Lesson 5.16: Plan and Prototype

Unit: Unit 5, Make It, Mend It, Wear It (Apparel and Textile Production and Design) **Topic:** 5.4 Upcycle Challenge project (day 2 of 6) **Grade:** 6 to 8 (written at grade 7; see Differentiation for the grade 6 support and grade 8 stretch) **Days:** 1 class period of 40 minutes (day 137) **Room:** FACS lab with the three work stations. Pins and scissors are out today, so the count-out and count-in routine runs.

Standards

- NYS module line: NYS ATPD 2. Production c) Demonstrate basic hand and machine sewing techniques by creating or repairing a textile product
- NYS module line: NYS ATPD 2. Production b) Demonstrate safe use and storage of equipment used in hand and machine sewing
- NYS module line: NYS ATPD 2. Production d) Develop sustainability practices for repurposing apparel items
- CTE theme line: CTE PSI 2. Design Process (Proactive) a) Implement a formal design process to solve a given problem by e. Selecting the best solution for evaluation; f. Developing and constructing a prototype or model of the selected design
- CTE theme line: CTE HSW 4. Classroom and Workplace Safety c) Apply safety practices when using tools, machines, and equipment
- NYS FACS Learning Standard 2 (Intermediate), Key Idea: Students will know the basic principles of home and community safety. They can demonstrate the skills necessary to maintain their homes and workplaces in a safe and comfortable condition. They can provide a safe and nurturing environment for themselves and others.; Performance Indicator: Students use age-appropriate techniques to select and maintain clothing.
- CDOS Standard 3a Universal Foundation Skills: Thinking Skills
- National FCS 3.0: 16.4.5 Show the basic skills for making, altering, repairing, and recycling textiles and apparel.
- National FCS 3.0: 16.3.3 Use the elements and principles of design when designing, making, or altering textiles and apparel.

Enduring understanding and essential question

Big idea: You cannot uncut fabric. Ten minutes of planning and one paper mock-up saves the whole project. **Essential question:** What is the one part of my item most likely to go wrong, and how do I find out before I cut?

Objectives

By the end of this lesson, students will be able to:

1. (Low) Label a plan sketch of their item with at least four measurements in inches, including the seam allowance.

2. (Mid) Construct a paper or scrap mock-up of the hardest part of their item and revise the plan based on what the mock-up showed.
3. (High) Evaluate a partner's plan against the four project constraints using the peer review checklist, and name one specific change with a reason.

Vocabulary

Tier 2 (general academic): prototype, mock-up, revise, sequence, evaluate Tier 3 (FACS): seam allowance, right side and wrong side of fabric, grain, casing (drawstring channel), order of work, mock-up, pinning. See Vocabulary 05.md for Turkish, Portuguese, and Spanish.

Materials and setup

- Every student's design brief from Lesson 5.15, returned at the door, sorted into "ready to plan" and "needs a one-minute conference"
- Every student's material: the scrap bin piece, the donation-drive piece, or the item from home with the signed note. A student with no signed note uses the bin, today, with no argument.
- Handout 05.16 - Plan Sheet and Peer Review.md, one per student
- Newspaper, scrap paper, or brown paper for mock-ups, about two sheets per student
- The two measuring tapes in each station kit (six in the room), plus three rulers per station, nine rulers total. The kit quantity is set in Lesson 5.5 and does not change for the build days
- Fabric-marking chalk or a sliver of soap, three per station. A pencil works on light woven fabric.
- Straight pins in the station kit, counted on the station count sheet (Handout 05.05 - Tool Kit Guide and Count Sheet.md); paper clips and binder clips as a pin alternative, at least ten per station
- Scissors: paper scissors for the mock-up, the one marked PAPER pair in each station kit plus two of the room's own classroom pairs per table, and the fabric shears for the approved cut, all six of them (two per station kit), pulled off the tables and kept at the teacher's table until a plan is signed
- Masking tape and a marker per station for labeling every piece with the student's name and station number
- One gallon bag or a labeled folder per student to store the plan, the mock-up, and the material between periods
- Slides: Slides 05.16 - Plan and Prototype
- Setup notes: put all six pairs of fabric shears at your own table. No fabric gets cut today until you initial the plan, which means every student has to talk to you once. That is the point of the design. Count the pins in each station kit before the bell and write the number in today's row on the station count sheet.

