

Thought#1 PhD Goals and Criteria

The only true wisdom is in knowing you know nothing.

– Socrates

The quote "The only true wisdom is in knowing you know nothing" suggests that true wisdom comes from recognizing the limitations of one's knowledge and being open to learning and discovering new things. In the context of PhD criteria, this quote highlights the importance of humility and a willingness to learn throughout the PhD journey. PhD students are expected to conduct independent research and make significant contributions to their field of study. However, this process can be challenging and involves facing many unknowns and uncertainties. The quote emphasizes that even with extensive knowledge and expertise in a particular area, there is always more to learn and discover. A successful PhD student should be humble and open to new ideas and perspectives. They should be willing to acknowledge gaps in their knowledge and actively seek out opportunities to learn and grow. This involves being open to feedback and constructive criticism from peers and mentors, as well as being willing to collaborate and engage in dialogue with others in their field. Therefore, the quote emphasizes the importance of recognizing the limitations of one's knowledge and being open to continuous learning and growth throughout the PhD journey. By embracing a humble and open-minded approach, PhD students can gain a deeper understanding of their field and make meaningful contributions to their area of study.

1.1 What is PhD?

A PhD is the highest academic degree one can attain in their field of study. It is awarded after the completion of original research that makes a significant contribution to the existing body of knowledge in a chosen field. By earning a PhD, one becomes the leading expert in their field, surpassing even their supervisor in terms of knowledge and experience. The journey to a PhD is often referred to as a marathon, not a sprint, as it is the culmination of a lifetime of study and dedication to a particular area of study. The work one produces during their PhD studies is what they will be remembered for, as it will have a lasting impact on their field of study. For many people, pursuing a PhD helps to avoid major life decisions as it provides a clear path towards a specific career goal.

1.2 Why should one get a PhD?

Getting a PhD can be a valuable and rewarding experience for several reasons. *Firstly*, if you have a passion for research and a strong interest in a particular field, a PhD can help you become a leading expert in that field. *Secondly*, a PhD allows you to put your studies into practice and make a tangible contribution to your field of study. *Thirdly*, the process of pursuing a PhD can be an enriching learning experience, as you will have the opportunity to learn with and from engaged peers who share your passion for research. *Fourthly*, a PhD can boost and broaden your career opportunities, help you reach your full potential, and challenge yourself in new and meaningful ways. *Fifthly*, a PhD can have a transformative impact on your life by helping you develop

important skills and capabilities, learn better ways to make life decisions, and gain a deeper understanding of the world. Ultimately, pursuing a PhD can be a rewarding and meaningful journey that can have a positive impact on your life and career.

You may consider getting a PhD if you have a strong passion for your field of study and you believe that a research degree will help you further pursue your passion. It is important to assess whether the subject is something you are truly passionate about, as a PhD requires a significant investment of time and effort. Additionally, you should consider whether you are ready for more university and whether you feel prepared to take on the challenge of a PhD program. Ultimately, the decision to pursue a PhD should be based on a combination of one's passion for the subject, your readiness for more university, and your long-term career and life goals.

1.3 What are the possible careers after one obtains a PhD?

A PhD can open up a variety of career paths, depending on the field of study and the individual's interests and skills. Some of the most common career options for PhD holders include:

1. *Academia*: Many PhDs go on to pursue careers in academia, teaching at universities and conducting research in their field of expertise.
2. *Research*: PhDs with a background in research may work in government agencies, private research institutions, or non-profit organizations.
3. *Industry*: Many PhDs opt to work in industry, using their expertise to solve problems and develop new products and technologies.
4. *Consulting*: PhDs with strong analytical and problem-solving skills may choose to work in consulting, where they help organizations make informed decisions.
5. *Science writing or communication*: PhDs with strong writing and communication skills may pursue careers as science writers or communicators, sharing complex scientific ideas with a wider audience. For example, Dr. *Brian Cox* is a successful Physics PhD in science writing and communication. He is a British physicist, television presenter, and author who is best known for his popular science books and television series, including "*Wonders of the Universe*" and "*Forces of Nature*". With his engaging and accessible approach to science communication, Dr. Cox has helped to bring complex scientific concepts to a wider audience, making physics more accessible and understandable to the general public. He is widely regarded as one of the most effective science communicators of his generation and has received numerous awards and honors for his work in this field.
6. *Entrepreneurship*: PhDs with a strong entrepreneurial spirit may choose to start their own companies, bringing their expertise and innovative ideas to the market. One example is Dr. *Nathan Myhrvold* (PhD in Physics). He is a former chief technology officer at Microsoft and the founder and CEO of Intellectual Ventures, a global invention and patent company. With his background in physics and his experience in technology, Dr. Myhrvold has been successful in identifying and developing new and innovative technologies, and bringing

them to market. He is known for his ability to see the potential in new ideas and to build successful companies around them, and has been recognized for his contributions to the field of entrepreneurship. Through his work at Intellectual Ventures, he has helped to create new industries and has had a significant impact on the global economy.

