SETTING UP A RESEARCH QUESTION FOR DETERMINING THE RESEARCH METHODOLOGY

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ABSTRACT

This paper presents an approach to determine a research question that would enable design researchers to fix their research question as early as possible. It supports Yin's recommendation that a researcher must determine the research question first because it will guide him or her on the appropriate research approach. The author has developed three main constructs for the formation of a research question—the "how", the "what" and the "who"—that would lead researchers to develop the subsequent research objectives. They, in turn, will guide the researchers to formulate their sub-research questions, and the appropriate research strategies. The author hopes that this approach will assist novice researchers in unraveling a preliminary design research approach very early on. Hence, it allows the researchers more time to refine their research methodologies upon further literature review.

Keywords: Design Research, Research Methodology, Research Questions

1. INTRODUCTION

Design research is complex and many novice researchers end up confused during the early phase. Many are unable to pinpoint a definite research approach to answer their research questions because in many instances, they need to utilize multiple research methodologies. Due to a strong desire to realize a study, many of these new researchers have prematurely embarked on data collection procedures causing prolonged data analyses due to inconclusive results. The methodology to develop a research question (RQ) appropriate for either a Masters or Ph.D. study stemmed from frequently asked inquiries from students on how the author would know whether one question meets the Masters level or the Ph.D. level.

The methodology is only one of the numerous approaches that the author believes senior and established researchers have developed over the years (Creswell, 2003; Yin, 2002; Barbie, 2001). This article makes no effort to conduct a comparative study amongst established researchers; hence, it makes no claim of any new knowledge contribution other than formalizing the author's personal approach in supervising graduate students in their first year of their graduate studies. In this article, the author presents the prerequisites for developing a RQ, how the author identifies the constructs for the RQ, how RQs are developed and ascertained, how to determine the research objectives, how the sub-RQs are developed, and finally the identification of which research methodology is the best to answer the main RQ and its sub-RQs.

2. PREREQUISITES FOR SETTING THE RQ

There are two prerequisites that graduate students require before developing their RQs. The first is, knowing the problem they intend to solve, and secondly, having completed substantial literature review in the area of their research interests. Both factors play an integral part in the early phase of a postgraduate study. Professionals who have several years of practice experiences have much easier time identifying their industry problems. However, they will need to conduct an extensive literature review to ascertain that there are no existing solutions that previous scholars have not resolved. On the other hand, those lacking professional experiences tend to work on issues that they found from gaps in the literature review. In either case, there is no excuse for not reading previous scholarly works in the problem area of interest. In a Ph.D. study, the need to read and critically analyze existing literature is very important since the Ph.D. candidate must prove that he or she truly contributes a new knowledge to the current body of knowledge (Hart, 2002).

3. DEFINITION OF RQ CONSTRUCTS

Backed by literature knowledge, graduate students then proceed to develop his or her RQ. The author defines the RQ as an inquiry that leads towards obtaining a solution through systematic and verifiable steps by the researcher. The RQ must not give a "yes" or "no" answer as such RQ will not need systematic and verifiable steps. The author has identified three major constructs in a thesis RQ: *who*, *what*, and *how*. They are:

1) WHO is the "element" that is being used or being impacted by the study.
2) WHAT is the "body of knowledge" that the researcher must know in order to solve the problem.
3) HOW is the "action" or "impact" that will occur on the "element" or the "body of knowledge" in the study.

4. DEVELOPING THE MAIN RQ

As a rule of thumb, there must be at least one of each construct for an acceptable Masters' RQ. On the other hand, an acceptable Ph.D. RQ should consist of at least two WHATs, one WHO, and one HOW respectively. Another alternative is having two HOWs, but one WHAT besides one WHO. In summary:

Masters:	one WHAT, one WHO, and one HOW
Ph.D.:	two WHATs, one WHO, and one HOW
	OR
	one WHAT, one WHO, and two HOWs

An example of a Masters RQ using this approach:

> What are the exterior artificial lighting requirements [WHAT] for enhancing a building's appearance [HOW] in the urban space at night [WHO]?

An example of a Ph.D. RQ using this approach:

> How can 3D sketching [WHAT1] be utilized in VR tools [WHAT2] for enhancing collaboration [HOW] among non-collocated design team members [WHO]?
>
> OR
>
> How can 3D sketching be utilized [HOW1] in VR tools [WHAT] for enhancing collaboration [HOW2] among non-collocated design team members [WHO]?

5. DEVELOPING RESEARCH OBJECTIVES AND SUB-RQS

Graduate researchers are recommended to incrementally develop systematic progresses in their thesis guided by their sub-RQs. In setting up their sub-RQs, graduate researchers must determine what they are seeking at the conclusion of their studies—i.e., their research objectives. Through iterative questions and answers sessions, many will be able to affirm their research goals while they are developing their sub-RQs.

An example of a Masters RQ:

Main RQ-
> What are the exterior artificial lighting requirements [WHAT] for enhancing a building's appearance [HOW] in the urban space at night [WHO]?

Objective 1-
> To document the available exterior artificial lighting technologies.

SubRQ1-
> What are the available exterior artificial lighting technologies for building facades?
> Note: Answer will provide data for [WHAT].

Objective 2-
> To understand the effects of exterior artificial lighting on building facades.

