Design-Based Research (Day 6)

CMSC 33231 - Diana Franklin

Goals for today

Look at the process for performing design-based research

Starting proposal writing…

Papers read

DBR

https://dl.acm.org/doi/pdf/10.1145/2089155.2089159

DBR for eBook design

https://dl.acm.org/doi/10.1145/2445196.2445250

Design-based Research: Essential Elements

Combination of theory and empirical processes

It’s not just about proving something correct, it’s about developing theory

It’s messy - not a carefully-constructed A vs B / control-treatment study

In an authentic environment with changes to the intervention that makes analysis a lot more difficult

You have more variables, including the intervention itself

DBR: Data Analysis

Rely a lot on qualitative data - interviews, focus groups, etc.

Trying to find patterns and interesting results rather than answering a very specific questions

> How do students do X?
>
> Instead of: Did X do better than Y?

Was the Peer Instruction Design-Based Research?

Yes:

- Not a controlled experiment, occurred over time
- We don’t know that the intervention was the same over time

No:

- Not a focus on developing a theory, picking out interesting elements
- Answered a question of the type for a careful comparison study

DBR: Advantages & Disadvantages (compared to a carefully constructed study)

Advantages

- Help people now rather than waiting for the “perfect” intervention
- Your results might be more generalizable to other ideas / interventions
- More realistic real-world setting - easier to get participants for study

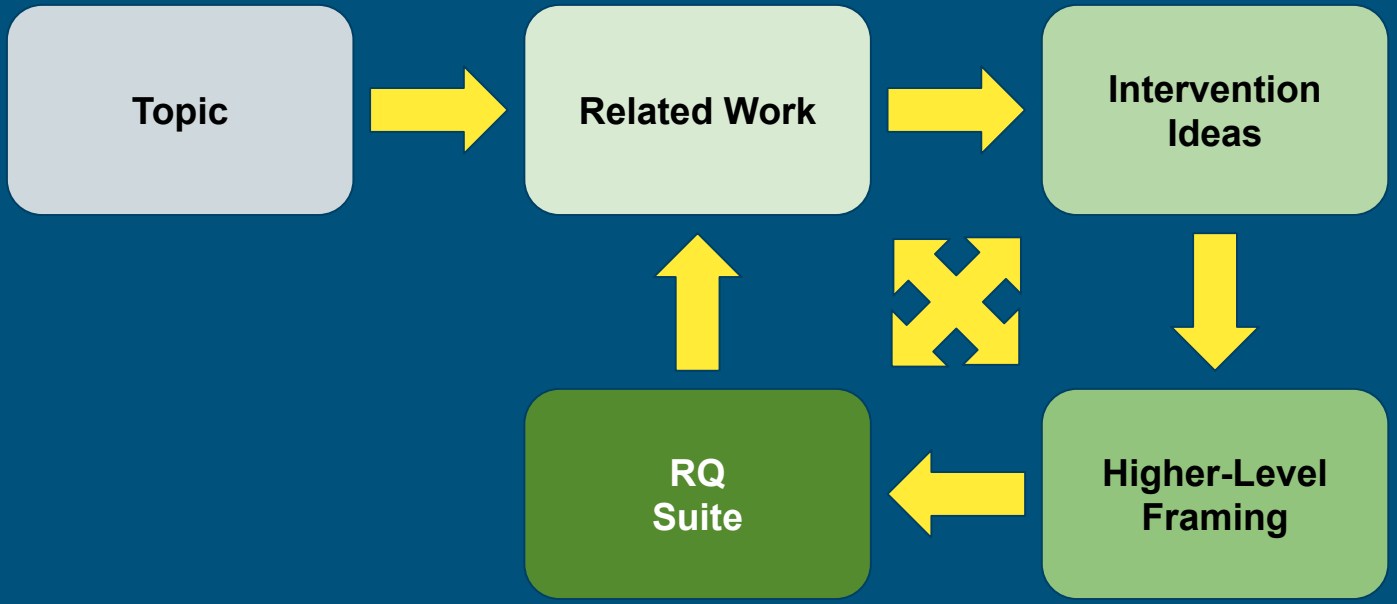
Disadvantages

- Really messy - hard to get strong, justifiable, defensible findings

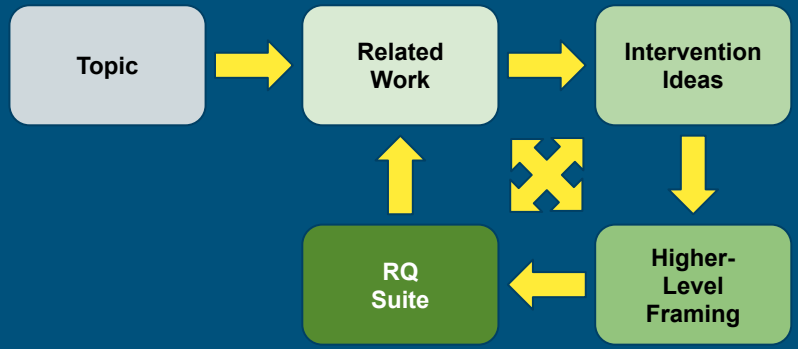
For the rest of today…

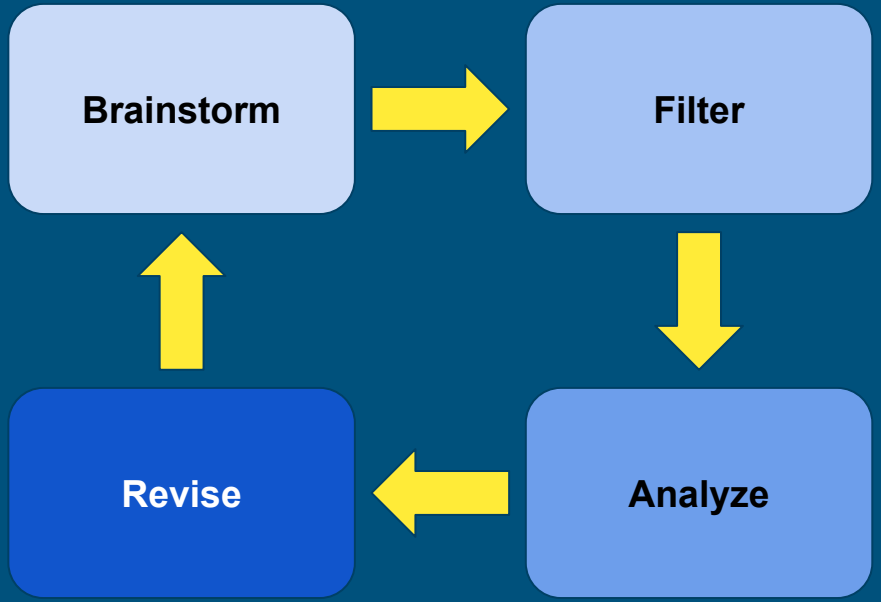
1) Overview of the process to develop intervention ideas and associated RQs
2) Do a case study in developing, together, ideas and associated RQs

Developing RQ's: Main Phases



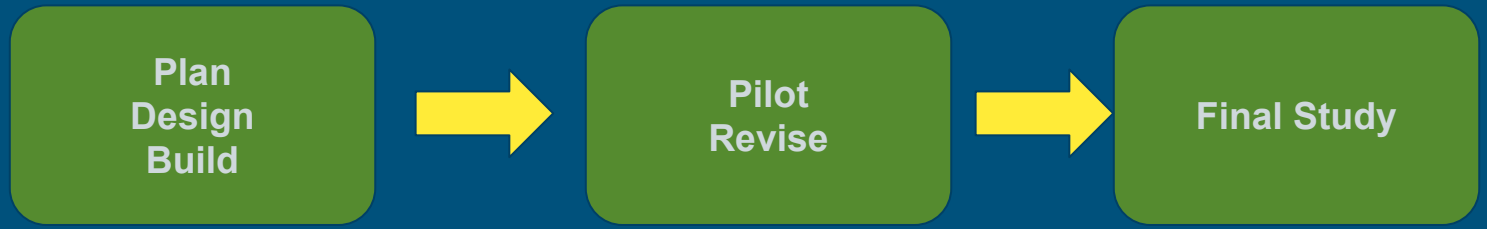
Developing RQ's: Within each Step





What makes a good RQ suite?

