

PART 4: Evaluation

Team 14

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PART 01 - Rationale

NEST (Network for Engineering, Science, and Tech) is a virtual makerspace platform designed to aid Georgia Tech students in their pursuit of creative, technical, and collaborative projects. It aims to reduce the friction often associated with initiating, organizing, and sustaining creative work, *particularly* among students facing time constraints, lack of structure, and limited access to physical makerspaces. Note, that these struggles were identified through early interviews with GT students. Thus, in response, by combining AI-assisted ideation, real-time collaboration tools, and project tracking features, NEST provides a digital environment that aims to provide solutions to these problems.

As briefly mentioned, initial user research identified three major barriers to student creativity: (1) difficulty getting started with ideas, (2) limited peer collaboration opportunities, and (3) poor follow-through due to lack of structure or motivation. These findings shaped the focus of NEST to work in three primary problem spaces: overcoming ideation blocks, enabling meaningful collaboration, and supporting long-term creative momentum. NEST directly addresses these pain points by offering: (1) an AI assistant that generates personalized project plans and 3D mockups, (2) collaborative virtual spaces like whiteboarding rooms within public or private servers, and (3) an interactive project management dashboard to track task progress and maintain engagement.

Next, we developed NEST with Figma, an online prototyping tool, and began evaluating it. Specifically, to evaluate the effectiveness of NEST's prototype, we conducted user interviews with students from various majors and academic backgrounds. In this study, participants were asked to use the prototype to complete three core tasks: use the AI assistant to generate a project plan, join a collaborative whiteboarding space to get feedback on the project, and add/manage their project tasks via the project dashboard. Lastly, we recorded both quantitative metrics (such as time on task, number of clicks, and confusion points) and qualitative feedback through follow-up questions and user reflections.

This paper will present our evaluation findings, organized by task. For each interface, we will provide detailed analysis of the results and then dive further into what they could mean

in terms of design implications. Lastly, we'll conclude by discussing how these results inform potential refinements to the prototype, tie back to our original user requirements and sustainability goals, and discuss any lessons we've learned about fostering creativity in digital environments like NEST.