7. *Policy*: PhDs with an interest in policy may work in government agencies or non-profit organizations, where they can influence policy decisions and contribute to societal change. One example is Dr. Stephen Hawking. He was a theoretical physicist and cosmologist who was widely regarded as one of the most brilliant minds of his generation. In addition to his groundbreaking research in physics and cosmology, Dr. Hawking was known for his advocacy for science and technology, and was a strong voice in shaping science policy. He was a strong advocate for funding for scientific research, and worked to ensure that science was given the support and resources it needed to make advances in our understanding of the universe. Through his writing, speaking engagements, and public appearances, Dr. Hawking made science accessible and understandable to a wider audience, and was a powerful voice for science in the policy-making arena. Another example is Dr. Neal Lane. He is a former science advisor to President Bill Clinton and former director of the National Science Foundation. With his background in physics, Dr. Lane has been successful in providing scientific expertise and guidance to policymakers on a wide range of issues, including research funding, energy policy, and the development of new technologies. He has been recognized for his contributions to the field of science policy and has had a significant impact on the direction of science and technology in the United States. Through his work in government and academia, Dr. Lane has been a strong advocate for science and has worked to ensure that science is given the support and resources it needs to make advances in our understanding of the world.

These are just a few of the many career options available to a PhD, and the specific paths will vary depending on the individual's interests, skills, and goals.

1.4 What are the differences between a graduate student and undergraduate student?

Graduate and undergraduate students differ in several aspects. Graduate students, who are typically pursuing advanced degrees such as a Master's or a PhD, are expected to have a more independent approach to their studies compared to undergraduate students. Unlike undergraduate students who follow a clearly defined syllabus and study well-established knowledge, graduate students have a more loose timetable and focus on cutting-edge research in their field. They are often only required to take two exams, but also have to defend their thesis, which is a major milestone in their academic journey. Graduate students face global competition in their field and work closely with one major supervisor. On the other hand, undergraduate students follow a clear timetable and are graded based on a cumulative grade derived from

standardized exams. They face local competition and typically have multiple teachers, who guide them through their studies.

1.5 What are the differences between a master student and a PhD student?

There are several differences between master's and PhD students:

1. *Degree requirements*: Master's students typically complete coursework and a final project or thesis, while PhD students complete coursework, pass qualifying exams, and conduct original research leading to a dissertation.
2. *Duration of program*: Master's programs typically last one to two years, while PhD programs usually take at least four to five years to complete.
3. *Focus of study*: Master's programs typically provide students with an in-depth understanding of a particular area of study or discipline. Students may take a variety of courses related to their field and may also be required to complete a final project or thesis. The focus is on developing expertise in a specific area, and while there may be some research involved, it is generally not as extensive as in a PhD program. PhD programs, on the other hand, are designed to train students to become independent researchers in their chosen field. Students are required to conduct original research that advances knowledge in their field, and they work closely with their advisor and other researchers to develop their research projects. The focus is on advancing knowledge in a specific field through original research.
4. *Funding*: PhD students are often fully or partially funded through teaching or research assistantships, fellowships, or grants, while master's students may need to pay for their education out-of-pocket or with loans.
5. *Career prospects*: Master's degrees can lead to a variety of careers in industry, government, or academia. Depending on the specific program and area of study, graduates may work in roles such as project managers, analysts, consultants, or educators. While a master's degree can lead to higher salaries and career advancement, it may not be necessary for all careers. A PhD is often required for advanced research positions in academia or industry. Graduates may work as university professors or researchers, or in research positions in industry or government. While a PhD can lead to higher salaries and greater opportunities for career advancement, it also requires a significant investment of time and effort.
6. *Independence*: PhD students are expected to work more independently than master's students, as they are conducting original research and advancing knowledge in their field. They often work closely with their advisor and other researchers, but have more autonomy in their research projects.

Overall, both master's and PhD students pursue graduate education to further their expertise and career prospects in their chosen field, but the requirements and focus of their programs differ significantly.

1.6 How can one to obtain a PhD?

Getting a PhD requires a significant investment of time and effort, but it can be a rewarding experience for those who are passionate about their field of study and want to make a significant contribution to the body of knowledge. To get a PhD, one must complete the following steps:

1. Finish required coursework: Depending on the field of study, students will need to complete a set of coursework in order to fulfill the requirements of the PhD program.
2. Pass both the written prelim and oral exams: After finishing coursework, students will typically take a written and oral exam to assess their knowledge and understanding of the field of study.
3. Chose a research advisor and determine research direction: Once exams are completed, students will need to select a research advisor and determine the direction of their research for their PhD thesis.
4. Perform research work towards PhD thesis: Next, students will engage in research work and gather data that will form the basis of their thesis.
5. Publish appropriate number of manuscripts and attend professional conferences: To build their reputation and make valuable connections, students may need to publish their research in academic journals and attend professional conferences to present their findings.
6. Write thesis: Based on their research, students will write their thesis, which is a comprehensive examination of the research question.
7. Defend thesis: The final step is to defend the thesis in front of a panel of experts in the field.

The defense is an opportunity for the student to demonstrate their mastery of the field and their ability to defend their research findings.