3-Year Intervention Research Plan



Two goals:

- Solid main 3-year research line
- Intermediate tasks that provide publishable results

What makes a good or fundable RQ suite / intervention idea?

Easy to test

Novelty and “cool factor”

What makes a good RQ suite?

Novelty

Cool Factor

Theoretical basis / Prior work justifies it

Broader Impact - your target audience matters (size and perceived need)

NSF “Dear colleague letters”

Audience (Reviewer) Opinions

Your partners: EPSCORE states (state that receives very little NSF funding)

Minority-serving institutions

Case Study

A project has morphed into a research project

Will use the development as a case study example of how to develop and nurture a research idea into a research proposal

Today: Setting the stage

Related Work

Plan > Project

Overview:

- Did students use their planning document when creating their projects?
- 2 different school years
  - 2019-20 - paper plans
  - 2020-21 - google forms (virtual learning/hybrid)
- M2 & M3 Create Scratch projects (after TIPP&SEE/Use & Modify)
  - Met requirements
  - Extensions
  - Above and Beyond
- Possible issues - Covid 19 shutdown - M3 (3/9 & 3/19)
  - David's graph proves this may not have impacted data much

Module 2 Create Plans

Objective: Today, I will create a Scratch project where sprites talk/think, change size, and move based on a topic of my choice.

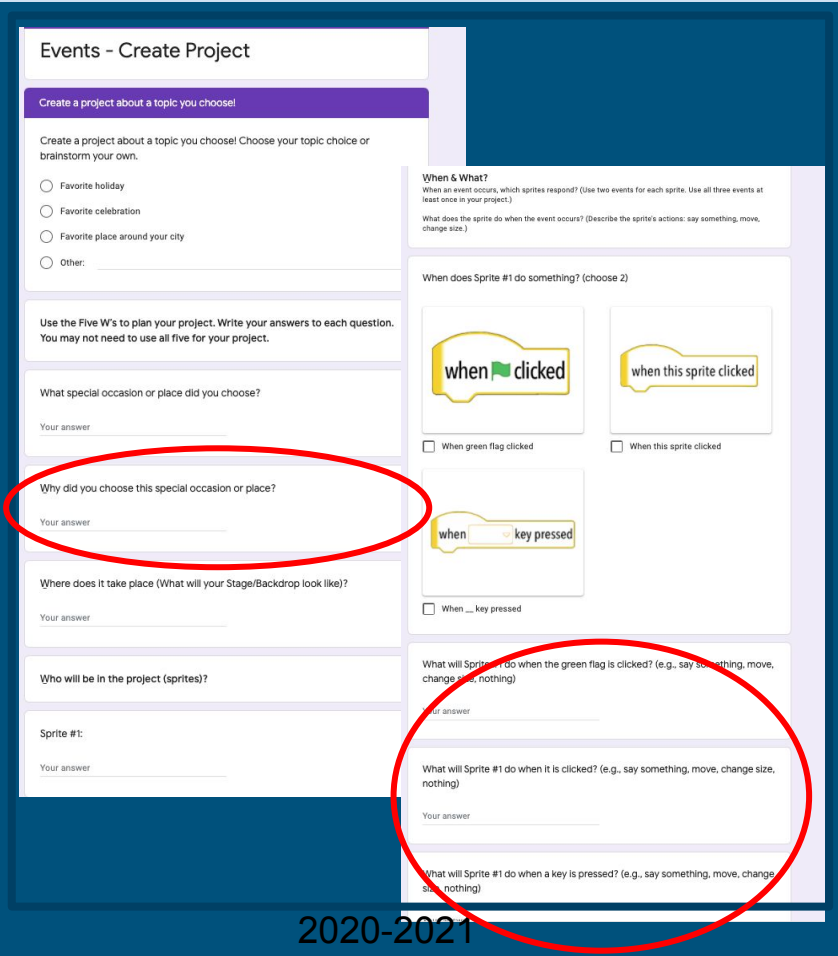
Create a project about a topic you choose! Circle or highlight your topic choice or brainstorm your own.

- Favorite Holiday _____
  or
- Family celebration _____
  or
- Favorite place around your city _____
  or
- My topic _____

Planning Your Project:

Use the Five W's to plan your project. Write your answers in the space provided. You may not need to use all five for your project.				Done
Who will be in the project (sprites)?	#1: _____	#2: _____	#3: _____	
What are they doing? Say, Move, Change Size by __ blocks				
When? The events this sprite will respond to are: *Choose at least two for each sprite. All three events need to be chosen at least once*				
Where (Choose your Stage/Backdrop)? _____				
Why did you choose this? Say blocks				

2019-2020



2020-2021

Module 3 Create Plans

Creating with Animation - Lesson 2

Objective: Today, I will create a Scratch project that animates sprites. I will animate at least tv
sprites to animate in place and at least one sprite to move across the stage using animation.

Create a project about a topic you choose! Circle or highlight your topic choice or brainstorm your ow

Tell about your favorite Sport *or* Tell a story (maybe about your culture) *or* My topic _____

Planning Your Project:

Answer the Five W's and One H questions to plan your project. Write your answers in the space provided. You may not need to use all questions for your project.

Who will be in the project (sprites)?	#1: _____	#2: _____	#3: _____
What are they doing?			
When will the sprites move (which event(s)?			
Where (Choose your Stage/Backdrop)? _____			
Why did you choose this story/sport? _____			
How are the sprites animating in place and/or across the screen?			

2019-2020

Create a Project about a topic you choose!

- Tell about your favorite Sport
- Tell a story (maybe about your culture)
- Other...

Answer the Five W's and One H questions to plan your project. You may not need to use all questions for your project.

Why did you choose this story/sport?

Short answer text

Where (Choose your Stage/Backdrop)?

Short answer text

Who is Sprite #1?

Short answer text

What is Sprite #1 doing?

Short answer text

When: Choose the event that will trigger Sprite #1's movement

- when green flag clicked

- when space key pressed

- when this sprite clicked

- Other...

How is Sprite #1 animated (in place and/or across the screen)?

- In Place
- Moving across the screen

2020-2021

Research Questions

RQ1: To what degree did students complete the plans?

RQ2: To what degree did student plans match with the project they created (were plan details implemented in the project)?

RQ3: Is there any correlation between having a planning document and completing the project requirements? Extensions?