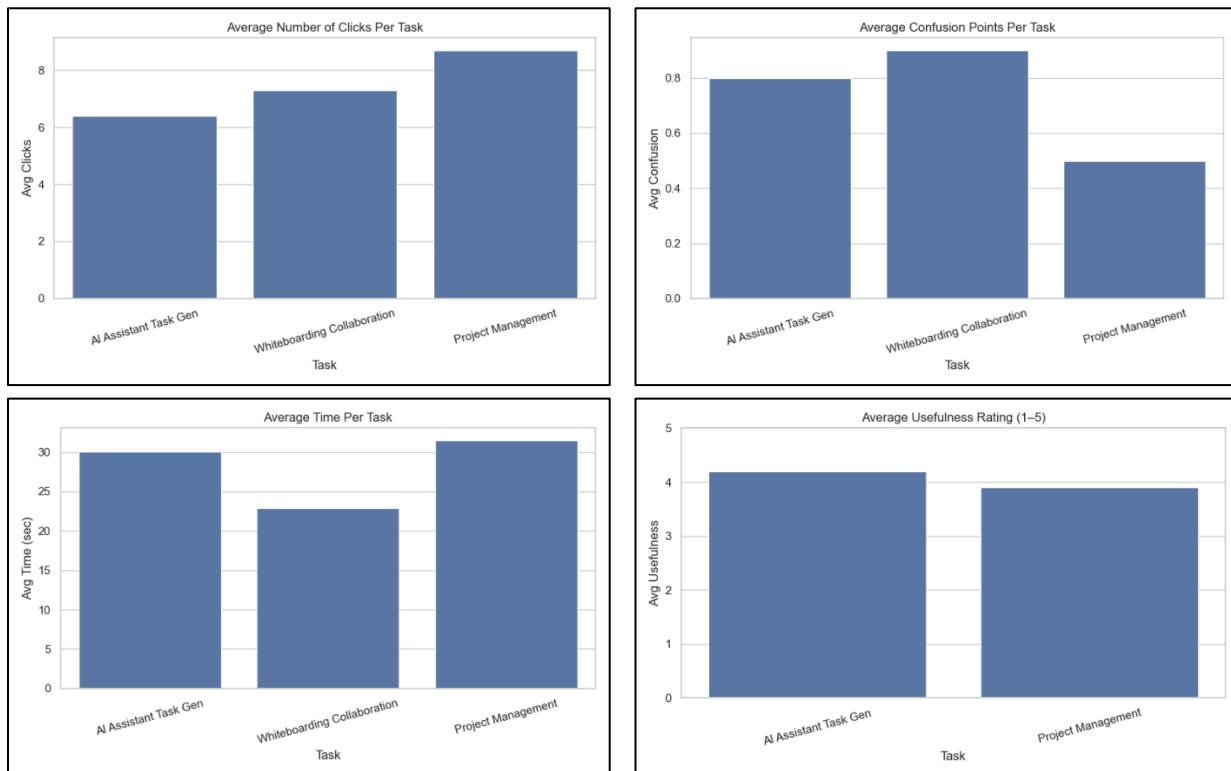
PART 2 - Analysis & Results

To evaluate user experience and effectiveness within the NEST virtual makerspace, we conducted an analysis based on three tasks representing core user workflows:

1. AI Assistant for Project Brainstorming
2. Chatroom/Meeting People
3. Manage Your Project

We collected quantitative data through usability testing and visualized the results using bar charts, box plots, and scatterplots. These visualizations helped us better understand user interaction patterns, variability in behavior, and relationships between metrics like clicks, confusion, time taken per task, and usability rating.

BAR CHARTS



We analyzed the following metrics:

- Average Number of Clicks – representing task complexity and interface friction
- Average Confusion points/score – indicating areas where users hesitated or asked clarifying questions
- Average Time to Complete Task (in seconds) – reflecting task duration and ease of navigation
- Usefulness rating (1 (worst) – 5 (best)) – indicating the usefulness and need of the feature of the website.

Task 1: AI Assistant for Project Brainstorming

This task involved using the AI assistant to help generate and structure initial project ideas. According to the **average number of clicks**, this task had the fewest interactions, with approximately 6 clicks per user, indicating a relatively streamlined interface. However, the **confusion metric** was relatively high—at approximately 0.8 on average, suggesting that users may have experienced initial uncertainty when engaging with the AI Assistant page or interpreting its output.

Interestingly, the **average time spent** on this task was substantial (about 30 seconds), nearly on par with the Project Management task. This may reflect users spending time interpreting the AI's suggestions or iterating ideas. Despite these challenges, this task received the **highest usefulness rating**, averaging around 4.2 out of 5. This shows that even if the task initially confused some users, they ultimately found it valuable and effective in helping them brainstorm.

Task 2: Chatroom / Meeting People

This task, corresponding to "Whiteboarding Collaboration" in the plots, was designed to facilitate interaction and ideation among users. It had a **moderate click count**, averaging approximately 7 clicks, suggesting a slightly more interactive experience than the AI assistant. However, it also had the **highest confusion score** at approximately 0.9, indicating that the interface or process for engaging with others in space may have been unclear or unintuitive.

