

Developing process models for an interdisciplinary project-based class

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INTRODUCTION

We explored interdisciplinary students' understanding of and interaction with process models within a graduate project-based educational software design course (ESD) through the following research questions:

1. What process models do interdisciplinary students propose when given the opportunity to adapt existing models or create their own?
2. How and why do students apply models in their projects?
3. How is this impacted by the course design?

Developing high-quality educational software requires a team with diverse expertise, potentially including [1-3]:

- Software engineering (SE)
- Software development (SD)
- Instructional design (ID)
- User experience design (UX)
- Computer graphics (CG)

Interdisciplinary process models

- Each discipline has its own preferred process model(s)
- Processes must overlap, interact, or be incorporated into a larger collaborative project process.

Preparing students to collaborate with interdisciplinary colleagues

- Acquaint them with diverse disciplinary process models [3-4]
- Provide experience selecting or adapting a process sensitive to the needs of the interdisciplinary team, clients, and users [5].

Challenge: Siloed academic programs

- Rarely incorporate interaction with students or faculty from other programs
- Rarely include instruction on processes, techniques, and language used in other disciplines.

GRADUATE LEVEL COURSE IN EDUCATIONAL SOFTWARE DESIGN

Course structure

- 1 semester, 3 hours/week
- Interdisciplinary student teams
- Authentic client-proposed project
- Analysis, design, prototyping, and usability testing

Competing objectives

- Each student develops & applies skills from across disciplines
- Interdisciplinary teams leverage members' backgrounds & skills

Pedagogical approaches

- Studio-model
team design with ongoing critique to encourage re-analysis & re-design
- Flipped classroom
online discussions encourage reading, sketching and writing, and discussion)
- Development of design documentation
Instructor-provided templates similar to those used in industry