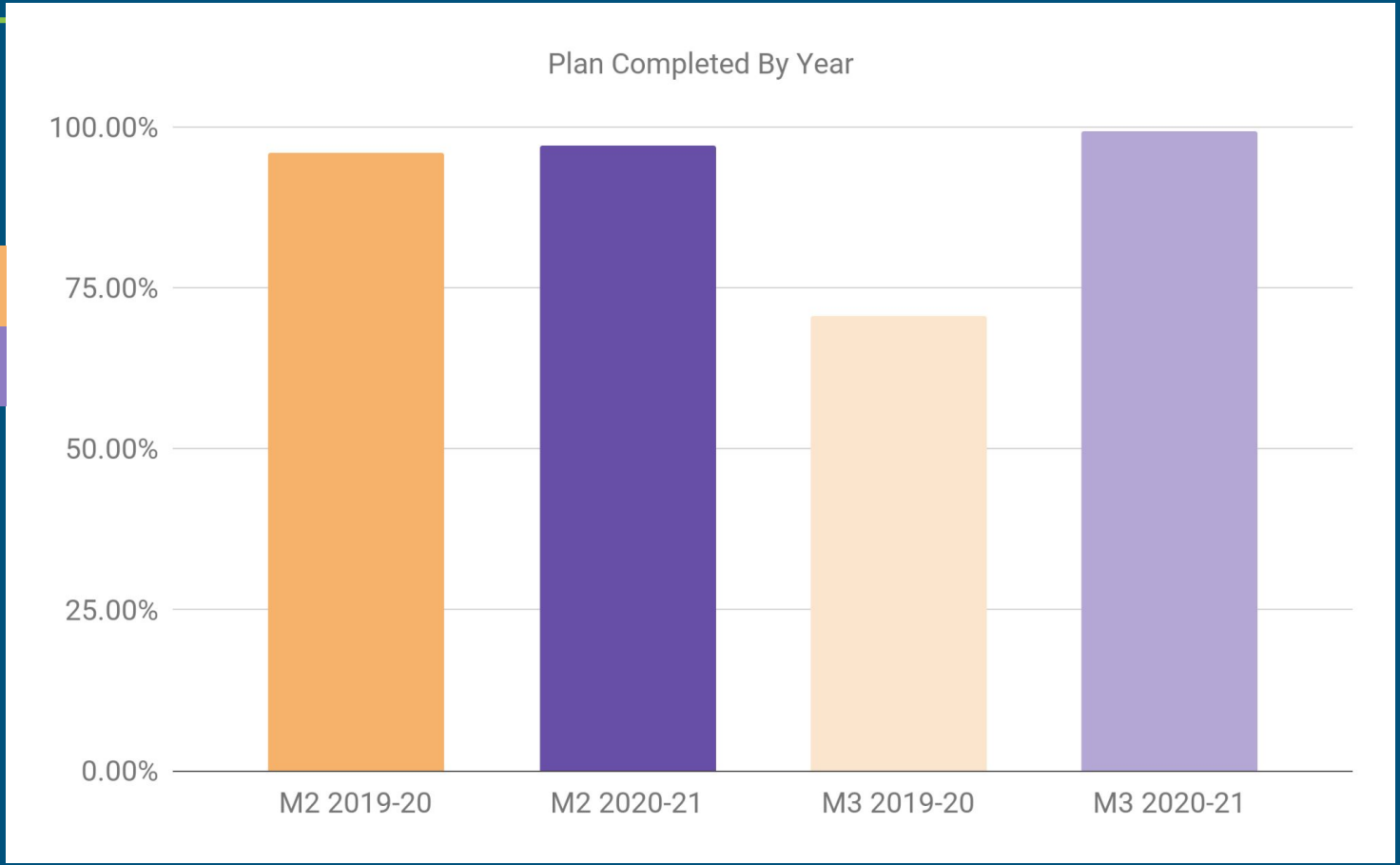
RQ4: Is there any correlation between using a physical paper vs. google form and the completion of project requirements?

RQ1: To what degree did students complete the plan?

By year & Module
Entire Plan

Paper Plan

Google Form Plan

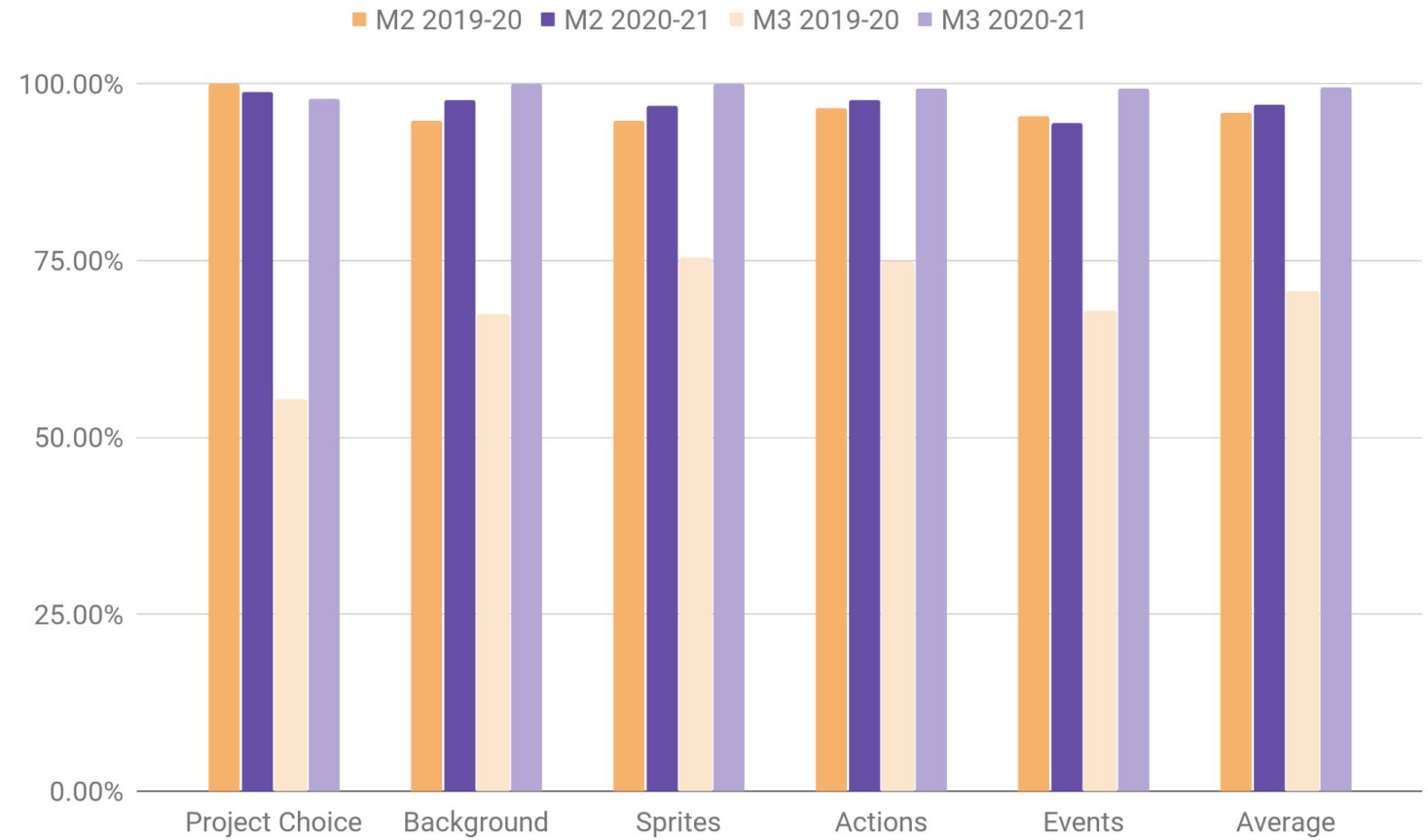


RQ1: To what degree did students complete the plan?

