

STEPS IN DOING A RESEARCH PROJECT (*and elements to include in your proposal*)

I. Develop a question that you want to answer. (Put the “box” around the problem)

This is the hardest part.

Common mistakes include trying to answer too many questions (or “sub” questions) and/or not limiting the scope of the investigation (i.e., trying to collect too many samples, too many types of data). Your adviser and this class are your resources to help with this aspect of your thesis.

II. Proposing the project

Very important step in clarifying for yourself (and adviser and committee) your objectives and how you intend to achieve them.

- A. State your question/hypothesis This could be in the form of one or two major questions or objectives and several sub-objectives within those major categories.

Clearly state your question(s) for your thesis proposal.

- B. Background research--results from similar studies

-Think about how your question fits in with previous work.

Develop an initial reference list that covers the major topics important to your thesis question.

-What new and different angle can you investigate?

Your final thesis proposal will cover both the background and the contribution you will make to scientific progress in your area.

You also need to be able to put your study in perspective. That is, how does your study fit into the larger scheme? What about it will be important to other earth scientists?

- C. Methods and Logistics--How are you going to accomplish your objectives?

-Experiments? Sample and data collection? Data reduction? Theoretical studies? Numerical calculations?

Your proposal should clearly outline your methodology, including where possible, field area, number of samples, type of mapping, number of GPS campaigns, etc.

- D. Anticipated results and benefits--what do you expect to achieve in this project?

Your proposal should discuss the goals/outcomes of the project. In some cases, 2 competing hypotheses are being tested. Other studies have more open-ended questions. In either case, however, the proposal should clearly outline the science that you expect to come out of your study. What new science will be contributed by your study?

- E. Schedule--outline a specific schedule of when you will accomplish each stage of the research and stick to it!

-Sometimes your project will take a different course as you proceed, but you should revise your schedule accordingly so that you always know what needs to be done to reach your final deadline.

Include a schedule in your proposal.

F. Budget

Include an approximate budget in your proposal.

III. Research

This is the easy (and fun!) part if you wrote a good proposal--just do what you said you were going to do. You have already done the most difficult part by this point.

- A.** Collect some data.
- B.** Think about it and analyze it. Evaluate uncertainties, etc.
- C.** Do some more library research in light of what you have found.
- D.** Repeat A through C several times.

IV. Write up your results

Don't neglect this part!!! Communicating your findings to others is an integral part of doing research. Many times people do an entire research project and never write it up so that others can learn from it. Don't fall into this trap. People are interested in what you have done--really! Don't be lazy or shy about communicating your results.

The written product is, of course, a requirement, but do not underestimate the time it takes to actually write and revise. You will need to iterate with your adviser at least once, more likely 2-3 times for a satisfactory outcome. In many cases, the goal is also to publish the results in a refereed journal. This will take even more work, patience, and checking your ego at the door.

WHAT TO EXPECT WHILE DOING RESEARCH

Think of the research process in terms of a washing machine with different cycles.

The Wash Cycle:

You start collecting data. You are chugging along, making lots of progress, you have a clear purpose and things seem to be perking along just fine. This is the wash cycle.

Soon you have a lot of data, but there is so much and it is so mixed up and spinning all around that you can't make sense out of any of it. You have barely started the project but you are already ready to give it all up and you think you are the most stupid person in the world for not figuring things out and you don't know which way to turn... (a great run-on!)

The Spin Cycle:

This is the spin cycle. (You are going round and round). There are times in every researcher's experience when he or she is frustrated with not being able to figure out what to do. You lose sight of the original goals and begin to think the project is totally worthless. Don't feel alone; this is part of the process.

What to do to escape the Spin Cycle:

- GET HELP. Talk things over with your advisor, other faculty, and fellow graduate students.
- REORGANIZE. Sometimes, this feeling comes from being disorganized.
- REREAD. Sometimes rereading your proposal helps you to recall your original intentions.
- REFOCUS. Focus on a small part of the project that you can do and don't become overwhelmed by the enormity of the whole.
- DO NOT BE AFRAID OF CHANGE. Think about new things to try or changes in your approach.

