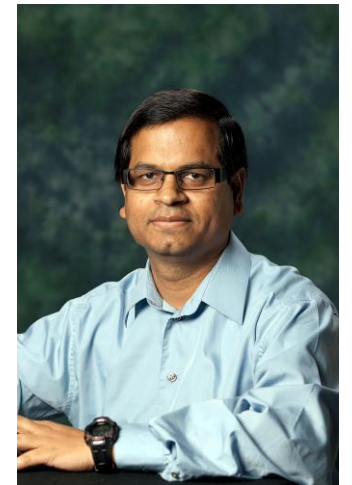
Expert Lecture 2024 – MNIT Jaipur

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Homepage:
www.smohanty.org

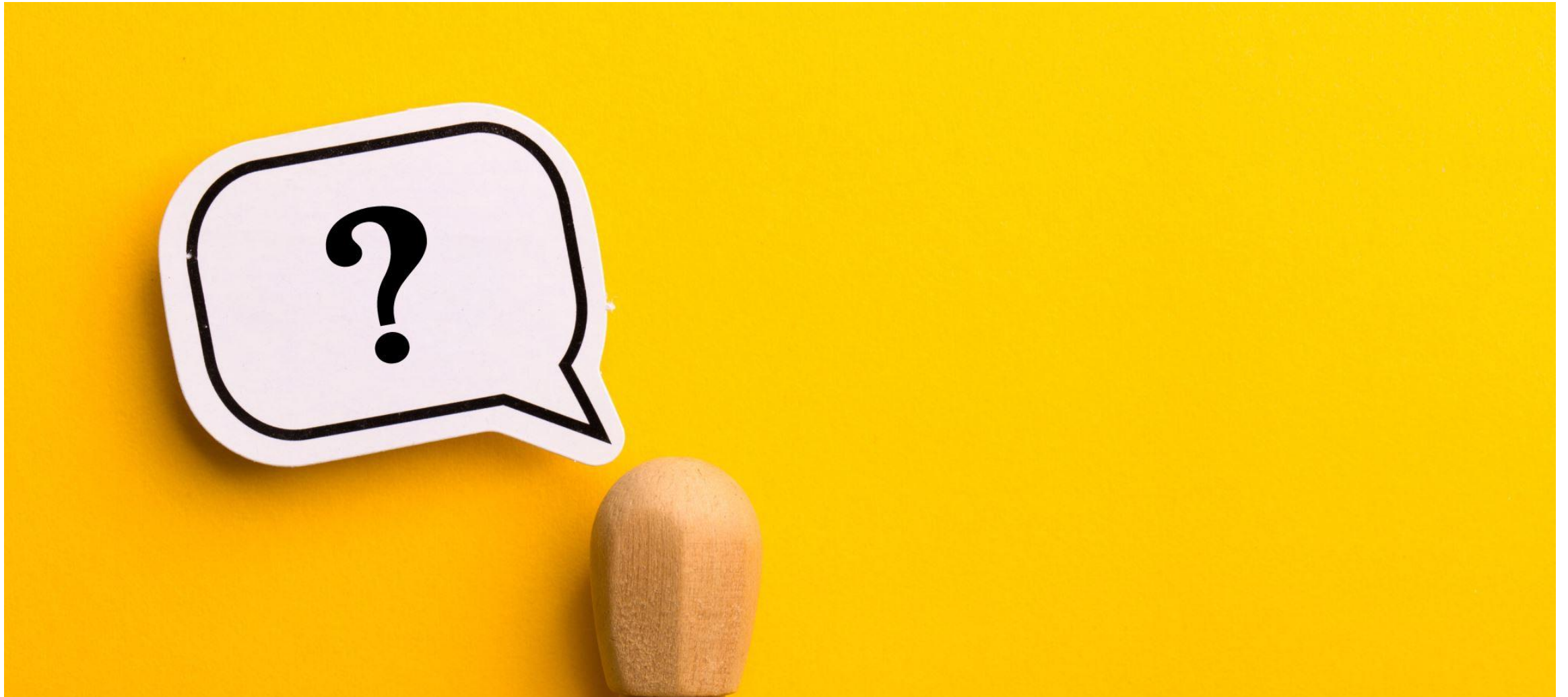
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Outline

- Why to Pursue a Ph.D.
- Rules of Writing a Ph.D. Dissertation/Thesis
- Rules of Writing a Research Paper
- Rules of Writing a Patent Disclosure
- Best Practices in Research Publishing
- Academia as a Career
- Rules for Productivity
- What we can control

Why Do I Need a Ph.D.?