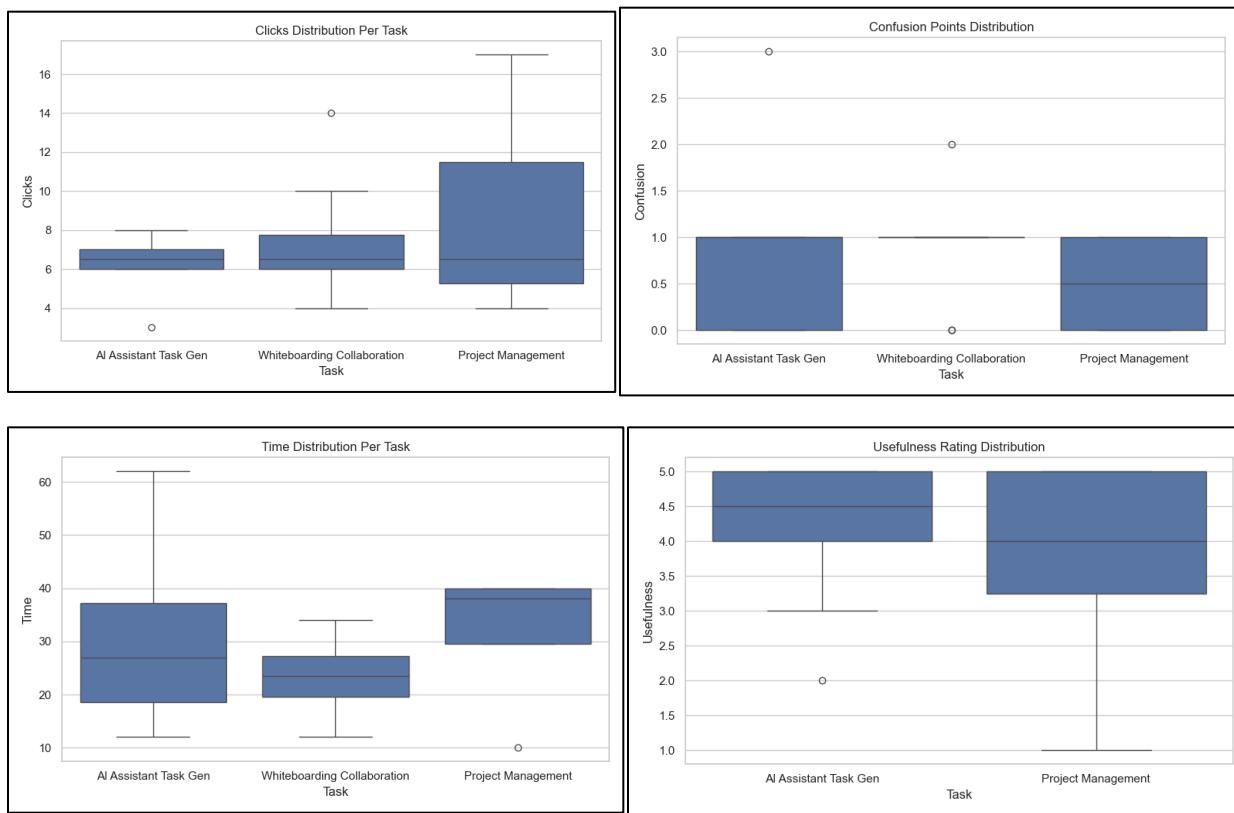
Interestingly, the **average time** spent on this task was the lowest (approximately 23 seconds), which could imply that users either gave up early due to confusion or that the task could be completed quickly once understood. Unfortunately, there is no usefulness rating shown for this task in the final plot, which may suggest this metric wasn't collected or visualized. However, based on the confusion and time data, this is a key area for usability improvement.

Task 3: Manage Your Project

For project management tasks, users engaged the most based on the **average number of clicks**, which peaked at approximately 8 to 9 clicks. This suggests that managing a project required multiple steps or more user interaction—potentially indicating either necessary complexity or inefficiency. Interestingly, **confusion was the lowest** for this task (around 0.55 score), suggesting that users generally understood how to navigate and complete it, even if it was more involved.

This task also had the **highest time spent**, averaging about 31.5 seconds, which aligns with the increased number of clicks and the more involved nature of managing a project timeline or tasks. The **usefulness rating**, while not as high as the AI Assistant, still averaged about 3.9 out of 5, indicating that users found this task beneficial, though possibly a bit more cumbersome.

BOX PLOTS



Task 1: AI Assistant for Project Brainstorming

For this task, the **click distribution** was relatively tight, with most users falling between 6 and 8 clicks. There was a single outlier below 4 clicks, suggesting one participant either

skipped steps or had a very quick interaction. This consistency shows the task had a predictable user flow.

