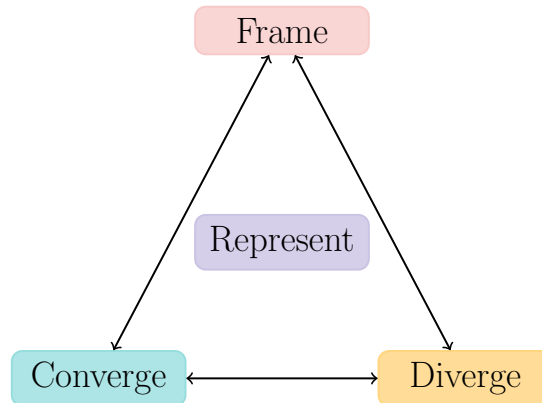# Praxis I Notes

FDCR Model

Figure 1: The FDCR model represents the iterative engineering design process.

- **Frame**: Defining an opportunity with stakeholders and requirements.

- **Diverge**: Generating ideas and exploring alternatives.

- **Converge**: Making decisions, justifying recommendations, filtering down, and actually coming up with a solution.

- **Represent**: Expressions of our ideas through words, images, diagrams, models, etc.

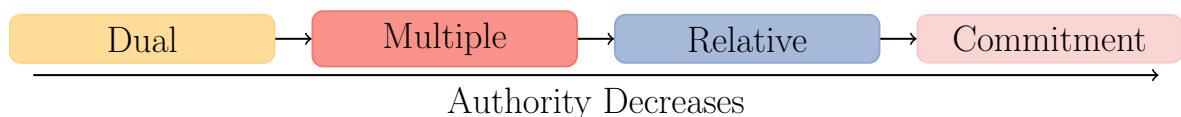## Perry Model of Intellectual and Ethical Development

Figure 2: The Perry Model describes students' attitude towards knowledge over time.

- **Dual**: At the start, We view the world as black or white. Authorities will tell us what to do and what is the right answer.

- **Multiple**: As we proceed, things get more confusing as we realize that there are multiple answers. We recognize the ambiguity and uncertainty of the world.

- **Relative**: We realize that opinions are relative; some opinions are better than others.

- **Commitment**: At the end, we are able to combine our values and analysis to help us make informed decisions.
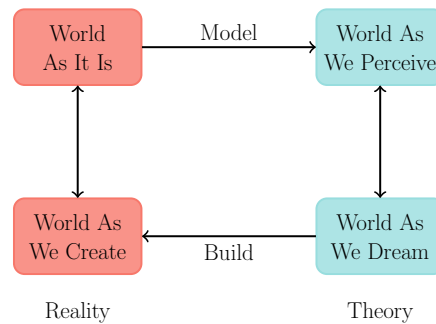
Hoover Dam Model

Figure 3: A model about the process of engineering design.
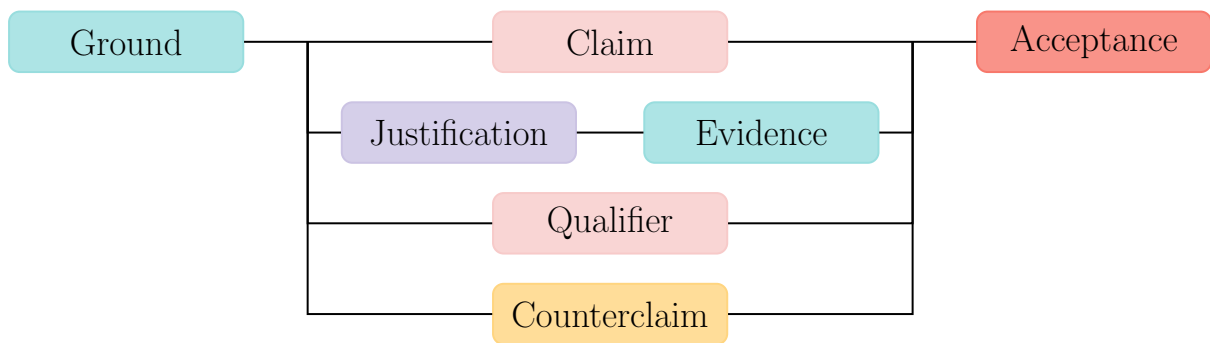
Toulmin's Structure of Argument

Figure 4: Toulmin's structure of argument describes the essential components of an argument.

- Anytime we construct an argument, we must have a **ground** on which we stand which is something that exists in an undisputed way.

- From that we would construct a **claim** which is something that we want to convince others of.

- For our claim to be accepted, we must first provide evidence and justification.