“Dr.” Infront of Name, The Title

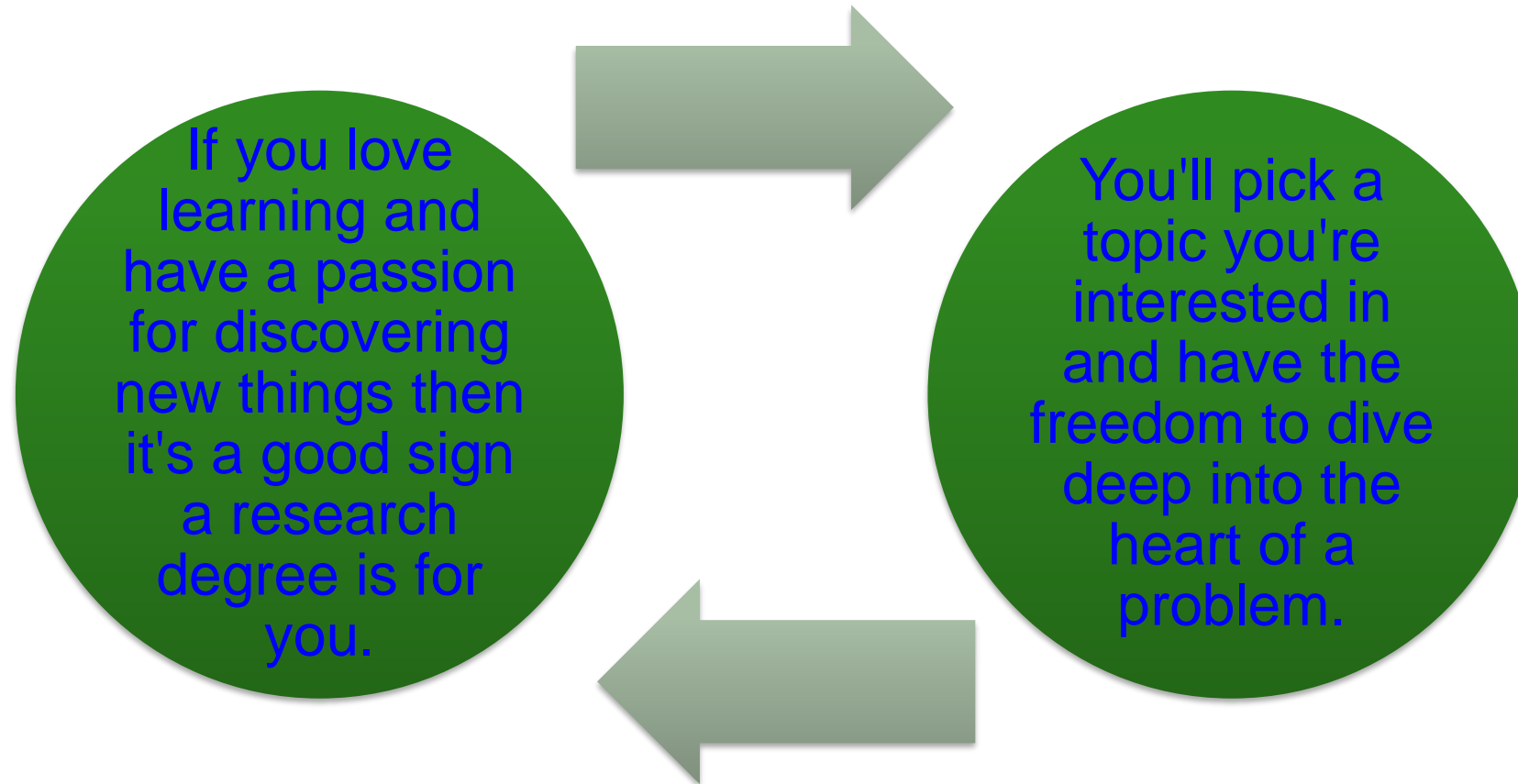
“Dr.” allowed to use before name:

- Dr. First-Name Last-Name

“Mr.”, “Ms.”, etc. for rest all degrees

An Honor in itself

Pursue Passion in Research



Source: <https://www.port.ac.uk/study/postgraduate-research/reasons-to-do-a-phd-or-research-degree>

Become an Expert in Field

Build on your knowledge from your Master's degree by engaging with complex topics in field of your choice.

Superspecialized

Bachelors – Broad

Masters – Specialized

Ph.D/Doctoral - Superspecialized

Improvement in Soft Skills



During a doctorate degree process one develops many of the soft skills that employers look for in applicants.



Education Process
→

Improves time management skills

Improves problem solving skills



Education Process
→

Improves critical thinking

Improves patience

Improves adaptability

Source: <https://www.careeraddict.com/should-phd>

Accumulation of Extensive Network of Professional Colleagues



During Ph.D. studies one works closely with professors, department chairs/heads, experts in a field, and fellow researchers.



This network of colleagues and researchers provides continual assistance with recommendations, references, job leads, and career growth.

Source: <https://www.careeraddict.com/should-phd>

Access to Most Prestigious Jobs/Positions



Ph.D. is the highest formal degree that one can earn.



Opens doors to careers at the highest levels.



Include leadership positions in science and engineering.



Ph.D. is a must for Tenure-Track Positions.

Source: <https://www.careeraddict.com/should-phd>

Challenges of a Ph.D.



