Colorado State University

Observe + Reflect + Articulate

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Overview

• Ideation and Research Direction
• Observe – Reflect – Articulate
  – Observation
  – Reflection
  – Articulation
• ORA in Communications and Publications
• Research Questions
Ideation and Research Direction

• If you are lucky, on Day 1 of your doctoral degree you might know
  – What general field you want to work in?
  – Who is your research advisor?
  – How do you learn best?
  – How do you learn on your own?
  – What are some big problems that you would like to have the solution to in 3-4 years?
Ideation and Research Direction

• If you are unlucky, on Day 1 of your doctoral degree you might not know
  – What general field you want to work in?
  – Who is your research advisor?
  – How do you learn best?
  – How do you learn on your own?
  – What are some big problems that you would like to have the solution to in 3-4 years?
Ideation and Research Direction

• A doctoral degree is about learning to be a person who generates new ideas and new knowledge, we call that research...
  – New knowledge is new, unknown, undiscovered
  – Innovators and research leaders are called to develop new ideas every day, so we had better learn how to do this

Bloom’s Taxonomy of Learning
Ideation and Research Direction

• I will present to you a method that I have used throughout my career to develop new ideas

• A couple of personal caveats
  – I am no genius, but I can reward myself for thinking
  – I like working in teams, and processes
  – I never have enough time
  – I get excited about many topics
Observe – Reflect – Articulate

- Observation
- Reflection
- Articulation

Initial Problem “Definition”

Idea/Solution

Scope of Inquiry

Time
Observe – Reflect – Articulate

• Advantages to a framework
  – I can assume that it can be applied to any field or problem
  – I can structure my inquiry as a 1 week or 3 week or 1 year process
  – I can identify my thinking, and direct efforts towards the overall objective
  – Can be renewed and repeated if/when hypothesis is disproved or problems come up
Observe – Reflect – Articulate

• Observation
  – **Objective:** to broaden your scope of knowledge without critique
  – **Input Tasks:**
    • Read a paper, go to the first citation, read that paper, go to the next citation, read that...
    • Read the most famous book, Go to the library, pull the next book over
    • Repeat the findings of previous studies
    • Interview experts and laypeople
    • Think AI might help? Learn about that too
Observe – Reflect – Articulate

• Observation
  – Output Tasks: You **must** ask and document your observations in written format
  • Question and Answers, repeated for each thread
    – What are the set of all definitions for XXX?
    – What is the environment or system in which XXX operates?
    – What are examples of XXX?
    – What are the characteristics of XXX?
    – More questions are at *Level 1* of
      [https://deseng.ryerson.ca/dokuwiki/design:four_levels_of_questions](https://deseng.ryerson.ca/dokuwiki/design:four_levels_of_questions)
Observe – Reflect – Articulate

• Observation
  – Example
  – What are examples of Hazard Analysis Techniques?

  • FHA – Functional Hazard Analysis
  • PHL – Preliminary Hazard List
  • PHA – Preliminary Hazard Analysis¹
  • SSHA – Subsystem Hazard Analysis
  • SHA – System Hazard Analysis
  • O&SHA – Operating and Support Hazard Analysis
  • HHA – Health Hazard Assessment
  • RHA – Requirements Hazard Analysis
  • EHA – Environmental Hazard Analysis
  • FTA – Fault Tree Analysis
  • FMEA – Failure Mode and Effects Analysis
  • FMECA – Failure Mode and Effects and Criticality Analysis
  • HAZOP – Hazard and Operability Analysis
  • ETA – Event Tree Analysis
  • CCA – Cause-Consequence Analysis
  • CCFA – Common Cause Failure Analysis
  • SwHA – Software Hazard Analysis
  • PHA – Process Hazard Analysis²
  • THA – Test Hazard Analysis²
  • FHA – Fault Hazard Analysis
  • SCA – Sneak Circuit Analysis
  • MA – Markov Analysis
  • PNA – Petri Net Analysis
  • BA – Barrier Analysis
  • BPA – Bent Pin Analysis
  • MORT – Management and Oversight Risk Tree
  • JHA – Job Hazard Analysis
  • THA – Threat Hazard Analysis²
  • SoSHA – System of Systems Hazard Analysis
• Reflection
  – **Objective:** to build new ideas and connections among ideas
  – Input Tasks:
    • Repeat the findings of a previous study, but using a new technique
    • Change perspectives on a problem (how does this look from a procurement PoV, manuf., policy PoV)
    • Compare and classify previous solutions
    • Compose composite inquiries or potential solutions (>1 is better)
Observe – Reflect – Articulate