LSA

The count-out and count-in routine (say it every sewing day)

Pins are out today, so the six-step routine from Lesson 5.5 runs exactly as taught, on the station count sheet (Handout 05.05 - Tool Kit Guide and Count Sheet.md). A new Station Manager each sewing day.

1. The Station Manager opens the kit and counts out loud: needles, then pins, touching each one.
2. The Station Manager writes both numbers in today's row on the station count sheet.
3. The station works. Any needle or pin not in a hand is in the pin cushion or the kit. Never on the table, never in a mouth, never in a pocket, never in a chair.
4. At the five-minute warning everything stops and every needle and pin goes back in the cushion.
5. The Station Manager counts again, out loud, and writes the second number.
6. The numbers match and the teacher initials the row, or they do not match and nobody leaves that station until it is found. If it is not found, the station stands back and the teacher sweeps with the magnet.

A dropped pin is announced out loud and picked up immediately by the person who dropped it. Shears and snips travel closed and pointing down and are handed over handle first. Fabric shears cut fabric only; the paper scissors are for the mock-up.

Pre-assessment

The design briefs collected at the end of Lesson 5.15 are the pre-assessment. Three checks on each: a used starting material with a measurement, two of the taught joins named, and a named user. The "needs a one-minute conference" pile gets those sixty seconds during the do now. Also note which students chose a knit for a project that wants a woven; those are the mock-ups to visit first.

Do now and hook (Time: 4 min)

On the board: "Look at your material and your brief. Write the two measurements you have to get right, and what happens if you get one of them wrong by an inch."

Two minutes of writing while the count-out runs and while the teacher holds the one-minute conferences with the "needs a conference" pile.

Hook: hold up a piece of fabric cut two inches too short and a finished pencil case. "This one was going to be that. One measurement, one inch, and now it is a scrap again. Today nobody cuts fabric until I have initialed a plan."

Procedure

Step	Teacher will	Students will	Time
1. Direct instruction: the plan sheet and measure twice, cut	Slides 2 to 5. Model one plan on the board from start to	Fill the plan sheet: the sketch, four or more measurements	7 min

once	finish using the jeans-leg pencil case: sketch the piece flat, write the finished size, write the cut size, and show where the difference went (the seam allowance, half an inch on every edge you sew). Say the rule and make the class say it back: measure twice, cut once. Show the three marks on a plan: cut line (solid), fold line (dashed), stitch line (dotted). Name the order of work out loud for the model, mark, cut, pin, stitch, finish, and show why order matters (you cannot pin after you stitch).	in inches, the finished size and the cut size, the seam allowance, the three marks, and the numbered order of work.	
2. Build the mock-up of the tricky part	Slides 6 and 7. Name the tricky part for each of the ten idea paths (the drawstring channel on a bag, the flap and button placement on a pencil case, the corner where three seams meet on a pillow cover, the joined seams on a patchwork square, the closed end of a phone sleeve). Release the paper. Circulate with one	Cut paper to the plan's cut size and build the one tricky part at full size: fold the channel, place the flap, join two squares with a drawn stitch line, whatever the brief said would go wrong. Then hold it against the real material and check that it fits. Write on the plan sheet what the mock-up showed and the one change made.	12 min

	question per student: “Show me the part you were worried about.” Do not let anyone build the whole item in paper; the mock-up is the one hard part, at full size.		
3. Order of work, stitches, and teacher approval	Slides 8 and 9. Sit at the approval table. Each student brings the plan sheet, the mock-up, and the material. Check five things out loud with them: the material is a used textile, the two named stitches are two of the four taught, the cut size includes the seam allowance, the order of work is in a possible order, and the reduced-scope version is written. Initial and date the plan. Then, and only then, hand over fabric shears if they are ready to cut today, or hold the cut for Lesson 5.17. Keep a class list and tick who is approved.	Line up by station with the plan, mock-up, and material. Answer the five questions. Write the two stitches and the order of work in final form. Once initialed, mark the fabric with chalk (do not cut unless told).	8 min
4. Peer review	Slide 10. Pair students inside the station (a three-person group is fine). Read the five-line checklist out loud before they start. Enforce the	Trade plans. Fill the peer review checklist on the partner’s sheet. Say the two things and the one change out loud to the partner. Write on your own	6 min

	format: two specific things that will work, one specific change with a reason. Ban “it’s good” and “I like it.”	sheet the one change you are taking and the one you are not, each with a reason.	
Closure	Slide 11. Closure task below. Count-in runs inside this block.	Count in the pins and scissors. Write the closure line. Bag and label everything.	3 min

Day total: 4 (the do now) plus 7 plus 12 plus 8 plus 6 plus 3 = 40 minutes.

