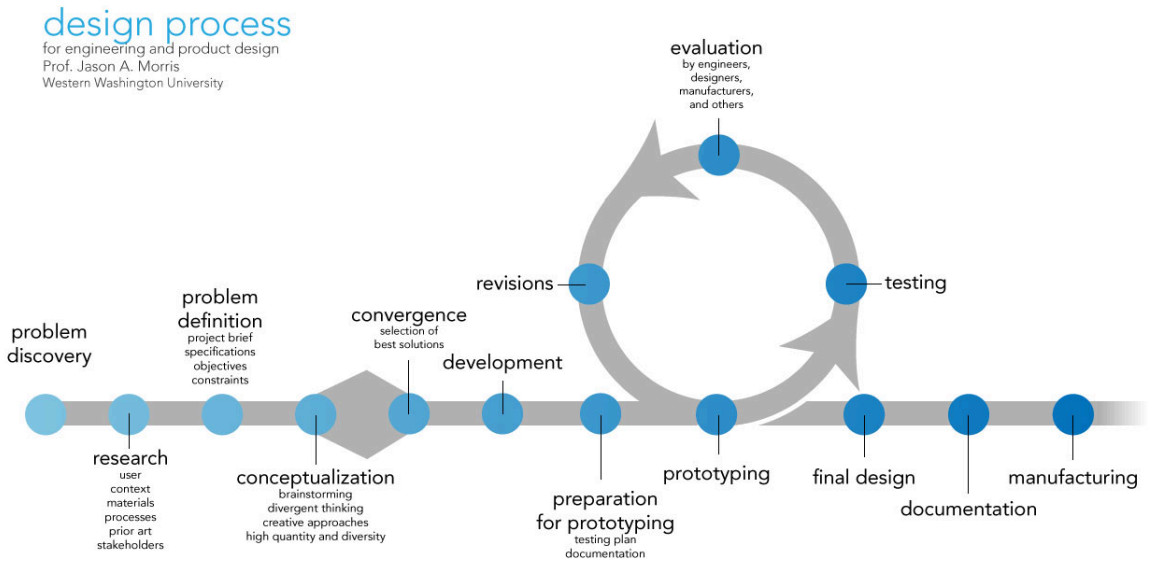
ENGR 101 Design Process Adaptive Utensil Design Challenge

NAMES: _____

Introduction: This activity is designed to help you better understand the steps of the design process. Pay close attention to each step in the process and ***don't skip ahead***. We will be using a slightly modified version of the below design process.



Problem Discovery:
THE DESIGN CHALLENGE

Challenge: Create a prototype of an adaptive eating utensil(s) that can be used by individuals with limited hand dexterity. The device(s) must be handheld and not exceed 12" in any dimension. It must not pose a safety hazard or risk to users. You have class time to design, build, and test your prototype. You will be limited to 1 class period to build your prototype. Testing will be completed in the following class session. You can not work on your prototype after the build day. You can make multiple utensils.

Materials Provided: Popsicle sticks, pipe cleaners, foam sheets, fabric (various thickness & sizes), Velcro strips, rubber bands, thin plastic sheets, moldable thermoplastic beads, string.

Tools Provided: Scissors, glue guns, craft knives, pliers, tin snips, wire cutters, heat gun, markers, tape measure, ruler.

Testing: The adaptive eating utensils will undergo a comprehensive testing phase to evaluate their performance and durability. *Refer to the testing procedure for more information.*

1. Durability Test: Each utensil will be subjected to a drop test to assess its robustness.
2. Dexterity Challenge: Using a variety of simulated food items, students will test their utensils using oven mitts and non-dominant hand to simulate limited hand mobility.
3. Performance Evaluation: Utensils will be rated on grip, control, comfort, and overall effectiveness.

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Day 1: Design

STEP 1: PROBLEM DEFINITION (10 minutes)
Summarize the main goal of the design problem in your own words. This involves a problem statement, a project brief, constraints, and objectives.

Step 1a: Problem Statement:
Summarize the overall problem this design project is working to solve in a global context (the big picture). Key questions you should answer: What problem are we solving? What potential benefit will it have? Who are the key stakeholders? *Typically, you want to use complete sentences but this exercise, bullet points are fine.*

Step 1b: Project Brief:
Summarize the overall goals of this design project (think locally; within the class structure). This should answer the questions: What are you designing, what are the overall goals of the project work, who is doing the work, where is the work being done, what is the approximate timeline. *Hint: you are designing a prototype device, you are working on a team in an ENGR 101 class, you'll be working in the makerspace and ET 155, you have one class day to design & build.*

Incorporate Inclusive Mindset: "What assumptions might we be making about how people use utensils?"

