GUIDE TO

VIGILANTE INNOVATION

take matters into your own hands

Vol 1

2018 SyBBURE Edition

doCOOL stuff

The SyBBURE Searle Undergraduate Research Program

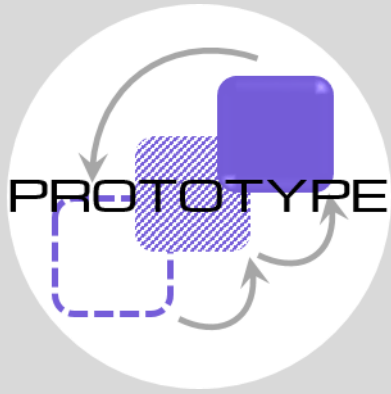
Design Process

Students explore their interests and related problems.

Students discuss their interests and skills, and then create teams around an area of interest.

Students conduct background research, talk to users and experts, and develop a problem statement.

Students brainstorm solutions and select the features to include in their design.



Students create initial versions of their ideas and make changes based on feasibility and feedback.

Students distribute their creations for feedback from a larger population and develop plans for commercialization.

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Explore areas of interest

Estimated Time | 3 hours

List out different areas that you are interested in doing a project around (ex: Computer Science, Health, etc). For each area, list of topics that you want work around (ex: App development, Bone spurs, etc). For each topic come up with ideas for projects and list them (ex: App that tells you when to eat based on your movement).

Area	Topic	Project Idea

Explore areas of interest

Estimated Time | 3 hours

List out different areas that you are interested in doing a project around (ex: Computer Science, Health, etc). For each area, list of topics that you want work around (ex: App development, Bone spurs, etc). For each topic come up with ideas for projects and list them (ex: App that tells you when to eat based on your movement).

Area	Topic	Project Idea

Take a picture of your notes and paste here

Form Teams

Estimated Time | 6 hours

List out the most compelling topics and projects you came up with. Talk to your peers and find out what interesting ideas they had. Make a list of topics and ideas, then write out who else was interested in them.

Topic	Project Idea	Other people Interested

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Form Teams

Estimated Time | 6 hours

List out the most compelling topics and projects you came up with. Talk to your peers and find out what interesting ideas they had. Make a list of topics and ideas, then write out who else was interested in them.

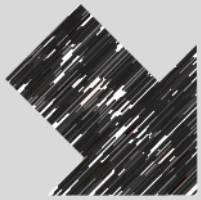
Topic	Project Idea	Other people Interested

Take a Picture of your notes and paste here

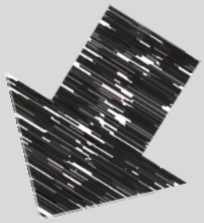
Team Formation

Complete this activity once you've formed a team.

1. Talk through the roles your team members play.



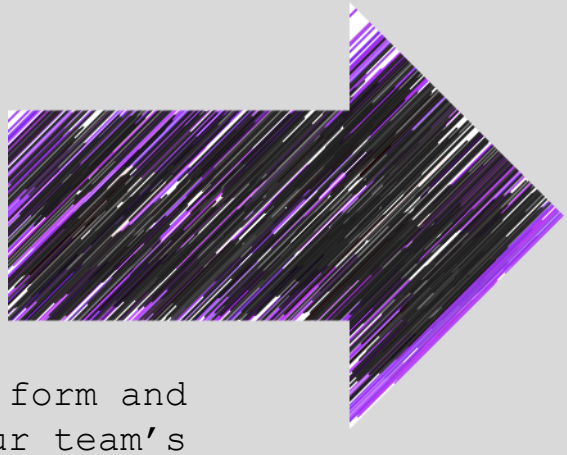
2. Determine any missing roles.

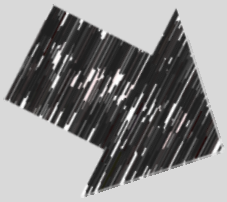


3. Find times when all of your team members are available to meet to discuss and/or work on your project.

4. Pick a team name.

5. Make a public slack channel for your team.





6. Fill out the form and upload to your team's box folder.

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Team Formation

Estimated Time | 1 hour

Write your team name in the top box, then fill out the following boxes with your team member names and roles. Set outside of ThinkTank meeting time(s) and record below.

Team Name	Research Guide

	Name	**Role(s)**
Team Member 1	Sean Bedingfield	Resource investigator, driver
Team Member 2	Jon Ehrman	Expert, Innovator, Analyst
Team Member 3	Josh Greenlee	Driver, Chairperson, Explorer/Innovator
Team Member 4	Katie Leaptrot	Executive, expert, chairperson
Team Member 5	Chrissy Marasco	Innovator, executive, analyst
Team Member 6	Georgia Murray	Team player, explorer, innovator
Team Member 7	Jessie Perlmutter	Expert, Executive, Analyst/Driver
Team Member 8	Chiaki Santiago	Driver, chairperson, executive
Team Member 9	Stacy Sherrod	explorer, driver, chairperson
Team Member 10	Kris Quah	Analyst, executive, expert
Team Member 11	Kyle Whitley	Explorer, Expert, analyst/driver

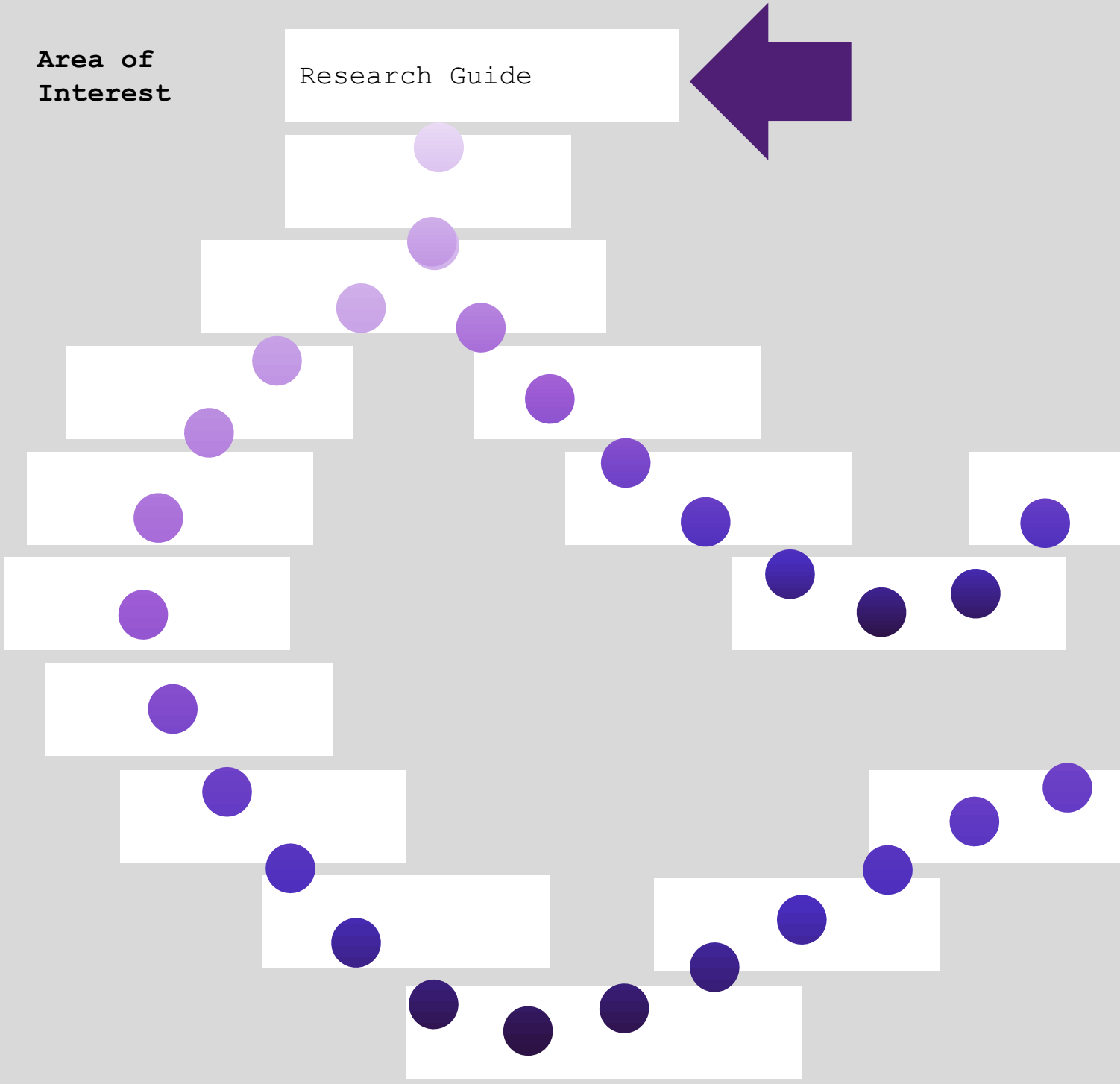
Missing Role(s)	completer
Meeting Time(s)	**Thursdays 1:30-2:30**

Area of Interest

As your team forms around roles and interests, take note of your area of interest here. Remember, this area can change! This is just your starting point. Your path will likely change, twist, develop and you go through the Understand phase. If your area changes, there's a place on the next page to note your final area of interest.