- **Evidence** includes everything from data and graphs to information and facts.

- **Justification** is the logical connection between evidence and claim.

- To strengthen are argument, a **qualifier** is used to limit the ambition of our claim and narrow our scope of our argument (ex. Bananas taste good only on Sundays).

- Lastly, it is important to acknowledge **counterclaim** arguments.

Figure 5: A Line graph for the different types of claims.

Requirements Model

- Requirements for an engineering opportunity should be defined by a set of **objectives**.

- Each objective should be chosen based on the **stakeholder**'s needs.

- Each objective must have a **metric**, and each metric should be informed by **criteria** or **constraints**.

- A metric consists of a **characteristic and a unit**.

- **High level objectives** should be split up into several **detailed objectives** each with their own metric, criteria, and constraint.

Example

Objective	Metric	Criteria	Constraint
The dishwasher should minimize the use of non-recyclable materials.	The percentage of mass of non-recyclable materials as defined by Toronto's Recycling guidelines.	Less is better.	Must be less than 50%.

Design For X

DfX Principles help us define specific requirements around common high level objectives.

Repairability, Maintainability, Testing, Environment, Assembly, Accessibility, Safety, Durability, Manufacturing, Reliability, Recycling, Logistics, Usability

CRAAP Test

The **CRAAP** Test can be used to evaluate sources.

- **C**urrency: The timeliness of the information.

- **R**elevance: The importance of the information for our needs.

- **A**uthority: The source of the information.

- **A**ccuracy: The reliability, truthfulness and correctness of the content.

- **P**urpose: The reason the information exists.

Framing Definitions

- **Design Space** - The set of all potential designs that meet our constraints.

- **Scoping** defines the boundaries of what is and is not in consideration.

- **Framing** defines how we are looking at the opportunity.

PUBS

The PUBS model can be used to write an effective introduction.

- **P**urpose: Establishes what the report is trying to do.

- **U**nknown: Hints at what we will find out.

- **B**ackground: Gives us what we need to start.

- **S**et-up Sets up the structure to guide us.
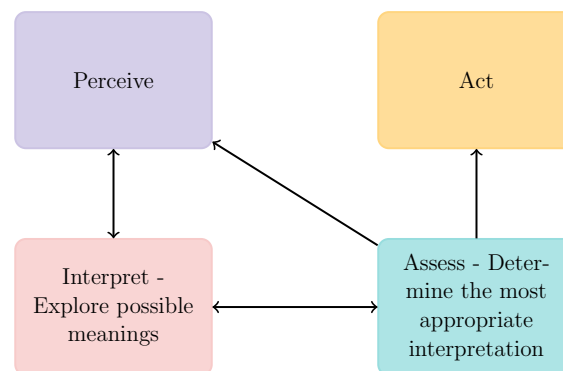
PIAA Model

Figure 6: This model helps us enhance our self-awareness and increase our intentionality when framing.

AID Model

The AID model is used for providing holistic feedback. It helps us provide beneficial **critique** and not criticism.

- **A**ction - What did the person do?

- **I**mpact - How did this behavior affect us?

- **D**evelopment - What can the person do to improve their actions?

Diverging Definitions

- **Refine** - Improve the clarity, detail, and substance of the brief.

- **Re-scope** - Change the magnitude of the opportunity in the brief.

- **Reframe** - Change the nature, kind, and objectives in the brief.

- **Bias** - Brainwriting, Lotus Flower, and Morph Charts are all methods of minimizing cogitative biases.

  - **Functional Fixedness** - When an individual develops an inability to use an object in more ways than it is traditionally intended to be used.

  - **Anchoring Bias** - When we rely too heavily on the first piece of information we are given about a topic.

- A **Prototype** is a model whose purpose is to generate or communicate information about a design concept.

- **Brainwriting** - Each person is given a piece of paper to sketch their designs, and every few minutes, everyone would swap papers.

- **Lotus Blossom Technique** - Choose a central theme, and then branch out into several other sub-themes, where design ideas for each subcategory would be written down.

- **Morph Chart** - Pick different functions/functions and think of different options of how they could be implemented into a design.

- **Scamper** - Substitute, Combine, Adapt, Modify, Put to other purposes, Eliminate, Reverse.

Converging Definitions

- Converging Techniques

  - **Pairwise Comparison Matrices** - Compare each design holistically and sum up points.
  - **Measurement Matrix** - Metrics of each design are listed in a table.
  - **Pugh Charts** - For each design, list out whether they meet or fail to meet each objective.

- **Proxy tests** allow us to compare designs with the materials, prototypes, and tools we have.