

# Project plan

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We're going to continue by talking about the project plan because it's going to be the first thing that you do.

## Slide 2: The “Why” of research (from Research Ethics module)

As you heard me mention earlier, one of the important things is the "Why of research". And we said that it's important it be worthwhile. Well, there's a very nice book by Heidi McKee and James Porter on the ethics of internet research, and they say in their book "ethical research begins with a coherent, valid, and sensible research design", and research needs to establish a "worthwhile purpose for the project - the why of research".

If you have a nice coherent design and if you're clear about what's the problem that you are researching, you're going to be much more successful in achieving that goal. If you don't have a clear goal, there's very little probability you're going to be successful in reaching that goal. So as we said, the objective of the research is that you want to develop new knowledge or understanding, and it should give benefits to someone, society, etc.

## Slide 3: Project plan

Now, what's the project plan? It's a plan for the research you're going to carry out, and, of course, the research is systematic. It's a series of activities that you're going to do, and each one of them is going to begin with planning.

## Slide 4: Project planning process

And, of course, the zeroth thing that you need to do - and that will absolutely be your initial task is, of course, to figure out who the authors are going to be. Who is your partner going to be in this research project? Then you need to start exploring the background you need to start saying: "Okay. I've chosen an area. I understand the context of the problem. Now, I need to find the relevant literature." And you're going to go start reading that literature. As you start reading, you're going to decide "Ah! That's relevant to me." In which case, let me see whom they reference. Also, look at whom references them. Those are good hints for: "Yes, this is probably relevant research". You want, as you're reading, one of the things you want to ask yourself is: What has no one done yet? Because quite often, even though the research is there, it's published, and people have worked on it for a long time. There is a part of it that you say, "No. Actually, they skipped thinking about this part of it. Maybe that's the thing that I should look at." Only at that point do you really want to select the problem. Right. Because you've now established enough of a base to work from - that you can identify "Yes. That is the problem." Now, you want to formulate your purpose. You want to say, "Why are we going to do this?" You want it identifying your objectives and goals. As part of understanding this, I am going to do the following things. And, of course, you want to write: "Why is this problem worth solving?" And in particular, why is it worth someone at the

master's level solving this problem. Both because you don't want to be attacking a problem that is really at the Bachelor's level. So and you certainly don't want to be attacking the problem at the doctoral level, because you're not going to get done this term. If you do the latter, okay! Now, you need to identify the deliverables. What is the set of things that you need to do? And what are the outcomes that you expect? And you want to think about them as ordered graded series of a set of things to deliver. Because now you have the information you need to write your timeline. The next thing you need to identify is what are the resources I need to be able to carry this out? Right. Do I need special equipment. Do I need access to certain data? No, I don't have access to that data, then back to the beginning, then I need to reformulate a new problem. Right. Now, I can't say that – “yes, you can go to Tele2 across the street, and they will open up their whole database you”. No, it is not going to happen! Right. So you have to choose a realistic problem with the resources that you have. And budget is always a problem. Whenever you think about projects, they're always limitations, so consider them. And finally, you need to create the final timeline or schedule, and that's going to be the graded set of tasks leading you (of course) to your objectives and the outcome you want.

### **Slide 5: The project plan (first three sections)**

So the project plan itself - the first three sections, of course, the title of the project is the first thing somebody sees on the page. And you want it to be short, you want it to be concise, you want it so that if somebody was passing you (it one of your friends) and they ask, what are you doing your project on? In five words or less, you would tell them exactly what they needed to understand you are working on. If you can, then you've got a great title. But you also don't want to mislead. You don't want to be too general, to have a fluffy title. Yes, cover all of these things, but it doesn't really describe what you're doing. Why do you need to do that? Every time you look at your document, you want to see that title, reminding you (yes) that's what I'm trying to do. Right. Because it's very easy and I come from a long misspent youth programming, and it's extremely easy to work on something and get tunnel-vision. Where you get distracted by a particular problem as you're working along and you forget what the big problem was you're trying to solve - because just let me compile it once more and I'm going to solve it. Right. You have to step back and say, "No. that actually wasn't what I was trying to do." So, use your title well. Next. The project team and their responsibilities. You need to decide how you're going to divide up responsibilities between the two of you. And then, you need to write the background. And the background is all written in the past tense because it's things that have already happened. It's extremely useful for you to figure out what's the background you need to have, and your reader needs to have to understand the rest of what you're writing.