• Reflection
  – Output Tasks: You must ask and document your reflections in written format
    • Question and Answers, repeated for each thread
      – How is XX similar/different to things that do the same thing as XX?
      – What is the point (main argument or thesis) presented by XX?
      – What are alternative explanations/theories that have been developed by others?
      – How does XX change the systems or subsystems around it?
      – More questions are at Level 2 of https://deseng.ryerson.ca/dokuwiki/design:four_levels_of_questions
Observe – Reflect – Articulate

• Reflection
  – Example
    • Vehicle to Grid charging is a way that we could use electric cars to provide energy back to the grid, providing “ancillary services” to the smart grid
Observe – Reflect – Articulate
Observe – Reflect – Articulate

• Reflection
  – Example
    • How does the communication pathway compare for these architectures?
    • What does the aggregated architecture assume about the “service provider” agent?
Observe – Reflect – Articulate

• Articulation
  – **Objective:** to redefine and clarify the observations and reflections to define new learnings, questions, and hypotheses
  – Input/Output Tasks:
    • Write/refine/write/refine ...
    • Diagram the solution/process
    • Is this question logical?
    • Is this provable?
    • What are the dis/advantages of this method?
• Articulation
  – Example:
  • I hypothesize that the three metrics of performance will lead to different optimal designs, in practice. To test this hypothesis, I will make a parametric design model of the subsystems, design the aircraft three times by maximizing each of the metrics of performance, and then compare them on the basis of detailed cost models.
Observe – Reflect – Articulate

- Articulation
Figure 2. Information flow within the optimization problem and DSM structure. Details of the Propeller/Motor/Fuel Cell CAs is shown in Figure 3.
Observe – Reflect – Articulate

Initial Problem “Definition”

Observation

Reflect

Idea/Solution

Scope of Inquiry

Time
• To convince anyone, you have to bring them along with your thought process (O-R-A)
• Here is an example and exercise:
  – Skip the abstract, read the introduction to this paper. Label each sentence/paragraph in the margin as an observation sentence, a reflection sentence or an articulation sentence.
Here is an example and exercise:

- Skip the abstract, read the introduction to this paper. Label each sentence/paragraph in the margin as an observation sentence, a reflection sentence or an articulation sentence.

  - [https://journals.sagepub.com/doi/pdf/10.2189/asqu.51.2.262](https://journals.sagepub.com/doi/pdf/10.2189/asqu.51.2.262)
  - Accessible from the CSU library online with VPN to CSU
• Every time that I have to write a proposal, I write it in ORA format
• Every time I have to give a scientific presentation, I present it in ORA format
• Every time I have to present a university colloquium, I present it in ORA format
Research Questions

• One of the first tasks of your first efforts in your doctoral research will be to define your research in terms of research questions or hypotheses

• It is totally normal to have some research agenda or research concept as you begin your studies (or not), work with your advisor and “dive into” O-R-A
Research Questions

• You will have to work with your advisor to define your research agenda
  – Share your ideas, documents, findings and processes as they come
  – Bring your advisor along with your ORA process and it will help to make a research team
  – Allow yourself 6-12 months and 6-12 meetings to do the process
  – Allow yourself to generate new ideas, reject bad ones, broaden scope, narrow, as you go
Research Questions

• In your preliminary examination documents and in your dissertation documents and in your presentations, you should use the O-R-A framework to present your work
  – Your introduction should be observations, and reflections
  – Your research questions or hypotheses, and tasks should be articulation statements
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