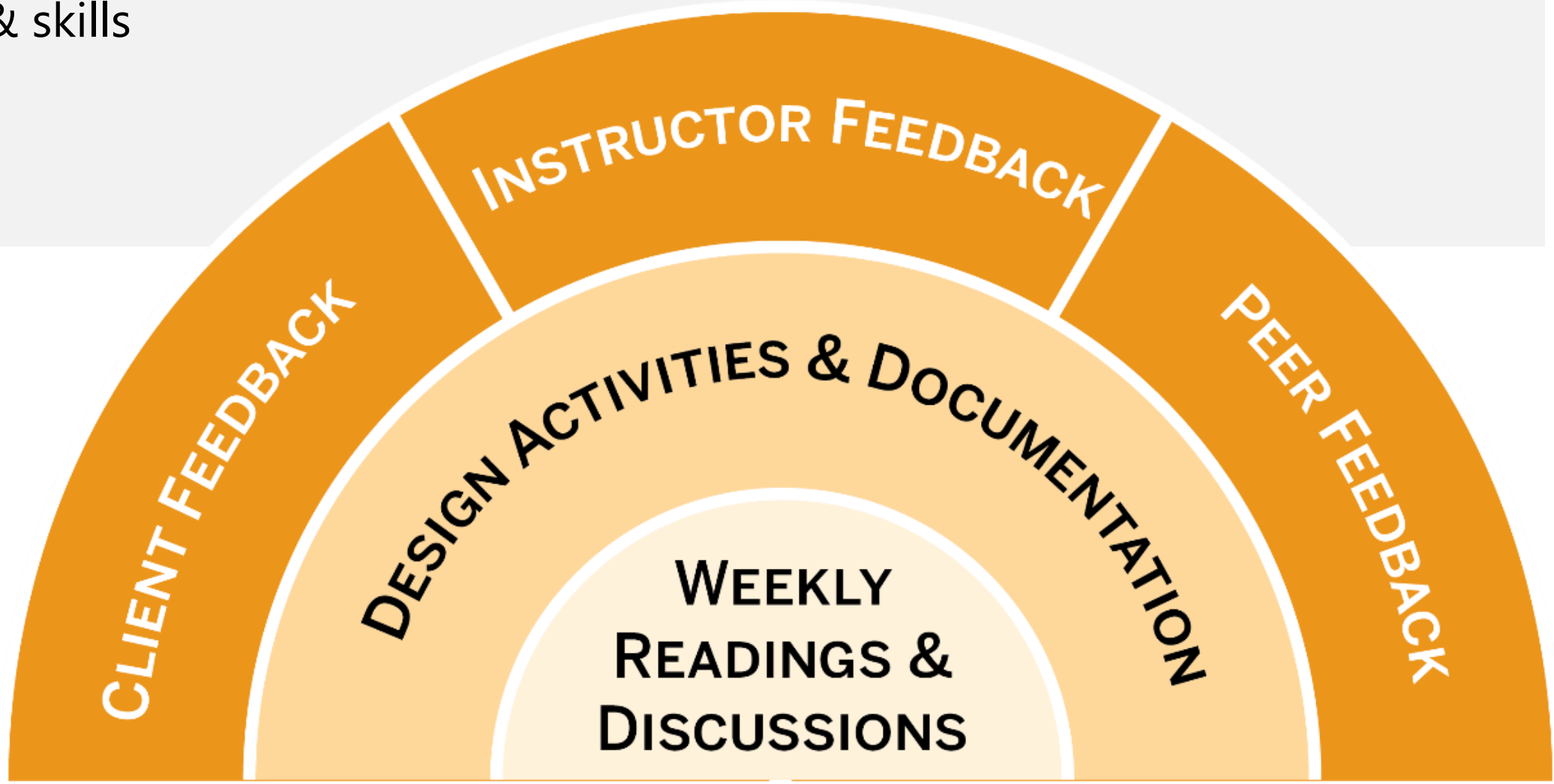


Fig. 1. Course Design

METHODS

Perspectives of 4 co-authors from CG, ID, and Mechanical Engineering as well as instructor & TA (ID)

Data sources:

1. Discussion forum posts, project documentation, and individual reflection papers of 10 class members from CG, ID, UX, and Engineering
2. Structured written reflections and responses by co-authors (4 students from CG, ID, and engineering)