By section

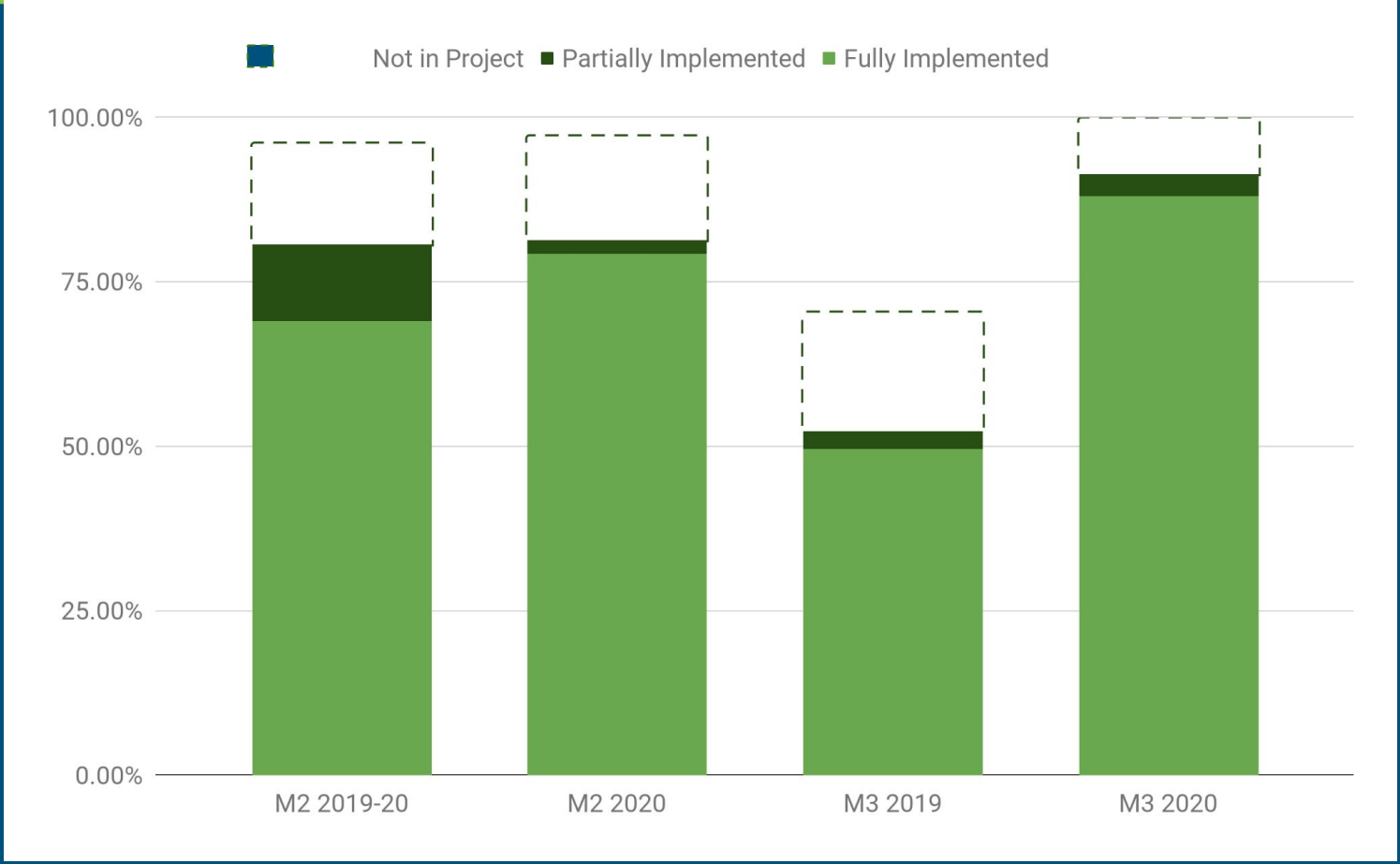
Paper Plan

Google Form Plan



RQ2: To what degree did student plans match with the project they created?

By Year & Module



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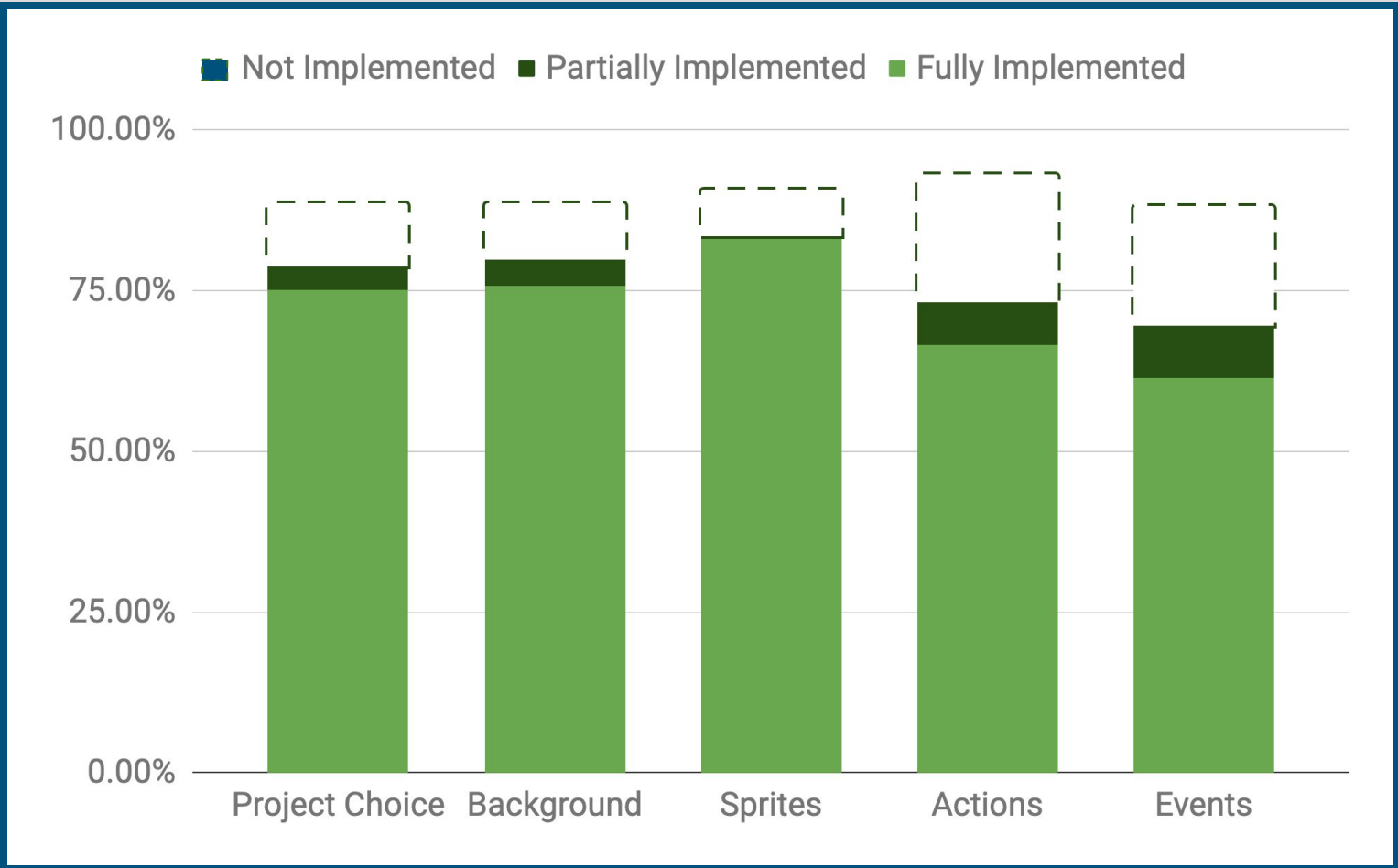
By Section

