

#### **STEM Clothing and Textiles Project Activities Lesson Plans**

Template based on identified **21<sup>st</sup> Century Skills and** 4-H Tennessee's Innovative Programming Priorities and adapted from FCS/STEM Template, Created by Lisa (Knight) Costa, FCS STEMFusion, 2015

Name of Activity: STEM Activity 1 - Learning about Fabrics: Fabric Weave and Knit Structures						
<b>General Description</b> : Participants will learn the difference in woven and knit fabric as well as learn specific weave and knit structures. <u>Hands-on</u> activities:						
<ol> <li>Group stretch comparing woven to knit fabric;</li> <li>Measuring the stretch of woven and knit fabric</li> <li>Inspecting fabrics with magnifying glasses identifying weave and knit structures</li> </ol>						
Performance Objectives (Outcome	1	Know Differen		wayan and knit fabric, cnoc	;fie	
(What will all students KNOW and	es bor	bla to DO	Know: Difference	te in	woven and knit fabric; spec	.iiic
as a result of this activity?)	Ded		characteristics	L SUL		
as a result of this activity: j			<b>Do:</b> Examine clo	thin	g and fabric and identify bo	
			the fabric is may	de fo	g and labile and identity no	vv n
Skills that student	<b>S</b> W	Il practice in	this activity* C		all that anniv	511.
Accessing and Analyzing		Innovation	and Creativity		Team work and	x
information		innovation			collaboration	^
Use Curiosity and Imagination	x	Critical Thi	nking and	x	Make appropriate use of	
		Problem Se	nking and	<sup>^</sup>	equipment tools	
		(identify/c	larify/define a		technology	
		problem o	r situation)			
Effective oral and Written	x	Compare a	and select the	Make the needed effort		
Communication (Communicate		best altern	ative for a		to carry out a task or a	
effectively)		given prob	lem.		plan.	
* Selected 21 <sup>st</sup> Century Skills and	TIPF	S - Tenness	ee's Innovative Pi	rogra	amming Priorities	
Definition			Connection wit	th Ac	<b>tivity</b> (What will participant	t
Demition			learn in this STEM area?)			
SCIENCE: Study of the natural world,	incl	uding the	Participants will examine various weave and knit			
laws of nature associated with physics	s, ch	emistry,	structures to determine how fabric is made.			
and biology and the treatment or app	licat	ion of facts,	They will discover the science behind why knit			
these disciplines	SSOC	lated with	fabric stretches through the group stretch activity.			
TECHNOLOGY: Comprises the entire	cyct	em of				
people and organizations, knowledge	. pro	cesses, and				
devices that go into creating and oper	atin	g				
technological artifacts, as well as the	artifa	acts				
themselves.						
ENGINEERING: Body of knowledge a	bou	t the design				
and creation of human-made product	s an	d a process				
for solving problems. This process is d	esig	n under				
constraint. One constraint in engineer	ing	design is				
the laws of nature, or science, and the	ie, n	ioney,				
available materials, ergonomics, envir	onm	ability				
MATHEMATICS: Study of natterns a	nd r	plationshins	Particinants will	lear	n to measure the stretch of	
among quantities, numbers, and shan	es	- actoristinps	fahric and use a	forr	nula to determine % stretch	
anion's quantities, numbers, and shap			Tabric and use a formula to determine % stretch.			

STEM Activity Lesson Plan STEM A	STEM Activity Lesson Plan STEM Activity 1 Cont.			
Assessment: (How will you know if the objectiv met?)	ves have been	Participants will have successfully identified fabric structures through ID exercise; They will have analyzed the difference in woven and knit through the measuring exercise.		
Reflection and Application: <u>Technique(s) you will use</u> to have participants reflect on: -what they have learned, -process involved and -how they can apply what they learned to other activities/projects or career possibilities Resources Needed:		Leader will ask questions (included in activity sheets) after each hands-on activity.		
Technology (computer):	None needed			
Space/location and room set up:	Room with tak Ideal to have o	ples and chairs for participants to sit around. Dutside space for "Let's Stretch It" group activity.		
Materials: (Mobile Learning Kit containing materials needed for activities is available through Regional UT Extension Offices to check out for use. Contact your 4-H agent for more information.)	<ol> <li>2 pieces of fabric (1 woven, 1 knit) 5 yds each sewn together</li> <li>Copies of Activity and activity handouts</li> <li>Fabric samples of various weaves and knits to use when teaching weaves and knit structures</li> <li>Fabric weave and knit structures for identification</li> <li>Tape measure and 2 pieces of fabric to measure (1 knit, 1 woven)</li> <li>Magnifying glasses for weave and knit identification</li> <li>Pencils</li> </ol>			
Volunteers:	Need at least 2 activities. Idea	2 leaders to teach concepts and assist with group al size of group – 10 participants.		

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**Name of Activity**: STEM Activity 2 – How Clothes Get their Color (Identify the dyeing process for various fabric types)

**General Description**: Participants will learn basic fabric dyeing processes including at what stage of the fiber to fabric process dye can be added. They will also be introduced to how patterns are made on fabric with specific details on Tie Dyeing Techniques.

