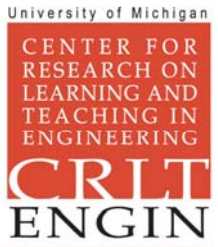




Solving wicked problems: A pre-college design pedagogy

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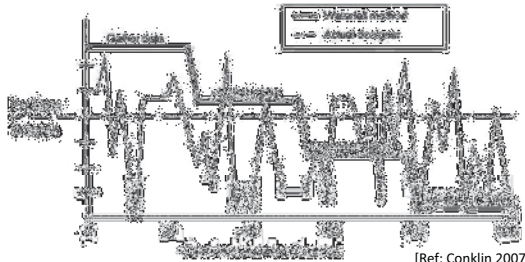
1 Abstract

We develop a framework to guide students through the design process of solving wicked problems, based on characteristic processes of expert designers. This pedagogy was piloted at a summer 'hands-on' design program for high-school students. Participant-maintained log books, voluntary surveys, and procedural data collected by trained observers were analyzed using both qualitative and quantitative techniques to determine the accessibility and effectiveness of this pedagogical approach. The results indicate that students understood and applied the framework to systematically address the problem, and found it particularly useful in the beginning stages of the design process, before conventional constraints and objectives were identified. Hence, we believe that this pedagogical approach is not only useful for helping students solve design problems, but more importantly, in shaping critical problems that need to be addressed in today's complex world.

2 Conceptual Background

A **wicked problem** is a complex system of problems where stakeholders cannot easily identify the best path forward, often due to conflicting values.

Experts intuitively know that standard design models do not apply to these **poorly-defined problems**.



[Ref: Conklin 2007]

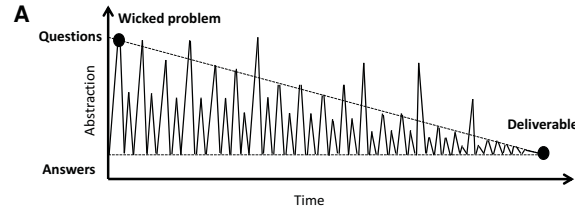
Characteristics of expert design process:

- Not afraid to jump to 'loosely-held' solutions
- Problem is repeatedly revisited and refined
- Iteration built into the entire design process
- Clear delineation between convergent and divergent thinking

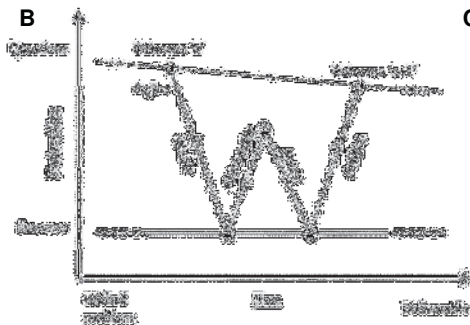
[Ref: Schon 1983]

3 Pedagogical Model

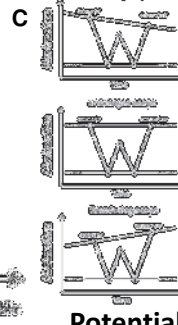
To provide an 'expert roadmap' for **messy** design:



Linear progress towards solution is not expected / desired



Individual 'W-cycle'



Potential outcomes

- Students encouraged to solve the **defined** problem immediately.
- Large quantities of solutions are developed during **ideation**.
- Students **synthesize** common themes arising in their solutions.
- Themes are **assessed** based on feasibility, desirability, viability.
- Built-in **reflection** time allows students to redefine the problem

Design cycles are NOT expected to always narrow the problem definition.

4 Teaching Environment

Shad Valley (U. Waterloo): 28-day residential program for 48 gr.10-12 students, focused on teaching design (www.shad.ca)

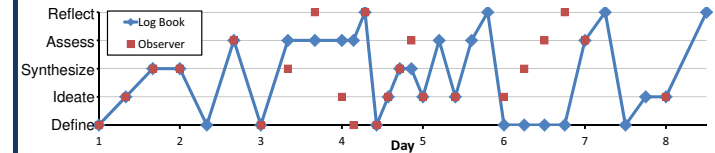
Capstone project: "How might we prevent / reduce obesity in North American youth?" Students work in teams of 4-8.

Deliverables: prototype, conference poster, website, logbook

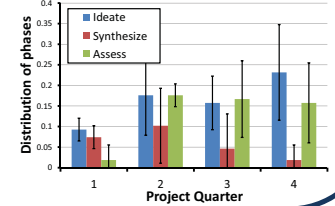
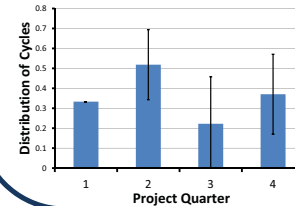
Teaching format: ~15 hrs design lectures, ~40 hrs scheduled project time, students free to invest more time if desired.

5 Accessibility of the framework

Participant-maintained log books and observations made by trained observers showed moderate agreement ($\kappa=0.48$), demonstrating reliability of logbooks as sources of information.



Students maintained use of the model throughout the project.



6 Utility of the framework

Qualitative analysis of voluntary surveys reveals the following consistent themes. The model:

- (1) has a steep learning curve
- (2) provides effective guidance in identifying what to do next
- (3) prevents a natural tendency to leap to a single solution
- (4) assists in separating divergent / convergent thinking during cycles
- (5) forces the use of objective, external criteria in decision making
- (6) utility is greatest in the initial stages of the design process

"Overall, although the model may be a pain to get used to, once you do, it's an amazing tool and strategy that can be used to find valid solutions to some of the biggest problems out there – it really forces you to think outside the box, consider where the crazy solutions come from, and if there's any real sense to them, and then come up with a totally unique solution that would have never come to mind any other way."

7 Summary: W-model features

- Cycles can apply consistently throughout design process
- Emphasis on intentionality keeps students on track
- Creativity and innovation are embedded components
- Synthesized themes shift focus to why solutions might work
- Assessment guided by prescribed universal high-level criteria
- Pedagogy acknowledges that the design process is not linear

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