Area of Interest

Research Guide



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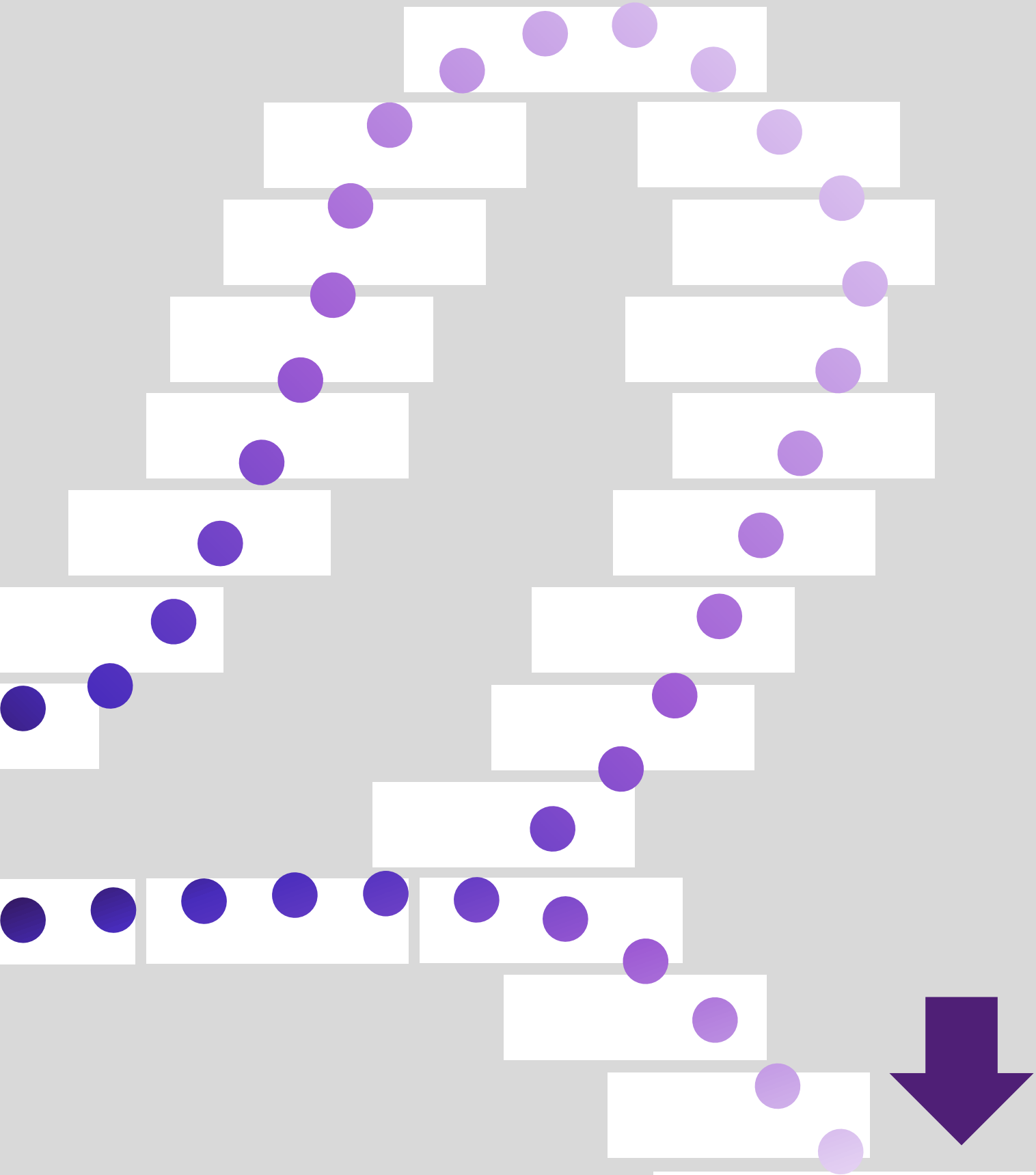
Area of Interest



Final Area of Interest

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MENU OF ACTIVITIES

Understand

Expert Interview
User Interviews
Visit Users in the Field
Background Research
Digest Similar Projects
Read Journal Articles
Stakeholder Map
360 Degree Lightning Talks
Condensation
How Might We? Question-Storm

Ideate

List Users And Issues
Design Requirements
Individual Brainstorming
Nominal Group Technique
Mind Mapping
Window Panes
List Adjectives For Each
Thinking Hats
Schematic Of Experiment
Outcome Chart
Dream Big

Prototype

Mockup
Box Diagram
Very Basic Prototype
Minimal Viable Prototype
C.A.P.E.R.S
List Issues and Solutions
Iteration and Feedback
Preliminary Experiment
Simplified Experiment Set
Demonstration
Video
Describe User Experience

Validate

User Testing
Stakeholder Validation
Characterize Performance
Business Plan
Technical Feasibility
Cost Function & Optimize
Replication
Statistical Analysis
Test Outside of Training
Survey
Compare Alt Approach
Layer Themes

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Recommended Pathways

Below are suggested activity pathways based on Business, Engineering, Science, and Social Outreach areas of innovation. This is only a guide and should not limit your activity selection.

	Understand	Ideate
Business	Stakeholder Map 5 year plan Competitive Overview	3Ds-Design Principles Nominal Group Technique Thinking Hats
Engineering	How might we? Q-storm 360 Degree Lightning Talks Digest Similar Projects	Individual Brainstorming Window Panes Design Requirements
Science	Read journal Articles Condensation Expert Interview	Mind Mapping Schematic of Experiment Outcome Chart
Social Outreach	Visit Users in the Field User Interviews Central User Journey Map	Dream Big List Adjectives List Users and Issues for Each

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Recommended Pathways

Prototype	Validate	
Mockup Box Diagram Minimal Viable Prototype	Stakeholder validation Characterize Performance Business plan	Business
Very Basic Prototype C.A.P.E.R.S Iteration and feedback	User testing Technical Feasibility Cost Function & Optimize	Engineering
List Issues and Solutions Preliminary Experiment Simplified Experiment Set	Statistical Analysis Replication Test outside of Training	Science
Demonstration Video Describe User Experience	Survey Compare Alt Approach Layer Themes	Social Outreach

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UNDERSTAND

Understand

Learn everything you can from others and the existing body of knowledge about your area of interest. Ask yourself and others questions about the field.

- **Question Generation |** Guide your learning; think about what you know and don't know and generate questions to build awareness.

Expert Interview | Go out and learn from experts in your field. Talk with 1-2 experts and learn what they care about.

User Interviews | Find future users of your idea. What do they want? Do they understand the problem you're trying to solve?

Visit Users in the Field | While interviewing, you can also observe your users in action. What do they do currently?

Background Research | Be a champion google searcher.

Market Analysis | What are needs and opportunities in this area?

Digest Similar Projects | Look for other projects around your interest. How can you improve upon what they already offer?

Read Journal Articles | Have every member of the team search for 3 or more journal articles and summarize them.

Stakeholder Map | Diagram the interactions between your users and your idea. Who cares about what and why do they care?

360 Degree Lightning Talks | Prepare a short pitch for your teammates on what the most important areas of this field are.

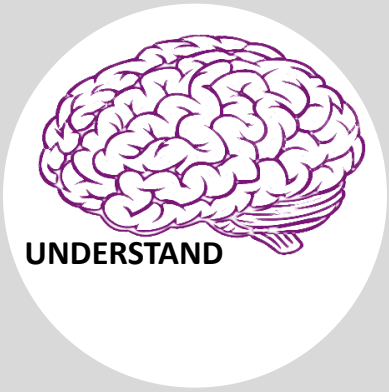
Condensation | Once you have learned about your field of interest, start distilling that knowledge into action.

How Might We? Question-Storm | Develop ideas by framing your problems as questions. Complete the sentence "How might we … ?"

- **Problem Statement |** Take all of your collected work thus far and write out your problem statement.

Activity Selection

Use the menu of activities to complete the chart below. Select the 3 activities that you plan to do for the **Understand Phase** and set a target date to complete each.



Question Generation
(start here)

		Target Completion Date
Activity 1	Digest Similar Projects	03/07
Activity 2	User Interviews	03/07
Activity 3	Background Research	03/07
Activity 3	Expert Interviews	03/07

Define Problem Statement

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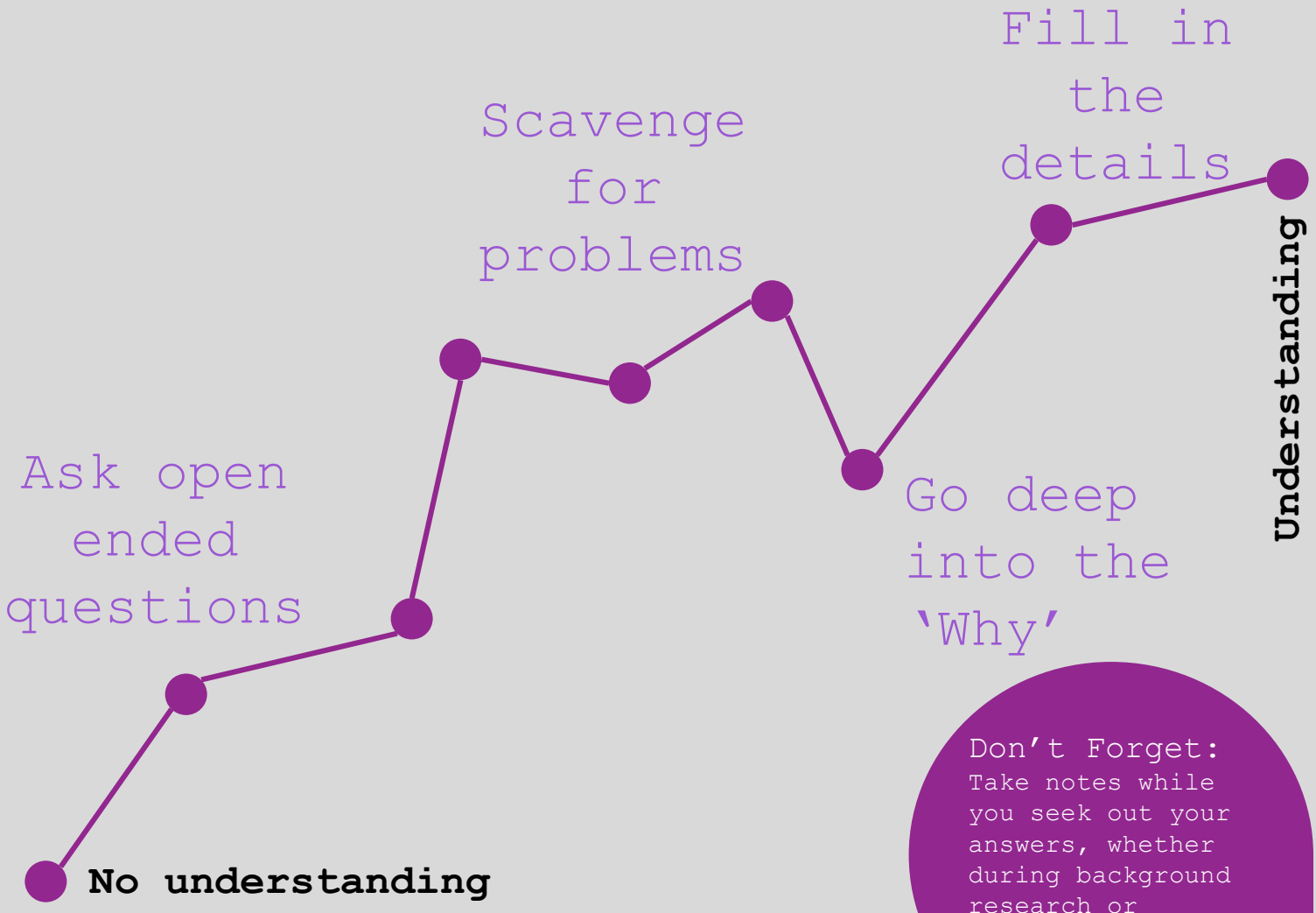
Question Generation

Generating Good Questions - allows you to go from no understanding of your area of interest to a full awareness of the problems in that area.



