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Guide to research questions

Based on the work of Meltzoff ("Critical Thinking About Research: Psychology and Related Fields", 1998) and Easterbrook et al ("Selecting Empirical Methods for Software Engineering Research", 2007).

What are research questions and why are they important?

A research question is a question that your research study/project sets out to answer. Often you have not only one but a set of between 1-7 related questions that you want to answer. These questions are important since they are the focus of your research; answering your questions is THE main aim of your study or thesis and "everything else follows from them". Thus, the research questions must be accurately and clearly defined.

Types of research questions

There are several main types of RQs and the figure below gives an overview. The basic difference is wether the RQs are focused on creating (better) solutions or on creating (better) knowledge. In the following we focus on the latter, but the detailed division given for it can also, partly, be used for the former. However, better knowledge is often a prerequisite for creating better or new solutions. There is also a larger variety of RQs for solutions-focused research, since the RQs depend more on the actual solution(s) investigated.

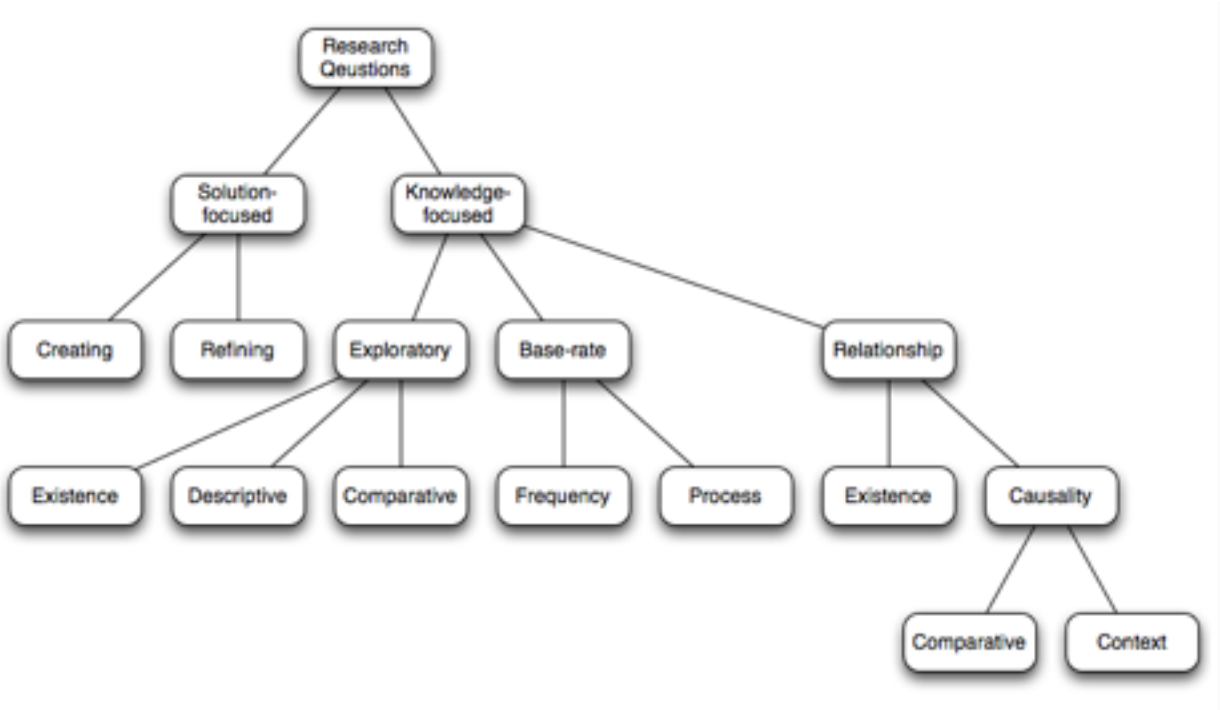

Figure 1. Taxonomy of different types of Research Questions

For knowledge-focused RQs, when not much is known about the phenomena/problem under study (PUS) the RQs are mainly *Exploratory* (Expl). Qualitative methods are often more appropriate since they help build a context for more knowledge and help create tentative theories and hypotheses. *Base-rate* RQs help describe how and when the PUS commonly appears. *Relationship* RQs focus on how the PUS relates to other concepts.

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How is it correlated with other phenomena and which of them is it caused/affected by as well as cause/affects?

Main Types of RQs	Answers
Exploratory	Answers give clearer understanding, better definitions of concepts, evidence that we can measure them validly
Base-rate	Answers describe the normal pattern of occurrence of the phenomena
Relationship	Answers describe if and how two phenomena are related
Solution-focused	Describes better ways to solve some problem or situation. Examples are: *"What is an effective way to achieve X?",* *"Which strategies help achieve X?",* *"How can we refined S to achieve X in a better way?"*

Sub-Types of RQs	Examples
Exploratory/Existence	*"Does X exist?",* *"Is Y something that software engineers really do?"*
Exploratory/Descriptive	*"What is X like?",* *"What are its properties/attributes?",* *"How can we categorize/measure X?",* *"What are the components of X?"*
Exploratory/Comparative	*"How does X differ from Y?"*
Base-rate/Frequency	"How often does X occur?", "What is an average amount of X?"
Base-rate/Process	*"How does X normally work?",* *"What is the process by which X happens?",* *"In what sequence does the events of X occur?"*
Relationship/Existence	*"Are X and Y related?",* *"Do occurrences of X correlate with Y?"* *"What correlates with X?"*
Relationship/Causality	*"What causes X?",* *"Does X cause Y?",* *"Does X prevent Y?",*
Causality/Comparative	*"Does X cause more Y than Z does?",* *"Is X better at preventing Y than Z is?"*
Causality/Context	*"Does X cause more Y under one condition than others?"*

Context is actually a very general concept and can be applied to several of the other types of RQs to qualify them.

Creating research questions

1. Given your chosen research topic, consider which main type of research it is.
   - a, Are you primarily focused on creating more and better understanding? (go 2)
   - b, Are you primarily focused on creating a better solution to a problem? (go 3)

2. How much is known about the topic?
   - a, “Not much is known, we need to explore.” => Consider which types of Explorative RQs is most suitable.
   - b, “We now a lot about the phenomena but not how common it is, or how and when it occurs” => Consider primarily Base-rate type of RQs
   - c, “We have good descriptions about the phenomena and its occurrences but we do not understand how it relates to other phenomena or what causes it” => Consider Relationship type of RQs

3. Consider different Solution-focused RQs

4. When you have create a few RQs based on this rough classification consider the other categories of RQs. Which are relevant given your “main” RQs? Often you need a set of different types of questions that together helps you answer a main one.