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Questions to ask

Monitor understanding:

- What is your cut size, and what is your finished size? Where did the difference go?
- Show me the part you were worried about. Did the paper version work?
- Which two stitches, and in what order?
- Does your fabric stretch when you pull it sideways? Does your plan care?

Deepen learning (why and how, tied to their lives):

- Why does a mock-up in paper tell you anything about fabric? What does it not tell you?
- Your partner suggested a change and you are not taking it. Say why in one sentence that would satisfy them.
- A tailor charges for alterations partly because a mistake costs them the garment. What does a mistake cost you here?
- Which step in your order of work is the one you cannot undo?

Check for understanding

The approval table in Step 3 is the check, and it is a real gate: every student talks to the teacher once, and nothing is cut without an initial. Keep the class list with five tick boxes per student (used material, two taught stitches, seam allowance included, order of work possible, reduced scope written). A student who fails a box gets the fix on the spot, in under a minute, and then the initial. A student who cannot be fixed in a minute is moved to a simpler Easy path from the menu with the same material, and that is noted on the plan sheet, not on the rubric.

Second check, during Step 2: hold up a hand count. “Hands up if your mock-up showed you something you did not expect.” In a class where nobody’s hand goes up, the mock-ups were too easy; send three students back to build the part they actually dread.

Closure (Time: 3 min)

The count-in runs first; nobody writes until all three pin counts match. Then one line on the plan sheet: “Tomorrow I start by ***. The part I am worried about is*** .” Two students read. Everything into the labeled bag: plan sheet, mock-up, material, and the design brief. Bags stack by station. Sort the plan sheets into “approved” and “approved with a simpler path” so Lesson 5.17 Day 1 starts with no line at the teacher’s table.

Differentiation and supports

- ELL: the plan sheet is mostly drawing and numbers, and a labeled drawing with measurements is the full-credit version; the three marks (cut, fold, stitch) are shown as three line types on the wall; the peer review checklist is five checkboxes with a picture cue and two sentence frames, "This will work because ***" and "One change:*** because ___"; the Turkish, Portuguese, and Spanish words for cut, fold, sew, measure, and inch are on the sheet’s word bank and in Vocabulary 05.md.
- IEP and 504 (general): a pre-measured and pre-marked material for any student whose plan says so, prepared by the teacher the day before from the same scrap bin; the mock-up may be built by the teacher alongside the student, hand over hand, as a demonstration rather than independent work; extended time, with the approval conversation moved to the start of Lesson 5.17; the order of work given as printed steps on cards to put in order instead of written from scratch; the peer review done with the teacher instead of a peer.
- Grade 6 support: the plan sheet comes with the sketch outline already drawn for the five Easy paths, so the student fills measurements onto a given shape. Two measurements required instead of four. The mock-up is one fold, done with the teacher’s model in view.
- Grade 8 stretch: draw the plan to scale on quarter-inch graph paper at 1 square = 1 inch (this reuses the Unit 4 scale drawing skill directly), compute the total fabric area used and the area wasted, and write one sentence on how to cut differently to waste less. A stretch student may also write the order of work as a numbered flowchart with a decision point ("if the channel is too narrow, then ___").
- UDL checkpoint used: multiple means of action and expression (a sketch, a full-size paper mock-up, and a spoken walkthrough at the approval table are three ways to show the same plan) and multiple means of representation (the rule stated, modeled on the board, and held in the hand as paper).
- No-machine alternative: the whole project is hand sewing; no machine is used today or on any project day. Reduced-dexterity alternative for today: binder clips and paper clips instead of straight pins, a pre-marked material, spring-loaded scissors or the teacher cutting on the student’s marked line while the student directs, and a hoop or clamp to hold the paper mock-up flat. None of these changes the rubric.