Don't Forget:
Take notes while you seek out your answers, whether during background research or talking to experts or users

*Each team member should generate questions on their own.

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Question Generation

Estimated Time | 1 hour

It can be hard to start a new innovation endeavor. There is much you don't yet know and even more that you don't yet realize you don't know. Keeping a running list of questions (and answers) will help. Each team member should do this. You can ask us for feedback on these questions to help refine them.

	Questions*	**Team Member**	Team SyBBURE
1	What happens when we disagree on what to include		
2	What is the baseline knowledge of students on our areas?		
3	What is the scope of what we cover - how long will it be?		
4	How many easter eggs should we include		
5	Who do they want to hear from - us or their peers?		
6	Who is our target audience		
7	What technical skills are shared across fields		
8	How many soft skills whould we include (conflict mgmt.,etc)		
9	Field specific details included or just common skills?		
10	How could we make a research guide that people actually want to read?		

***Duplicate this sheet for each team member and if you need space for additional questions.**

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Question Generation

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	Questions*	**Team Member**	Team SyBBURE
11	What is our final format? (physical dimensions / digital)?		
2			
3			
4			
5			
6			
7			
8			
9			
10			

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Question Generation

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	Questions*	**Team Member**	Katie Leaptrot (for user interviews)
1	What information or topics would it have been helpful to have read about before starting research?		
2	If you were about to train a new-to-research student to help you, what would you make sure to cover?		
3	What kind of format would be most accessible to you for a research guide?		
4	What features, other than text on paper or a screen, would be cool in a research guide that would make you want to read it? (i.e. format, activities, completion log)		
5	What aspects of a research guide do you imagine would be prohibitive to its use? (i.e. length, boring, technical)		
6			
7			
8			
9			
10			

***Duplicate this sheet for each team member and if you need space for additional questions.**

Question Generation

Estimated Time | 1 hour

It can be hard to start a new innovation endeavor. There is much you don't yet know and even more that you don't yet realize you don't know. Keeping a running list of questions (and answers) will help. Each team member should do this. You can ask us for feedback on these questions to help refine them.

	Questions*	**Team Member**	Jessie Perlmutter (for expert interviews)
1	What do you think any undergraduate researcher should know, either technical, professional, or soft skills?		
2	What do you think all undergraduate researchers should be able to do by the time they graduate?		
3	What common problems have you run into when training undergraduates? What common knowledge are they missing?		
4	What do you wish you had known as an undergraduate?		
5	What knowledge or skills have helped you in graduate school that you learned as an undergraduate?		
6	What skills do you wish you had known as an undergraduate?		
7	What are common skills that any scientist should have that an undergraduate could start learning?		
8	What resources should undergraduates take advantage of?		
9	What can undergraduates do to make their research go well?		
10	What do you typically teach undergraduates in your lab?		

***Duplicate this sheet for each team member and if you need space for additional questions.**

Expert Interview

Estimated Time | 8 hours

Find three experts in your design field and schedule to meet with them. You could meet in person (ideal) or just chat on the phone/email. Write down questions that you would like each to answer before meeting. Get feedback on your questions from the SyBBURE team before the meeting. Use what you learn from the experts to shape your direction and design.

		Meeting Time & Location
Expert	Dylan Shropshire (grad student mentor)	Feb 15, noon, lunch area
Questions	All questions listed above	**(reference by Team Member last name + Question #)**
Answers/Notes	Notes in notebook. Summary: communication, time management, put in the work/time, learn lab etiquette/professionalism, keep organized, be coachable, writing, statistics, university resources, take time to explore, understand the structure of labs/academia, ask questions, etc.	

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***Duplicate this sheet for each expert and if you need space for additional notes.**

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		Meeting Time & Location
Expert	Katrina Ngo (grad student mentor)	Feb 18, noon, lunch area
Questions	All questions listed above	**(reference by Team Member last name + Question #)**
Answers/Notes	Summary: ask questions, learn lab culture, basic skills like pipetting, common calculations (like M1V1=M2V2), Sterile technique, read instructions, pre-read things, understand lab safety, learn lab jargon, failure is ok	

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		Meeting Time & Location
Expert	Seth Bordenstein (PI)	March 5, 3 pm, office
Questions	All questions above	**(reference by Team Member last name + Question #)**
Answers/Notes	Learning scientific method, communication, immersing yourself to see if you really like something, being involved in scientific conversations about research (lab meetings, seminars, journal clubs) “get behind the scenes”, learning to use a calendar, respond to emails in 24 hrs, reading papers, funding opportunities, transitioning to grad school	

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Expert Interview

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		Meeting Time & Location
Expert	Will Grissom (PI)	Feb 27, office
Questions	Listed below	**(reference by Team Member last name + Question #)**

Answers/Notes

1. What do you wish your undergrad students know or what do you expect from them?
   Does not expect them to have any background knowledge, so long as they are willing to learn.

2. What resources do you wish your students had access to?
   More hard skills such as being better at MATLAB or electronics

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***Duplicate this sheet for each expert and if you need space for additional notes.**

Expert Interview

Estimated Time | 8 hours

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		Meeting Time & Location
Expert	Charlotte Sappo (Grad Student)	Feb 27, office
Questions	Listed below	**(reference by Team Member last name + Question #)**

Answers/Notes

1. What do you wish your undergrad students know or what do you expect from them?
   Wishes for them to be willing to ask questions. Talked about how many are afraid to speak up (seem as if they are afraid to look like they don't know things)

2. What resources do you wish your students had access to?
   Something related to communication skills, or emphasizing that it is alright that we don't know anything, and that they don't expect us to know a lot, so it is good that we ask more questions

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***Duplicate this sheet for each expert and if you need space for additional notes.**

User Interview

Estimated Time | 8 hours

Find four potential users you can interview. Write down questions that you would like each to answer and record their responses. Get feedback on your questions before the meeting. [illegible] these users will interact with your

User

Yoanna Ivanova, Matt Gothard, Callie Webber, Blake Hannan, Louis Schatzki

Meeting Time & Location

ESB 044 2pm
February 20th

Questions

Josh Greenlee

(reference by Team Member last name + Question #)

Answers/Notes

What are some things you wish you would have known before starting research that you know now?

- Be calculated, and don't be timid when first contacting professors (send lots of emails, stop by office hours, immerse yourself in their research before meeting)
- Know the lab style going in, make sure you can work with PI and grad students alike (personality and expectations)
- Work in a smaller lab at first for more intimate PI relationship and more hands on time with people (less independent)
- Make research part of your class schedule
- Seek advice from senior SyBBURE students early and often

User Interview

Estimated Time | 8 hours

Find four potential users you can interview. Write down questions that you would like each to answer and record their responses. Get feedback on your questions before the meeting. Keep in mind how each of these users will interact with your idea while designing it.

		Meeting Time & Location
User	Callie Weber	Feb 18, 2019 10:15 am SC 5420A
Questions	Leaptrot (All)	**(reference by Team Member last name + Question #)**

Answers/Notes

1. Topics applicable to field. List of labs and what they do specifically. Careers to do after research. Basic tools in labs, kinds of microscopes. Resources on campus, cores, ESB, how to access. Intro to R programming, Graphpad prism, maybe Matlab for non-engineers.
2. Cell culture basics, hood sterilization, confocal microscope (change fluorescence, handling), autoclave, hydrogel creation (different types of gels), cell staining, bio-printing, chemical properties of commonly used (EtOH, MeOH, PEG). Tips for how to ask a PI for help, info on lab hierarchy of positions, level of formality. How to read papers, how to write an introduction to a manuscript. Ways to look busy. Link to already available resources (interactive pipette activity exists).
3. Spiral bound preferred over online pdf.
4. Fun activities. Discussion topics for subgroups to follow along, senior student input in group mtgs. Review questions at the end of each chapter. Completion log. Cupcakes. Include pictures and diagrams. Make it fun writing with good jokes and metaphors.
5. Length of each topic (avoid redundancy). Feeling it is droning on on a topic. Accessibility, maybe pdf would be better if it's not just for SyBBURE students. 30 pages would be considered long.

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***Duplicate this sheet for each user and if you need space for additional notes.**

User Interview

Estimated Time | 8 hours

Find four potential users you can interview. Write down questions that you would like each to answer and record their responses. Get feedback on your questions before the meeting. Keep in mind how each of these users will interact with your idea while designing it.

		Meeting Time & Location
User	Yigit Atay	Feb 18, 2019 3:15 pm SC 5420A
Questions	Leaptrot (All)	**(reference by Team Member last name + Question #)**

Answers/Notes

1.Finding research, especially as international student. All about learning, not underqualified. How to approach professors and students to start research. Start as freshman, sophomore, etc. Stress that it is a learning experience. R programming basics (medical software). ACCRE cluster training, how to send jobs or store data. Bash, how to use UNIX. Statistics. How to write a paper, process, setting goals. Figure making. Analyzing medical images (MRI). ITK-SNAP software. How to read papers. Various opportunities offered at VU over summer for research. How is research helpful in the next career steps (PhD, med school, etc.).
2.Make sure their interests align with the specific type of research.
3.PDF.
4.Example emails to professors, research abstracts, published papers, quotes from students doing research. Statistics about current students (how many at VU do research) and specific fields, is research essential. Similar to Yuzu. No worksheets. Useful links for specific fields (databases for physicists, organic chemist or computer science links, how to learn R). Completion log, checklist/certificate. Links to read further. Chapter summaries. Keywords with page numbers, bold keywords in text.
5.Printed version, too long. No pictures. Too technical descriptions.

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***Duplicate this sheet for each user and if you need space for additional notes.**

Visit Users in the Field

Estimated Time | 6 – 8 hours

Find 2 potential users that you can shadow in action. Write down questions that you would like each to answer and record their responses. Log observations from you experience and share with your team.

		Meeting Time & Location
User		
Questions		**(reference by Team Member last name + Question #)**
Answers/Notes		
Observations		

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***Duplicate this sheet for each user and if you need space for additional notes.**

Background Research

Estimated Time | 1 hours

Individually find three or more sources relevant to your project. Read each of them and generate a few summary bullet points.

Source 1 Title	
URL	
Summary	

***Duplicate this sheet for each source and if you need space for additional notes.**

Team Member	

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Background Research

Estimated Time | 1 hours

Individually find three or more sources relevant to your project. Read each of them and generate a few summary bullet points.