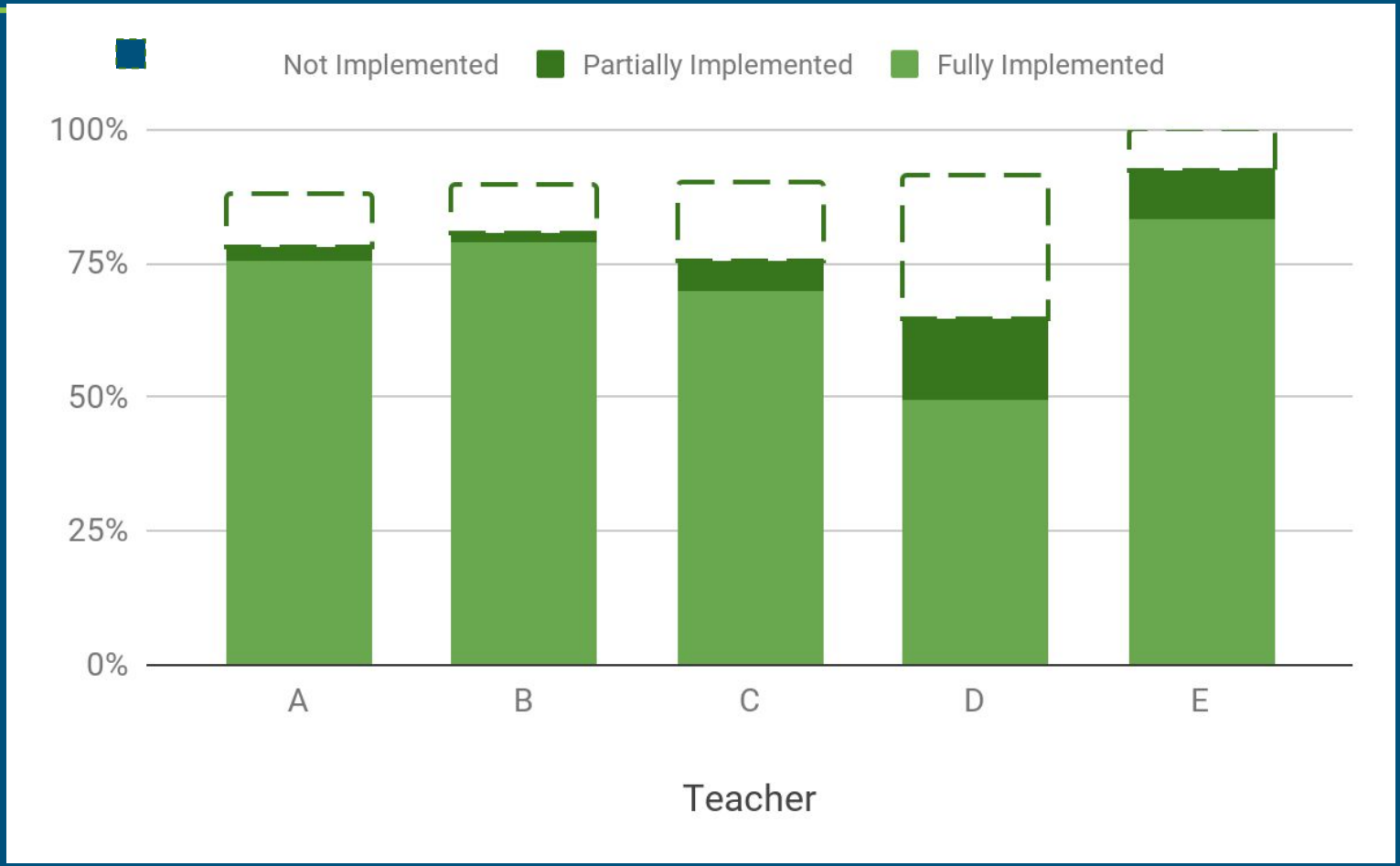


RQ2: To what degree did student plans match with the project they created?

By Grade

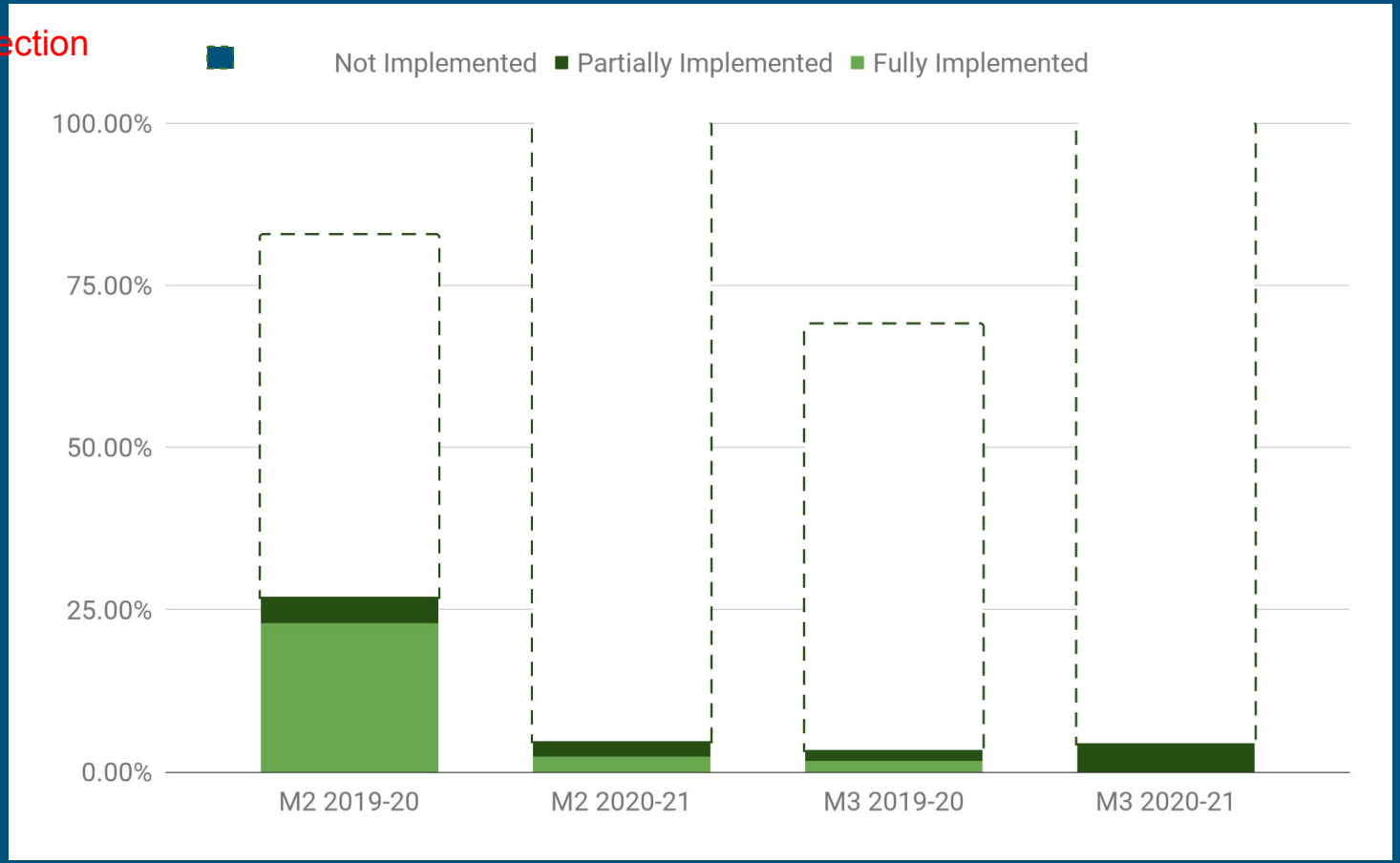
RQ2: To what degree did student plans match with the project they created?