Assessment

Objective	Standards met	Learning task	Assessment (formative or summative; tool)

1. Label a plan sketch with four or more measurements including the seam allowance	ATPD 2. c); PSI 2. a) e.; National FCS 16.3.3	Plan sheet, Step 1	Formative; the approval table's five-box class list, box 3
2. Build a mock-up of the tricky part and revise the plan	PSI 2. a) f.; ATPD 2. c), 2. d); National FCS 16.4.5	Mock-up, Step 2	Formative; "what the mock-up showed and the one change made" line on the plan sheet, checked at the approval table
3. Evaluate a partner's plan against the constraints and name a change with a reason	PSI 2. a) b., c.; CDOS 3a Thinking Skills; HSW 4. c)	Peer review, Step 4	Formative; the peer review checklist on the partner's sheet, scored complete, partial, or missing for daily work

The approved plan is deliverable 2 of Project 05 - Upcycle Challenge.md and is scored on Rubric 05 criterion 1 together with the design brief.

Homework

None. If your permission note is not signed yet, bring it tomorrow or use the scrap bin.

Connections

Math: measurement in inches and fractions of an inch, perimeter, and the grade 8 stretch's area-and-waste calculation. The scale drawing on graph paper is the Unit 4 floor plan skill used again, and saying that out loud is the transfer. Technology education: prototyping before production is the same step the technology teacher calls a model. Community: a tailor or an alterations shop would answer one question on video in two minutes, "How much fabric do you leave for a seam, and what happens if you leave too little?" *[Sal: the dry cleaner near the school probably has an alterations tailor on site.]*

Sources

- NYS Middle Level CTE FACS Content Module 03, Apparel and Textile Production and Design (nyctecenter.org, June 2018), lines 2. b), 2. c), 2. d). Copy in 02 Standards/NYS Module PDFs/.
- NYS Middle Level CTE Theme Modules: Problem Solving and Innovation 2. a) e. and f.; Health, Safety, and Wellness 4. c). Same folder.
- NYS Learning Standards for Health, Physical Education, and Family and Consumer Sciences (1996), Standard 2, Intermediate, FACS strand. Wording per 02 Standards/STANDARDS SOURCES - web research.md, section 2. *[Sal: confirm against the NYSED PDF.]*

- National Standards for Family and Consumer Sciences Education 3.0 (LEAD FCS Education, 2018), competencies 16.3.3 and 16.4.5, per 02 Standards/STANDARDS SOURCES - web research.md, section 4.16.
- The count-out and count-in routine and the four taught hand stitches and the machine seam come from Topic 5.2 of this unit (Lessons 5.5 to 5.10).

Teacher notes

- The approval gate is the single most important design decision in this project. Fabric shears stay at your table. Every student has a sixty-second conversation with you before they cut, and that conversation catches almost every failure the project can have.
- If the period runs short, cut the peer review to two minutes and one line ("one change, with a reason"). Never cut the mock-up or the approval.
- Common mistake: the cut size equals the finished size, with no seam allowance. It is the number one reason an item comes out too small. Ask every student for both numbers at the table.
- Second common mistake: a student plans to sew the closure on before they sew the body, and then cannot reach inside. Walk the order of work with your finger on the mock-up.
- Third common mistake: cutting a knit t-shirt for a project that needs a woven, then wondering why the edge curls. Fix it in Step 2 by having them pull the fabric sideways.
- Keep the mock-ups. They go in the bag and come out in Lesson 5.18 as part of the display; a before-and-after with a paper mock-up next to a finished item is the most convincing thing on the table at the gallery.
- *[Sal: your airplane-crash simulation worked because students had to defend a decision under a constraint. The approval table is the same move, quietly. Ask the five questions the same way every time and students start pre-answering them.]*
- Budget note for the unit plan: mock-up paper is free (newspaper, the recycling bin, or brown grocery bags). Chalk or soap slivers are free. Add fabric-marking chalk if you want it, about $3 for a pack of three *[update]. Binder clips, a box of 12 for about $2 [update],* are the reduced-dexterity alternative to pins and are worth having.