Work in Progress: Does Practice Make Perfect? How First Year Students Develop Reflective Learning Skills

Natalie Van Tyne

Associate Professor of Practice

Virginia Polytechnic Institute and State University

Mxc#5</#534;

July 2018

Foundations of Engineering Sequence

- Required for all students in College of Engineering
- Two 15-week semester courses, each two credits
- Current entering cohort approx. 2,000 students
- 30-student sections, one instructor per section (for now)

Foundations II Objectives

- Demonstrate how to use various engineering skills and tools to solve design problems
- Demonstrate proficiency in implementing an engineering design process
- Communicate engineering designs to technical managers
- Contribute effectively to an engineering team
- Evaluate the ethical implications of engineering solutions

Reflective Learning in the First Year

- One briefing about the overall purpose
- Tie in to meaningful learning
- Students recognize value if it means something to them
- Value to faculty ≠ value to students

Research Question

How extensively can first year students apply the reflective judgement skills identified by King and Kitchener through a series of periodic reflections?

Why Reflection? Meaning → Retention

- Foundation for engineering curricula
- What lasts? Critical Thinking Skills
- Critical thinking ability leads to better metacognition and learning that lasts

King and Kitchener's Reflective Judgement Stages

Stage	Knowledge	Beliefs
1	Is absolutely certain and concrete, based on observation	Need no justification, are absolutely true, other beliefs do not exist
2	Is absolutely certain but not immediately available, based on either observation or authority figure	Are unexamined or depend on the beliefs of an authority figure
3	Is absolutely certain (from authority figures) or temporarily uncertain (beliefs serve as substitute until absolute knowledge is available)	Are obtained from an authority figure or based on personal opinion without benefit of evidence

King and Kitchener's Reflective Judgement Stages, cont.

Stage	Knowledge	Beliefs
4	Is uncertain because knowing always involves some ambiguity; data are not always reliable and may be subject to error	Are based on evidence that is selected to support an idiosyncratic view
5	Is based on context, and is subjective because it depends on individual perception and criteria for judgement	Are influenced by context and context-specific interpretations; alternate beliefs are recognized as potentially valid
6	Is constructed as a series of individual conclusions about ill-structured problems; information comes from a variety of sources. Conclusions are based on evaluations of evidence across contexts and can be derived from the opinions of well reputed others.	Are justified by comparing opinions across different contexts; are formed by weighing evidence and the pragmatic need for action, such as being "sure enough" to act.
7	Is constructed as a series of individual conclusions about ill-structured problems; is re-evaluated based on new evidence or perspectives, or the availability of new tools of inquiry	Are justified by judging the strength of a position in terms of evidence, risk of error, consistency across contexts and consequences of alternative positions

Proposed Research Method and Data Collection

- Estimate 100 participants, depending on consent to participate
- Participants complete 5 reflective assignments over a 15- week semester
- Each assignment contains these questions:
  - What was the most important item of knowledge that you learned?
  - Why is it important to you to learn it?
  - How else could you use this knowledge?

Proposed Research Method and Data Collection, cont.

- Responses will be open coded to discern evidence of increased reflective judgement, a form of critical thinking

- Looking for evidence of increased reflective judgement by the end of the semester

Grading Criteria vs. Reflective Judgement Stages

Stage	Perry Model of Intellectual Development Regarding Knowledge	King and Kitchener's Reflective Judgement Stages Regarding Knowledge	Course Grading Rubric Criterion for "Importance of This Item of Knowledge"	Course's Grading Rubric Criterion for "Where Else Could You Use It?"
1	Is right or wrong, a collection of facts obtained from authority	Is absolutely certain and concrete, based on observation	N/A	N/A
2	Is generally right or wrong. Authority gives us the right answer or give us problems to solve in order to find it.	Is absolutely certain but not immediately available, based on either observation or authority figure	N/A	N/A
3	Is right or wrong, but some of it may be unknown. Authority gives the answers or the means by which to find them.	Is absolutely certain (from authority figures) or temporarily uncertain (beliefs serve as substitute until absolute knowledge is available)	Identifies a non-specific benefit or consequence (e.g., " I can use this in my job as an engineer.") (1 point)	Names a non-specific use (e.g., " I can use this in my job as an engineer.") (1 point)
4	Some of it is right or wrong, but most of it is unknown. If authority does not know, then everyone can have their own opinion.	Is uncertain because knowing always involves some ambiguity; data are not always reliable and may be subject to error. Idiosyncratic beliefs may exist.	N/A	N/A
5	Most of it is contextual and can be judged qualitatively or subjectively.	Is based on context, and is subjective because it depends on individual perception and criteria for judgement	Identifies a specific benefit gained or consequence avoided (3 points)	Identifies a specific use outside of this course (3 points)
6	Is not absolute. Student accepts responsibility for making judgements and commitments based on their values.	Is constructed as a series of individual conclusions about ill-structured problems; information comes from a variety of sources. Conclusions are based on evaluations of evidence across contexts and can be derived from the opinions of well reputed others.	Identifies a specific benefit gained or consequence avoided clearly and convincingly (5 points)	Identifies a specific use outside of this course clearly and completely (5 points)
7	Is relative. Judgements are made among alternative views, and doubt is recognized and accepted.	Is constructed as a series of individual conclusions about ill-structured problems; is re-evaluated based on new evidence or perspectives, or the availability of new tools of inquiry	N/A	N/A

Implications for Practice

- Is feedback through a repeated rubric sufficient to prompt reflective judgement, or is more guidance necessary?
- Can today's engineering students progress any farther in their intellectual development than Pavelich and Moore found in the early 1990's?
- Be aware that students, left to their own devices, often form snap judgements just to get the assignment done.

  Caveat from an earlier study, same type of students: reflective judgement rarely happens naturally at this stage.

Thank You