In terms of **confusion**, the distribution showed some variability, including one outlier at 3 confusion points. While most users reported 0 or 1 confusion point, this outlier indicates that the interface may have caused significant uncertainty for at least one participant.

The **time distribution** for this task was wide, ranging from just over 10 seconds to more than 60 seconds, with a median around 25–30 seconds. This indicates that some users spent more time engaging with or interpreting the AI assistant's suggestions.

For **usefulness**, this task had generally high ratings, with most responses clustering around 4–5. There were a few lower outliers (as low as 2), but the median remained close to 4.5. This suggests that despite occasional confusion, users found the AI brainstorming tool quite valuable.

Task 2: Chatroom / Meeting People

This task, corresponding to “Whiteboarding Collaboration” in the plots, had a more varied **click distribution** compared to the AI assistant. The range extended from 4 to 10 clicks, with one outlier at 14 clicks, implying some users may have engaged more deeply or struggled to complete the task efficiently.

Confusion levels had moderate consistency, with most values clustered at 1 point. There was one outlier at 2 and one instance of 0, suggesting that while the interface was mostly intuitive, occasional breakdowns occurred.

The **time distribution** was tighter than the other tasks, with times spanning 13 to 35 seconds and a median around 25 seconds. This suggests users either quickly figured out how to use the chat feature or disengaged quickly if confused.

There is no corresponding boxplot for usefulness of this task, but based on the confusion and click data, we infer that improvements in guidance and interface clarity could reduce user friction.

Task 3: Manage Your Project

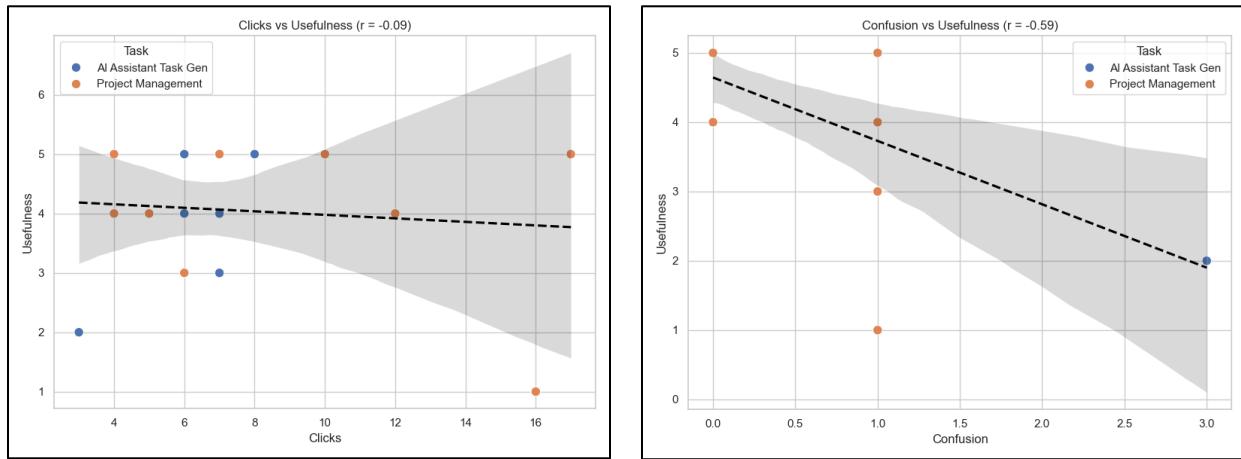
This task showed the **widest variability in clicks**, ranging from 4 to 17 with multiple outliers. The median was around 6–7 clicks, but the large spread suggests different user interpretations of task flow or varying levels of familiarity with project management tools.

In terms of **confusion**, this task showed relatively low values overall. Most users recorded 0 or 1 confusion points, with no significant outliers, which suggests that the task was clearly understood despite its complexity.

The **time distribution** was again broad, ranging from 10 to over 50 seconds. Despite this variation, the median hovered around 40 seconds, implying a heavier cognitive load or more steps required compared to the other tasks.