Hands-on Activities: 1. Identifying fabric and yarns as fiber, yarn, or fabric dyed

- 2. Examining samples of fabrics dyed using tea and blackberries
- 3. Examining various samples of tie dyeing

4. Tie Dyeing activity							
Performance Objectives/Outcomes			Know: Participants will know how fabric and				
(What will all students KNOW and	be a	able to DO	clothing is dyed and techniques to dye their own				
as a result of this activity?)			fabric through	tie d	ye.		
			Do: Examine fa	bric	and clothing to determine of	dye	
			process. Creat	e th	eir own fabric surface desigi	n 1	
			through tie dye	e.	0		
Skills that student	s wi	II practice in	this activity* Cl	HECK	all that apply:		
Accessing and Analyzing	Х	Innovation	and Creativity	Х	Team work and		
information					collaboration		
Use Curiosity and Imagination	Х	Critical Thin	iking and	Х	Make appropriate use of		
		Problem So	lving		equipment, tools,		
		(identify/cla	arify/define a		technology		
		problem or	situation)				
Effective oral and Written		Compare ar	nd select the	Х	Make the needed effort		
Communication (Communicate		best alterna	ative for a		to carry out a task or a		
effectively)		given proble	em.		plan.		
*Selected 21 <sup>st</sup> Century Skills and T	*Selected 21 <sup>st</sup> Century Skills and TIPPS - Tennessee			's Innovative Programming Priorities			
Definition			Connection with Activity (What will participant				
			learn in this ST	EM a	area?)		
SCIENCE: Study of the natural world,	incl	uding the	Participants will learn the chemistry behind how				
laws of nature associated with physics	s, ch	emistry, and	fibers, yarns, and fabric absorb dyes.				
biology and the treatment or applicat	ion c	of facts,					
principles, concepts, or conventions a	ssoc	iated with					
these disciplines.							
<b>TECHNOLOGY:</b> Comprises the entire	syst	em of	Participants will learn equipment used for various				
people and organizations, knowledge,	, pro	cesses, and	types of dyeing techniques				
devices that go into creating and oper		g					
themselves							
ENGINEERING: Body of knowledge a	hou	t the design					
and creation of human-made product	s an	d a process					
for solving problems. This process is d	esig	n under					
constraint. One constraint in engineer	ing	design is the					
laws of nature, or science, and time, r	none	ey, available					
materials, ergonomics, environmenta	l reg	ulations,					
manufacturability, and repairability.							
MATHEMATICS: Study of patterns a	nd re	elationships					
among quantities, numbers, and shap	es.						

STEM Activity Lesson Plan STEM A	ctivity 2 Cont.					
Assessment:		Completion of dye identification activity.				
(How will you know if the objectiv	es have been	Completion of tie dye project.				
met?)						
Reflection and Application:		Questions will be asked after participants have				
Technique(s) you will use to have	participants	completed the dye identification activity.				
reflect on:		After the participants have completed their tie				
-what they have learned		dye project, they will be asked how they can				
-process involved and		apply what they have learned in dyeing or				
-how they can apply what they lea	rned to other	creating a design for future projects.				
activities/projects or career possib	oilities					
Resources Needed:						
Technology (computer):	None needed					
Space/location and room set up:	Room with tab	les and chairs for participants to sit around.				
	For tie and dye	need sink available				
Materials: (Mobile Learning Kit	1. Samples	of various tie dye techniques				
containing samples of various	2. Activity s	heet				
tie-dye techniques, rubber	3. Supplies	for tie dyeing (rubber bands, rubber gloves,				
bands, rubber gloves and	marbles,	dye, tub, jug to mix dye, squirt bottles, bib aprons				
marbles is available through	to cover o	clothes, garbage bag, hangers for hanging and				
Regional UT Extension Offices to	drying fin	ished product)				
check out for use. Contact your	4. Participar	nts should bring t-shirt				
4-H agent for more information.)						
Volunteers:	At least 2 volur	nteers needed (Ideal group size = 5-10)				

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**Name of Activity**: STEM Activity 3 – Investigating Fabrics that Keep You Warm (Thermal Quality of Fabric)

**General Description**: Participants will learn about different fabrics that keep them warm including: wool, hollow fibers, weaves of fabric that are warmer, knits, fleece and quilted fabric. Hands-on Activities: Participants will test the thermal quality of 3 fabrics, fleece, jersey, and shirt fabric, through a body wrap exercise.

	Know: Participants will know the thermal quality					
(What will all students KNOW and be able to DO			of various fabrics.			
as a result of this activity?)			<u>Do</u> : Select clothing that has the best thermal			
			comfort based on the weather.			
practice in	this activity* CF	IECK	all that apply:			
Innovation a	and Creativity	Х	Team work and	Х		
			collaboration			
Critical Thin	king and	Х	Make appropriate use of	Х		
Problem So	lving		equipment, tools,			
(identify/cla	arify/define a		technology			
problem or	situation)					
Compare ar	nd select the	Х	Make the needed effort	Х		
best alterna	tive for a		to carry out a task or a			
given proble	em.		plan.			
Tennessee	's Innovative Pro	grar	nming Priorities			
	Connection with Activity (What will participant					
	learn in this STEM area?)					
ding the	Participants will learn the physics and chemistry					
mistry, and	behind why certain fabrics keep you warmer than					
facts,	others.					
principles, concepts, or conventions associated with						
these disciplines.						
m or						
esses, and						
٠ts						
the design	Participants wi	ll lea	rn how various industries			
a process	design products to keep you warmer.					
under						
esign is the						
, available						
lations,						
- + !  - !	Denticinenterri	ال ما م				
ationships	Participants wi	n ae	rise used in the meal when			
	periormance o	IIdu	ncs used in thermal wrap			
	activity.					
	practice in Innovation a Critical Thin Problem So (identify/cla problem or Compare ar best alterna given proble Tennessee ling the nistry, and facts, ted with m of esses, and ts che design a process under esign is the , available ationships	Know: Participationile to DOSelect cloth of various fabri Do: Select cloth comfort basedpractice in this activity* CHInnovation and CreativityCritical Thinking and Problem Solving (identify/clarify/define a problem or situation)Compare and select the best alternative for a given problem.Tennessee's Innovative ProConnection w learn in this STling the nistry, and facts, ted withm of esses, and ts:he design a process under esign is the , available ationshipsParticipants wi performance o activity.	Ide to DOKnow: Participants of various fabrics. Do: Select clothing comfort based on tpractice in this activity* CHECKInnovation and CreativityXCritical Thinking and 	Know: Participants will know the thermal qualities of various fabrics.         Do: Select clothing that has the best thermal comfort based on the weather.         practice in this activity* CHECK all that apply:         Innovation and Creativity       X         Team work and collaboration         Critical Thinking and robust       X         Problem Solving       activity* Check all that apply:         (identify/clarify/define a problem or situation)       technology         Compare and select the best alternative for a given problem.       X         Make the needed effort to carry out a task or a plan.       plan.         Tennessee's Innovative Programming Priorities       Connection with Activity (What will participar learn in this STEM area?)         ling the nistry, and facts, ted with       Participants will learn the physics and chemistri behind why certain fabrics keep you warmer to others.         ted with       Participants will learn how various industries design products to keep you warmer.         ts       Participants will determine insulative performance of fabrics used in thermal wrap activity.		