Source 1 Title	What is research?
URL	https://www.science.purdue.edu/careers/find_internship_research/getting_started_with_research/what_is_research.html
Summary	Answer basic question of what is research in the research guide. And then outline the difference between basic and applied research. After reading through a few 'undergraduate research guides' – they all start with the basics of 1. what is research 2. the benefits 3. How to get started 4. How to write a cover letter or personal statement info (might be interesting to include) 5. Recommendation letters 6. Sometimes...answering the question of what is research at the undergraduate level (which the Oregon website dives into); others it's a few sentences, basic and broad

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Team Member Stacy

Background Research

Estimated Time | 1 hours

Individually find three or more sources relevant to your project. Read each of them and generate a few summary bullet points.

Source 1 Title	ACS Undergraduate Research Chemistry Guide
URL	https://www.acs.org/content/acs/en/education/students/college/research/guide.html
Summary	Most helpful list from the all the info...I think this will outline sections for us or content that should be included. What will I learn by participating in an undergraduate research program? 1. Literature searches (confidently!)& understand, interpret and extract data from journal articles relevant to your project. 2. Design experiments and/or products 3. Operate instrumentation/perform laboratory techniques **4. Interpret results, reach conclusions and generate idea based on results** 5. Interact with other professionally (PI's, colleagues, etc.) 6. Communicate results effectively.

***Duplicate this sheet for each source and if you need space for additional notes.**

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Team Member	Stacy

Background Research

Estimated Time | 1 hours

Individually find three or more sources relevant to your project. Read each of them and generate a few summary bullet points.

Source 1 Title	Strategies for Engaging Undergraduates in Research
URL	https://urop.uoregon.edu/for-faculty/considering-undergraduate-research-and-creative-scholarship/engaging-undergraduate-students-in-research/strategies-for-engaging-undergraduate-students-in-research/
Summary	What I learned... 1. Our document must be highly structured. 2. The document should be written such that students understand importance of rigor, academic integrity, responsible conduct of research ← this should be our main goal?! Other points of interest... 1. Frequent and consistent feedback (students know when it is coming, etc.) 2. Clear directions and expectations 3. When we assess students – we should outline rewards and outcomes (interesting!) 4. Students should be allowed to get sidetracked and chase down a rabbit hole (inquiry based learning) 5. We run the research teams, consultant, joint creation, and traditional models in SyBBURE (might want to outline these)

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Team Member	Stacy

Market Analysis

Estimated Time | 1 hours

What are the needs and opportunities in this area? Use sites like IBIS World to research your project area. Screen shot and paste key findings and make notes on what you discover.

Related Market Area	
URL	
Summary Findings	
Needs and Opportunities	
Notes	

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***Duplicate this sheet for each market area related to your project.**

Digest Similar Projects

Estimated Time | 4 hours

Find several products or solutions that are similar to what you want to make. List out features and functions of each one, then consider their importance to your design and those you may want to include or improve. Think about what role each plays in the overall scheme.

Similar Project	
URL	
Key features & functions	
Include	
Improve	

***Duplicate this sheet for each project and if you need space for additional notes.**

Digest Similar Projects

Estimated Time | 4 hours

Find several products or solutions that are similar to what you want to make. List out features and functions of each one, then consider their importance to your design and those you may want to include or improve. Think about what role each plays in the overall scheme.

Similar Project	How to Conduct Scientific Research - wikiHow
URL	https://www.wikihow.com/Conduct-Scientific-Research
Key features & functions	Visual, annotated, generalized process of conducting research from planning the project to analyzing and publishing data
Include	The idea of the annotated, visual style is good.
Improve	Make more interesting/engaging, include more specifics

The SyBBURE Searle Undergraduate Research Program

***Duplicate this sheet for each project and if you need space for additional notes.**

Digest Similar Projects

Estimated Time | 4 hours

Find several products or solutions that are similar to what you want to make. List out features and functions of each one, then consider their importance to your design and those you may want to include or improve. Think about what role each plays in the overall scheme.

Similar Project	University of Minnesota, Office of UGR site
URL	https://ugresearch.umn.edu/node/5366
Key features & functions	Much is specific to their school, but they have general pieces like tips on approaching a faculty member, writing, poster design, presentations. Web format with heading + image + short text + learn more button More visual for some pieces, text heavy for others Reasonably succinct
Include	Web format, possibly consider some of their content areas
Improve	Cover actual conducting reseach

***Duplicate this sheet for each project and if you need space for additional notes.**

Digest Similar Projects

Estimated Time | 4 hours

Find several products or solutions that are similar to what you want to make. List out features and functions of each one, then consider their importance to your design and those you may want to include or improve. Think about what role each plays in the overall scheme.

Similar Project	The Indispensable Guide to Undergraduate Research: Success in and Beyond College 1st Edition
URL	https://www.amazon.com/Indispensable-Guide-Undergraduate-Research-Success/dp/0807758507/ref=sr_1_12?keywords=scientific+research+guide&qid=1551975554&s=gateway&sr=8-12
Key features & functions	*These judgements are based on the book preview. Focuses on motivations for research, why to do it, how to fit it in, finding an opportunity, writing/presenting. Largely text based, not many figures/graphics. Nothing on the actual conducting of research.
Include	Starting with the motivation may be good, but why would someone look for this type of guide if they weren't already interested. Explanations/insights into different types of research.
Improve	Way more on how to do research.

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***Duplicate this sheet for each project and if you need space for additional notes.**

Digest Similar Projects

Estimated Time | 4 hours

Find several products or solutions that are similar to what you want to make. List out features and functions of each one, then consider their importance to your design and those you may want to include or improve. Think about what role each plays in the overall scheme.

Similar Project	**Graduate Research: A Guide for Students in the Sciences**
URL	https://www.amazon.com/Graduate-Research-Guide-Students-Sciences/dp/0128037490/ref=sr_1_8?keywords=scientific+research+guide&qid=1551975554&s=gateway&sr=8-8
Key features & functions	*These judgements are based on the book preview. Includes things from getting started to getting a job. Some pieces are graduate student specific, but plenty overlaps. Covers ethics, time management, literature search, writing, speaking, safety/regulatory issues, getting grants, etc. Largely text based, not many figures/graphics. Seems minimal around the executing/implementing research side.
Include	Time management, scientific principles, ethics, lit search, writing, speaking, use of animals/humans in research, careers
Improve	Experimental design, data collection, data analysis, stats, teamwork in research

***Duplicate this sheet for each project and if you need space for additional notes.**

Digest Similar Projects

Estimated Time | 4 hours

Find several products or solutions that are similar to what you want to make. List out features and functions of each one, then consider their importance to your design and those you may want to include or improve. Think about what role each plays in the overall scheme.

Similar Project	Harvard Library research guides
URL	https://guides.library.harvard.edu/?b=s
Key features & functions	There are many guides uploaded by numerous people. Most of them focus on a specific lab setting or technique – for instance there is an intro guide on mouse work. If there in one for the topic you are interested in, it it likely well written, but there are lots of topics that are not discussed
Include	I like the variety, we could make some sections on the more common types of labs – wet labs, animal labs, computation etc
Improve	These are probably too specific for what we are doing and skip the intro content that everyone needs to know

***Duplicate this sheet for each project and if you need space for additional notes.**

Digest Similar Projects

Estimated Time | 4 hours

Find several products or solutions that are similar to what you want to make. List out features and functions of each one, then consider their importance to your design and those you may want to include or improve. Think about what role each plays in the overall scheme.

Similar Project	Research guide for students
URL	http://www.cckln.edu.hk/libweb/library_lesson/studentresearchguide.pdf
Key features & functions	This is actually aimed at high school students writing a research paper, but I think there are some good ideas and structures here. They cover generating a hypothesis, finding sources, assembling and organizing information, writing styles
Include	The finding reliable sources, having a question when you are researching, and organizational tips are areas we should include
Improve	We should lump the writing styles in with a section about reference managing

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***Duplicate this sheet for each project and if you need space for additional notes.**

Digest Similar Projects

Estimated Time | 4 hours

Find several products or solutions that are similar to what you want to make. List out features and functions of each one, then consider their importance to your design and those you may want to include or improve. Think about what role each plays in the overall scheme.

Similar Project	Undergrad in the lab
URL	http://undergradinthelab.com/blog?page=1
Key features & functions	This is a blog based website with a lot of tips for undergrads. Ex: labelling bottles, finding the right lab, authorship requirements and asking about it
Include	Maybe a tips section with quick bits of knowledge after each section?
Improve	This isn't organized at all – need to find the right order

The SyBBURE Searle Undergraduate Research Program

***Duplicate this sheet for each project and if you need space for additional notes.**

Read Journal Articles

Estimated Time | 4 hours

Individually find three journal articles relevant to your project. Read each of them and generate a paragraph summarizing the main points. Each member chooses the best article they found and the team reads them together.

Article 1 Title	
URL	
Summary	

***Duplicate this sheet for each source and if you need space for additional notes.**

The SyBBURE Searle Undergraduate Research Program

Team Member

Stakeholder Map

Estimated Time | 2 hours

Map out the relationships between key stakeholders and your project. Stakeholders are the people who are impacted by your idea. A stakeholder could be a group of individuals, like "doctors", or it could be a specific person.

1. Identify the key stakeholders relevant to your project
2. Put yourself in the shoes of your stakeholders. What do they care about most? Where do they direct their interest? Discuss with your team.
3. How much influence does each stakeholder have? Who is most influential?
4. Prioritize your stakeholders and rank them in importance.
5. Pick the most important stakeholder to design for. **Define why they're the most important.** Are they making purchasing decisions, do they care the most about this topic? What makes them important?

Stakeholder Name:
Cares About:

Influence Level :
Low Medium High

Stakeholder Name:
Cares About:

Influence Level :
Low Medium High

Your Project Idea

Stakeholder Name:
Cares About:

Influence Level :
Low Medium High

Stakeholder Name:
Cares About:

Influence Level :
Low Medium High

360 Degree Lightning Talks

Estimated Time | 2-3 hours

1. On your own time, find an important aspect of your line of inquiry that you want to share with your team.
2. Prepare a quick presentation of 5-7 minutes on the topic. Your goal is to make your team as knowledgeable as you on this same topic.