Changes are a part of the process. Don't be afraid to take the project in new directions that you hadn't anticipated at the beginning. **BUT...** this is not a reason to avoid making a detailed plan and sticking to it. You should always have a plan in mind but be flexible enough to change it as you go along.

You will find yourself going through the Wash Cycle (periods when you are making good progress) and the Spin Cycle (no idea which way to turn next) several times during the course of your project. Remember, when you hit an obstacle, this is an opportunity to re-examine your project. This may lead to a new direction that you wouldn't have otherwise considered.

The Rinse Cycle:

By this time you will have collected a lot of data, conducted many modeling runs, etc. Much of this will not be incorporated into your final thesis! In the rinse cycle, you need to cull through what you have, sort out what will go into the final write-up and what you will discard.

Hanging It Out to Dry:

When you have finished analyzing your data through several wash and spin cycles, you need to get

it written up and out for people to see while it's still fresh in your mind.

Tips on Writing:

- Do it right away; the more you put it off the harder it will be to remember what you did.
- Write a detailed outline and share it with your adviser.
- Start by putting your data into tables, graphs, etc.
- If you find it difficult to begin writing a general introduction, start by describing your data or methods and then go back to the introduction.

The Gentle Cycle vs. Dry Cleaning vs. Hand Washing (advice, advice, advice)

- Do not be afraid to ask for help. Getting lost and found is part of the process.
- Stay organized and **WRITE EVERYTHING DOWN**. You **THINK** you will remember what happened to this or that sample, or what the parameters were for this or that simulation, but you won't.
- Keep your data tables in order and write the methods sections (informally) as you go. Don't let this part pile up for the end.
- Keep your eye on your goal. Don't get lost in the details.
- Expect your perspective to change. You **SHOULD** find mistakes and problems with your approach. No one does it correctly the first (or even second, third) time. This is why this is a training program!
- Stay in touch with your adviser. This part is the balance between independence and wasting time. Think about the problems you are having and come up with solutions, but for anything critical, meet with your adviser. A few minutes with him/her could save lots of time (and \$\$). We are here because we've been through the washing machine a number of times already.

HAVE FUN!

STEPS IN DOING A RESEARCH PROJECT (*and elements to include in your proposal*)—An Example

I. Develop a question that you want to answer.

What is the fault slip history or kinematics of fault motions within the ECSZ?

II. Proposing the project

A. State your question/hypothesis

What is the fault slip history or kinematics of fault motions within the ECSZ?

Specific objective: test and refine a new kinematic model for fault motions

within the ECSZ

B. Background research--results from similar studies

-Think about how your question fits in with previous work.

Previous GPS and geologic work have established present-day and long-term slip rates for a number of these faults—this data set formed the foundation for the new kinematic model

-What new and different angle can you investigate?

Data from these studies, integrated with results from ongoing GPS investigations in the area by others, will provide an excellent opportunity to document

- (1) the space-time distribution of fault motions from the Pliocene to present-day in this part of the ECSZ—important for understanding tectonic processes over a much broader area.
- (2) Comparing patterns of strain accumulation (GPS studies) with strain release (our proposed investigations) will provide important constraints on geodynamic hypotheses proposed for the ECSZ.
- (3) Well constrained geologically determined Holocene slip rates will improve model slip rates based on GPS data.
- (4) Better constraints on geological and geodetic slip, data that are essential for estimating frequencies of damaging earthquakes, will improve seismic risk assessment in this region of California.

C. Methods and Logistics

Objectives: tests of predictions 1 through 4

Methods: combination of geologic mapping, geomorphic, paleoseismic, structural, kinematic, and geochronologic studies.

Propose to study the Pleistocene to Holocene movement histories of the Owens Valley, the Hunter Mountain, and central part of the White Mountains faults.

D. Anticipated results and benefits--what do you expect to achieve in this project?

Slip histories through time—3 Ma and younger; pre-historic EQ's,

refine kinematic model

E. Schedule—

summer 1 ---

fall 1 ---

summer 2 ----

fall 2 ----

etc

F. Budget

travel: field work—per diem, mileage, lodging—and meetings

geochronologic analyses

graphics, drafting supplies, maps, airphotos, film

sample bags,

salary

special equipment

computer services

publication costs

telephone, xerox, postage

expendables for trenching