STEM Activity Lesson Plan STEM A	ctivity 3 Cont.				
Assessment:	yes have been	Completion of crossword puzzle and activity.			
met?)					
Reflection and Application: <u>Technique(s) you will use</u> to have participants reflect on: -what they have learned -process involved and -how they can apply what they learned to other		Questions (listed in activity sheet) will be asked after participants have completed the activities.			
activities/projects or career possib	ollities				
Technology (computer):	None needed				
Space/location and room set up:	Room with tab Space for partie	les and chairs cipants to stand and do thermal wrap exercise.			
Materials: (Mobile Learning Kit containing materials needed for activities is available through Regional UT Extension Offices to check out for use. Contact your 4-H agent for more information.) Volunteers:	<ol> <li>3 Yards of fleece fabric</li> <li>3 Yards of jersey knit fabric</li> <li>3 Yards of top weight (shirt) fabric</li> <li>Infrared Laser Temperature Gun</li> <li>Magnifying glasses to use to examine fabric and identify structure</li> <li>Activities handouts</li> <li>At least 2 volunteers needed (Ideal group size = 5-10)</li> </ol>				

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	Name of Activity: STEM Activity 4 – Discovering Fabrics with Protective Functions					
General Description:Participants will learn about fabrics that protect you including: Nylon, Gore- Tex®, Reflective Strips, Hospital Surgical Masks, Pesticide application protective clothing, Bullet Proof Clothing, Wet Suits, Fire Protective Fabric.Hands-on:(Project group) examining fabric swatches with protective functions and carry out experiments (nylon test water repellency sprits then pour; flame retardant burn) and examine surgical mask and camouflage.						
<b>Performance Objectives/Outcomes</b> (What will all students KNOW and be able to DO as a result of this activity?)			<u>Know</u> : Participants will know how fabrics that protect are made. <u>Do</u> : Use appropriate clothing made of fabric for			
	<b>.:</b>	II www.ation.iv	this activity * C			
Accessing and Analyzing	X	Innovation a	and Creativity* CF	IECK	Team work and collaboration	x
Use Curiosity and Imagination	Х	<ul> <li>Critical Thinking and</li> <li>Problem Solving</li> <li>(identify/clarify/define a problem or situation)</li> <li>X</li> <li>X</li> <li>Make appropriat equipment, tools technology</li> </ul>		Make appropriate use of equipment, tools, technology	Х	
Effective oral and Written Communication (Communicate effectively)	Х	Compare ar best alterna given proble	nd select the itive for a em.	х	Make the needed effort to carry out a task or a plan.	х
*Selected 21 <sup>st</sup> Century Skills and T	PPS	- Tennessee'	's Innovative Pro	gran	nming Priorities	
Definition			<b>Connection with Activity</b> (What will participant learn in this STEM area?)			
Demition			learn in this ST	EM a	area?)	
SCIENCE: Study of the natural world, laws of nature associated with physics biology and the treatment or applicati principles, concepts, or conventions a these disciplines. TECHNOLOGY: Comprises the entire people and organizations, knowledge, devices that go into creating and oper technological artifacts, as well as the a themselves.	inclu s, cho ion c ssoci syst pro- rating artifa	uding the emistry, and of facts, iated with em of cesses, and g acts	Connection wi learn in this ST Participants wi fabrics used for chemical finish the physics beh strips reflective Participants wi nonwoven fabr made.	EM a EM a II lea r pro es an nind e. II lea rics a	area?) rn the chemistry behind ho tection are made, why re added to some fabrics an how light is reflected to ma rn the technology behind h and bullet proof clothing are	d ke ow

STEM Activity Lesson Plan STEM A	STEM Activity Lesson Plan STEM Activity 4 Cont.					
Assessment:		Completion of activities.				
(How will you know if the objectives have been						
met?)						
Reflection and Application:		Questions (listed in activity sheet) will be asked				
<u>Technique(s) you will use</u> to have p	participants	after participants have completed the activities				
reflect on:						
-what they have learned						
-process involved and						
-how they can apply what they lea	rned to other					
activities/projects or career possib	ilities					
Resources Needed:	Γ					
Technology (computer):	None needed					
Space/location and room set up:	Room with tabl	es and chairs				
	Water and sink	available				
	Well nontalent	ed area or do burn test outdoors				
Materials: (Mobile Learning Kit	1. Activities hand	dout				
containing materials needed for	2. Fabric sample	s of fabrics that protect				
activities is available through	3. Samples of we	etsuit fabric to use for experiments				
Regional UT Extension Offices to	4. Samples of Ri	ostop nylon fabric to use for experiments				
check out for use. Contact your	5. Samples of Ar	amid Fire Retardant fabric to use for experiments,				
4-H agent for more information.)	6 Samples of Su	(need candle for burn test)				
	7 Spray bottle f	or experiments				
	8. Tub to use wit	th water spray experiments				
Volunteers:	At least 2 volun	teers needed (Ideal group size = 5-10)				