The **usefulness rating** for this task showed the **widest spread**, ranging from 1 to 5. While some users found it extremely helpful, others rated it very low, indicating inconsistency in perceived value. This likely reflects a combination of personal expectations, usability differences, and task complexity.

SCATTER PLOTS



To better understand how user experience impacts perceived value, we analyzed the relationship between clicks, confusion, and usefulness ratings for the AI Assistant and Project Management tasks. These scatterplots help reveal user sentiment trends and friction points in the prototype's design.

For task 01, In the **Clicks vs. Usefulness** scatterplot, the AI Assistant task shows a **slightly negative correlation** ($r = -0.09$), suggesting that an increase in the number of clicks did **not necessarily increase** perceived usefulness. However, this relationship is **weak**, and most data points cluster around high usefulness values (4–5), regardless of click count. This reinforces earlier findings that, while the task may have had slight usability issues (click-wise), it still delivered value to most users.

In the **Confusion vs. Usefulness** scatterplot, the correlation is **strongly negative** ($r = -0.59$). This means users who experienced more confusion during the task rated it as less useful. One noticeable outlier shows a confusion score of 3 paired with a usefulness rating of 2, clearly reflecting frustration with the interface. This highlights a key design improvement opportunity: minimizing ambiguity or vague responses from the AI assistant.

For task 03, the **Clicks vs. Usefulness** relationship also trends slightly negative and weak, with usefulness ratings scattered across all click counts. One participant recorded **over 16 clicks** but gave the task a **usefulness rating of just 1**, indicating a frustrating experience where higher interaction didn't lead to a better outcome. Overall, this suggests that simply adding more steps or options may not enhance the perceived value.

In the **Confusion vs. Usefulness** plot, the **strong negative correlation** (again, $r = -0.59$) holds here as well. Multiple users who encountered even one confusion point rated the usefulness much lower (as low as 1–2), suggesting that clarity and ease of navigation are essential to retaining user satisfaction in task-heavy interfaces like project management. On the other hand, users who reported zero confusion consistently rated the task as very useful (4–5).

PART 3 - Results For Each Task

Task 1: AI Assistant for Project Brainstorming

Quantitative Data:

- Avg clicks: ~6
- Avg time: ~30 seconds
- Avg confusion: ~0.8
- Usefulness rating: ~4.2

Alignment with Evaluation Criteria:

- **Ease of finding and using the AI:** User were able to successfully find the AI assistant page. However, its identity as “AI Assistant” was obscured as multiple users commented that it wasn’t obviously AI-powered.
- **Process Satisfaction:** Positive reaction. In general, users appreciated the quick setup and “getting to business,” aligning with the high usefulness score.
- **Improvement Suggestions:** Clearer labeling of AI, more structured prompts, better explainability of timeline generation. These came up both in individual evaluation and in aggregate analysis (e.g., user u-010).

Task 2: Chatroom / Meeting People

Quantitative Data:

- Avg clicks: ~7
- Avg time: ~23 seconds

- Avg confusion: the highest was at ~0.9

Alignment with Evaluation Criteria:

- **Finding and Understanding Chatrooms:** Met with mixed reactions. Most users found the concept cool but were confused by the navigation process.
- **Interface Clarity:** The interface lacked clarity as users were unsure how to join rooms or what features were supported inside the whiteboard. The scatter in confusion scores reflects this inconsistency.
- **Improvement Suggestions:** Suggestions include adding on-boarding tooltips and clarifying the room entry process. This was echoed by multiple users (e.g., u-005, u-003), and some users wanted zoom-in and clearer server instructions.

Task 3: Manage Your Project

Quantitative Data:

- Avg clicks: ~8–9
- Avg time: ~31.5 seconds (highest)
- Avg confusion: had the lowest at ~0.55
- Usefulness rating: ~3.9 with wide variability (1–5)

Alignment with Evaluation Criteria:

- **Task Clarity:** Largely achieved task clarity. Low confusion levels support this, and users were able to complete the task with ease.
- **Design & Navigation:** The design and navigation need refinement. Despite successful task completion, small UI issues (icons, buttons, progress indicators) hindered the experience.
- **Usefulness Perception:** Mixed results were present with a high variance in usefulness scores aligning with feedback such as the UI being functional but visually inconsistent or lacking polish.