1		6	
2		7	
3		8	
4		9	
5		10	

List topics of interest above and assign them to individual team members to discuss

1		3	
2		4	

***Duplicate this sheet for each Team Member.**

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Team Member

Condensation

Estimated Time | 1 hour

Individually write a paragraph about the point of your project, then combine as a team. Individually write three sentences about the point of your project, then combine as a team. Individually write a single sentence that covers all aspects of your project. Combine as a team

Paragraph	
Three Sentences	
Single Sentence	

***Duplicate this sheet for each Team Member.**

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Team Member	

How Might We? Question Storm

Estimated Time | 1 hour

Frame the problems that you have found in the form of a "How might we… X?" question. Start each question with How Might We and finish with X, where X is an element of the problem you identified. The goal is to open your mind and not limit the scope of your problem.

Some examples are provided below to get you started.

Problem You Want to Tackle	**How Might We..?**
College Applications	*"How might we connect disadvantaged high school students with scholarship opportunities and colleges?"*
Medical Devices and Global Health	*"How might we sterilize surgical tools in low-resource settings"*

Flex Activity

Estimated Time | XXXX

Create an activity for VIX. Write the instructions here, come up with a good title, and estimate the amount of time it will take. You can take images, boxes, or tables from any of the other activates. Complete the activity.

Placeholder

Define Problem Statement

Estimated Time | 30 minutes

Take all of your collected work thus far and write out your problem statement.

What is the need in your topic area?

Better research preparation (1)

Who has this problem?

undergrads (2)

Why do they have this problem?

Research is complex and preparation not always available (3)

Why is this important for YOU to solve?

We regularly see the need in our students (4)

Who needs What and Why

*and Why are you motivated to work on this?

Problem Statement

Undergrads need better research preparation to enlighten their journey towards success in research

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Vision Statement

Estimated Time | 30 minutes

Take all of your collected work thus far and write out your vision statement for your project.

What does the future look like? (1)

Who will use this? (2)

What will this technology allow the user to do? (3)

Why is this important to YOU? (4)

Who needs What and Why

*and Why are you motivated to work on this?

Vision Statement


IDEATE

Activity Selection

Use the menu of activities to complete the chart below. Select the 3 activities that you plan to do for the **Ideation Phase** and set a target date to complete each activity.

Individual Brainstorming (start here)

		Target Completion Date
Activity 1	Outcome Chart	4/11
Activity 2	Window Panes	4/11
Activity 3	Thinking Hats	4/11

Solution Description

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Ideate

Develop new ideas and solutions

Individual Brainstorming | Individuals come up with 30% more ideas alone than in groups. Use the power of your own mind to generate solutions.

List Users and Issues for Each | Document each user of your solution and what their individual issues are. Some users might overlap and some may have certain specific issues.

Design Requirements | Select the most important requirements for your solution. These will help guide your journey in developing a prototype.

Nominal Group Technique | An integrated approach to problem selection, solution generation, and decision making. Helpful when there are multiple options your team could take, but you can't decide which one is best.

Mind Mapping | Write down thoughts that come into your mind and start connecting the ideas together.

Window Panes | Organize your project into sections, then connect the sections together to see the whole.

List Adjectives | If you asked someone to describe your solution in just a few words, what would they be? Is it intuitive, cheap, fast, comfortable?

Thinking Hats | Assign members of your team to assume different perspectives. Each person is responsible for advocating for their individual perspective when generating solutions.

Schematic of an Experiment | Generate a diagram of your experimental protocol. What do you want to get out of the experiment?

Outcome Chart | Generate possible outcomes that your solution will generate. Which one of these is most optimal for success?

Dream Big | Think of the world-changing possibilities your idea might bring. A few might be really awesome to work toward.

Solution Description | Converge on a single solution as a group. Draw and use text to fully describe your solution.

Individual Brainstorming

Estimated Time | 4 hours

Individually draw at least two solutions to the problem your team identified and insert the images below.

Drawing 1

***Duplicate this sheet for each Team Member.**

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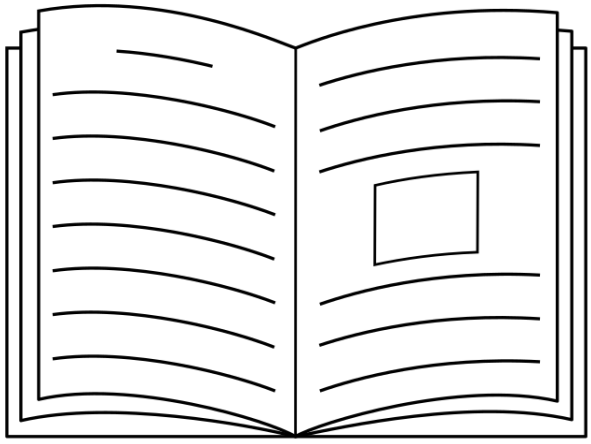
Team Member

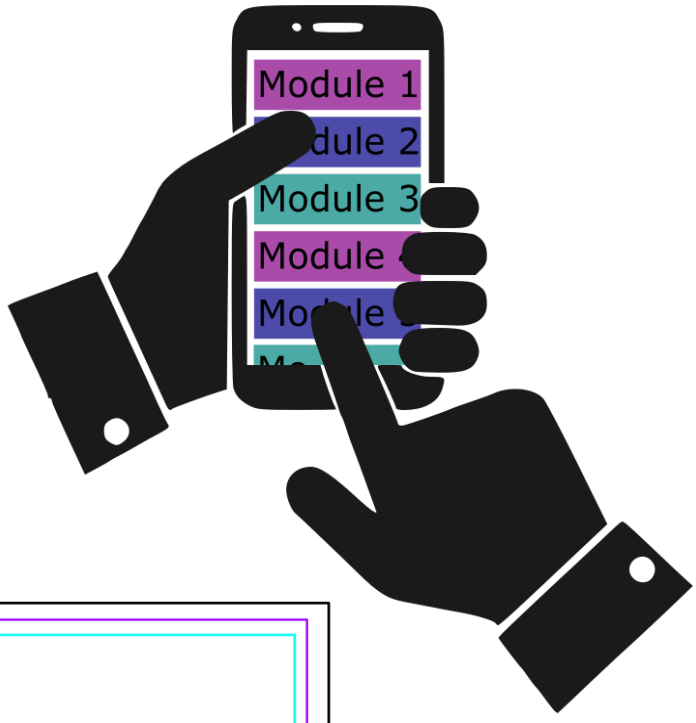
Individual Brainstorming

Estimated Time | 4 hours

Individually draw at least two solutions to the problem your team identified and insert the images below.

Drawing 2





Certificate of Completion

This certifies that
John Smith
has successfully completed the following module

How to do cool research

on Friday 08 February 2019
Presented by SyBBURE

Chrissy Marasco
Chrissy Marasco

***Duplicate this sheet for each Team Member.**

The SyBBURE Searle Undergraduate Research Program

Team Member Katie Leaptrot

List Users and Issues

Estimated Time | 3 hours

Explore how each user will interact with your idea. List out all the different types of users and think of any issues they might have. Brainstorm solutions to these issues but don't worry about feasibility, just think of the optimal solution.

User	Issue	Solution(s)

Design Requirements

Estimated Time | 1 hour

1. Compare individual solutions and discuss what requirements would be needed to address the problem.
2. Combine your requirements into one list and record it here.
3. Select the most important one(s) that you MUST achieve to be successful and list their respective numbers in the box below.

Tips:

- Consider the features of similar products – why are they there?
- What's wrong with existing solutions? Do other people agree with your assessment of the problems?
- What features do other products market themselves on?
- Think about services that might accompany your solution. What do those auxiliary services and features need to provide?
- Consider both general design requirements and specific features

1		6	
2		7	
3		8	
4		9	
5		10	

Most Important

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Nominal Group Technique

Estimated Time | 1 – 2 hours

This activity is another form of brainstorming that helps generate solutions and consensus on how to solve problems

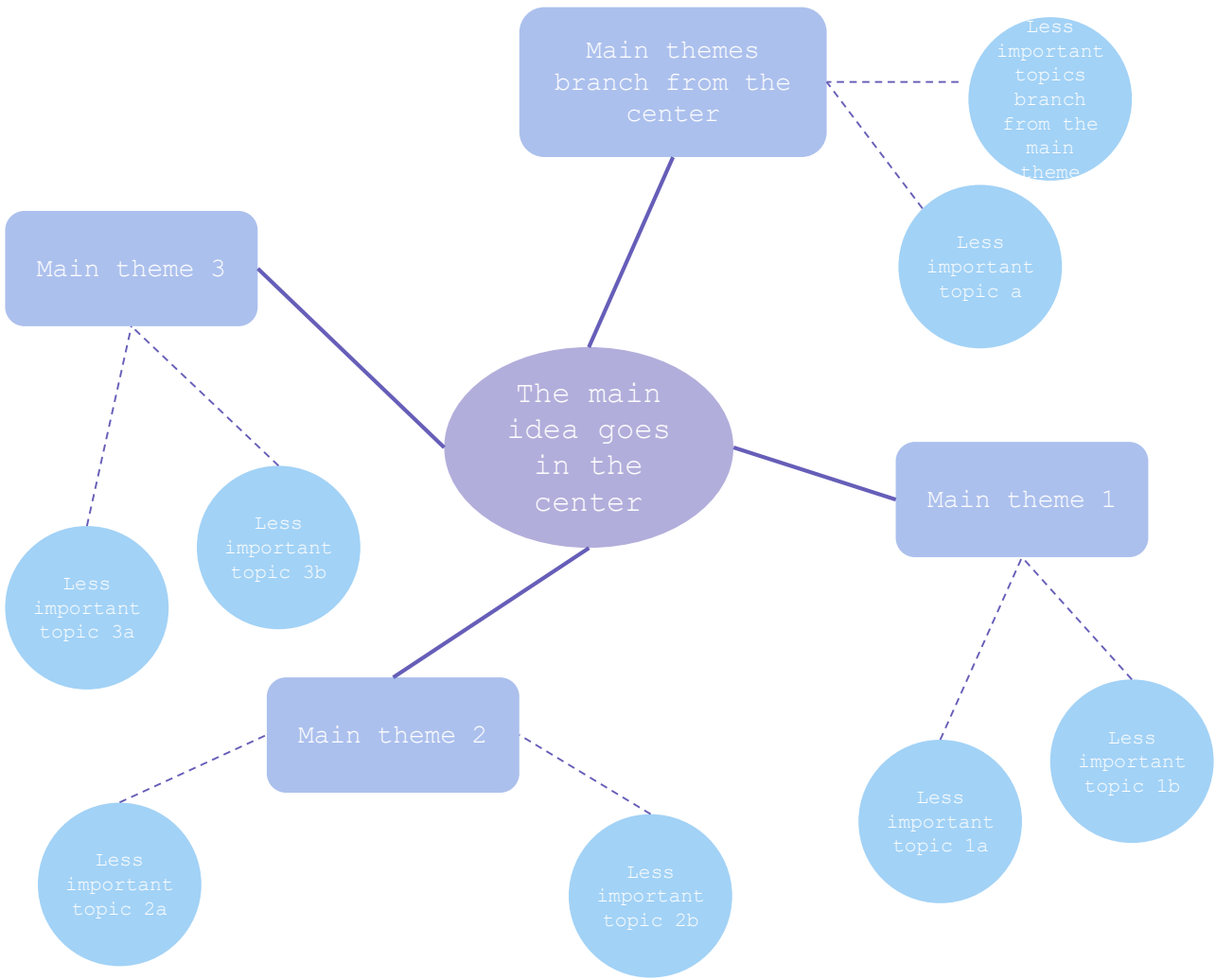
1. Write a clear sub-problem statement that you want to tackle.
2. Take your problem and outline exactly what and who you want to focus your solution on.
3. Once your team knows what the problem is, have each team member silently generate potential solutions. Draw out your individual solutions on paper.
4. Collect the solutions and ask each person to explain their idea, in detail, for about 5 minutes.
5. Group similar ideas together. List key features that your group agrees upon.
6. Take a vote and decide on the best solution to execute.