Expensive



Lonely Experience



Stress and Frustration



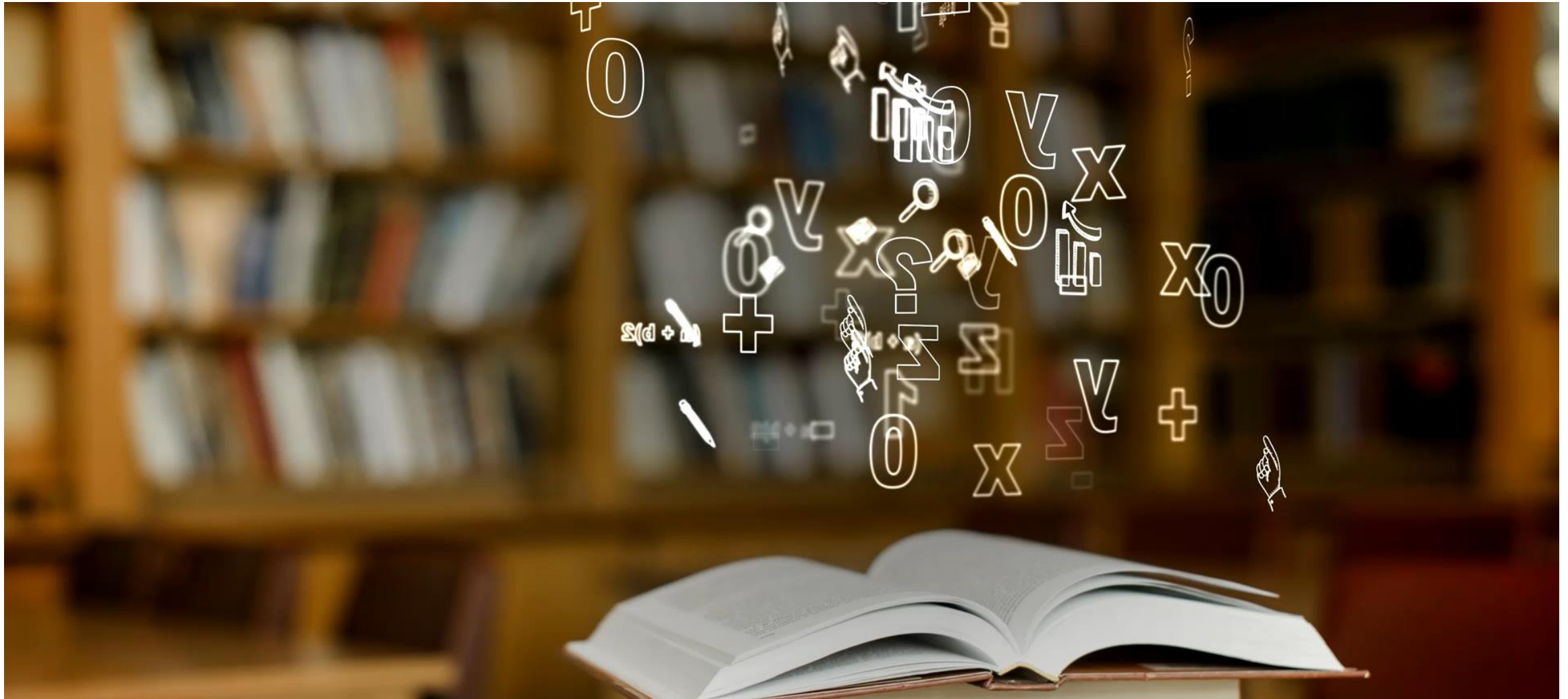
Job Opportunities Reduces due to Highest Qualification



Less Financial Reward as Compared to Education

Source: <https://www.careeraddict.com/should-phd>

Golden Rules of Writing a Ph.D. Dissertation/Thesis



Ph.D. Dissertation/Thesis



Keep in Mind: An Independent Document that needs to sustain for years.



One should be proud of seeing this in a library decades after it is written and defended.

Typical Structure of a Ph.D. Dissertation/Thesis - Various Chapters



Abstract



Introduction (Include Novel Contributions Section)



Related Prior Works



Innovative Chapters – 3/4 of these



Experimental Results



Conclusion

Ph.D. Dissertation/Thesis Writing ...: Abstract



Abstract is not a Chapter



It is like a separate Chapter portion par with a Chapter, but doesn't count towards Chapters.



Brief overview of the overall work.



Very important to sell the dissertation/thesis to perspective readers as gives first impression.

Ph.D. Dissertation/Thesis Writing ...:

Introduction Chapter

- Must sell the research work in this Chapter.
- 2 to 3 Sections big picture, social impact, motivation, etc. in a top-down fashion.
- Novel Contributions of the Dissertation/Thesis Section: 3 Subsections
 - What is the Problem Addressed? What is the Significance of the Problem? What Research Questions have been Addressed? What are the Challenges?
 - What is the Solution Proposed? What are the Hypotheses?
 - What is the Novelty and Significance of the Proposed Solution?
- **Last Paragraph** should mention dissertation/thesis organization.

Ph.D. Dissertation/Thesis Writing ...: Related Prior Works Chapter

- Important Chapter
- What other researchers have done in this domain?
- What others have done to address the specific problem if the problem addressed is not new? Nothing wrong if multiple solutions of a old and relevant problem.
- Must present Table and/or Taxonomy to present the comparative perspectives to present a case for the dissertation/thesis and to improve readability.

Ph.D. Dissertation/Thesis Writing ...: Innovative Contributing Chapters



Good to present at least 3 Chapters – For 3 distinct and related contributions of the dissertation/thesis



Follow Top-Down style to present the ideas and contributions

Ph.D. Dissertation/Thesis Writing ...: Experimental Results Chapter

Experimental Setup

Datasets

Results Analysis

Direct Comparison if same problem is solved by others.

Comparative Perspective if the problem is not handled before.