### **Slide 6: Writing a good background section**

So, what are the keys to writing a good background section? You want to focus on your specific problem, don't get too general. Stay focused on your problem. Identify the relevant literature and cite it. And you want to learn how to summarize, what others have said. This

is a really, really important skill. To be able to look at paragraph of text is say, "here are the three words, I don't need all of this text. This is the summary of what this tells me." Right. Because you've already identified your context, you identified the direction you are headed, [hence] you ought to be able to really condense what it is that others have done. And, of course, cite it properly. A good literature study is going to make your life ever so much better. Right. Because you're going to avoid the mistakes that other people made. Right. And that will avoid you wasting a lot of time pursuing things that you didn't need to do. And it's going to increase the quality of your work. Because now you're building on a good foundation. So, that's we said it was critical to learn how to read critically - to decide if it is good or bad? Next, as we said, read how the others evaluated their solution. It's going to give you a good idea of how to evaluate your solution. And quite often I find it's very easy to think about a little matrix, here are the set of other resources I read, here are the good things, here are the bad things. I look at the whole set of it and say. Where are the missing points? And I want to produce a solution that has all these good features but skips all these bad features. Right. Because you have the advantage of following, so you don't necessarily have to make the bad choices that they did. Make your own bad choices! Right. Okay, as we said to understand what metrics you're going to use and to identify the data you need to collect.

### **Slide 7: The project plan (next two sections)**

The next two sections are the problem statement; it is written in the present tense because that is the problem you're solving now. And the problem itself, that's ideally one perfect sentence, it's the essence of the problem you're trying to solve. Whereas the problem statement gives you the background, it says, Why I'm doing this? Why is this the problem? But when you get to the problem statement - you wanted to be as absolutely concise as you can. Why? Because that's **the** problem you're trying to solve.

### **Slide 8: Writing a good Problem statement section**

How do you write a good problem statement? You really want to start out with a good detailed description of the problem and the major issues. And this is very important that it be a real problem, not a made-up problem. You want to try to solve a real problem, and as I say, often, the real problems are hidden in amongst the other data. So you may need to dig a little bit to identify what your problem is. So I once had a master's thesis project that many people thought was an incredible failure because what the students started out to do turned out not to be the problem. Well, what the student did was identify what the real problem was, and there were three subsequent masters theses, that were motivated because he had identified what the real problem was. So his contribution was identifying the real problem, which nobody else had done before. Again, we want to make sure you reference your sources well. And I left out the line there about your vision. What's your vision for solving the problem? Why do you think you can solve the problem now when others couldn't? Right. Because technology may have changed, the cost of the technology may have changed, and the processor speed may have changed, the area I may have to lay out my network on a chip may now be much larger because the feature size has shrunk, etc. So what is it now that this problem can be solved?

And, of course, this section is going to be able to take your reader from the current state-of-the-art to your desired future state. Right. What can you do at the end of this project that can't be done now? That's what you're trying to lay the foundations for. And, of course, you describe the current state in terms of Who's affected? What the effects are? Where does this problem occur? How are they manifest? And when is this problem important? So quite often, lots of people who have studied theory of computation (right), you know about big-O notation? How many have studied that? Okay. What's the first thing you learn to ignore whenever you started writing these kinds of descriptions? "The constants" Right. Unfortunately, in real life, the constants are often really important. Why? Because sometimes you might have something that would look really, really bad the coefficient for it might be very, very small. Other times you might have something where you say, "Ah! It's linear - it may be even sublinear" Oops !. It has a giant constant in front of it; hence I need to do something about it. So, for example, Google researchers wrote a very interesting paper on the one percent, they were not talking about rich people, they were talking about the queries that took longer than the ninety-nine percent which they had optimized. And they look at what is the cost of having your query take longer than the bound they had set. You might say, "it's only one percent". Is it important - it's just one person - no the problem is the multiplier is huge right- because they have billions of queries a day and if 1% of those queries takes much longer than the 99<sup>th</sup> percentile query, then their end-users become very happy and then the limit they become extremely unhappy, particularly if they are doing lots of queries. Right. So sometimes those constants do matter. And so what may be important to you - and what changed the situation - is it simply that the load went up - the number of users who are using the system increased above a threshold, so now these threshold effects start kicking in - because the coefficients are big enough, so now you have to do something about them. Yeah. So be sure to explain why it's important.

### **Slide 9: Writing a good Problem section**

Write a good problem statement section – giving a clear, concise description of the problem that you're going to solve. As I said; ideally, it is one sentence. It may even be the question to answer. If I can answer that question, I know. So my doctoral advisor told me, the best way to focus on getting your dissertation done is to write the ten questions you can answer at the end of it that you can't answer now. Put it on a piece of paper in front of you at your desk - so you look at it every day, and you say to yourself, "How am I solving these questions?" You don't have to ten, just one. Okay.

### **Slide 10: The project plan (optional section)**

An optional part of the project plan may be a hypothesis section. But not every project has a hypothesis. But if you do have a hypothesis, it is going to be written in the conditional or future tense because you don't know if it may or may not be true but, you need to state it. And you need to state it in a way that you can refute it. But as I said, not every project is going to have a hypothesis.