Data analysis: Thematic analysis using three coders

FINDINGS

INITIAL THOUGHTS ON PROCESS MODELS

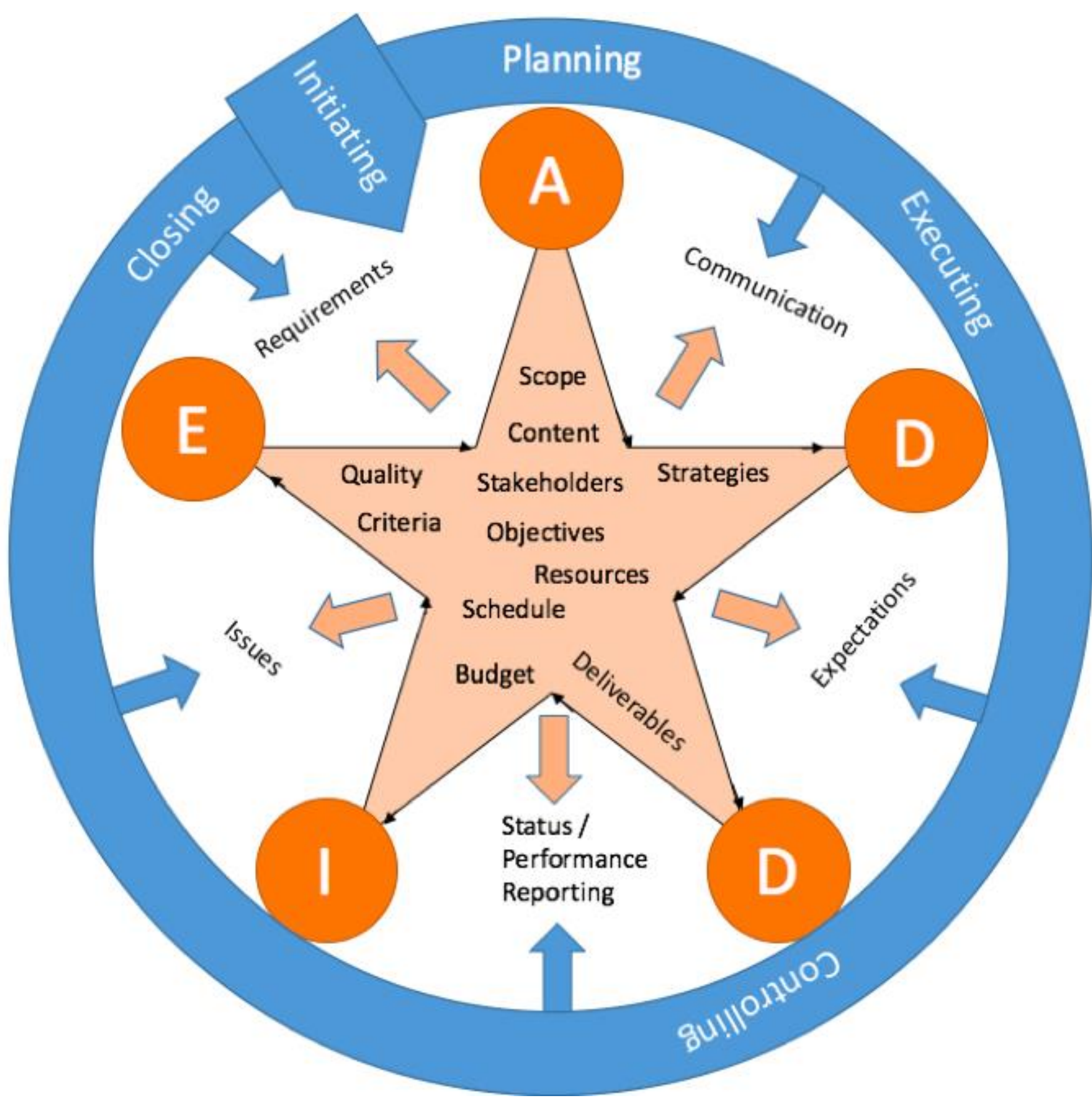