Ideas	
Key Features	
Best Solution	

Mind Mapping

Estimated Time | 30 min – 1 hour

The purpose of this activity is to get information out of your head in a visual, logical manner. You can use this technique around anything and during any phase of your project. This can be done either in group format or individually with a comparison at the end. Try it on paper, a wipe board, or using any of the online mind-mapping tools. Record your work here by pasting in a picture of what you did.



Window Panes

Estimated Time | 2 hours

This exercise is geared towards organizing the user experience for software. In each box, write out the contents of a single screen of your program, then connect the screens together with arrows. Take each box and draw out what the screen will look like then cover the box with that image**Pane A**

Research Guide Table of Contents

1. Purpose
2. Finding your interests
    a. Research areas
    b. Value assessments
    c. Getting short-term opportunities
    d. Setting up experiences
3. Types of Lab Experiences
    a. Wetlabs
        i. Biological
        ii. Chemical
        iii. Animal
        iv. Clinical
    b. Drylabs
        i. Computational
        ii. Theoretical
        iii. Design
4. Getting Research Experiences
    a. How to join a lab
    b. Communicating with mentor
    c. Choosing the right mentor
    d. Finding the right lab culture and where you fit in
    e. How to leave a lab
5. Relationships
    a. PI / mentor
    b. Peers
    c. Mentees
6. Lab Safety
7. Technical skills
    a. Statistics
    b. Data interpretation
    c. Analysis software
    d. Literature search
    e. Reference managers
    f. Experimental design
    g. Hypothesis generation
    h. Setting research goals
    i. Critical thinking

Pane A

8. Scientific communication
    a. Building a narrative
    b. Identifying your audience
    c. Oral presentations
        i. Format
        ii. Sizing
        iii. How to practice
        iv. Speaking clearly
    d. Posters
        i. Format
        ii. Sizing
        iii. Talking tips
    e. Writing
        i. Abstract
        ii. Intro
        iii. Figures
        iv. Methods
        v. Results
        vi. Conclusions
    f. Publishing
        i. What constitutes a paper
        ii. Typical authorship requirements
        iii. Targeting journals
        iv. Finding formatting rules
        v. Review process
9. Networking
    a. Starting conversations
    b. Maintaining relationships

List Adjectives

Estimated Time | 30 minutes

1. On a separate piece of paper, individually write out lists of adjectives that describe what you are designing. Don't think, just write.
2. Combine the lists as a group and rank. Record below.
3. Take the highest rated adjectives and write out how you might design a solution that users would describe with the same words

1		6	
2		7	
3		8	
4		9	
5		10	

Solution Designs to Meet Top Adjectives

Thinking Hats

Estimated Time | 1 hour

Put on your thinking hats! In this activity, you will assume the viewpoints of different stakeholders. The goal is to give every voice a seat at the table so that you can consider all angles of the solution.

1. Brainstorm the most important stakeholders, or use one of the previous activities where you outlined stakeholders.
2. Have each group member adopt the mindset of a stakeholder. Your goal is to represent that stakeholder's viewpoint throughout the discussion.
3. Go around the table and have each person advocate for a solution.
4. Note any useful conclusions below.

Tips: Consider, what this person cares about most? How might you rank the stakeholders and the solutions you discussed?

	Stakeholder	Team Member
		
		
		
		
		
Conclusions		

Thinking Hats

Estimated Time | 1 hour

Put on your thinking hats! In this activity, you will assume the viewpoints of different stakeholders. The goal is to give every voice a seat at the table so that you can consider all angles of the solution.

1. Brainstorm the most important stakeholders, or use one of the previous activities where you outlined stakeholders.
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3. Go around the table and have each person advocate for a solution.
4. Note any useful conclusions below.

Tips: Consider, what this person cares about most? How might you rank the stakeholders and the solutions you discussed?

Stakeholder	Comments
 New-to-Research Student	I want an online resource that tells me every step of how to get started in research, but it can't be very long or I won't read it.
 Experienced-at-Research Student	I already know most techniques, but it would be great to get tips on making better figures and on writing up my results. I also want to know how to talk to my mentor and describe my work for grad school applications.
 Research Mentor	I want the guide to teach my students how to be self-starters. They should know how to find and read papers. I want them to be proactive and ask questions instead of waiting for me to tell them what to do.
 Subgroup Leader	I want students to feel comfortable getting started with research. They should know how to interpret data and make figures. They should be able to talk about their work and know to be familiar with the overarching motivation, or sky-high view of their project.
 Administration	Students should be comfortable at the bench or computer. We want to see great results both in terms of the science and with respect to student experience. They should leave wanting to be an advocate for the research experience and our school.

Schematic of Experiment

Estimated Time | 3 hours

Draw out the schematic of your experiment. Start with a list of every input (cell type, pump speed, laser frequency, etc.) then add a description of your detection scheme. Describe the data that is output and the analysis flow. Draw your experimental setup

Inputs	Detectors	Data Analysis

Draw Experimental Setup

Outcome Chart

Estimated Time | 1 week

Contrive two experiments, A and B, such that the possible outcomes are all positive. List the outcomes and what you learn in each case.

Experiment A

First off, this description is super strange.
We could take different styles of formatting for a few different guide topics, give each student 5 minutes to review it before taking a brief quiz.

Experiment B

We could compare rankings of what younger and older students perceive as most important to cover, identify overlap and common differences. Stage the early interest subjects to encourage topics considered more important by early students.

Outcome A

Students respond better to style A vs B

Outcome B

The students have a shifted distribution of interests that correlate with age.

Outcome A2

Students respond better to style B vs A.

Outcome B2

The students have discipline-specific clusters of interests that do not correlate with age.

Outcome Chart

Estimated Time | 1 week

Contrive two experiments, A and B, such that the possible outcomes are all positive. List the outcomes and what you learn in each case.

Experiment A

After the completion of the research guide, have a small group of students who have not worked in research yet take a quiz before and after having time to read through the guide. Quiz questions should be mostly scenarios/written response.

Experiment B

Compare the needs of a researh guide between novice and senior research undergraduates.

Outcome A

Students learn from guide and give answers that more closely mimic what we expect of them in these scenarios on the second quiz attempt.

Outcome B

Undergraduates of different research skill levels all want fairly similar things in the guide. The guide can stay uniform for all levels of experience.

Outcome A2

Students have poor answers in certain topics. We address these in the validation stage and restructure to meet these needs.

Outcome B2

Large disparity between senior and novice students in terms of topics to address. Make the guide in parts to address the needs of both separately.

Dream Big

Estimated Time | 4 hours

Individually write out every attribute, function, or feature that you want your project to have without worrying about feasibility. Come together as a team to decide what the most important features are, then decide which ones are reasonable. Draw out what your design might look like in the box.

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.

Design Drawing

Potential Strategies

Estimated Time | 3 hours

How will your team incorporate the features and functions you listed in your design requirements. Search for and list potential strategies to achieve your desired end product.

Feature/Function	Potential Strategies

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***Duplicate this sheet for additional features/functions.**

Flex Activity

Estimated Time | XXXX

Create an activity for VIX. Write the instructions here, come up with a good title, and estimate the amount of time it will take. You can take images, boxes, or tables from any of the other activates. Complete the activity.

Placeholder

Strategy Description

Estimated Time | 4 hours

Converge on a single strategy for accomplishing your team's functions and features as a group. Describe your strategy below with a simple box and line drawing and written description.