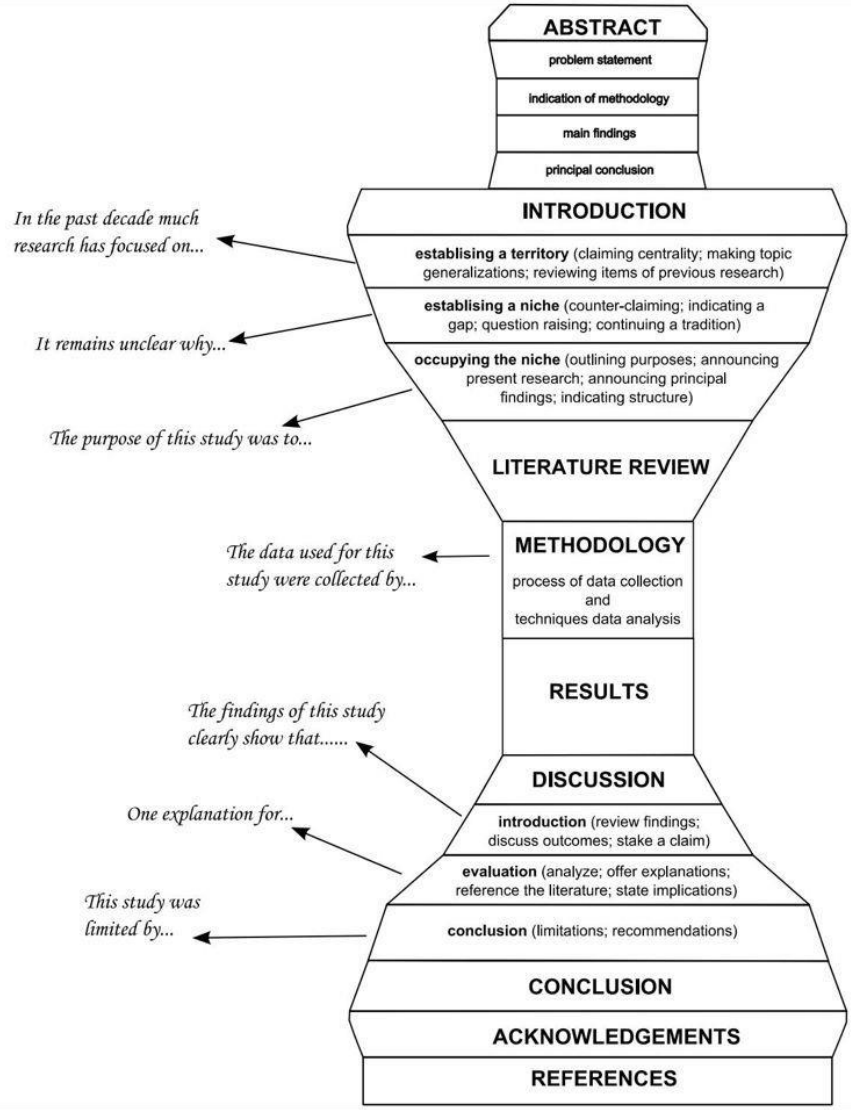
Ph.D. Dissertation/Thesis Writing ...: Conclusion Chapter

- 2/3 Sections:
 - Summary
 - Conclusion
 - Future Directions
- Conclusion is **not** repeat of the abstract.
- Conclusion Discusses what has been learnt in the process of this research execution and experimentation.
- **Future Directions:** Some pointer if someone wants to carry forward this research.

Golden Rules of Writing a Research Paper



Research Paper - Anatomy



Source: https://www.linkedin.com/posts/drasadnaveed_academia-phd-research-activity-7094980347829895168-R6TH

Typical Structure of a Research Paper - Various Section

- Abstract
- Introduction
- Novel Contributions
- Related Prior Works
- Innovative Sections – Few of them to sale the paper
- Experimental Results
- Conclusions
- Future Directions

Research Paper Writing ...: Abstract



Brief overview of the overall work.



Very important to sell the paper as gives first impression to the reviewers.

Research Paper Writing ...: Introduction Section



Must sell the research work in this Section.



2 to 3 paragraph big picture, social impact, motivation, etc. in a top-down fashion.



Last Paragraph should mention paper organization.

Research Paper Writing ...: Novel Contributions Section

3 Subsections

What is the Problem Addressed? What is the Significance of the Problem? What Research Questions have been Addressed? What are the Challenges?

What is the Solution Proposed? What are the Hypotheses?

What is the Novelty and Significance of the Proposed Solution?

Research Paper Writing ...: Related Prior Works Section



Important Section



What other researchers have done in this domain?



What others have done to address the specific problem if the problem addressed is not new?
Nothing wrong if multiple solutions of a old and relevant problem.



Must present Table and/or Taxonomy to present the comparative perspectives to convince the reviewers and to improve readability.

Research Paper Writing ...: Innovative Contributing Sections



Good to present 2 – 3 Sections



Follow Top-Down style to present the idea and contributions

Research Paper Writing ...: Experimental Results Section

Experimental Setup

Datasets

Results Analysis

Direct Comparison if same problem is solved by others.

Comparative Perspective if the problem is not handled before.

Research Paper Writing ...: Conclusion Section

This is not repeat of the abstract.

Discuss what has been learnt in the process of this research execution and experimentation.

Research Paper Writing ...: Future Directions Section

- Some pointer if someone wants to carry forward this research.
- Gives a good impression to the reviewer and reader that you a clear vision of the research that is being undertaken.