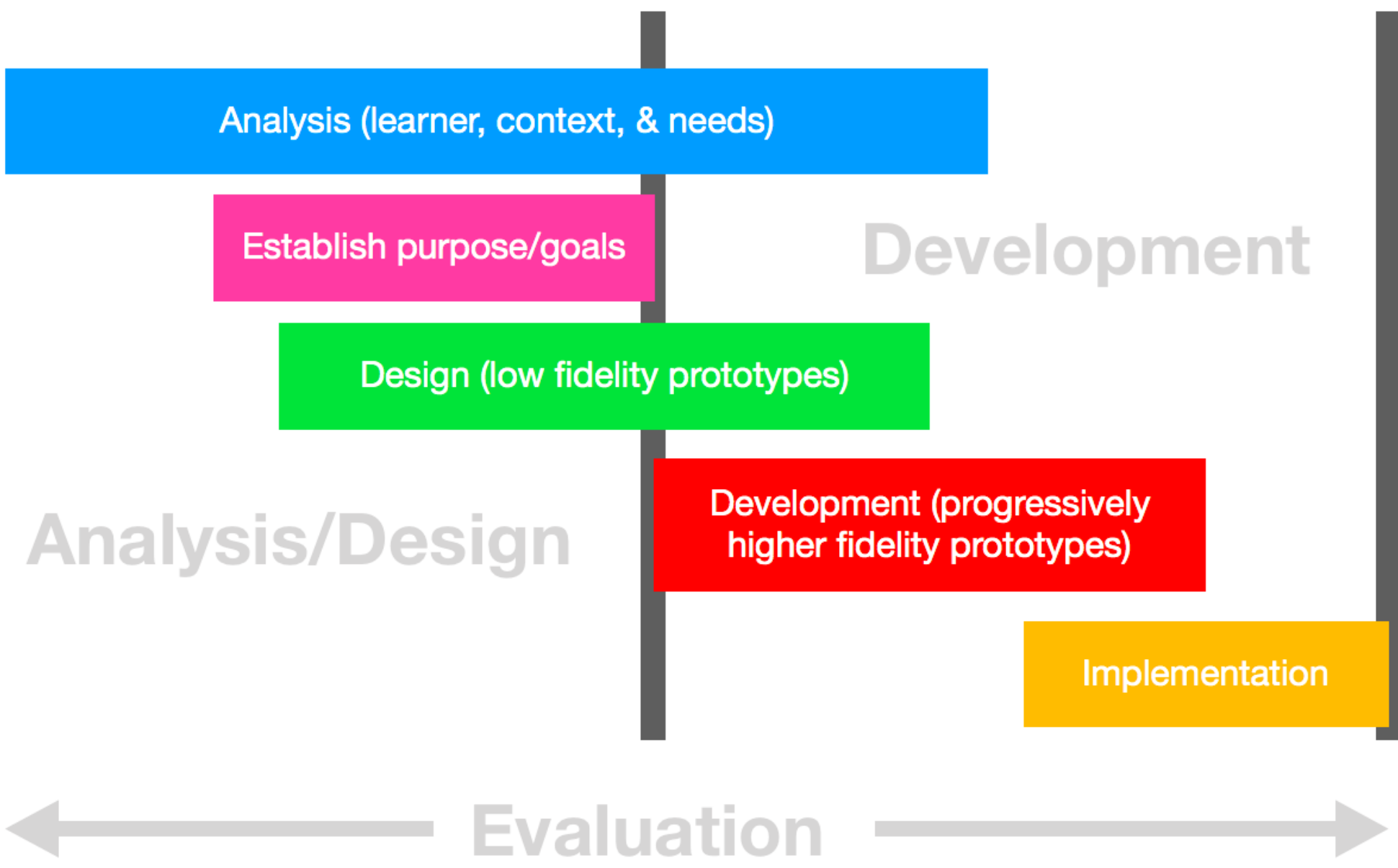
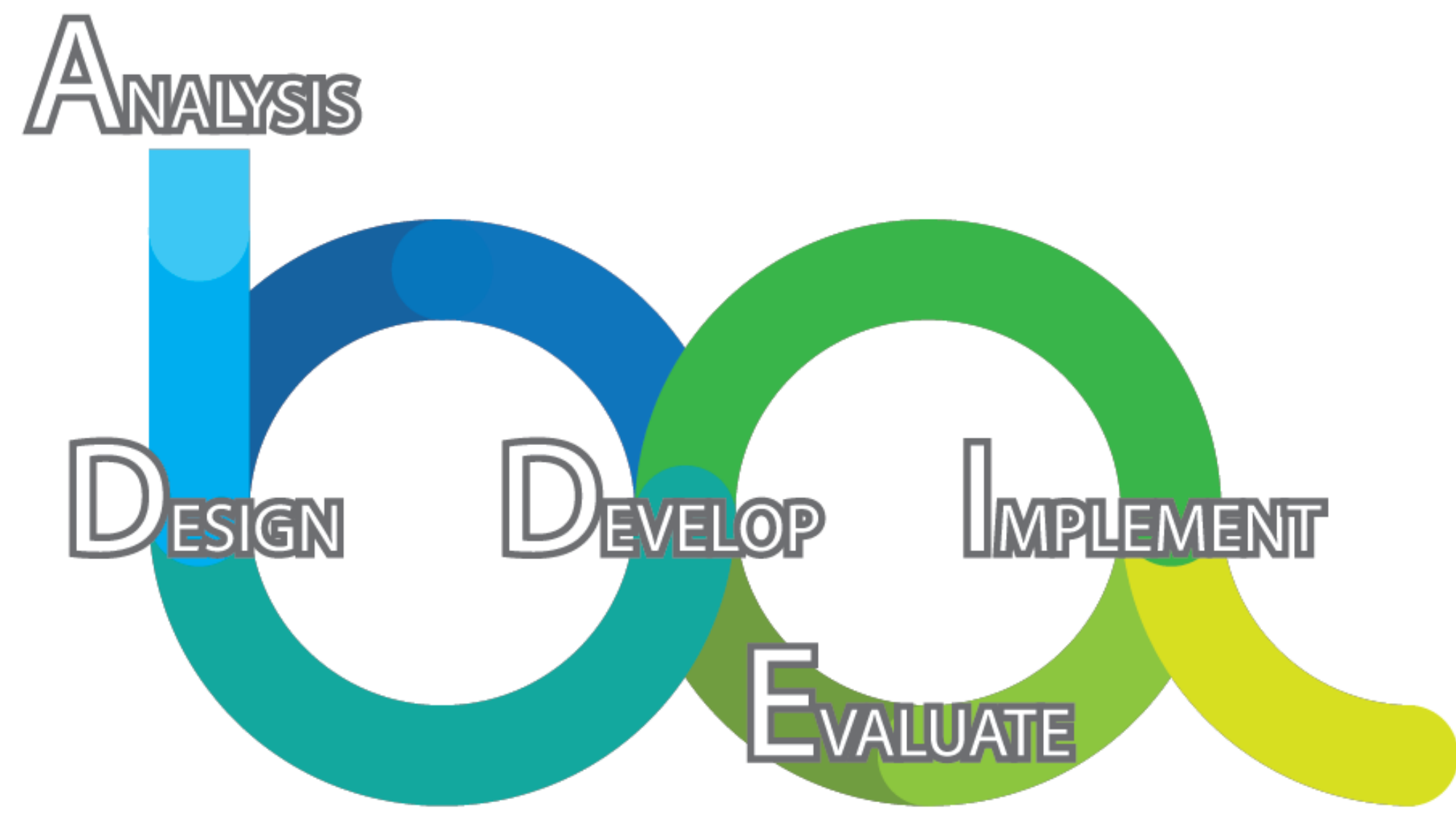
Most students did not consider process models early in the course