Summary

| Task | Strengths | Pain Points | Design/Eval Alignment |
|---------------|----------------------------------|------------------------------|--|
| Task 1 | High usefulness, fast engagement | Lack of clarity that it's AI | Met goals, but needs clearer AI identity and smarter feedback loop |

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|---------------|--------------------------------------|--|---|
| Task 2 | Good concept, collaboration tool | High confusion, poor onboarding | Misses onboarding clarity evidenced by user interviews; needs UI guides |
| Task 3 | Low confusion, strong task execution | UI issues, usefulness rating is varied | Solid core design, but visual and interaction details need work |

PART 4 - Implications

The following are the implications for the design from the results of the user testing interviews.

Interface 1: AI Task Generation

- The fact that there is an AI Assistant must be made explicit.
 - u-010: “It is not clear if the AI assistant is an AI assistant.”
- The timeline view in the AI assistant page needs to be more explainable for the user.
 - u-005: “But I'm not sure how AI can come up with the timelines.”
- AI assistant must incorporate feedback from the user to modify the generated plan.
 - u-001: “It's helpful if you're starting from scratch, but might be too generic for more advanced users”
 - u-006: “How can I provide feedback on the tasks generated by AI assistant.”

Interface 2: Collaborative Whiteboarding

- The flow to join the whiteboarding rooms caused confusion to users It must be improved with more guiding text to direct the flow to the whiteboarding room.
 - u-005: “The screen to join the whiteboarding room caused a bit of confusion”
 - u-003: “Was a little confused that they had to click on the whiteboarding door to enter it.”
- The Join Server page caused some confusion where the user did not quite understand which Server to join.
 - u-006: “The screen to join server is confusing. Unless I know it beforehand how I would figure it out.”
- The Makerspace layout needs to be revamped to avoid confusion for the users. The design must make it clear what capabilities it offers to the participants.
 - u-005: “it is not clear what all is possible in the whiteboarding room.”
 - u-007: “unclear if schematic drawing supported”

Interface 3: Project Management

- User Experience must be cleaned up regarding small font sizes and color choices.
 - u-001: “UI could use work; color choices hard to follow; page felt disconnected”
 - u-010: “The details and design should match the background. The tasks area looks like a screen shot.”
- My Projects Page needs more header details.
 - u-009: “Missing headers”
- My Project Detail Page needs more details.
 - u-006: “More details needed. Assigned to in the case of multi-person project. Backlog of tasks would be needed in case of things I could not prioritize for the present.”

Design Alignment with Requirements Gathering Problem Solution Space

The design is tailored for the primary users we have identified as part of our requirements gathering process who are defined as follows.

GT Graduate or Undergrad students who are pursuing Engineering with the following characteristics.

- Age Group: 17-25
- Computer Usage: Expert.

Their major pain points and how the design addresses them are listed below.

- Creativity is important for problem solving: NEST Virtual Makerspace prototype facilitates this by being a makerspace that is fully virtual.
- Active collaboration with other students for creative problem solving: Interface 2 Collaborative Whiteboarding to enhance collaboration with people who match your creative interest.
- Use creativity as a stress-relief mechanism: Interface 2: NEST Virtual Makerspace prototype facilitates this by being a virtual makerspace that the user can log in from anywhere.
- Lack of sufficient knowledge about campus resources: This has not been addressed by current interfaces.

The NEST makerspace directly the lack of time and campus resources by proposing a virtual makerspace where the users can log in from anywhere and are not limited by physical constraints.

The interface that has been designed addresses Places (Context & Environment) of the primary users which the defined in Part 1 as follows.

- Lack of time due coursework: The NEST makerspace makes this easier has it is virtual, and the user does not need to physically go to current spaces like GT Makerspaces and HIVE.
- Having too many ideas leads to paralysis in decision-making: Interface 1 AI Project Assistant and Interface 2 Collaborative Whiteboarding helps the users flush out the ideas, get feedback and get over the paralysis by taking constructive feedback.