1.7 How one can track the progress during the PhD pursuit?

Tracking the progress of a PhD pursuit involves regularly assessing your research work and personal development. You should ask yourself questions such as: "Do I make enough and efficient progress in my research?", "Am I improving my hard and soft skills?", "Am I gaining more skills?", "How do I compare to peers in other universities?", and "Do my current activities align with my career goals?" By regularly reflecting on these questions, you can identify areas where you may need to improve and make adjustments to ensure you are on track to achieving your PhD and reaching your career goals. It is also helpful to seek feedback from your advisor, colleagues, and peers, as well as attending conferences and workshops to stay current in your field and gauge your progress against others. More specifically, the following aspects should be considered:

1. Research Progress: It is important to track the progress of research work to ensure that you are making enough progress in a given time frame. This can be done by keeping a record of the research work done, and setting achievable goals to ensure steady progress.

2. *Skills Development*: A PhD program provides ample opportunities to develop both hard and soft skills. Regularly evaluating your skills can help you identify areas where you need improvement and determine if you are making progress.
3. *Gain New Skills*: A PhD program also provides opportunities to gain new skills. Keep track of the new skills you acquire, and ensure that they align with your career goals.
4. *Comparison with Peers*: Regularly comparing your progress with peers in other universities can provide valuable insights into your own progress.
5. *Career Goals*: Your PhD journey should align with your career goals. Regularly evaluating your progress can help you ensure that your current activities match the requirements of your career goals.

1.8 When is a time for one to complete a PhD?

Completing a PhD degree is a significant accomplishment that can prepare one for a variety of careers in academia, research, and industry. During the program, students have the opportunity to contribute to original research, become experts in their field of study, and develop a range of skills that are highly valued by employers. These skills include the ability to use scientific methods to make unbiased decisions, write manuscripts and reports fluently, give professional presentations, communicate effectively with others, handle multiple tasks, take ownership of projects, lead groups of people, and collaborate well with others.

In addition to developing these practical skills, completing a PhD program can also help one establish good habits such as strong time management, attention to detail, and a commitment to lifelong learning. These habits are essential for success in a wide range of careers and can help one make the most of their PhD degree.

1.9 What are the skills that a PhD shall develop?

As a PhD student, you are expected to have strong research skills, including the ability to read, understand, and critically evaluate literature in your field. You must also have a solid understanding of the theories and experiments related to your research area, as well as the ability to analyze and interpret data. Additionally, strong writing and presentation skills are essential, as you will need to effectively communicate your research findings in manuscripts, reports, and professional presentations. These skills are what make up the hard skills required for a successful PhD career, and it is important to continuously develop and improve them throughout your studies.

A PhD requires not only mastery of technical and academic knowledge but also strong soft skills. These skills can include: having good habits to maintain focus and motivation, managing multiple tasks effectively, clear and concise communication, working well with others in collaboration, exhibiting leadership qualities, and networking to build professional relationships. These soft skills are essential to succeed not only in academia but also in many professional fields. They can enhance one's ability to perform research and make original contributions to the body

of knowledge, as well as allowing one to effectively communicate and collaborate with peers and colleagues. Developing strong soft skills can help a PhD candidate to succeed in their research, as well as in their future career endeavors.

1.10 What are the differences between a TA-supported PhD student and a RA-supported PhD student?

A teaching assistant (TA) and a research assistant (RA) are both positions for a graduate student supported by faculty members in a research university, but their responsibilities and duties differ. A TA is responsible for assisting with the delivery of course material and providing support to students. This may include grading assignments, holding office hours, and leading discussions or laboratory sessions. On the other hand, an RA is typically responsible for supporting faculty in their research endeavors. This may include conducting literature reviews, collecting and analyzing data, preparing research reports, and assisting with grant proposals. In general, a TA focuses on teaching and student support, while an RA focuses on research and supporting the faculty in their research activities.

A TA-supported PhD student has to spend a significant amount of time each week, around 20 hours, on teaching-related duties. This leaves limited time for their own research work, and the time they do have may be chopped into smaller chunks, making it difficult for research projects that require a long, focused time investment. To maintain the same quality of research work as an RA-supported student, the TA-supported student may need to double their efforts. Alternatively, if they maintain the same working hours, the quality of their research may be less than half that of an RA-supported student.

On the other hand, an RA-supported PhD student has the opportunity to focus all of their time on their research project. This support is often funding-oriented, meaning that the student may not always get the chance to work on what they initially were interested in. The demand may also be high depending on the funding agent, which can lead to a high pressure environment.

In conclusion, both TA and RA support have their pros and cons, and it is important for a PhD student to consider these differences when making their decisions.

1.11 Resources

- The basic principles every PhD student needs to know: <https://www.youtube.com/watch?v=VrMwAOtB9S4>
- Things about a PhD nobody told you about: <https://www.youtube.com/watch?v=CAKsQf77nHU>
- Own your PhD project: How to take charge of your research: https://www.youtube.com/watch?v=q_rEqcO7hMY
- 5 Mistakes PhD Candidates Make: <https://www.youtube.com/watch?v=z4yCSdazQsI>
- The Real Story About Employment for Physics Graduates: https://www.youtube.com/watch?v=eb_X6kaQDrw