"I don't think we've followed much of a process so far."

STUDENT-GENERATED PROCESS MODELS (MID-SEMESTER DISCUSSION ACTIVITY)

- Students generally adapted one model provided in readings by adding features of other(s):

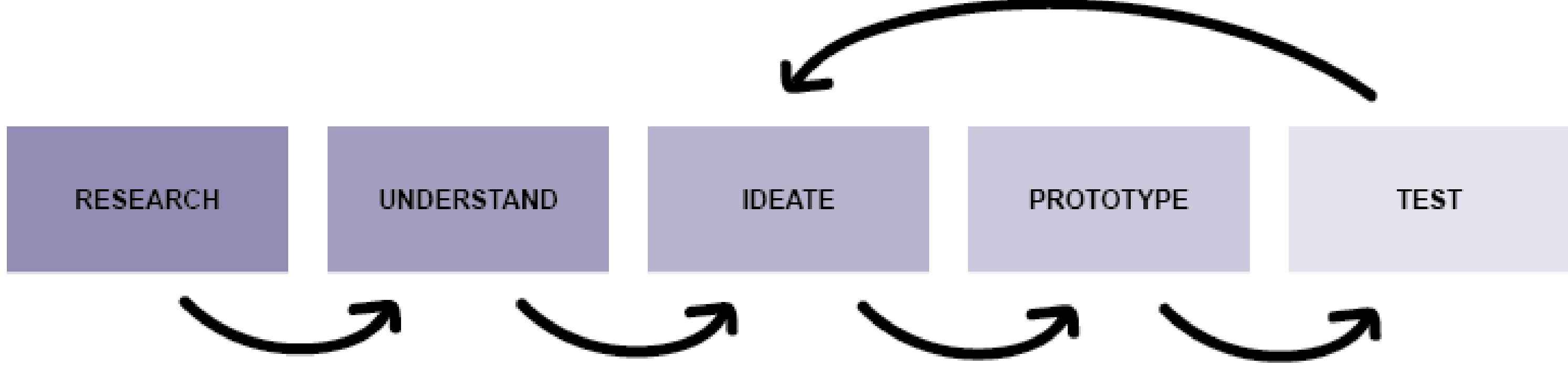
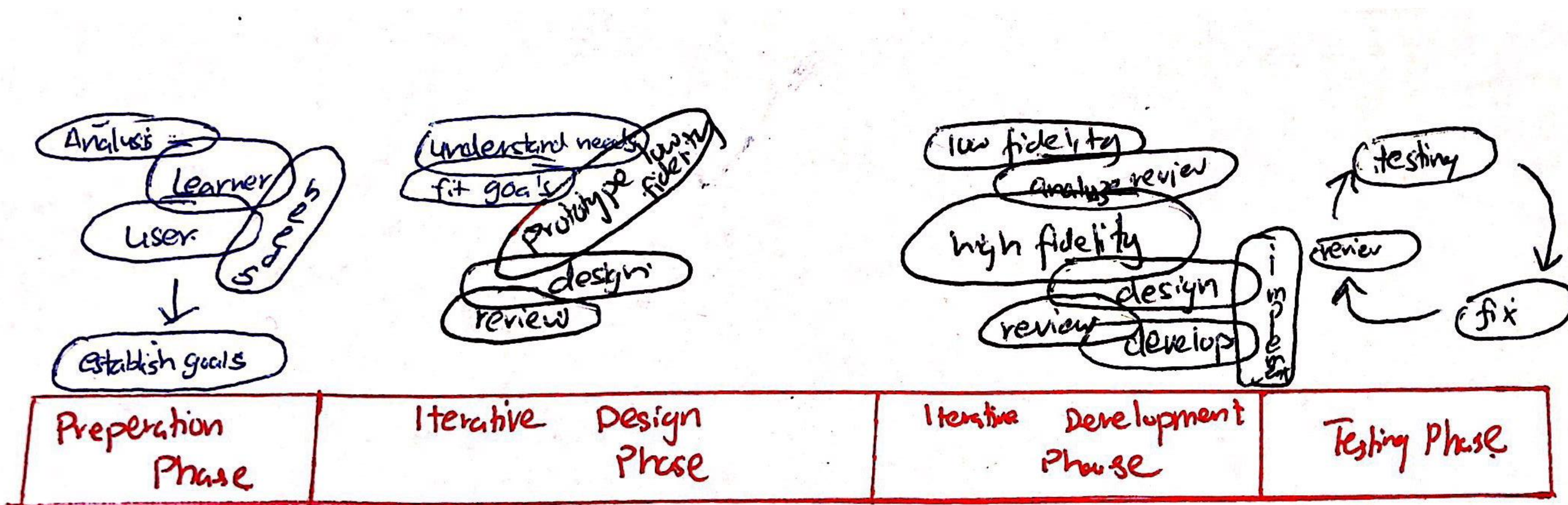
"...if I had to choose one, I'd say it would resemble an ADDIE [linear ID process model] or waterfall-type model that is characterized by a linear approach to design."