By Teacher



RQ2: To what degree did student plans match with the project they created? Wy

Why Section



PlanIT! A New Integrated Tool to Help Novices Design for Open-ended Projects

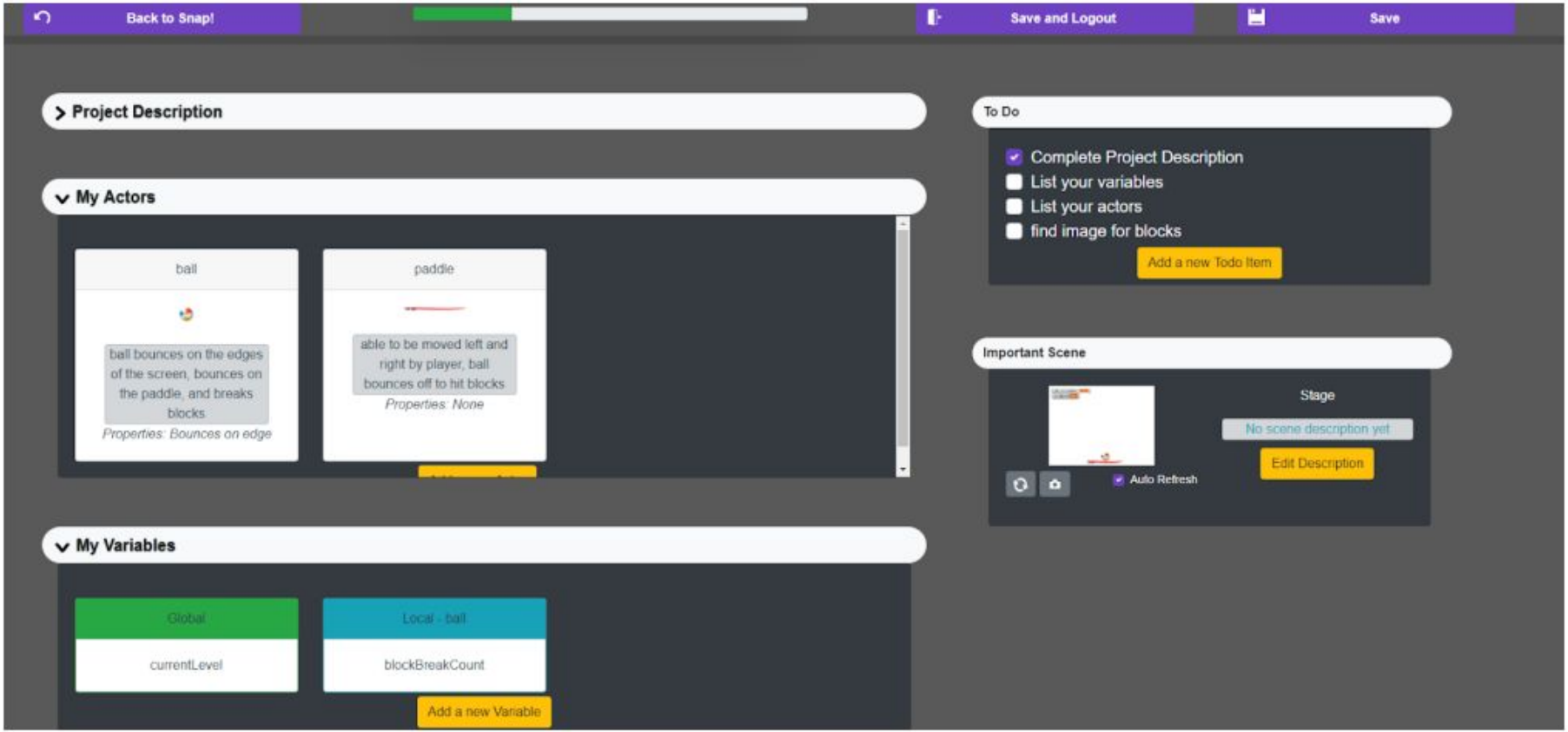
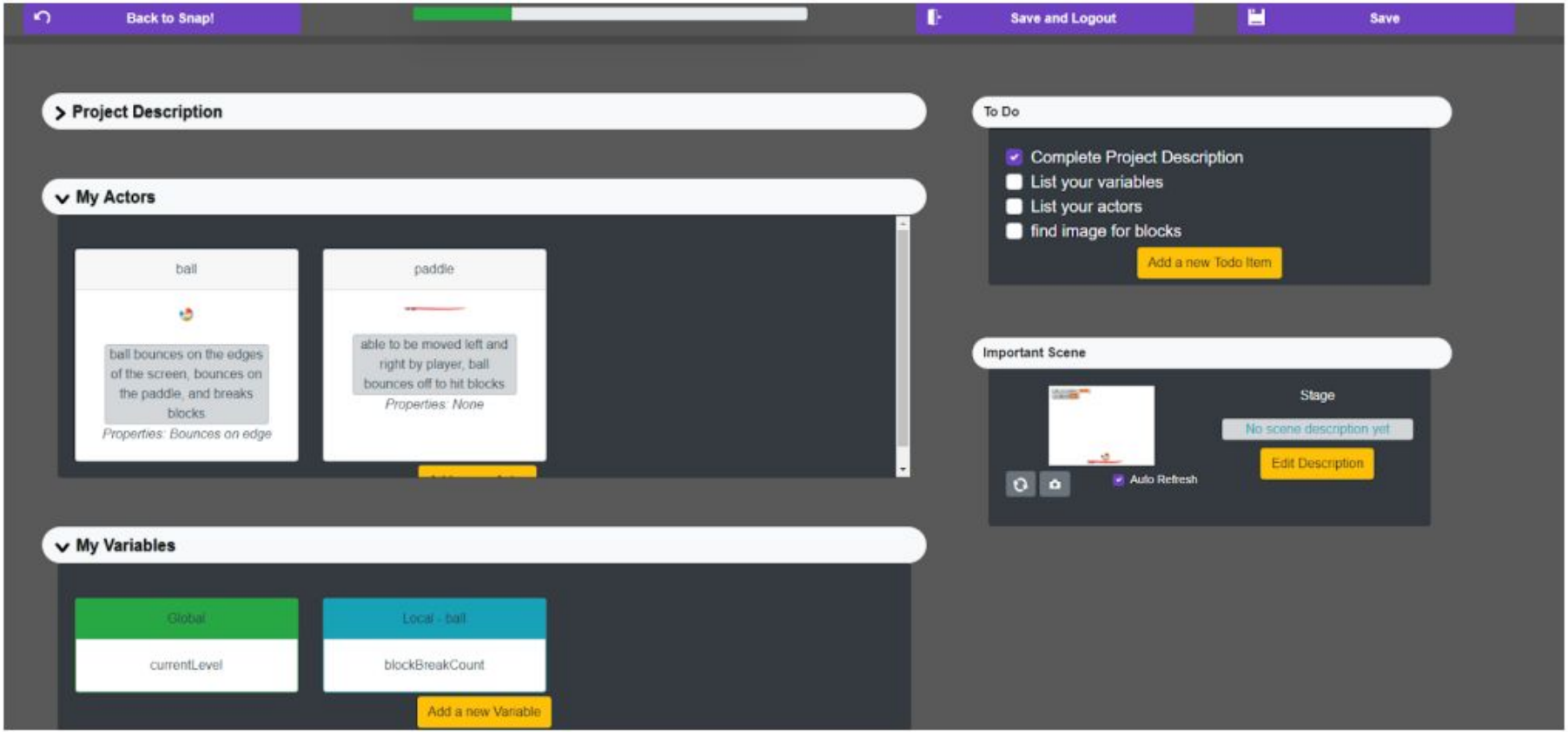