A Good Way to Work on a Research Paper

- Overall Skeleton using tentative Sections
- Draw the figures for various Sections
- Generate the Plots
- Generate the Tables
- Write the Text
- Iteratively Improve

A Quick Check of the Contents of a Manuscript

Manuscript Evaluation

Language <ul style="list-style-type: none">• Inclusive Language• Plain Language Summary• Grammar• Mechanics and Style• Readability• Vocabulary	Structure <ul style="list-style-type: none">• Manuscript Structure• Structured Abstract	Disclosures <ul style="list-style-type: none">• Author Contributions Statement• Conflict of Interest Statement• Data Access Statement• Ethics Statement• Funding Statement
References <ul style="list-style-type: none">• Age of References• No Citations in Abstract• Number of References• Reference Citations	Counts <ul style="list-style-type: none">• Abstract Length• Manuscript Length• Title Length• Use of Brand Names• Use of Copyrighted Methods	Metadata <ul style="list-style-type: none">• Corresponding Author's Email Address• List of Contributing Authors• List of Keywords• Word Count
	Figures and tables <ul style="list-style-type: none">• Figure and Table Citations• Figure Legends	

Source: https://twitter.com/Faheem_uh/status/1705131512210035159

Rules of Patent Filing



Why is it Important to Patent My Research Idea?

- Patent Provides Exclusive Right
- Patent Provides Competitive Advantage
- Technology Transfer
- Potentials for Financial Returns
- Increase Valuation
- Attract Investment
- Helps to Obtain Funding
- Satisfaction to see Lab Research → Mass Product

Source: <https://henrygoh.com/top-10-reasons-why-a-patent-is-important/>

What is the Right Time to File the Patent?

Before Publishing the research

- OR

After Publishing the research

Rules to Balance Patents and Publications



File a patent before you present or publish your work in the public domain to be fully careful.



Be careful while presenting your idea or writing an abstract.



Avoid providing too many details that can enable a 3rd party to copy your invention.



Present only broadly outline your ideas while discussing with potential organizations or companies.



If you intend to have business discussions with a 3rd party, ensure that a none-disclosure agreement (NDA) is in place prior to the discussions.

Source: <https://www.enago.com/academy/publish-or-patent-first>

Patent – Key Points



Something extraordinarily novel idea so that we protect it.



Incremental innovations can not be patented.



It costs money to file.



Inventors write the technical details.



Lawyers write the patent text with innovations, claims, etc.

Patent Filing - Steps



Disclosure of Potential Intellectual Property (IP)



Preliminary Evaluation



Provisional Patent Application



Utility Patent Application



Assessment of Application



Ownership and IP Protection

Source: <https://in-part.com/blog/how-to-get-research-patented-a-quick-guide-for-academic-researchers>

Patent Filing: Writing a Disclosure ...

- When was the invention invented? Who are the inventors?
- What technical problem does your invention solve?
- What were the deficiencies of previous solutions? How does your invention overcome or improve them?
- How does your invention work?
- Are there any previous publications associated to your work? Have you presented it in front of an audience? Have you built a prototype, proof-of-concept or developed software?
- Are there any sources of funding or support? Any collaborators you have? Are there any potential licensees?

Source: <https://www.highereducationdigest.com/how-to-boost-patent-filings-in-academia/>

Patent Filing: Writing a Disclosure ...

- The title of the invention
- The inventor's name, address, and phone number
- When and how you thought of the invention
- Date of the actual reduction to practice
- Date of public disclosure of the invention
- A description of the invention
- Any results you have from testing the invention
- A set of keywords to help the patent attorney find the right classification
- Research funding sources if there were any
- References to related patent searches done by the inventor
- A list of potential competitors
- Witnesses who are scientifically competent and understand the invention
- Signatures of all inventors involved

Source: <https://www.upcounsel.com/invention-disclosure>

Patent Filing: Disclosure Description



What makes it novel, useful, and better than any prior art?



The purpose of the invention (what will it be used for?)



Drawings, sketches, or photos of the invention with all the parts labeled.



How the invention is used?



What features of the invention are different from prior art and how do they offer better results?



The advantages of this invention over other prior art.

Source: <https://www.upcounsel.com/invention-disclosure>

Research Publishing – Best Practices



Publishing Venue – Where to Publish?

- Magazine, Transactions, Letters, or Conference Proceedings?
- Depends on the content of a manuscript.
- First fix a venue → Write? **OR** First Write → venue?
- **Magazine Article** – Broad scope
- **Journal/Transactions Papers** – Focused scope and concrete results
- **Letters Papers** – Focused scope and brief results
- **Conference Proceedings Papers** – Focused scope and quick dissemination to receive direct feedback from peers

Publishing Venue – Magazine?

- Articles should be broadly scoped.
- Technical articles may be suitable, but these should be of general interest to an engineering audience and of broader scope than archival technical papers or conference proceedings papers.
- Articles related to the background story behind engineering standards or practical experiences in product specification and design of mainstream systems.
- Tutorials on related technologies or techniques are also strongly encouraged.

Publishing Venue – Journal/Transactions?



Journal/Transactions are archival venues, just not intended for quick dissemination of research.



Articles should have both depth and breadth.



The work should have strong novelty. It must advance the state-of-the-art to be published.



The work should stand for decades without being outdated.



The experimental results need to be rigorous.



Manuscripts need to survive multiple iterations of review process.



Long Review Cycles. So authors should pay attention to every minor detail. It may get one more round of revision just for a minor issue.

Publishing Venue – Conference Proceedings?

Conference Publishing may be for quick dissemination.

Conference Presentations facilitates direct interaction with peers.

Conference attendance may help researchers in their career advancement.

Conference reviews can help to improve the work further which may then eventually become a journal publishing.

Work-in-Progress (WIP) and Research-Session-Demo (RDS) are alternative modes of dissemination to get feedback on ongoing research from the peers.