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Name of Activity: STEM Activity 5 - How Designs are Made on Fabric

General Description: Participants will learn the science behind resist and direct printing, equipment used, and the process involved on the manufacturing level as well as for home use. Hands-on activities:

- 1. Examine printed fabric to determine pattern.
- 2. Create block to use in printing fabric and print fabric.

3. Use a stencil to create a de	3. Use a stencil to create a design on a t-shirt.						
Performance Objectives/Outcome	Performance Objectives/Outcomes		Know: The difference in resist and direct printing,				
(What will all students KNOW and be able		equipment used and process.					
to DO as a result of this activity?)		Do: Examine fabric to determine pattern; create design					
		using resist and direct	t prii	nting.			
Skills that student	s wi	ll prac	tice in this activity* CH	IECK	all that apply:		
Accessing and Analyzing	Х	Innov	ation and Creativity	Х	Team work and		
information					collaboration		
Use Curiosity and Imagination	Х	Critical Thinking and		х	Make appropriate use of	Х	
		Probl	em Solving		equipment, tools.		
		(iden	tify/clarify/define a		technology		
		nrohl	em or situation)				
Effective oral and Written		Comr	hare and select the	x	Make the needed effort	x	
Communication (Communicate		hest :	alternative for a	~	to carry out a task or a	^	
effectively)		given	nrohlem		nlan		
*Selected 21 <sup>st</sup> Century Skills and T	DDC	- Topr	problem. Dessee's Innovative Pro	aran	ming Priorities		
	FFJ	- Telli	Connection with Act		()A/bat will participant loar	, in	
Definition			<b>Connection with Activity</b> (what will participant learn in				
	to als	. alta a	Chis STEW died:)				
SCIENCE: Study of the natural world,	incit	laing	direct printing				
the laws of nature associated with phy	SICS	,	direct printing.				
chemistry, and biology and the treatment	ient	01 vr					
conventions associated with these dis	rinlii						
TECHNOLOGY: Comprises the entire	cyct	om	Particinants will learn	aho	ut technology used in print	inσ	
of people and organizations knowled	JYJU De	CIII	fabric in the manufacturing process				
processes and devices that go into cre	∍≃, ≥atin	σ		turn			
and operating technological artifacts.	as w	ell as					
the artifacts themselves.							
ENGINEERING: Body of knowledge a	bout	t the					
design and creation of human-made p	rodu	ucts					
and a process for solving problems. The	nis						
process is design under constraint. On	e						
constraint in engineering design is the	law	s of					
nature, or science, and time, money, a	availa	able					
materials, ergonomics, environmental							
regulations, manufacturability, and							
repairability.							
MATHEMATICS: Study of patterns and	nd						
relationships among quantities, numb	ers,	and					
shapes.							

STEM Activity Lesson Plan STEM A	ctivity 5 Co	ont.
Assessment:		Completion of analysis of printed fabric.
(How will you know if the objectiv	es have	Completion of direct and resist printing projects.
been met?)		
Reflection and Application:		Questions will be asked after participants have
Technique(s) you will use to have		completed projects.
participants reflect on:		Sample questions: What challenges did you have during
-what they have learned		the process; what will you do differently if you do this
-process involved and		again?
-how they can apply what they lea	rned to	
other activities/projects or career		
possibilities		
Resources Needed:		
Technology (computer):	None ne	eded
Space/location and room set up:	Room wi	th tables/chairs and water source.
Materials: (Mobile Learning Kit	1. F	Printed fabric
containing materials needed for	2. ł	Handout with "Basics of Block Printing and Tips for
activities [wooden blocks, roller	5	Successful Stenciling" which are part of the activity sheet.
stamp, stencils, and samples of	3. 5	Supplies for resist and block printing (acrylic paint, sponge
block printing] is available	k	prushes, potato for carving block print, knife, stencils,
through Regional UT Extension	١	white or beige fabric, painter's tape, card stock for
Offices to check out for use.	k	between t-shirt [wooden carved blocks or rubber stamps,
Contact your 4-H agent for more	r	oller stamp if available].
information.)	4. F	Participants should bring a t-shirt.
Volunteers:	At least 2	2 volunteers needed (Ideal group size = 5-10)

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Name of Activity: STEM Activity 6 - How Fabric is Made from Natural Sources General Description: Participants will learn the processes used to transform raw fiber to finished

fabric for natural fibers including technology, engineering, and science concepts. Hands-on Activities:

1.Examine garments in wardrobe, identifying the fiber content of the fabrics from which they are made.

2. Identify qualities of fabric from which garments in wardrobe are made.

3. Complete Transformer Match Game.

4. Observe fibers under microscope, describing characteristics.

5. Visit a fabric store and find fabrics with the fiber content learned about in this activity/lesson.

6. Create a poster display focusing on one of the natural fibers in this activity and share with others.

 

 Performance Objectives/Outcomes (What will all students KNOW and be able to DO as a result of this activity?)
 Know: How fabric is made from various natural resources. Facts and qualities of fabrics made from natural resources.