Drawing

Technical Description

Strategy Description

Solution Description

Estimated Time | 4 hours

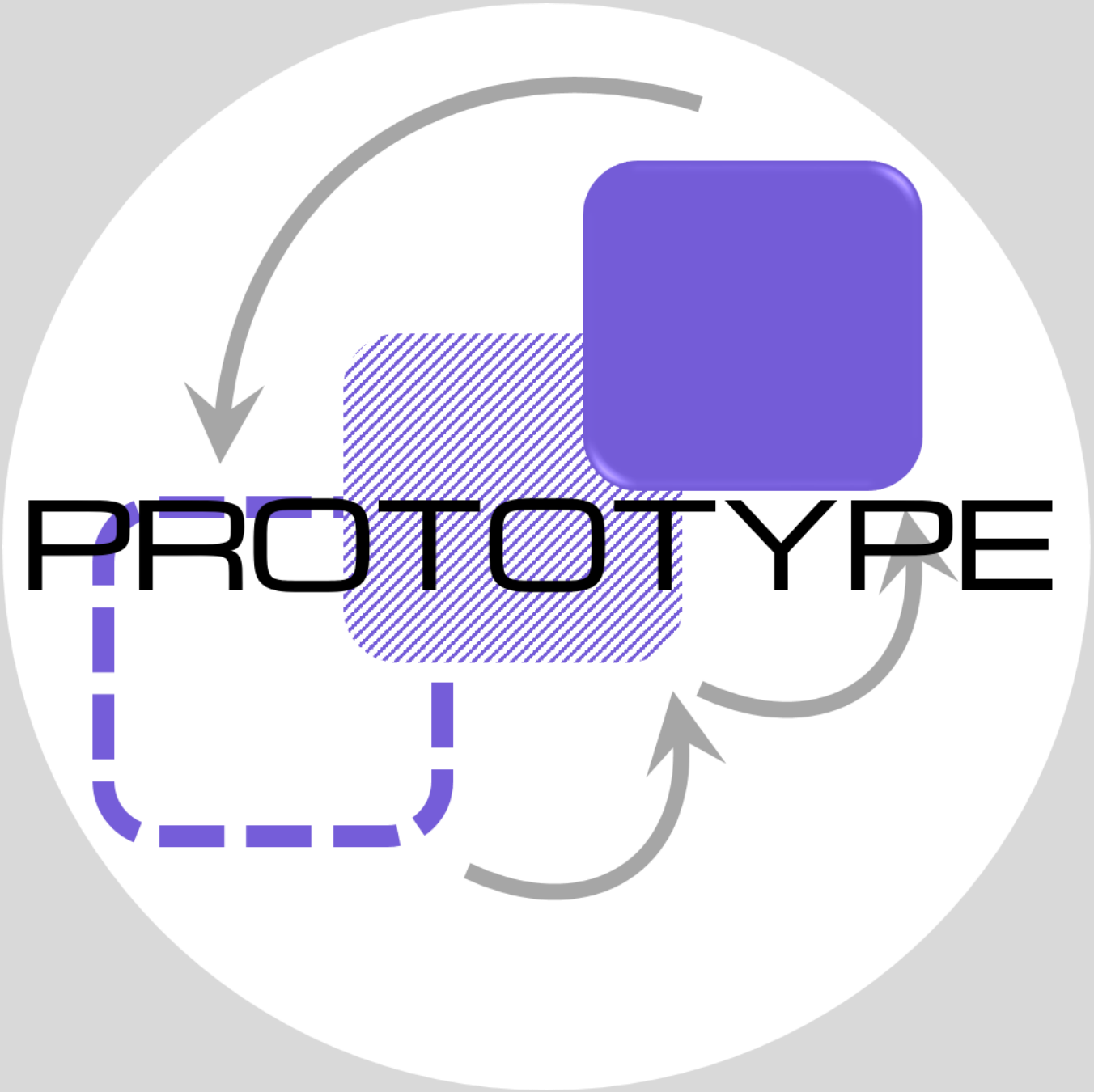
Converge on a single solution as a group. Draw and use text to fully describe your solution.

Research Guide Table of Contents

1. Purpose
    a. Mentality of research
        i. Not everything is perfect
        ii. Observe the world
        iii. Write everything down
2. Finding your interests
    a. Research areas
    b. Value assessments
    c. Getting short-term opportunities
    d. Setting up experiences
3. Types of Lab Experiences
    a. Wetlabs
        i. Biological
        ii. Chemical
        iii. Animal
        iv. Clinical
    b. Drylabs
        i. Computational
        ii. Theoretical
        iii. Design
4. Getting Research Experiences
    a. How to join a lab
    b. Communicating with mentor
    c. Choosing the right mentor
    d. Finding the right lab culture and where you fit in
    e. How to leave a lab
5. Relationships
    a. PI / mentor
    b. Peers
    c. Mentees
6. Lab Safety
    a. RCR
    b. Ethics
7. Soft skills
8. Technical skills
    a. Statistics
    b. Data interpretation
    c. Analysis software
    d. Literature search
    e. Reference managers
    f. Experimental design
    g. Hypothesis generation
    h. Setting research goals
    i. Critical thinking
9. Scientific communication
    a. Building a narrative

Drawing

Team Solution


PROTOTYPE

Prototype

Build something

Mockup | A mockup is a simple barebones version of your solution. This could be a drawing , a PowerPoint walkthrough of an app, or anything that quickly gets your most important ideas across.

Box Diagram | A box diagram can help break down multi-system or multi-step solutions into separate parts.

Very Basic Prototype | A physical, tangible, rendering of your idea. This can be made with simple materials like cardboard and duct-tape or a wireframe template.

Minimal Viable Prototype | This is the prototype that achieves all the functionality you want without any streamlining. Demonstrates your idea in action.

C.A.P.E.R.S | Look at your project from a new perspective by modifying the pieces of it in various ways.

List Issues and Solutions | Your prototype isn't going to work perfectly. Identify some problems and list potential ways to solve them.

Iteration and Feedback | Now that you have generated 1 version of your idea, try and build on it. Go from Version 1.0 to V. 6.0.

Preliminary Experiment | Generate some preliminary data and put your methods to the test. Are your results in line with your expectations?

Simplified Experiment Set | Show a proof of concept of your project

Demonstration | Give a demonstration of your prototype in action to some users, experts, and people who can generate feedback.

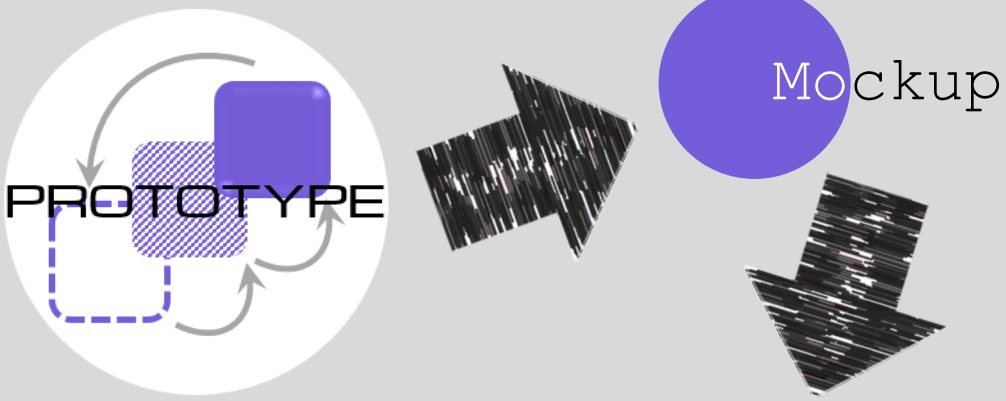
Video | Sometimes you just need to get your idea on film. Think about what you want your audience to take away from the film.

Describe User Experience | Detail what your users will experience as they use your solution. See how these align with their roles.

MVP Production | Detail what your users will experience as they use your solution. See how these align with their roles.

Activity Selection

Use the menu of activities to complete the chart below. Select the 3 activities that you plan to do for the Prototype Phase and set a target date to complete each activity.



		Target Completion Date
Activity 1		
Activity 2		
Activity 3		

MVP Production

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Mockup

Estimated Time | 4 hours

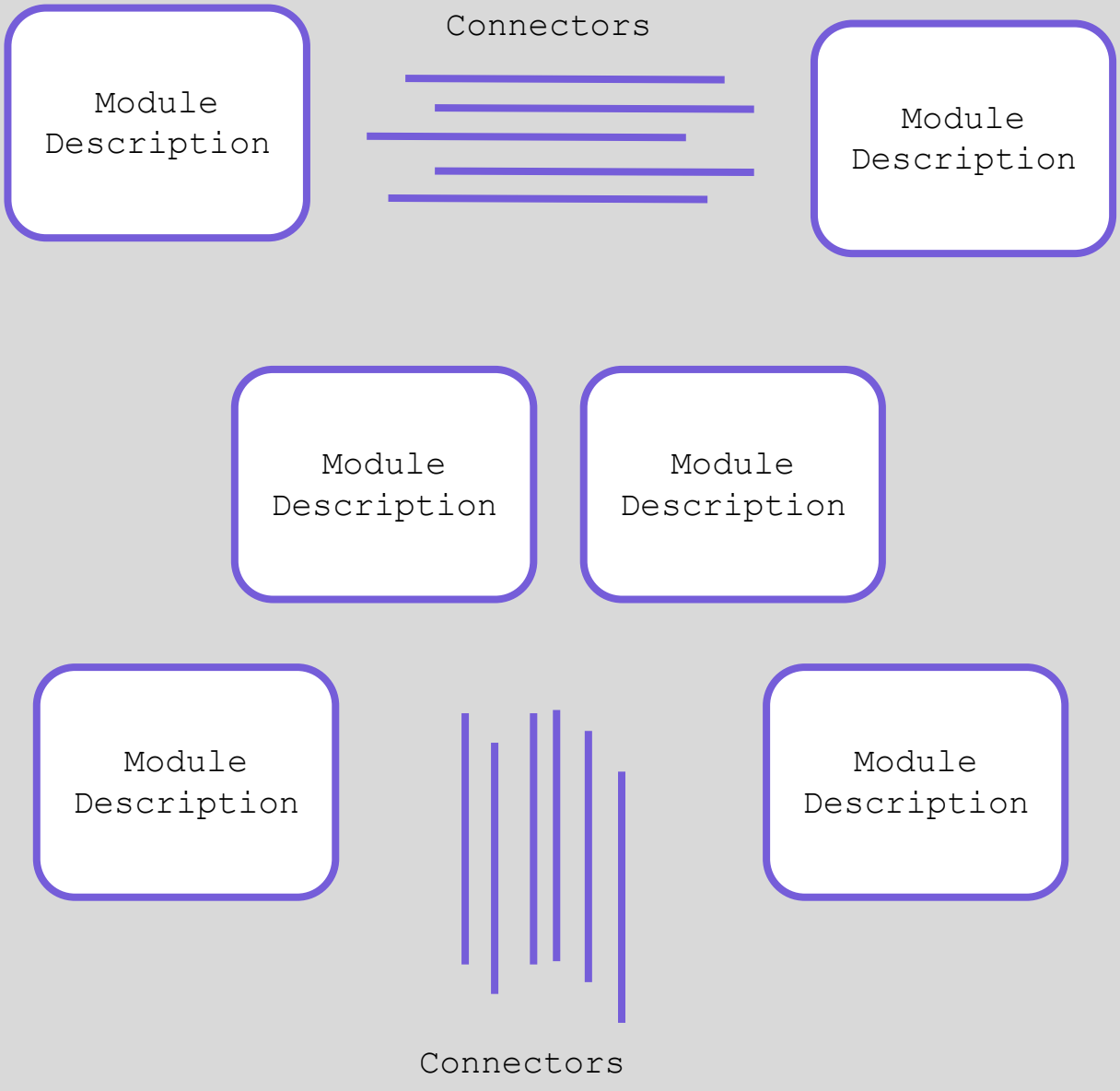
Draw a schematic of your design. You can use a CAD program or draw by hand with a ruler. Include the dimensions, materials, and label any moving parts. Draw several views so that another person could replicate your design entirely.

Drawing

Box Diagram

Estimated Time | 4 hours

Break your design into modules and put each module into a box. Connect the boxes together to represent how each of the modules interact. Drag and reshape the boxes and lines around to form the simplest connection chart. Think about connections or modules that would improve or simplify your design.



