

PhD Research and Dissertation Writing in Statistics

1 An Introduction to PhD Research

- The goal of this course is to present to potential Ph.D. students the tools and strategies for planning, writing, and defending a successful doctoral dissertation.
- What distinguishes the work performed by a person having a Ph.D. from the work of other persons in an academic setting? The primary distinction is the extension of knowledge from **research**.
- The extension of knowledge from research in statistics comes from the exploration, and investigation of a specific unsolved problem in statistics.
- Before pursuing a Ph.D, the student should realize that the piece of paper stating you have a Ph.D. should not be the primary goal. The goal is not to receive a diploma to hang on the wall of your office. It should be much more than that.
- student should realize that **a Ph.D. prepares you for continued research**. What is important is the research work that you become involved with after you graduate from Thammasat University with a Ph.D.
- This all seems like a lot of work, so why do many researchers enjoy research? The enjoyment comes from the personal satisfaction of discovering things that no one else has yet discovered. Most researchers feel that all of the time and effort spent on research is worth it.
- You are taking this course because you decided are are trying to decide whether or not to pursue a Ph.D.. Now ask yourself the following questions:

(Q1)] *Do you want a professional career requiring you to perform research?*

- Working on a Ph.D. dissertation trains you to perform independent (and sometimes collaborative) research. Remember that research is performed at many places other than at universities. Research is performed in industry, agriculture, and the government. Therefore, carefully consider your long-term professional goals. Specifically, ask yourself whether or not a research position is your long-term goal and where you plan to work.

(Q2) *Are you planning to work in an academic position?*

- If your goal is to work in an academic position at a university (referred to as “working in academia”), you need to determine if performing research is required. If research is required, then a Ph.D. is almost always required.
- The reason faculty are required to have a Ph.D. and perform research are (i) to be sure that the faculty have sufficient knowledge and academic training to teach advanced/graduate courses and (ii) to be sure the faculty are knowledgeable on current topics in their academic discipline.

- In the United States, it is uncommon to be hired to an academic position without a Ph.D. Major universities require a faculty member to have a Ph.D. and engage in research activities. But, if you plan to work for a governmental agency or a private business, a Ph.D. may not be required. However, you will be better prepared to perform research for these organizations if you have a Ph.D..

(Q3) *Do you have the necessary skills and determination it takes to complete a Ph.D.?*

It is difficult for people to assess whether or not they are capable of successfully completing a Ph.D.. You should consider the following criteria:

- **Time Demands:** A Ph.D. dissertation will probably be the project that is largest in scope and longest in time you will ever work on in your life. So ask yourself “Will you be able to commit the time needed to complete a dissertation?”. After completion of your Ph.D. courses, you must be committed to working at least two more years on the dissertation. You must be willing to change your academic work habits. You will no longer have assignments that you can work collaboratively with other students. You will have to get used to working alone.
- **Creativity:** Ph.D. research is not like a homework assignment in which the teacher already knows the answer. It involves a problem that no person has yet solved. Therefore, you will need to be creative when working on your Ph.D. research problem. Two common approaches to new research in statistics are (i) modifying and extending techniques used by other researchers in the past and (ii) developing and applying new techniques that resulted from your creativity.
- **Interest:** It is important that you are interested in the area of your dissertation research and the specific research problem. Remember a dissertation requires a large commitment of your time, and it will be much easier to work on your research problem if you are interested in it. If you are not interested in the research problem, then it usually will take longer and be more difficult to complete.
- **Ability to Adapt:** As I mentioned earlier, working on Ph.D. research is very different than the assignments and exams in your coursework. This is one reason that graduate students are not initially prepared for Ph.D. research. The student has to adapt to working alone. Ph.D. students are initially surprised when the Ph.D. advisor will not answer a question and tells them that they have to find an answer on their own. The Ph.D. students have to adapt to this change. I will talk a lot more about advising later in the course.
- **Determination:** When working toward an undergraduate degree, a masters degree, or early in a Ph.D program, students are given a set of tasks (such as exams and homework assignments) and then receive feedback in the form of grades. This

is not the case after the Ph.D. coursework is completed and work begins on the dissertation. Ph.D. research is less structured. You (with advice from your advisor) will often set a time frame for your research goals, and, in particular, you will determine your schedule each day. As a Ph.D. student, you must be motivated and determined to work toward a goal without having the graded exams and homework assignments to assess your progress.

- The dissertation requires the student to become “actively involved” with research. “Actively involved” does not mean only doing what your advisor and committee tells you to do. You will be expected to work independently of your advisor and committee.
- This process of writing a dissertation will improve your expertise in one or more areas of statistics. The process will improve the skills and knowledge you have acquired in your courses. This knowledge is necessary when you have to work independently.
- When you are performing Ph.D. research and writing a dissertation, you accept the serious responsibility, with the support of an advisor and a committee, for continuing your education. This responsibility involves personal commitment to the research, efficient management of your time, and the professional presentation of your research results.
- Ph.D. thesis research in statistics is still considered the best method to develop new researchers because it allows a student to:
 - Explore an area of statistics in great depth.
 - Learn the professional process of producing new knowledge.
 - Manage a complex and time-demanding project from beginning to end.
 - Develop written and oral communication skills on a topic at a high intellectual level.
- Many Ph.D. students in statistics believe the research topic of their dissertation will be the only research area they will ever pursue in his or her entire life. This is usually not the truth.
- The dissertation process prepares you to do research *in general*. After completion of the dissertation, you now have the skills to perform research in many areas of statistics.
- Future research is usually more interesting than your dissertation research because you will already know how to do it. You will continue gain confidence in your research ability.
- In summary, the dissertation requires a Ph.D. student to:
 - Be involved in an original research problem in statistics.
 - Demonstrate the ability to work independently.
 - Present research results in a dissertation that satisfies professional requirements.

My personal experience

- My dissertation research involved an experimental design problem in response surface methodology (RSM). After my dissertation I continued to work on problems in RSM, but these problems were not related to my dissertation (such as mixture experiments and applications of genetic algorithms).
- I also began to work with my colleagues (i) in statistics on other research topics such as problems in sampling and statistical quality control, and (ii) in other disciplines such as problems in engineering, ecology, microbiology, and agriculture.
- Researchers continue to expand their research interests because they know that working on problems in the same area become less interesting over time or only a few new problems in the area of their dissertation may arise. Therefore, productive researcher will change topics and the areas in statistics to work in.
- This is the philosophy that I believe. Expanding the research areas in statistics makes my job interesting and exciting. My research has given me opportunities that I would not have gotten otherwise (such as teaching this course). And, the reason I am able to do research is because of the skills I developed in my dissertation process.
- It is because of research that I experienced a lot of interesting professional activities I would not have experienced otherwise. For example, I was invited to teach and advise Ph.D. students at Thammasat University because I established a reputation of conducting research after receiving my Ph.D.