The interface that has designed address Activities (User Tasks & Goals)

- Initiation creative projects beyond the ideation phase: Interface 1 AI project assistant addresses this by giving the user a “co-pilot” for project planning.
- It is difficult to find people that match your creative interest: Interface 2 Collaborative Whiteboarding is explicitly allows to collaborate with people that matches your creative interest
- Creative Project Tracking: Interface 3 Project Management feature addresses this need by providing detailed project tracking.

Design Alignment with Utility Goals

| Utility Goal | Interface |
|--|---|
| Facilitating Project Initiation | Interface 1 AI Project Assistant to be a “co-pilot” for your project initiation. |
| Enhancing Collaboration | Interface 2: Collaborative Whiteboarding to enhance collaboration with people who match your creative interest. |
| Reducing Stress Through Creative Outlets | Interface 2: NEST Virtual Makerspace prototype facilitates this by being a virtual makerspace that the user can log in from anywhere and start project with minimum friction. |
| Increasing Awareness of Creative Opportunities | Not addressed by current interfaces. |

| | |
|---|--|
| Minimizing Creative Friction (Perfectionism & Time Constraints) | Interface 1 3D prototyping capabilities and Interface 3 project tracking capabilities address this goal. |
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Limitations

- Our interfaces were limited to primary users and their places and activities. Going forward we must accommodate the needs of secondary and tertiary users in the system. Since our interfaces were limited to primary users our user interviews were also limited to primary users.
- The prototype has an AI assistant, and it is difficult for the end user to comprehend or critique the usefulness of an AI assistant without a working prototype. Since our prototype was based in Figma, this was a limitation of our evaluation as the user could not see the assistant in actual action.
- The whiteboarding room layout caused concerns among the users. The 2D prototype in Figma put constraints on bringing to life the vision that the team had on this front and possibly the users could not completely comprehend the vision.
- The user requirement of lack of knowledge about the campus resources has not been addressed by the current interface and must be a priority going forward.
- Limited set of user interviews i.e. 10 given the large and diverse GT community.

Moving Forward

Improvements

There are several improvements we could make to our design moving forward. For one, we would make the AI assistant more visually and functionally distant, clearly signaling to users that it is an intelligent, interactive feature. We would also implement a feedback loop—allowing users to respond to the assistant's suggestions with comments or preferences, which the system would then use to generate revised plans. This iterative process would create a more personalized and dynamic experience, where the AI adapts to the user's evolving needs rather than providing static, one-size-fits-all output.

In the collaborative whiteboarding room, we could also make some improvements. These include adding visual cues for joining rooms to aid users when they first join the hub. As it stands, navigating to the whiteboarding room can be confusing due to unclear interface elements and limited guidance. We could add user interfaces with tooltips explaining the to the user how to navigate to the whiteboarding room. Additionally, we could add more

functionality to the whiteboarding room to make it more dynamic, such as drawing tools to enhance usability and engagement.

Together, these refinements would make the user experience much more interactive.

Further Evaluations

To test our system more in depth, we could redesign our three main tasks as these experiments:

1. AI assistant
 - a. Independent variable – feedback loop
 - i. One group has static AI suggestions while the other has a feedback loop
 - b. Dependent variable – several ratings
 - i. Time to finalize a project plan
 - ii. Usefulness rating (1-5)
 - iii. Number of edits made to suggestions from AI
2. Whiteboarding room
 - a. Independent variable – onboarding guidance
 - i. One group has no tooltips, other has tooltips + onboarding prompt)
 - b. Dependent variable – several ratings
 - i. Time to successfully join whiteboard
 - ii. Number of navigation errors / confusion points
 - iii. Task success rate
3. Project Management dashboard
 - a. Independent variable – UI enhancement
 - i. One group uses the current UI, the other uses a new layout with clearer headers / visual hierarchy
 - b. Dependent variable – several ratings
 - i. Overall time to complete task
 - ii. Number of usability issues reported
 - iii. User satisfaction rating