 Do: Identify the qualities of fabrics made from different natural resources. Identify natural fibers through microscope.

Skills that students	S WI	Il practice in th	is activity . Cr	IECK	ali that apply:	_
Accessing and Analyzing		Innovation an	d Creativity	Х	Team work and	
information					collaboration	
Use Curiosity and Imagination		Critical Thinki	ng and	Х	Make appropriate use of	х
		Problem Solvi	ing		equipment, tools,	1
		(identify/clari	fy/define a		technology	1
		problem or si	tuation)			
Effective oral and Written	Х	Compare and	select the		Make the needed effort	Х
Communication (Communicate		best alternati	ve for a		to carry out a task or a	1
effectively)		given problen	n.		plan.	
*Selected 21 <sup>st</sup> Century Skills and T	PPS	- Tennessee's	Innovative Pro	gran	nming Priorities	
Definition			Connection	with	Activity (What will	
			participant le	earn	in this STEM area?)	
SCIENCE: Study of the natural work	d, in	cluding the	Participants will learn the science behind what			
laws of nature associated with physics	s, ch	emistry, and	natural fibers look like and why.			
biology and the treatment or applicat	ion c	of facts,				
principles, concepts, or conventions a	ssoc	iated with				
these disciplines.						
<b>TECHNOLOGY:</b> Comprises the ent	tire s	system of	Participants will learn the technology used to			
people and organizations, knowledge,	pro	cesses, and	harvest and p	oroce	ess fibers used to make fabr	ic.
devices that go into creating and oper	atin	g technological				
artifacts, as well as the artifacts them	selve	<u></u>	<b>D</b>			
<b>ENGINEERING:</b> Body of knowledg	e ab	out the design	Participants will learn the engineering involved			ed
and creation of human-made product	s and	d a process for	in processing	fibe	rs to make fabric.	
solving problems. This process is desig	gn ur	ider				
constraint. One constraint in engineer	ing (	Jesign is the				
materials ergonomics environmental	rog	y, available				
manufacturability, and repairability.	ιcg	ulations,				
MATHEMATICS: Study of pattern	is an	d relationships				
among quantities, numbers, and shan	es	a relationships				
	among quantities, numbers, and snapes.					

STEM Activity Lesson Plan STEM A	STEM Activity Lesson Plan STEM Activity 6 Cont.					
Assessment:		Completion of garment(s) analysis, fabric analysis (for selected				
(How will you know if the objectiv	es	garments), poster creation, transformer matching game,				
have been met?)		microscopic fiber examination and description.				
Reflection and Application:		Questions are asked within the activity/lesson that				
Technique(s) you will use to have		participants will answer. Through the creation of a poster,				
participants reflect on:		participant will reflect and pull together what they have				
-what they have learned		learned. When they use the poster to present information,				
-process involved and		they will exemplify what they have learned.				
-how they can apply what they						
learned to other activities/projects	5					
or career possibilities						
Resources Needed:						
Technology (computer):	1.	Microscope				
	2.	Slides, slide covers, small cup, medicine dropper				
	3.	Computer to use with DVD or YouTube video				
Space/location and room set up:	Ro	om with tables and water source				
Materials: (Mobile Learning Kit	1.	For group activities: fabric and garments made from natural				
containing materials needed for	fib	ers [cotton, flax, silk, wool] (this will replace the participant				
activities [including microscope,	loc	oking in their closet in the lesson)				
slides, DVD, fabric/fiber samples	2.	Wool, cotton, and silk fabric/fibers (use to make slide to look				
Transformer Match Game] is	at	using microscope)				
available through Regional UT	3.	DVD or YouTube explaining how natural fibers are processed.				
Extension Offices to check out	4.	Instructions for making slides				
for use. Contact your 4-H agent	5.	Copies of Transformer Match Game playing board and pieces				
for more information.)	6.	Microscope				
Volunteers:	1 v	olunteer per every 5-8 participant				

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Name of Activity: STEM Activity 7 - How Manufactured Fibers/Fabrics are Made

**General Description**: Participants will learn the process of making fabric from manufactured fibers including the science, technology, and engineering behind the processes. Hands-On Activities:

1. Examine garments in wardrobe, identifying the fiber content of the fabrics from which they are made.

2. Determine characteristics of selected fabrics made from manufactured fibers.

3. "Creating" a synthetic thread.

Performance Objectives/Outcomes			Know: The process involved in making cellulosic			
(What will all students KNOW and be able to			manufactured and synthetic (manufactured) fabric.			
DO as a result of this activity?)			Facts and qualities of manufactured fabrics.			
			<u>Do</u> : Identify the o	hara	acteristics of fabrics made	
			from manufactur	ed fi	ibers.	
Skills that student	s wi	II practice i	in this activity* CH	IECK	all that apply:	
Accessing and Analyzing	Х	Innovatio	n and Creativity		Team work and	
information					collaboration	
Use Curiosity and Imagination		Critical Th	inking and	Х	Make appropriate use of	Х
		Problem S	Solving		equipment, tools,	
		(identify/	clarify/define a		technology	
		problem of	or situation)			
Effective oral and Written		Compare	and select the		Make the needed effort	Х
Communication (Communicate		best alter	native for a		to carry out a task or a	
effectively)		given pro	blem.		plan.	
*Selected 21 <sup>st</sup> Century Skills and T	IPPS	- Tennesse	e's Innovative Pro	gran	nming Priorities	
Definition			Connection with Activity (What will participant			
			learn in this STEM area?)			
SCIENCE: Study of the natural world,	inclu	uding the	Participants will learn the science behind what			
laws of nature associated with physics	s, ch	emistry,	manufactured fibers look like and why and the			
and biology and the treatment or app	licat	ion of	associated characteristics of fabric made from			
facts, principles, concepts, or convent	ions		manufactured fibers.			
associated with these disciplines.			Dertisinent will learn the technology used to greate			
<b>TECHNOLOGY:</b> Comprises the entire	syst	em of	Participant will learn the technology used to create			
people and organizations, knowledge,	pro	cesses,	manufactured fibers, yarn, and fabric.			
tochnological artifacts as well as the	oper	ating				
themselves						
ENGINEERING: Body of knowledge a	bou	t the	Participants will learn the engineering process			
design and creation of human-made r	produ	ucts and a	involved in creating manufactured fibers to make			
process for solving problems. This pro	cess	is design	fabric			
under constraint. One constraint in er	ngine	ering				
design is the laws of nature, or science	e, an	d time,				
money, available materials, ergonomi	cs,					
environmental regulations, manufactu	urabi	ility, and				
repairability.						
<b>MATHEMATICS:</b> Study of patterns a	nd	l				
relationships among quantities, humb	ers,	and				
silapes.						