"ADDIE process in a quasi-Agile lens: we have primary loops through design and development in which we can design educational content and feed it into a modular interface (like vertical slices of functionality), as well as evaluation back into development following tests of a given implementation."

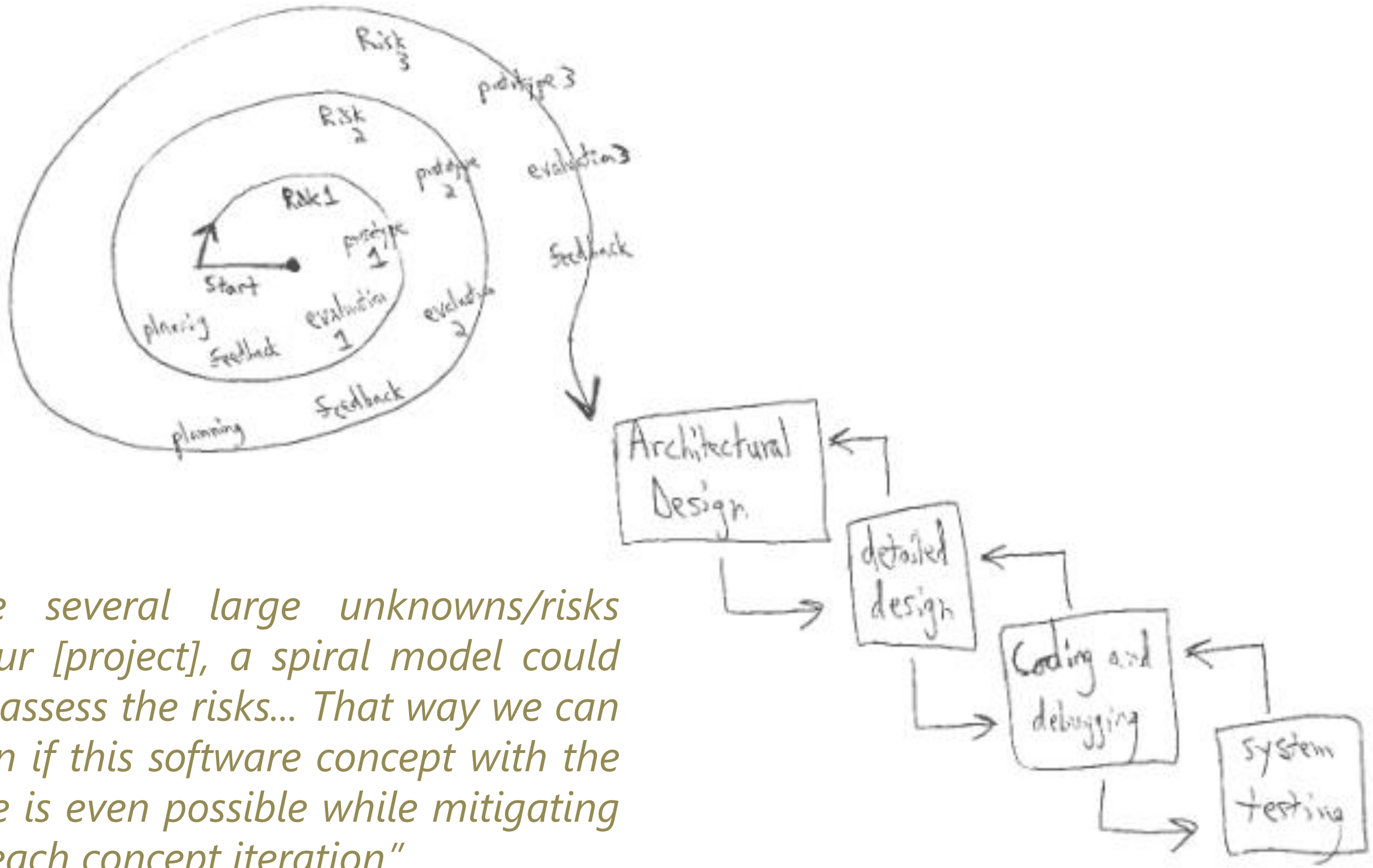
"My process model closely resembles an instructional design rapid prototyping model... I tried to represent this flexibility with the overlapping processes; multiple tasks may be occurring simultaneously... Despite the flexibility, I do believe in a progressive product maturation process as the project continues. I tried to illustrate this by using vertical bars that show (roughly) the order of stages that this maturation occurs."