Conference → Journal OR Journal → Conference?

- Conference publishing first → corresponding journal
OR

Journal publishing first → corresponding conference

- To my experience: I see that most of the researchers follow the first option and few researchers follow the second option.
- In either case one shouldn't have the same text and figures.
 - These are two distinct publications for the authors.
 - After acceptance both the journal paper and conference paper appear in digital library, a **similarity software will flag** the similarity.

Shall I Target Journal/Transactions Submission Directly Without a Conference Paper of the Work?



Short Answer: No



Reviews received from the Initial Conference Version of the work can strengthen the work to become a journal paper eventually.



Reviewers of the journal manuscript can have better impression if they find that it is already based on a quality conference paper.



Journal have longer review cycle which may not correctly timestamp the idea published in the journal paper. Imagine rejection of the journal manuscript after 6-8 months of review cycle, losing the time.

Conference → Journal: How to Do it?



Publisher need anywhere between 30%-70% additional materials over the conference version for a journal article.



Final judgement is typically up to the Editor-in-Chief (EiC) of specific journal/transactions.



Key aspects of extending a conference paper to a journal article: additional novel contributions, thorough literature analysis, more experimental results, additional figures, and additional Tables.



Complete rewriting of the text and redrawing of any figures used is a good idea to avoid similarity issues and the copyright aspects as in many cases the publishers conference proceedings and the journal/transactions may not be the same.



Remember to cite the conference paper on the current journal paper; may be even write in the acknowledgement.

Journal → Conference: How to Do it?

- It is not common to present a journal published paper as a conference paper.
- Things are changing – Too many conference looking for audience
- Short conference paper as possible option
- Research Demo Session (RDS) papers is another option
- Complete rewriting of the text and redrawing of any figures used is a good idea to avoid similarity issues and the copyright aspects as in many cases the publishers of conference proceedings and the journal/transactions may be different.
- Remember to cite the journal paper on the current conference paper; may be even write in the acknowledgement.

Is it Important to Suggest Reviewers Names when Submitting a Journal/Transactions Manuscript?

- Short Answer: Yes
- Associate Editors are typically overloaded, they may pick few of the reviewers from your suggested list.
- The manuscript may be handled by an AE who is working on a closely, but not exactly on the area of the manuscript, so may take time to find sufficient reviewers.
- You never know your preferred reviewer may see your work favorably!

How Important is Open-Access Publishing?



Thoughts on the current state of academic publishing

Journal papers are important OR
Conference papers
Open Access is better OR traditional closed access



Thoughts on Open-Access:

Arxiv
(<https://arxiv.org/>),
TechRxiv
(<https://www.techrxiv.org/>)
Data Regulation –
Quality Data is key



One aspect of academic publishing that is very important/significant these days

Open Access and Research
Reproducibility

Journal Review Process Takes Long Time, Should I Only Publish in Conference?

- Short Answer – No
- Journals are archival purposes and publish thoroughly reviewed works. So quality of work can improve if reviews are good.
- Option to time stamp the idea, before submitting to Journal:
 - Make a conference paper
 - Put it in open access depository like arXiv, TechRxiv, etc.

Journal Review Process Takes Long Time, Should I Submit to Multiple Venues for Faster Publishing?



Short Answer: No



Submitting same manuscript to multiple journals/transactions at a time is not allowed.



Submitting same manuscript to a journals/transactions and a conference at a time is not allowed.



Danger of being rejected without review from multiple venues.

I Can Publish in Journals, Why Should I Bother for Conferences?

- Short Answer – Yes
- Networking with Global Peers
- Direct Interaction with Peers → Boost Researcher's Confidence
- Meet people who can help in job search
- Meet people who can your reference for job search
- Meet people who can be reviewer of your next papers
- Meet people who can be external examiner of thesis/dissertation (if applicable)

Does the Look and Formatting of the Manuscript Matter during Submission?

- Short Answer: Yes
- Note: First Impression Lasts Long
- Reviewer maynot be interested to read details if the manuscript doesn't look professional and clear.
- Look and legibility are important to attract attention.
- Danger of the manuscript being returned without review.

How important is author ordering in a publication?



Short Answer: No definite answer



In some disciplines the faculty mentor is typically the last author.



In some cases, the primary contributor is the first author and other is made based on level of contributions to the work.

How Important is Social Media for Researchers?



Short Answer: Not Much



How important is social media for researchers? Should Ph.D. students invest time in building profiles & networks social media?

Neutral – Publicity + Typical Negativity of social media (Privacy issues)



How challenging do you feel it is for new Ph.D. researchers to get published? Any advice/tips?

Reasonable challenging for new researchers, Conference → Journals

What are the Best Practices of Publishing?

- Short Answer: No definite answer
- Differs in one area of research to another area of research, from disciplines to another, and from publisher to another publisher. Some rule of thumb:
 - ❑ Publish one idea in one venue
 - ❑ Do best job for all text including references
 - ❑ Give credit to existing literature
 - ❑ Read articles/papers from a target venue before preparing own manuscript
 - ❑ Pay attention to each minor or major aspects; too many small → rejection
 - ❑ Learn to handle rejection

A Big Question – Where to Publish?

- As an author after I have always asked myself:
 - **First Option:** My article is an excellent scholarly product because it got published what my peers think as a selective or top avenue.