STEM Activity Lesson Plan STEM Activity 7 Cont.						
Assessment:		Completion of wardrobe (or fabric) analysis,				
(How will you know if the objectiv	es have been	identification of fabric characteristics, and				
met?)		experiment "creating" a thread.				
Reflection and Application:		Participants will be asked to determine				
Technique(s) you will use to have p	participants	characteristics of fabric based on experiments with				
reflect on:		their own garments (or fabric samples) and reflect				
-what they have learned		on what they have learned compared to what the				
-process involved and		experiments show.				
-how they can apply what they lea	rned to other					
activities/projects or career possib	oilities					
Resources Needed:						
Technology (computer):	Computer to	use with DVD or YouTube video				
Space/location and room set up:	Table and Ch	airs				
Materials: (Mobile Learning Kit	1. Samples of	Manufactured Fabrics such as polyester, nylon,				
containing materials needed for	rayon, acetat	e (this will replace the participant looking in their				
activities [including microscope,	closet in the l	esson; they will examine the fabric samples)				
slides, magnifying glasses,	2. Carpet san	nple made of Olefin				
fabric/fiber samples] is available	3. Acrylic (fa	ke fur or sweater)				
through Regional UT Extension	4. Yarn mad	e from polyester				
Offices to check out for use.	5. Magnifyir	ng glass				
Contact your 4-H agent for more	6. DVD or Yo	ouTube that shows how Acrylic, Nylon and Polyester				
information.)	is made					
	7. Nylon fab	ric, glass rod, tweezers, candle				
Volunteers:						
	1 Volunteer f	or 5-8 participants				

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Name of Activity: STEM Activity 8 - Fabrics Made with Nontraditional Natural Sources

**General Description**: Participants will learn how microfibers are made and the use of nontraditional natural substances (milk, corn, bamboo, hemp) to create fabric.

Hands-on Activities:

- 1. Research of selected fiber.
- 2. Create poster or other presentation based on information in activity/lesson and research.
- 3. Research garments available made from nontraditional natural substances.

		The shear the held of the second seco				
Performance Objectives/Outcomes			Know: The chemistry behind how microfibers are made			
(What will all students KNOW and be able			and the technology behind making fabric and garments			
to DO as a result of this activity?)			using nontraditional natural fibers.			
			Do: Research and pre	sent	information on the use of	
			nontraditional natura	l fib	ers.	
Skills that student	s wi	ll prac	tice in this activity* CH	IECK	all that apply:	
Accessing and Analyzing	Х	Innov	ation and Creativity		Team work and	
information					collaboration	
Use Curiosity and Imagination		Critic	al Thinking and	Х	Make appropriate use of	Х
		Prob	em Solving		equipment, tools,	
		(iden	tify/clarify/define a		technology	
		prob	lem or situation)			
Effective oral and Written	Х	Com	pare and select the		Make the needed effort	Х
Communication (Communicate		best	alternative for a		to carry out a task or a	
effectively)		given	problem.		plan.	
*Selected 21 <sup>st</sup> Century Skills and T	IPPS	- Tenr	nessee's Innovative Pro	gran	nming Priorities	
Definition			Connection with Act	<u>.</u> ivitv	(What will participant learn	n in
Definition			this STEM area?)			
SCIENCE: Study of the natural world,	inclu	uding	The participant will learn the Chemistry behind how			
the laws of nature associated with ph	ysics	,	Microfibers are made.			
chemistry, and biology and the treatm	nent	or				
application of facts, principles, concept	ots, c	or				
conventions associated with these dis	cipli	nes.				
<b>TECHNOLOGY:</b> Comprises the entire	syst	em	The participant will learn the technology used to make			
of people and organizations, knowled	ge,		fabric and garments from nontraditional natural fibers.			
processes, and devices that go into cr	eatir	ng 				
and operating technological artifacts,	as w	ell as				
the artifacts themselves.						
ENGINEERING: Body of knowledge a	bou	t the				
aesign and creation of numan-made p	oroai	ucts				
process is design under constraint. Or						
constraint in engineering design is the	ie Iaw	sof				
nature or science and time money	avail	able				
materials, ergonomics, environmenta						
regulations, manufacturability, and						
repairability.						
MATHEMATICS: Study of patterns a	nd					
relationships among quantities, numb	ers,	and				
shapes.						