Very Basic Prototype

Estimated Time | 1 week

Create a barebones version of your prototype. Use whatever materials you can readily get your hands on. Cardboard, paper, pencils, Microsoft PowerPoint, etc.

Don’t worry about demonstrating that it works, just get some ideas together so you can share them and get feedback.

Helpful if you want to get a “feel” for how something might look and work before creating the full prototype.

Picture

C.A.P.E.R.S

Estimated Time | 1 hour

Make changes to your prototype to explore new possibilities. Follow the instructions in each box individually, then share what you come up with as a group. Implement ideas.

Combine a new feature with your design

Adjust a design feature

Put your design to use in another situation

Eliminate a feature

Rearrange parts of your design

Substitute a part of your design with a new feature (e.g. change the materials)

List Issues and Solutions

Estimated Time | 1 hour

Individually list out the problems that your group is facing. Combine the lists as a group and rank the issues as a team

Generate Potential Solutions

Determine how many issues are imperative to solve and generate several solutions for each.

Try out your solutions!

1		6	
2		7	
3		8	
4		9	
5		10	

Design Drawing

Iteration and Feedback

Estimated Time | 3 -4 days

Take your current version of your prototype and make a single change. List your expected outcome, test and record the actual outcome, and use the results to inform your next change. Complete at least 4 iterations.

Change	Expected Outcome	Actual Outcome	Next Change

Preliminary Experiment

Estimated Time | 1 - 2 week(s)

Develop and conduct an experiment to show proof of concept for your idea. Take copious notes about what you did.

Science Question/ Hypothesis

Methods and Procedures

Results and Interpretation

Next Steps

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Demonstration

Estimated Time | 1 - 2 week(s)

Write a script that showcases every feature of your design. Practice giving the demonstration with your teammates, then give it to users or experts and ask for feedback. Implement what they tell you to improve your design.

1

2

3

4

Script

User/Expert	Feedback

Video

Estimated Time | 4 hours

Create a three minute video that showcases all the features of our prototype. Spend 30 seconds on the problem statement and why your project is important, two minutes on the progress that you have made in the development of your prototype, and the last 30 seconds on what your next steps are.

Video

Describe User Experience

Estimated Time | 1 hour

Describe each step that a user takes to interact with your design and list what information they get out of each step. Rearrange the steps until you are satisfied with the flow

Step Description	Information Obtained

*Duplicate this sheet for additional steps.

Flex Activity

Estimated Time | XXXX

Create an activity for VIX. Write the instructions here, come up with a good title, and estimate the amount of time it will take. You can take images, boxes, or tables from any of the other activates. Complete the activity.

Placeholder

MVP Production

Estimated Time | 1 week

Build out your prototype with the minimal set of features to satisfy early use of your invention. You can create this as a single prototype or separate elements of Form, Function, and User Experience.

Form

What does the product look and feel like?
Physical and/or digital representation

FXN

What does the product do?
Show how it meets your design requirements

UX

How does the user interact with the product?
Outline of Instruction manual

Prototype Images

MVP


VALIDATE

Validate

Put your ideas to the test

User Testing | Give your solution to users and see what they say!

Stakeholder Validation | Set up some meetings with stakeholders and see what they say. Try to evaluate their honest opinions and see how you can build off their suggestions.

Feature Testing | Evaluate how well your solution works, how long it works, under what conditions it performs best.

Business Plan | Generate a business plan to bring your idea to a greater audience. Evaluate how your idea might create a sustainable business.

Technical Feasibility | Explore the technical limitations of your solution.

Cost Function & Optimize | Your prototype isn't ready to ship just yet. Try to optimize the performance, materials, and cost by substituting materials.

Replication | You can't just work with a single result. Replicate your findings and expand your number of samples to gain significance.

Statistical Analysis | Perform some statistical tests to see what you can learn from your data.

Test Outside of Training | You can train for a set of problems, but real testing is done in the field. Trial your ideas in a real-world scenario.

Survey | Create a survey of your users to get a sense of what they think.

Compare Alt Approach | Head to Head Matchup! See how your solution really stacks up against the competition.

Layer Themes | Provide vertical consistency in your project to make the themes more apparent

Validated MVP | Evaluate how well your solution works, how long it works, under what conditions it performs best.

Activity Selection

Use the menu of activities to complete the chart below. Select the 3 activities that you plan to do for the Validate Phase and set a target date to complete each activity.

User Testing

		Target Completion Date
Activity 1		
Activity 2		
Activity 3		

MVP Characterization

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User Testing

Estimated Time | 6 hours

Determine which features that you would like feedback for. Find four users to test your design and specifically ask for feedback. Include any general feedback from each user. Write out the steps that you will take to implement the feedback.

User	Feature Feedback	Feature Feedback	General Feedback

Next Steps

Stakeholder Validation

Estimated Time | 8 hours

Take your designs to key stakeholders and receive feedback. Find what they like and more importantly, what they want to change. Write out the steps that you will take to implement the feedback.

Stakeholder	Feature Feedback	Feature Feedback	General Feedback

Next Steps

Feature Testing

Estimated Time | 1-4 hours

Take your design requirements and features to the test bed. How can you assess these features and what is the result of those tests? Think of it as building out your solution's spec sheet. Some of this might be hypothetical at this point.

Feature	Evaluation Method	Evaluation Result	Notes

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***Duplicate this sheet for additional features.**

Business Plan

Estimated Time | 4 -5 days

Developing a business plan is a great way to take your idea to the next level. The goal is to evaluate where your idea might fit into the world at large. Is this going to be a product you sell through Amazon or a service you provide as a nonprofit? There are many opportunities and types of businesses out there, see what you can come up with! Great resources on how to fill this out can be found through this link to the business model canvas.
https://strategyzer.com/canvas/business-model-canvas

The Business Model Canvas

<table>
<tr>
<td rowspan="2">Key Partners
Companies and agencies you need to get on your side</td>
<td>Key Activities
you need to do to keep your business going</td>
<td rowspan="2">Value Propositions -
What you offer to your customers</td>
<td>Customer Relationships
What do you need to do to build relationships with customers?</td>
<td rowspan="2">Customer Segments -
The types of customers who would want to use your product</td>
</tr>
<tr>
<td>Key Resources
Most important things you need for your business i.e. materials or shipping.</td>
<td>Channels
The ways you get your product and how you get it out to customers.</td>
</tr>
<tr>
<td colspan="3">Cost Structure
What does your product cost you?</td>
<td colspan="2">Revenue Stream
Where you plan to generate your money from, both by selling things, and by getting money to startup.</td>
</tr>
</table>

Technical Feasibility

Estimated Time | 3 hours

Break your design down into pieces. For each piece, find an instance of that piece currently in existence and discover how it is accomplished. Write down that path that you need to take to make each piece and estimate the time it will take. Avoid anything to time consuming or technically difficult.

Piece of Design	Current Instance	Path and Time to Creation

Cost Function & Optimize

Estimated Time | 2-3 hours

You are so close to selling! But you want to be sure you put the best solution out their at the best price. To do this, you need to assess your performance and cost to make and sell your solution. Optimizing these two parameters together can help you create a solution that matches a price point.

1 **Cost**

2 **Price**

3 **Subtract line 1 from line 2**

4 **Reduced Cost**

5 **Assess Performance**

6 **Performance vs Price**

7 **Optimize Performance vs Price**

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Replication

Estimated Time | Experiment x 3

In order to be certain that a result is correct, the experiment must be repeated multiple times. Record the setup parameters (temperature, flow rate, etc.) detector settings (gain, exposure, etc.) and the results for three different experimental runs. Compare the results.

Parameters	Detector Settings	Results

Statistical Analysis

Estimated Time | 6 hours

Perform the correct statistical analysis on your results. For each data set, record the distribution and sample size, test and significance level, the null hypothesis, and generate a confidence interval. Be sure to choose the correct test for the distribution that you have and interpret using strict statistics definitions.

Data set				
Distribution and Sample Number				
Test Statistic and Significance Level				
H_0				
Confidence Interval				

Test Outside of Training

Estimated Time | 6 hours

Define the parameters that were used to design and test your product (temperature, terrain, operating system, etc.). List parameters that you did not design your product to handle. Test in those parameters and record the results. List the issues that arise and potential solutions. Implement them.

Design Parameters				
New Parameters				
Results				
Issues				
Potential Solutions				

Survey

Estimated Time | 1 week

Create questions that users can answer to help you improve your project. Find at least 3 people to interact with your project and answer the survey. Analyze the results and implement suggestions.

Question	Answer 1	Answer 2	Answer 3

Compare Alternative Approaches

Estimated Time | 3 hours

You made a cool solution, but how does it compare to something similar that's on the market. Get that other solution in your hands (literally or figuratively) and compare with yours.

Comparison Factor	Your Solution	Competitor Solution

Layer Themes

Estimated Time | 3 hours

The goal of this exercise is to make the themes of your design consistent across all of its scales. Colors, materials, concepts, and styles should be thematic no matter how you interact with your design. Break your design into layers and list the attributes and their interactions for each. Make them consistent. Example: if your webpage has the links on the left for one page, have them on the left for all pages.

Object	Attribute	Corrections Needed

Flex Activity

Estimated Time | XXXX

Create an activity for VIX. Write the instructions here, come up with a good title, and estimate the amount of time it will take. You can take images, boxes, or tables from any of the other activates. Complete the activity.

Placeholder

MVP Validation - 1

Estimated Time | 1 hour

Summarize all of your validation efforts. Include updated Form and FXN images with callouts to describe key features, as well as an updated UX description. List your final design requirements and the features and functions that enable those to come to life.

Form

Updated Form Images

Validated MVP

MVP Validation - 2

Estimated Time | 1 hour

Summarize all of your validation efforts. Include updated Form and FXN images with callouts to describe key features, as well as an updated UX description. List your final design requirements and the features and functions that enable those to come to life.

FXN

Updated FXN Images

Validated MVP

MVP Validation - 3

Estimated Time | 1 hour

Summarize all of your validation efforts. Include updated Form and FXN images with callouts to describe key features, as well as an updated UX description. List your final design requirements and the features and functions that enable those to come to life.

UX

Updated UX Description

Validated MVP

MVP Validation - 4

Estimated Time | 1 hour

Summarize all of your validation efforts. Include updated Form and FXN images with callouts to describe key features, as well as an updated UX description. List your final design requirements and the features and functions that enable those to come to life.

Final Design Requirements	Feature/Function

Validated MVP

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*Duplicate this sheet for additional design requirements.