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Step 1c: Design Constraints:

List the specific ***constraints*** placed on your design. These are limits on materials and any other limits that arise as a result of the context of the design problem.

Constraint	Description
Materials	
Tools Available	
Size	
Safety	
Time	

Step 1d: Design Objectives:

Identify specific ***design objectives*** that your design should exhibit in order to be successful. There are two types of objectives, those determined by the design challenge (usually related to the testing. Labeled with a "T") and those defined by the project team (things the team decides are important, labeled with a "P"). Usually, the team will develop these based on a combination of the project goals and their personal goals. For this exercise, I have provided them.

Design Objective	Description
Durability (T)	
Functionality (T)	*(Relate this to the food simulation test – think about what it will need to do. Ex: scoop)*
Grip (T)	
Control (T)	
Comfort (T)	
Aesthetics (P)	*(looks, form)*
Innovative (P)	*(unique, creative solution)*
	(add one of your own – refer to design considerations in background information)

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STEP 2: INFORMATION GATHERING & RESEARCH (5 minutes)
Research existing designs and determine what knowledge would be useful to solve the problem (ex: scientific principles, materials information, etc.). Since we have limited time for this exercise, I will provide some background information. You can also use AI *(Suggested Prompt: Summarize key elements of existing adaptive utensil designs that address dexterity limitations. Provide an overview of current solutions in the market).*

What are some conditions that may impact utensil use?

What are some of the challenges for people with limited dexterity:

List some key design considerations (things you need to consider when designing a new utensil):

What are some current solutions to this problem:

STEP 3: CONCEPTUALIZATION

Step 3a: Brainstorming (10 minutes)

Brainstorming the first step in your conceptualization process (the second step is coming up with specific design ideas).

Brainstorming is….	**Brainstorming is NOT….**
Generation of many ideas Free of judgement Relaxed & informal	Coming up with detailed solutions A time to eliminate ideas

Brainstorm with your team. Record all ideas.

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Step 3b: Consolidate Ideas (10 minutes)
Come up with at least ***TWO*** designs that you could build to meet this design challenge. For each design, draw a basic sketch and write a brief summary of what it is (key features), how it works, and how it meets ***EACH*** performance objective that you identified for Step 3. Also verify that each design does not violate any of the constraints you identified.
Incorporate the Inclusive Mindset:

- How can we ensure our design doesn't stigmatize the user or draw unwanted attention?
- In what ways could our design benefit users beyond those with dexterity limitations?

Concept 1 Sketch and Description:

Does this design meet all design constraints?_____

Concept 2 Sketch and Description:

Does this design meet all design constraints?_____

STEP 4: CONVERGENCE
Choose one of the ideas from the previous step that you will build and test. Use the space below to briefly justify your choice. How did you incorporate the inclusive mindset?

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DAY 2: Build

STEP 5: DEVELOPMENT

Development is where you refine your design, create technical drawings, and determine the materials/tools you will need to fabricate your design. ***We won't be doing this for this assignment due to time constraints and simplicity of the project.***

STEP 6: PROTOTYPING (Build – Test – Evaluation – Revision)

Incorporate the Inclusive Mindset:

- Who might be excluded by our current design choices?
- How does our design respect the dignity and independence of the user?

Step 6a: Build*:*

- Construct your prototype!
- A model test station will be available during the building phase so you can test your devices as you go.
- Each time you test, you are engaging in the **test – evaluate – revise** portion of the design process.
- Keep some notes as you go so you can reflect on your process.

DAY 3: Test

Step 6b: Test

We will test our devices according to the below plan. Refer to the "Test Data & Design Review" worksheet for test details

Durability Test

Test Procedure:

1. Drop your utensil from table height (approximately 30 inches) onto a hard floor.
2. Repeat the drop three times.
3. Examine your utensil for any damage, breakage, or design flaws after each drop.
4. Record your observations.

Dexterity Test

Meal Kit Contents:

- Gummy worms (simulating cooked pasta)
- Kinetic sand (simulating mashed potatoes)
- Modeling clay (simulating soft vegetables & meats)

Test Conditions: Wear an oven mitt on your non-dominate hand

Test Procedure:

1. Transfer 2 gummy worms from one plate to another.
2. Scoop and transfer a cup of kinetic sand to an empty plate.
3. Cut a 2-inch piece of modeling clay into smaller pieces, then spear and transfer two pieces to another plate

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Develop an Inclusive Mindset!

Throughout the process, remember to:

- Challenge your assumptions

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- Consider diverse user experiences
- Think beyond functional requirements to emotional and social aspects
- Recognize the broader impact of inclusive design