STEM Activity Lesson Plan STEM A	STEM Activity Lesson Plan STEM Activity 8 Cont.					
Assessment:		Research completed, poster or other presentation				
(How will you know if the objectives have		developed and presented. Research completed on				
been met?)		garments available.				
Reflection and Application:		Participant will reflect through reviewing information in				
Technique(s) you will use to have		the activity/lesson and determining which fiber				
participants reflect on:		interests them to research. They will receive feedback				
-what they have learned		from the 4-H agent or others of their presentation.				
-process involved and						
-how they can apply what they lea	rned to					
other activities/projects or career						
possibilities						
Resources Needed:	I					
Technology (computer):	Compute	er for research				
Space/location and room set up:	Table and	d chairs				
Materials: (Mobile Learning Kit	1. Samp	ble of Corn Fiber				
containing materials needed for	2. Samp	ble of Hemp Rope				
activities [including samples of	3. Garm	nent samples (2 samples from among clothing made of				
fiber, fabric, garment] is	Baml	boo, milk, containing Insect repellent)				
available through Regional UT	4. 2 exa	mples of fabric made from microfibers				
Extension Offices to check out	5. Copie	es of activity/lesson with images or computer to show				
for use. Contact your 4-H agent	images.					
for more information.)						
Volunteers:	1 volunte	eer 10-15 participants				