OR

- **Second Option:** My article is an excellent scholarly product because it is read and/or cited by my peers and it makes the avenue great wherever it is published.
- Most of the researchers have a tendency to choose the first option from the above.
- However, I strongly believe that if an article has real strength then it should be second option.

Why Should I Spend Time as a Reviewer?

- Short Answer - Yes
- Early Learning: Researchers who are engaged in cutting-edge research can't find learning materials from the text books. By the time a research findings appear in text book, they are outdated. A researcher can stay up to date and learn from other researcher if he/she reviews their manuscripts.
- Learning Quality expected in a specific journal/conference. Accordingly, one can use that experience to improve own manuscripts before submissions.
- Service to the profession and community.

Academia – Is it a Good Career Choice?

Academia as a Career



Academia is more than a career choice.



It is a lifestyle.



It follows you home and it's by no stretch of imagination a typical 8-to-5 job.



One may not be allowed into the system (in the case of tenure-track professorships).

Source: <https://www.quora.com/Why-is-a-career-in-academia-such-a-terrible-path-to-choose-now>

Academia as a Career



There is an oversupply of Ph.D. holders. There are very few openings per year in some fields than the number of Ph.D. holder.



You won't have a big paycheck. Working for a company will yield the greatest economic benefits.



There is significant pressure to publish. A non-academic won't know the type of pressure this translates into.



Grant money is the golden standard for many disciplines and applying is unbelievably time-consuming. Many academics spend more time applying for grant money than doing research.

Source: <https://www.quora.com/Why-is-a-career-in-academia-such-a-terrible-path-to-choose-now>

Academia as a Career

- The positive things clearly outweigh the negative ones.
- More freedom, time to travel, time to spend with activities of interest.,
- Intellectual stimulation than most if not all non-academics.
- Travel often to interesting places and have wonderful conversations with people who are at the cutting edge of the science.
- Working with a set of students who challenge and approach for help.

Source: <https://www.quora.com/Why-is-a-career-in-academia-such-a-terrible-path-to-choose-now>

Academic Life – 3 Main Tasks



Teaching



Research



Services

Academic Life – Teaching



Class room formal lectures



Graduate and Undergraduate student mentoring

Academic Life – Research

- Publishing
- Project Proposal and Execution
- Patenting

Academic Life – Service



Institutional Service



Professional Service

Academic Life – Task Allocations

Important is to maintain or have a TRS% as to suit one's career objectives and stage of career.

Golden Rules of Productivity



Rules of Productivity – 1 - Avoid Large Meetings



Large meetings waste valuable time and energy.



They discourage debate



People are more guarded than open



There's not enough time for everyone to contribute



Don't schedule large meetings unless you're certain they provide value to everyone.

Adopted from: https://www.linkedin.com/posts/mehdi-soodi-phd-26590a16_team-energy-people-activity-7001759811293896704-bDJX?utm_source=share&utm_medium=member_android

Rules of Productivity – 2 - Leave a Meeting if You are Not Contributing



If a meeting doesn't require your Input or Value Your Recommendations/Decisions
→ Your presence is useless



It's not rude to leave a meeting. But it's rude to waste people's time.

Adopted from: https://www.linkedin.com/posts/mehdi-soodi-phd-26590a16_team-energy-people-activity-7001759811293896704-bDJX?utm_source=share&utm_medium=member_android

Rules of Productivity – 3 - Forget the Chain of Command



Communicate with colleagues directly.



Not through supervisors or managers.



Fast communicators make fast decisions.



Fast decisions → competitive advantage.

Adopted from: https://www.linkedin.com/posts/mehdi-soodi-phd-26590a16_team-energy-people-activity-7001759811293896704-bDJX?utm_source=share&utm_medium=member_android

Rules of Productivity – 4 - Be Clear, not Clever



Avoid nonsense words and technical jargon.



It slows down communication.



Choose words that are:

Concise
To the point
Easy to understand



Don't sound smart. Be efficient.

Adopted from: https://www.linkedin.com/posts/mehdi-soodi-phd-26590a16_team-energy-people-activity-7001759811293896704-bDJX?utm_source=share&utm_medium=member_android

Rules of Productivity - 5 - Ditch Frequent Meetings



There's no better way to waste everyone's time.



Use meetings to: 1) Collaborate, 2) Attack issues head-on, 3) Solve urgent problems



But once you resolve the issue, frequent meetings are no longer necessary.



You can resolve most issues without a meeting.



Instead of meetings: 1) Send a text, 2) Send an email, 3) Communicate on a discord or slack channel

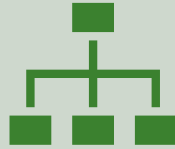


Don't interrupt your team's workflow if it's unnecessary.

Adopted from: https://www.linkedin.com/posts/mehdi-soodi-phd-26590a16_team-energy-people-activity-7001759811293896704-bDJX?utm_source=share&utm_medium=member_android