SubRQ2-
> What are the effects of exterior artificial lighting on building facades?
> Note: Answer will provide data for [HOW] and [WHO].

Objective 3-
> To recommend how owners can enhance their buildings' exterior facade lighting.

SubRQ3-

What are the recommendations to owners in order to enhance exterior building façade lighting?

Note: Answer will provide data for [HOW] and [WHO].

An example of a Ph.D. RQ:

Main RQ-

How can 3D sketching [WHAT1] be utilized in virtual reality (VR) tools [WHAT2] for enhancing collaboration [HOW] among non-collocated design team members [WHO]?

Objective 1-

To document how designers are currently sketching during collaborative design sessions.

SubRQ1-

How do designers conduct 3D sketching during collaborative meetings?

Note: The answer will provide data for [WHAT1] and [HOW].

Objective 2-

To understand the operating characteristics of non-collocated collaboration using VR tools.

SubRQ2-

What are the virtual reality (VR) operating characteristics of non-collocated project teams?

Note: The answer will provide data for [WHAT2] and [WHO]

Objective 3-

To recommend how a non-collocated design team can use VR tools to support their collaboration.

SubRQ3-

What are the key enablers for using 3D sketching collaboration in VR?

Note: The answers will provide data for [HOW] and complete the thesis.

Of course, the granularity of a research focus will depend on how much literature review the researchers have done. Therefore, researchers are expected to continuously refine their main RQ and sub-RQs within the original intention of their main RQ constructs as their theses progress.

6. DEVELOPING RESEARCH STRATEGIES

In this section, the author explains how the main RQ and its sub-RQs unravel their respective research strategies. The author refers to Yin (2003) who explains how the initial question can guide the researchers' approach for designing a research strategy. This article reproduces the summary from Yin (2003) as reference below.

Table 1: Relevant Situations for Different Research Strategies (Source: COSMOS Corporation in Yin (2003), Figure 1.1)

Strategy	Form of RQ	Requires Control of Behavioral Events	Focuses on Contemporary Events?
Experiment	how, why?	Yes	Yes
Survey	who, what, where, how many, how much?	No	Yes
Archival analysis	who, what, where, how many, how much?	No	Yes/No
History	how, why?	No	No
Case study	how, why?	No	Yes

Referring to Table 1, the example Masters RQ and all its sub-RQs start with "What…?" It is focused on contemporary events (night lighting). It does not require any control of respondents' behavior. Therefore, the researcher is expected to conduct a survey—a quantitative research methodology. Once the main approach has been identified, the researcher can then proceed to detail the design of his or her research strategy according to well established quantitative research methodology. Notice that the researcher can obtain all the required data by using one survey instrument.

On the other hand, the example Ph.D. main RQ starts with a "How…?". In this case, Yin (2003) advises that researchers use experiment or case study. In

a not clear cut situation, researchers are advised to evaluate the sub-RQs for guide. Sub-RQ1 starts with a "How…?", but sub-RQ2 and sub-RQ3 start with "What…?" For sub-RQ1, the researcher can choose to use a case study of an architectural design studio where ethnography is the dominant data collection procedure. The researcher uses ethnography to know how designers conduct 3D sketching during collaborative meetings. This strategy is supported by the fact that he cannot control the behavioral events during his data collection. For sub-RQ2, the researcher can choose a controlled experiment in a laboratory since it will be difficult to collect data on non-collocated project teams in Malaysia. Additionally, this option is taken to reduce the researcher's risk since there are not many architectural firms which have virtual reality tools in their offices. For the final sub-RQ3, the researcher conducts an analysis that integrates results obtained from the ethnography case study and the controlled experiment.

Notice that there are several layers of data collection and analysis activities in a Ph.D. research. Firstly, the ethnography results guide the setting up of the virtual reality (VR) experiment for a non-collocated project team. Secondly, the controlled experiment results will identify the operating characteristics of a non-collocated project team. Thirdly, the researcher conducts an analysis of both ethnography study and controlled experiment to identify the key enablers for using 3D sketching for collaboration in VR condition. Comparatively, the Masters RQ is able to provide the answers by conducting only a sequential data collection and analysis activities. The author posits that this multiple layer of intellectual exercises during the course of a research study is the source for differentiating a Masters and Ph.D. RQs respectively.

Although it is very early to have substantial feedbacks from the students, the author is pleased to note here that three Ph.D. students from the first two courses have successfully passed their comprehensive examinations slotted in the fifth semester by their third and fourth semesters respectively. Two of them are on track to submit their doctoral dissertations before the end of their sixth semesters respectively. Four Masters' students from the first course have submitted their completed dissertations for examination before the end of their fourth semester respectively. Prior to this approach, it was common to have the Masters' and Ph.D. students submitting their dissertations for examination by the sixth and tenth semesters respectively.

7. CONCLUSION

Having multiple layers of intellectual exercises during the course of a research study is the basis for differentiating a Masters from a Ph.D. RQ respectively. Hence, the development of the main RQ is important towards this end. This article presents an approach in formulating these research questions for design studies. It is an on-going effort to simplify the design of research methodologies by graduate students from developing countries who are not trained in critical literature reading. The author appreciates any feedbacks to the proposed approach.

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