"The process looks like a combination of project management and instructional design from my point of view. One of the reasons is because [our project request] was delivered as an open project without specific goals and expectations."



"I drew upon knowledge and readings about different models, and mostly from the standard design thinking model that is widely used across design projects."

"...In red is the SAM model. I have divided our work into four different phases. The second model that I have integrated is the bubbles I use for the first three phases. That is the Modified Waterfall process. It is more of a life cycle planning model for software but I think it can work well within our SAM Model from instructional design. The overlapping bubbles allow the capability for us to hover around a few spaces. The sizes of the circle are representative of the amount of work or information...in terms of importance of each bubble."



"Since there are several large unknowns/risks associated with our [project], a spiral model could be used at first to assess the risks... That way we can determine early on if this software concept with the specified user base is even possible while mitigating the risks through each concept iteration."

STUDENTS' REFLECTIONS AFTER COURSE:

Students based models based on:

- Individual project needs
- Prior educational/work experience
- Similarities across models

Ideal process models are:

- Flexible
- Systematic & iterative
- Rigorous & robust
- User-centered

Impact of course structure on process

"The structure of the course (e.g., assignments, due dates, feedback) had a big impact on what we did and what we did not do. Sometimes the rigidity of the course prevented us from applying the iterative model of design we all seemed to appreciate."

"My instinct is to quickly sketch and scrap ideas until the dominant, reliable aspects rose to the top, but with the problem being so nebulous and large scale (ideally requiring some sense of curriculum, not just a witty fix-it solution), it was clear that rushing in wasn't going to get the job done, or worse, would disrupt the momentum I had in the analytical stage with my partner."

Impact on understanding of design & themselves as designers

"I learned how critical it is to design for the user. Everything you do is useless if it doesn't cater to the end user you're designing it for"

"The actual process was a reflection of how we, as designers, integrated our knowledge and prior experience into the design and development, and also a reflection of how we adapted to the unique challenges of our project, based on the guidance of the instructor, timeline and requirements of the course"

DISCUSSION

Selection, adaptation, or development of process models was not part of proactive student team discussions

Potential reasons:

- 1) Process models are predetermined by disciplinary conventions, which led to little reflection on the variety of potential models prior to class discussion
- 2) Course structure imposed main steps through timeline for deliverables

Mid-semester process-design & discussion activity & end-of-course reflections

- Students observed that process models bore similarities and had advantages & disadvantages
- Reflection tended to be reductionist –
 - Breaking the steps down, rather than seeing a process as a larger and more holistic system.
 - Adjust existing models by adding steps/aspects of others
 - Limited synthesis

Co-authors' reflection

- Several students indicated this would cause them to question and explore use of process in their future design process
- Two of our co-authors said that this will also impact their teaching of process back in their home departments.

Course redesign

- Scaffold & prompt thinking about process models throughout semester
- Increase flexibility in class deliverables to encourage experimentation with processes



References