Figure 1: The PlanIT tool with Actors, Variables, To Do, and Important Scene components



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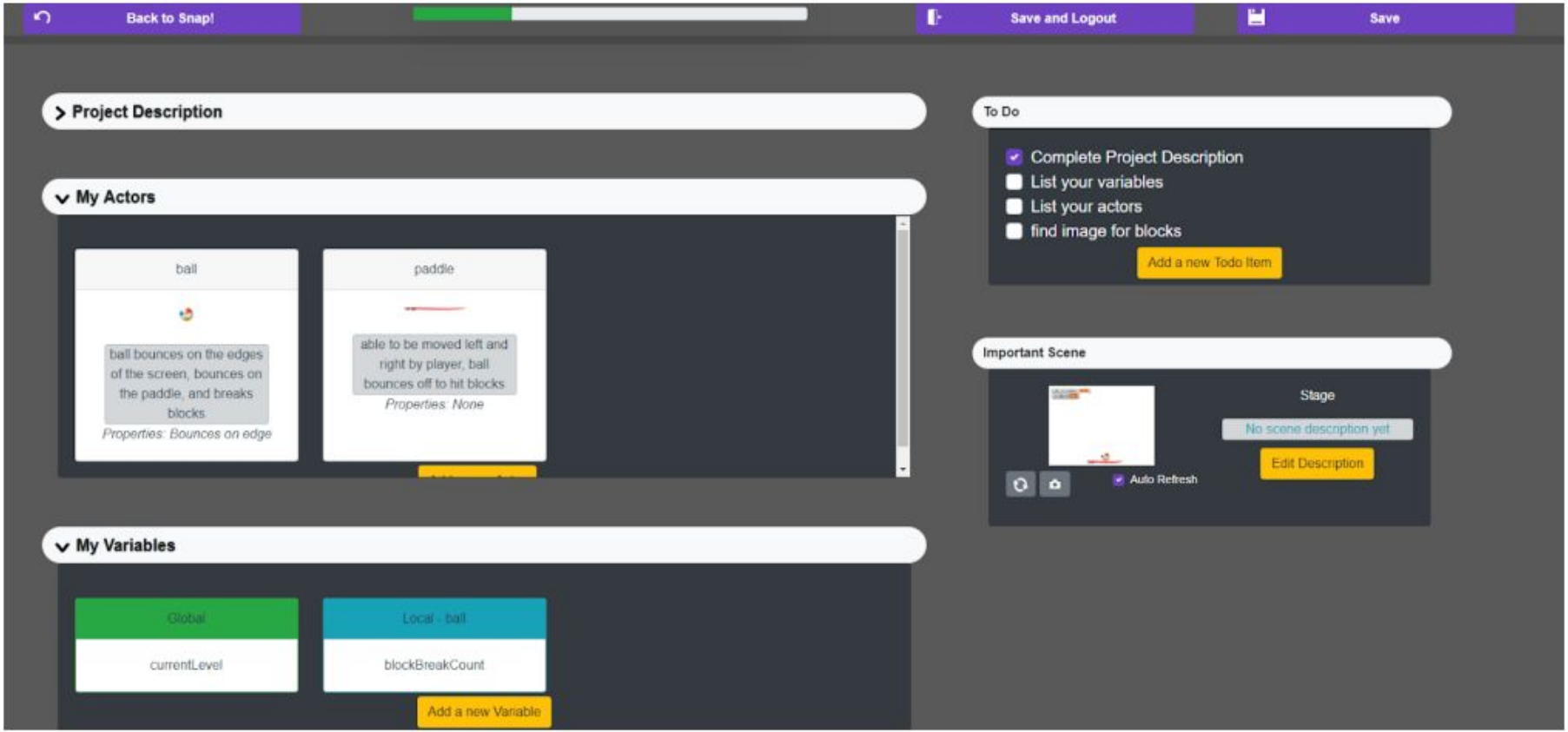

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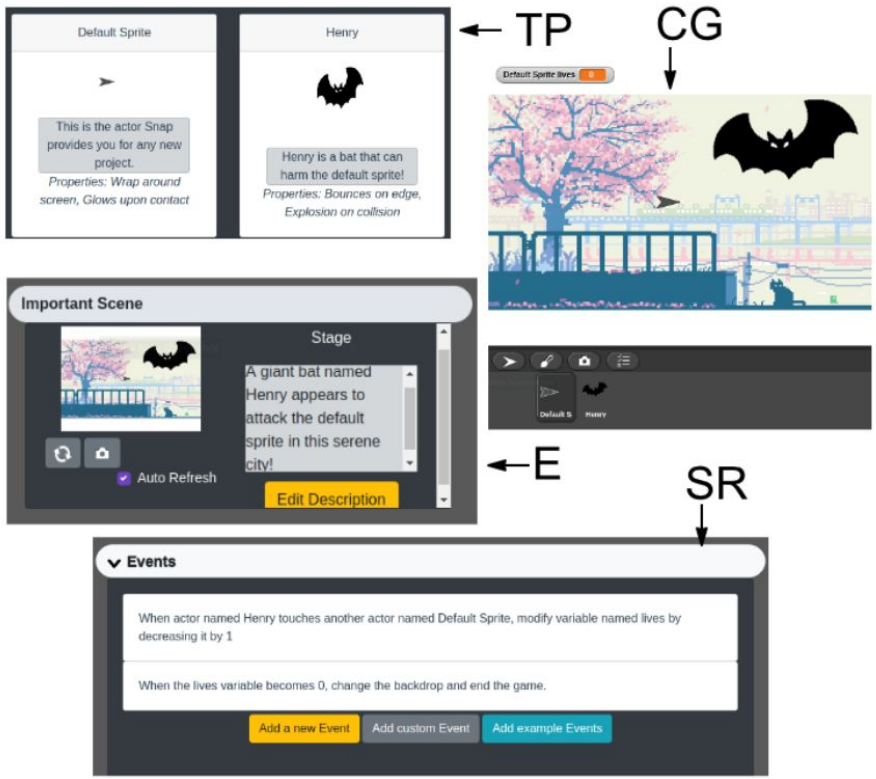