Golden Rules of Productivity – 6

– Use Common Sense



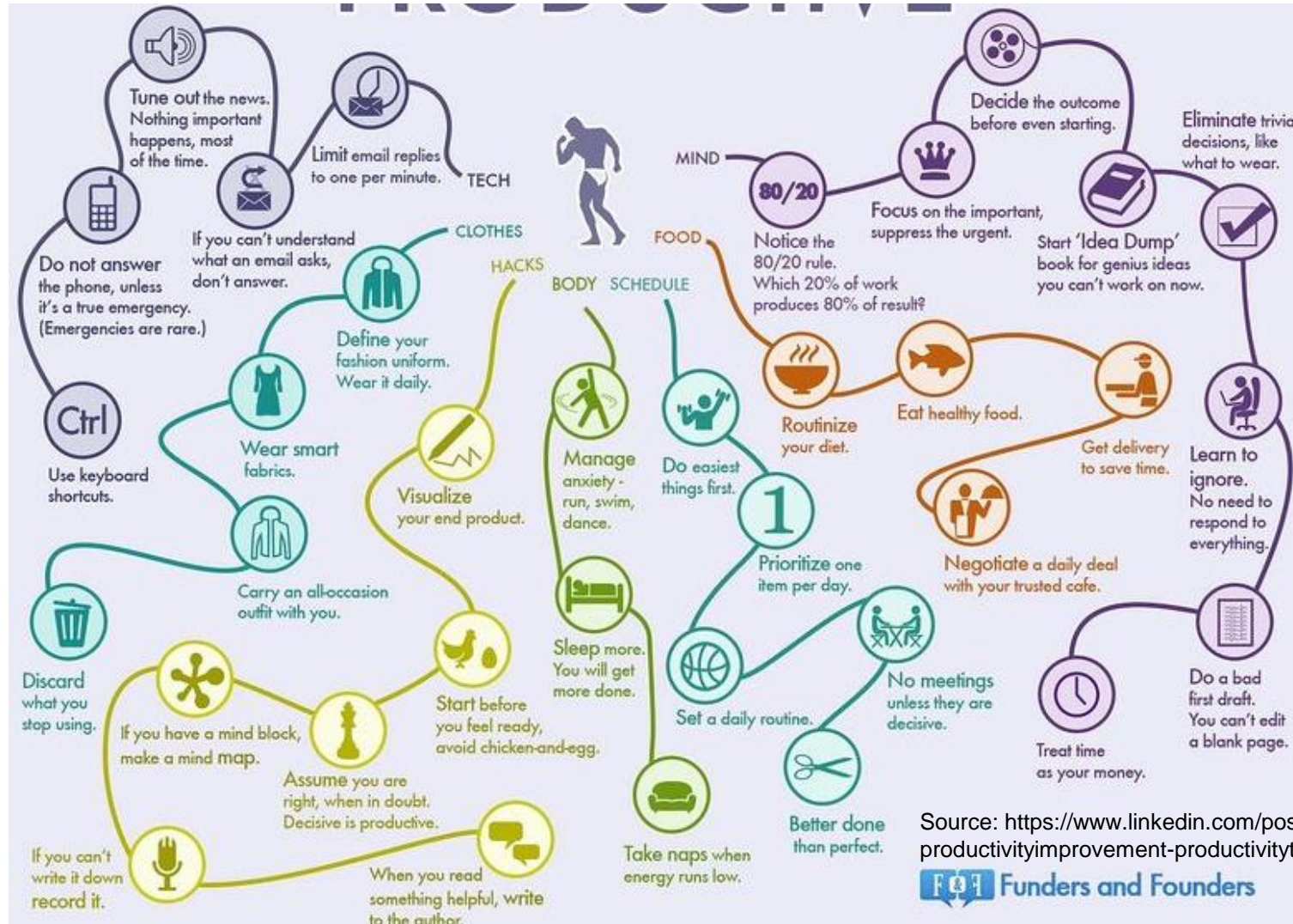
If a company rule doesn't: Make sense, Contribute to progress, or Apply to your specific situation



Avoid following the rule with your eyes closed.

Adopted from: https://www.linkedin.com/posts/mehdi-soodi-phd-26590a16_team-energy-people-activity-7001759811293896704-bDJX?utm_source=share&utm_medium=member_android

Productive Mantra – Simple Habits



Source: https://www.linkedin.com/posts/danoctaviancatana_productivity-productivityimprovement-productivitytips-activity-7067369521589739520-VPVq



What We Can't Control? – Lots of Things



There are Lots of Things Around us that we Can't Control



Source: <https://twitter.com/dapliflife/status/1587735833850875904>

We Can't Control the Phases of Life?

- 1) Brahmacharya (Student Life)
- 2) Grihastha (Household Life)
- 3) Vanaprastha (Retired Life)
- 4) Sannyasa (Renounced Life)

Adopted from: M. Sawhney 2022: https://www.linkedin.com/posts/mohansawhney_lifelessons-spirituality-mentoring-ugcPost-7004465445311328258-yEwI?utm_source=share&utm_medium=member_android

Can We Control the Phases of Academic Life?

- 1) Shishya (Learner)
- 2) Karta (Doer)
- 3) Daata (Giver)
- 4) Bodhi (Enlightened)

Adopted from: M. Sawhney 2022: https://www.linkedin.com/posts/mohansawhney_lifelessons-spirituality-mentoring-ugcPost-7004465445311328258-yEwl?utm_source=share&utm_medium=member_android

Time and Rules – Most Important

Importance of “Time” is evident:

"Deadline" has "Dead"; Niyam has "Yam" (God of Death)

Summary and Conclusion



Homepage:
www.smohanty.org



Listen to Yourself.



Don't do just same things at different phases (e.g. Assistant, Associate or Full Professor) of career.



Expectation should be different at different phases of career.



Maintain a balance between patent, journal papers, and conference papers.



Be your own example instead of following other. Everyone is different and unique, and have distinct constraints.



Research is not about Publishing or Funding. It is about solving problems.



Don't follow rules. Follow principles.