### **Slide 11: The project plan (next two sections)**

The next two sections are the purpose and goals. The purpose is going to explain why you're doing this project, Who benefits? What's the reason for it? That is about the purpose, and the goals are the things that you're going to achieve. What are the results? What are the objectives? What will I produce as a result of carrying out this project? And, of course, as you are writing, you're writing it in the present tense, but you believe those to be the goals you are going to deliver. It isn't yet clear, of course, that you can, but you believe you can deliver. Because if you don't believe you can deliver them, then you shouldn't be writing that as one of your goals.

### **Slide 12: The project plan (next two sections)**

The next part, also written in the present tense, is the task or tasks that you need to carry out to complete your project. And you want to think about a work breakdown structure. What has to be done at a particular time. Make sure that you think about any synchronization of tasks that are dependent on each other. Make a note of it. Why? The one thing I've learned in networking is, and I've been looking for all my life is an element that I can put in your network has a negative delay. Because if I can put this negative delay element into a network, I can solve nearly all networking problems. But the problem is as soon as I put something in the network it always adds some amount of delay, even though it may be very, very small. Unfortunately, it is positive. Right. So, the same thing happens in your task plan; each one of those tasks is going to take a longer period of time [than you have planned]. And if there is a dependent task it's going to push your time forward. The next section, the methods you need to explain your research methods and why you chose them and why they are appropriate.

### **Slide 13: The project plan (next two sections)**

You want to write your milestones chart - using whatever the style of your favorite chart is – Gantt charts, whatever. There are plenty of tools about that. And to help you with your references, I really encourage you to use something that put in the document identifiers, DOIs, ISBNs, and URLs, ... , etc. and the tool that I love is Zotero. And I have my own style sheet, that includes DOIs, ISBN, URLs, etc.

### **Slide 14: Writing a good Milestone chart/Timeline section**

For those of you who were so inclined. Writing a good milestone chart, is very, very helpful - because it's going to identify the things you need to deliver and bring out the dependencies and indicate who's responsible for each of the tasks. Then, you can say, "It's his responsibility". Right. Now you should be able to identify who it is. But it's important every single thing there be measurable. If it isn't measurable, then It shouldn't be on your milestone chart. It has to be a clear definitive thing; I know it's done because I have done this. And you don't want too many milestones- Right. You're not working for a government agency. You

don't need to have a giant big budget. You want to keep it fairly concise and make sure that you coordinate it. And there are plenty of useful tools to help you in this.

### **Slide 15: Project plans – beyond this course**

Now, those aren't the only components you might in a project. In your careers, you may see project plans with all of these different possible elements to them. Right. Because some are going to have to include things like a commercialization plan, some may include exploitation plans, publication plans, and institutional review boards if there are humans involved, ethical review boards, sustainability plans, etc.

### **Slide 16: Relation between research proposal, plan, report (Inspired by table on page 18 of [van Vliet 2010])**

Now, if you say what's the difference between a proposal, a plan, and my final report - well this table nicely summarizes this. You can see on the left-hand side the elements of a proposal. Right. You're proposing to do research. Now, that's your first draft. It includes those pieces. Your plan has got more details. And finally the report - now has your conclusions, your results, etc. You are no longer a plan. So, of course, what does this immediately suggests that all of you should be thinking about? Right. A proposal - so you go into the meeting on Wednesday or Thursday with the other set of students and can say, "I have a proposal for an idea that I think would make a really, really good topic for a research project." Right,. Why is that a good strategy? He who has a good proposal is most likely to get it accepted. He or she who doesn't have a good proposal is likely to work on with someone else thinks is a really interesting proposal. Right? So as they say. "propose ahead". You're likely to end up with a good plan. The other thing is, of course, at some point you do have to find someone else - so if you give them something concrete to look - at you're much more likely to find someone else who says, "Yeah. I really want to work with you." Right. Because if you have something that is clear, it will be really exciting and interesting to work on.

### **Slide 17: Written report organization**

So, if you think about writing - one of the common methods is called IMRAD. Is to think about Introduction, Methods, Results, and Discussion. This is a widely used approach – when you look at lots and lots of journals it is like cookie-cutter - every article you pick up has the same structure. And, in fact, many journals -when you look at abstract even they have the abstract even in a very structured fashion. But you also find differences, and different communities organize things differently.

So in some cases, the related work is really early - it's before the introduction or just after the introduction. In some cases, it's part of the discussion and related works section. So, for whatever context you're thinking about writing in the future, take a look at what are the other papers that have been submitted to that journal, and you will have a good idea of what their style is.

## Slide 18: References

So there are some more references here.

## Slide 19: ¿Questions?

Any questions? I know there are lots of practical questions about sections. And why I can't access the videos. I'm trying to deal with getting everybody registered, as I said. "Please see my wife to make sure that your there your name is checked." With regard to the videos once you get registered for the course, then you should be able to see that on the left-hand side of the course webpage. Any other questions?