Figure 2: PlanIT provides (TP) tailored plans, (CG) code generation, (E) extensibility, and (SR) set of relationships

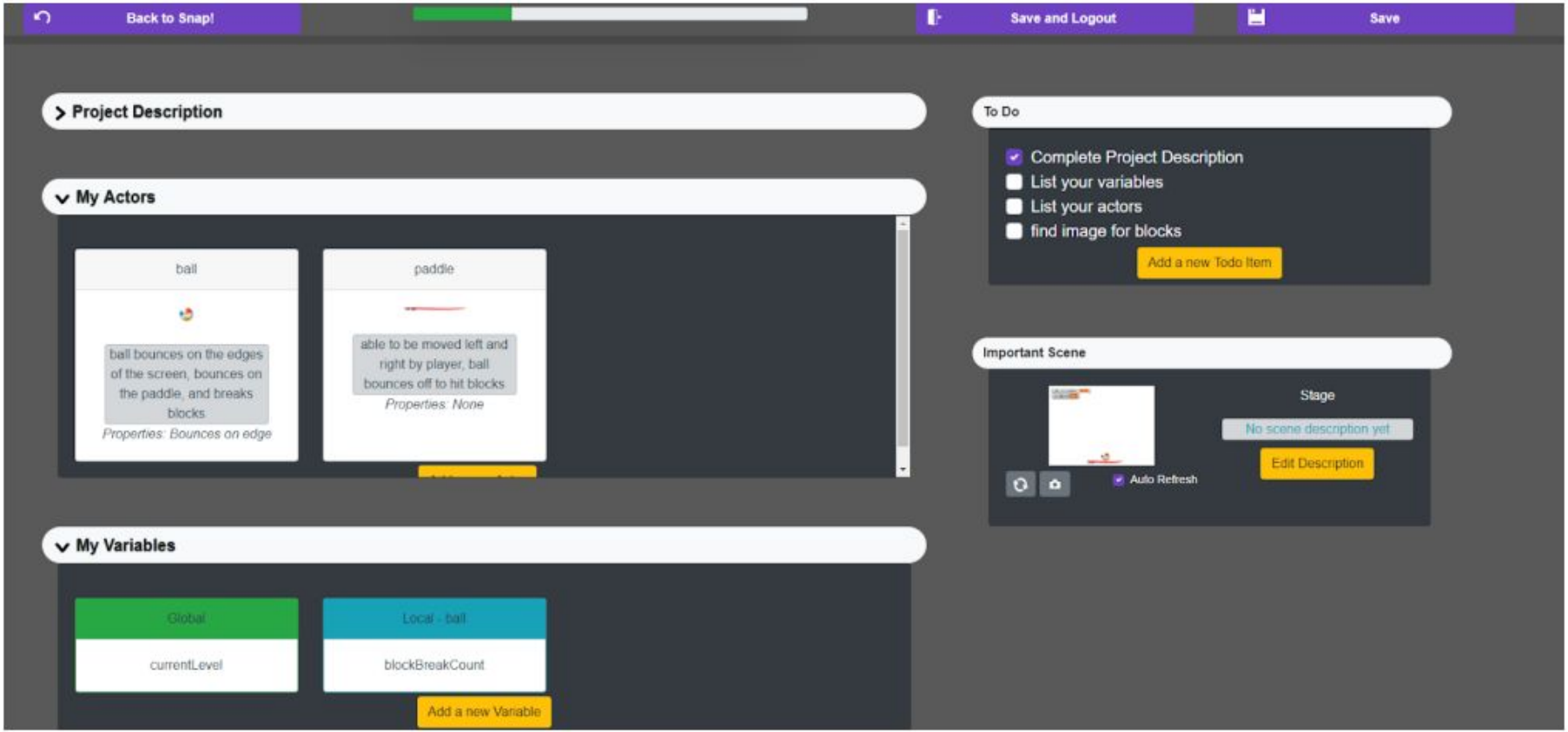

Figure 1: The PlanIT tool with Actors, Variables, To Do, and Important Scene components

Methods

- Pilot study with 26 high school students from an unpaid CS summer internship
- Students planned and programmed three games
  - 1st: Traditional worksheet,
  - 2nd: Half used PlanIT and half used worksheets
  - 3rd: Switched who used PlanIT and worksheets
- Interviewed after each game was made
- Pair programming

Analysis

- PlanIT interactions - log data
- Interviews - thematic analysis
- Survey Data
- Planning artifacts - thematic analysis

Comparison of Planning Worksheets: Analysis

Compared those who used PlanIT on the second project to those who used the worksheet.

Used planning elements (e.g. used psuedocode, used conditionals, planned game mechanics)

Categorized level of planning detail: None, Low, Medium, High

Identified which elements changed for each pair between the first and third project

Comparison of Planning Worksheets: Results

7 pairs who used PlanIT for project 2

- All 7 pairs Made meaningful changes to the way they completed the worksheet (added more elements)
- All 7 pairs added PlanIT-inspired components
- 5 pairs added references to specific programming concepts
- 4 pairs added other elements (e.g. game mechanics or specific Snap blocks)
- 5 pairs increased level of detail in descriptions
- Removed a smaller number of elements

Insights

Planning documents improve projects (on an overall basis, not an individual-level correlation)

Use of integrated planning documents improves over multiple uses

An integrated system can allow us to use planning document information to improve the programming experience

Brainstorm

How could we improve programming experience in Scratch if we knew what students ***wanted*** to do?

Navigation / Using the interface:

Filter out blocks they won’t need in the Blocks pane before they even start

- Microworlds
- Franklin’s group paper

We can create sprites and help them with the costumes - PLANIt

Navigate to the code based on the task they say they want to work on.

Feedback and Help

Provide positive feedback / encouragement when they complete something, describing in their own words

Increase the specificity of autograders - tailored to their project

We could also provide hints if they are having trouble with their task

Analyze task they want to do and provide example code for similar task (with explainer)

Could we bring up a Parson's problem? (give them the blocks or a superset but not the order and not the parameters)

Assessment

Evaluate their understanding? Could we ask questions about their code while the code is right there?

Increase the specificity of autograders - tailored to their project

How can we improve these?

Make sure the elements are designed for students:

- Students with disabilities (neurodiverse) - Cathy Thomas
- English Language Learners and students below grade level in reading

Cool factor

- Tailoring the programming experience / autograder to the student project
- Tailored Parson’s problems as help - Barb Ericson