Assessing Iterative Planning for Real-world Design Teams

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Abstract: Design disciplines require iteratively defining the problem, and building and testing solutions—consequently design requires regularly planning. However, we do not have frameworks to assess design planning. We propose Team Planning Trajectories (TPT)—a technology assisted formative assessment framework for planning in design classrooms.

Introduction

Learning environments for real-world design help students learn to tackle highly ill-structured design problems while working closely with stakeholders to create solutions to stakeholder problems (Jonassen, 2000)—solutions such as products, services, or policy. For example, in our research in an instructional design class, one team worked with multiple stakeholders to create a software voting system to generate plans for how a university department could better support underserved students.

One core and under-taught practice in real-world design is planning. Planning in real-world design is vital because design problems are so highly ill-structured—design problems have no initially obvious solution, and no clear steps for solving the problem (Jonassen, 2000). Consequently, design teams must continually plan (Cross, 2011). Unlike experienced designers, student designers tend to plan in a way that reduces their chances of meeting stakeholder needs. Students struggle to plan: (a) in a way that is aligned with the needs of the project, (b) in an efficient way that maximizes learning what solutions might work, and (c) an appropriate workload given their time and experience (Adams et al., 2003; Rees Lewis et al., 2018; Cross, 2011). Assessing planning in real-world design is challenging because teachers do not know the right solution or solution path. Despite the importance of planning, we have not developed formative assessments for design planning.

The Team Planning Trajectories Assessment Framework

We propose the Team Planning Trajectories (TPT; Figure 1) a technology supported assessment framework we are developing to help teachers and researchers know the extent a learning environment is supporting student team design planning. TPT is a conceptual assessment framework (Pellegrino, 2014)—an assessment blueprint that defines (a) the student performance variables to attend to (student model), (b) the student and teacher activities, and tools used (task model), and (c) how evidence is collected and analyzed (evidence model).

TPT involves organizing the class into iterative 1-2 weeks cycles. At the start of each cycle teams use a project template and a plan template to create a written record of (a) the state of their project, (b) the risks that can make the project fail, and (c) their plan to reduce these risks (Rees Lewis et al., 2018). First, student teams define the current state of their design problem and proposed solution such as user needs, and problem causes. Teams then identify risks—what aspects of their problem and proposed solution might stop them making an effective solution (Carlson, Maliakal, Rees Lewis, Gorson, Gerber, & Easterday, 2018). For example, it is risky if teams have limited evidence of their assumed user need. Teams then plan to reduce their most severe risks.

We propose three variables for assessing student plans drawn from research on design practice and student struggles in design planning (Adams et al., 2003; Rees Lewis et al., 2018; Cross, 2011): (a) Alignment—the extent a plan is aligned with the project. An aligned plan is logically consistent with what the team understands about the problem and solution (e.g. user needs, why existing solutions fail), and most severe risks (e.g. users are 60+ years old, so might not want proposed software solution). (b) Efficiency—the extent the plan achieves the goals efficiently. If the team's goal is to understand if a solution is desirable, are they planning to spend 3 hours building a prototype, or 3 weeks building a complete working software? (c) Appropriateness of workload—the extent the plan outlines work that the team can achieve given their time and expertise.

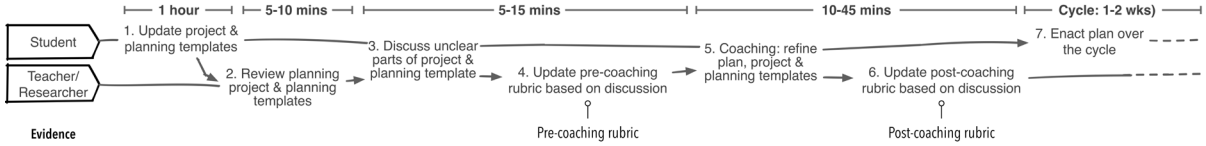

Figure 1. Team Planning Trajectories technology supported assessment framework involves student design teams planning iterative cycles of work and teachers or researchers creating a pre- and post-coaching rubric.

Each cycle, TPT involves the following student and teacher activities, tools, and technology (Figure 1): (1) At the start of a cycle, the teams fill out a project and plan templates, which involves defining the state of the project, risks, and planning to reduce those risks. The plan stipulates the goal(s) of the cycle and activities to meet the goal. (2) The teacher then reviews the teams' templates, and uses an online rubric to create a pre-coaching record of the plan's alignment, efficiency, and appropriateness of workload. (3) The teacher and team then discuss any parts of the templates the teacher found unclear. (4) The teacher updates the online rubric based on this discussion. (5) The teacher and students then engage in coaching, revising the templates. (6) The teacher then creates a post-coaching record of the plan using the same online rubric. (7) The team then enacts the plan.

We created TPT to collect and assess teams' plans within and across cycles for real-world design projects. Each cycle, the teacher or researcher captures rubric scores of the plans pre- and post-coaching. At its most simple, the TPT captures yes/no/unclear for plan alignment, efficiency, and appropriateness of workload, displayed on a dashboard (Table 1). TPT helps answer two questions: (1) how are teams producing design plans outside of coaching? This is measured by the change in the quality of the pre-coaching plan scores across cycles—that is, what is each team's pre-coaching score in cycle 1 compared to cycle 2 etc.; (2) How are teams planning with coaching? This is measured by the difference between the pre- and post-coaching scores within each cycle. A learning environment created to help student design team planning would aim to: increase the pre-coaching scores over time (across cycles), increase in pre-coaching scores and post-coaching scores in the same cycle, and decrease difference between the pre-coaching scores and the post-coaching scores over time.

We now illustrate TPT in an ongoing design-based research initiative (data display Table 1). We focus on a team in cycle 3 of an instructional design class working with their client, a university department's diversity committee. Their client experienced the challenge of drawing on diverse community perspectives to create action plans for better supporting underserved students. The team had proposed a software voting system to gather data that can generate action plans. The team noted a risk: they did not know what data the client needed from the community to generate and justify action plans. The team planned to create a prototype of the voting system using off-the-shelf technology, gather data from 20+ stakeholders, and then present the data to the client to test if it met their needs. The teacher rated this pre-coaching plan as (a) aligned, as the activities sought to reduce a risk by testing something with the goal of solving stakeholder problems, (b) not efficient, as the team had already collected data from 30 stakeholders, and didn't need to collect new data, and (c) an inappropriate workload, as the proposed workload is more than undergraduates can typically undertake in 2 weeks. During coaching, the team and teacher refined the plan to be more efficient with a more an appropriate workload.

Table 1. A technology data display of the planning rubric scores of one team in a 10-week class

Team 3	Cycle 1: Pre-coaching	Cycle 1: Post-coaching	Cycle 2: Pre-coaching	Cycle 2: Post-coaching	Cycle 3: Pre-coaching	Cycle 3: Post-coaching	Cycle 4: Pre-coaching	Cycle 4: Post-coaching
Alingment	No	Yes	No	Yes	Yes	Yes	Yes	Yes
Efficiency	No	No	No	Yes	No	Yes	Yes	Yes
App. Work	No	No	No	No	No	Yes	No	Yes

Conclusion

We presented TPT, a novel approach for teachers and researchers to regularly formatively assess design planning. TPT allows us to (a) regularly track changes in performance, (b) assess both independent and coach supported planning, and (c) avoid letting students flounder by only assessing planning without support. TPT uses technology to allow us to better assess and create learning environments for students learning design.

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