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Name of Activity: STEM Activity 9 – The Science Behind Fabric Finishes							
<b>General Description</b> : Participants will learn about different types of finishes applied to fabric, the purpose behind different finishes, and how various finishes are applied to fabric. Hands-on Activity:							
<ol> <li>Experimenting with fabric with and without specific finishes applied to them (wrinkle resistant, water repellency. Scotchgard™, antistatic, fire retardant).</li> </ol>							
Performance Objectives/Outcome	es es	ablo	Know: Participants w	vill kr	now special functional finish	nes,	
to DO as a result of this activity?)	De a	able	<u>Do</u> : Participants will b	be ab	le to select appropriate		
			functional finishes on intended use.	fabi	ric or garments based on		
Skills that s	tud	ents w	ill practice in this activ	vity*	CHECK:		
Accessing and Analyzing information	Х	Innov	vation and Creativity		Team work and collaboration	X	
Use Curiosity and Imagination	Х	Critic Probl (iden probl	al Thinking and lem Solving tify/clarify/define a lem or situation)	Х	Make appropriate use of equipment, tools, technology	x	
Effective oral and Written		Comp	pare and select the	Х	Make the needed effort	Х	
Communication (Communicate		best	alternative for a		to carry out a task or a		
effectively)		given	problem.		plan.		
*Selected 21 <sup>st</sup> Century Skills and T	PPS	- Tenr	nessee's innovative Programming Priorities				
Definition			Connection with Act	<b>Connection with Activity</b> (What will participant learn in this STEM area?)			
Definition			this STEM area?)	ivity			
SCIENCE: Study of the natural world,	inclu	uding	this STEM area?) Participants will learn	the	Chemistry behind fabric		
SCIENCE: Study of the natural world, the laws of nature associated with physical statements of the statement	inclu ysics	uding	this STEM area?) Participants will learn finishes.	the	Chemistry behind fabric		
SCIENCE: Study of the natural world, the laws of nature associated with phy chemistry, and biology and the treatm	inclu ysics	uding , or	this STEM area?) Participants will learn finishes.	the	Chemistry behind fabric		
<b>SCIENCE:</b> Study of the natural world, the laws of nature associated with phy chemistry, and biology and the treatm application of facts, principles, concept conventions associated with these dis	inclu ysics ient ots, c	uding , or or	this STEM area?) Participants will learn finishes.	the	Chemistry behind fabric		
SCIENCE: Study of the natural world, the laws of nature associated with phy chemistry, and biology and the treatm application of facts, principles, concept conventions associated with these dis TECHNOLOGY: Comprises the entire	inclu ysics ient ots, c cipli	uding , or or nes.	this STEM area?) Participants will learn finishes.	the	Chemistry behind fabric		
SCIENCE: Study of the natural world, the laws of nature associated with phy chemistry, and biology and the treatm application of facts, principles, concept conventions associated with these dis TECHNOLOGY: Comprises the entire of people and organizations, knowled	inclu ysics ient ots, c cipli syst ge,	uding , or or nes. em	Participants will learn finishes. Participants will learn finishes.	the the	Chemistry behind fabric		
SCIENCE: Study of the natural world, the laws of nature associated with phy chemistry, and biology and the treatm application of facts, principles, concept conventions associated with these dis TECHNOLOGY: Comprises the entire of people and organizations, knowled, processes, and devices that go into cro	inclu ysics ient ots, c cipli syst ge, eatir	uding , or or nes. em	this STEM area?) Participants will learn finishes. Participants will learn finishes to fabric.	the the	Chemistry behind fabric		
SCIENCE: Study of the natural world, the laws of nature associated with phy chemistry, and biology and the treatm application of facts, principles, concept conventions associated with these dis TECHNOLOGY: Comprises the entire of people and organizations, knowled processes, and devices that go into creat and operating technological artifacts,	inclu ysics nent ots, c cipli syst ge, geatir as w	uding , or nes. .em .em .em	this STEM area?) Participants will learn finishes. Participants will learn finishes to fabric.	the the	Chemistry behind fabric		
SCIENCE: Study of the natural world, the laws of nature associated with phy chemistry, and biology and the treatm application of facts, principles, concept conventions associated with these dist TECHNOLOGY: Comprises the entire of people and organizations, knowled, processes, and devices that go into created and operating technological artifacts, the artifacts themselves.	inclu ysics ient ots, c cipli syst ge, eatir as w	uding , or or nes. em ng rell as	this STEM area?) Participants will learn finishes. Participants will learn finishes to fabric.	the the	Chemistry behind fabric technology used to apply		
SCIENCE: Study of the natural world, the laws of nature associated with phy chemistry, and biology and the treatm application of facts, principles, concept conventions associated with these dis TECHNOLOGY: Comprises the entire of people and organizations, knowled processes, and devices that go into creat and operating technological artifacts, the artifacts themselves. ENGINEERING: Body of knowledge a	inclu ysics nent ots, c cipli syst ge, eatir as w bou	uding , or or nes. rem ng rell as	this STEM area?) Participants will learn finishes. Participants will learn finishes to fabric.	the the	Chemistry behind fabric technology used to apply		
SCIENCE: Study of the natural world, the laws of nature associated with phy chemistry, and biology and the treatm application of facts, principles, concept conventions associated with these dis TECHNOLOGY: Comprises the entire of people and organizations, knowled processes, and devices that go into creat and operating technological artifacts, the artifacts themselves. ENGINEERING: Body of knowledge at design and creation of human-made p	inclu ysics nent ots, c cipli syst ge, eatir as w bou	uding or or nes. :em ng rell as t the ucts	this STEM area?) Participants will learn finishes. Participants will learn finishes to fabric.	the the	Chemistry behind fabric technology used to apply		
SCIENCE: Study of the natural world, the laws of nature associated with phy chemistry, and biology and the treatm application of facts, principles, concept conventions associated with these dist TECHNOLOGY: Comprises the entire of people and organizations, knowled, processes, and devices that go into cro- and operating technological artifacts, the artifacts themselves. ENGINEERING: Body of knowledge and design and creation of human-made pricess for solving problems. The	inclu ysics nent ots, c cipli syst ge, eatir as w bou brodu	uding , or nes. em rell as t the ucts	this STEM area?) Participants will learn finishes. Participants will learn finishes to fabric.	the the	Chemistry behind fabric technology used to apply		
SCIENCE: Study of the natural world, the laws of nature associated with phy chemistry, and biology and the treatm application of facts, principles, concept conventions associated with these dis TECHNOLOGY: Comprises the entire of people and organizations, knowled processes, and devices that go into create and operating technological artifacts, the artifacts themselves. ENGINEERING: Body of knowledge at design and creation of human-made p and a process for solving problems. The process is design under constraint. Or	inclu ysics nent tots, c cipli syst ge, eatir as w bou produ	uding , or nes. rem ng rell as t the ucts	this STEM area?) Participants will learn finishes. Participants will learn finishes to fabric.	the the	Chemistry behind fabric technology used to apply		
SCIENCE: Study of the natural world, the laws of nature associated with phy chemistry, and biology and the treatm application of facts, principles, concept conventions associated with these dis TECHNOLOGY: Comprises the entire of people and organizations, knowled processes, and devices that go into creat and operating technological artifacts, the artifacts themselves. ENGINEERING: Body of knowledge and design and creation of human-made p and a process for solving problems. The process is design under constraint. Or constraint in engineering design is the pature or science and time money and	inclu ysics nent ots, c cipli syst ge, eatir as w bou brodu nis le law	uding , or nes. :em rell as t the ucts s of able	this STEM area?) Participants will learn finishes. Participants will learn finishes to fabric.	the the	Chemistry behind fabric technology used to apply		
SCIENCE: Study of the natural world, the laws of nature associated with phy chemistry, and biology and the treatm application of facts, principles, concept conventions associated with these dist TECHNOLOGY: Comprises the entire of people and organizations, knowled, processes, and devices that go into creat and operating technological artifacts, the artifacts themselves. ENGINEERING: Body of knowledge at design and creation of human-made p and a process for solving problems. Th process is design under constraint. Or constraint in engineering design is the nature, or science, and time, money, at materials, ergonomics, environmental	incli ysics ient ots, c cipli syst ge, eatir as w bou brodu nis ie law avail	uding , or pr nes. rem rell as t the ucts s of able	this STEM area?) Participants will learn finishes. Participants will learn finishes to fabric.	the	Chemistry behind fabric technology used to apply		
SCIENCE: Study of the natural world, the laws of nature associated with phy chemistry, and biology and the treatm application of facts, principles, concept conventions associated with these dis TECHNOLOGY: Comprises the entire of people and organizations, knowled processes, and devices that go into creat and operating technological artifacts, the artifacts themselves. ENGINEERING: Body of knowledge and design and creation of human-made partial and creation of human-made partial and a process for solving problems. The process is design under constraint. Or constraint in engineering design is the nature, or science, and time, money, a materials, ergonomics, environmental regulations, manufacturability, and	inclu ysics ient ots, c cipli syst ge, eatir as w bou produ nis ie law avail	uding , or nes. em rell as t the ucts s of able	Participants will learn finishes. Participants will learn finishes to fabric.	the	Chemistry behind fabric technology used to apply		
SCIENCE: Study of the natural world, the laws of nature associated with phy chemistry, and biology and the treatm application of facts, principles, concept conventions associated with these dis TECHNOLOGY: Comprises the entire of people and organizations, knowled, processes, and devices that go into cru- and operating technological artifacts, the artifacts themselves. ENGINEERING: Body of knowledge and design and creation of human-made pricess is design under constraint. Or constraint in engineering design is the nature, or science, and time, money, a materials, ergonomics, environmental regulations, manufacturability, and repairability.	inclu ysics eent ts, c cipli syst ge, eatir as w bou bou bou is e law avail	uding or or nes. rem rell as t the ucts s of able	this STEM area?) Participants will learn finishes. Participants will learn finishes to fabric.	the the	Chemistry behind fabric technology used to apply		
SCIENCE: Study of the natural world, the laws of nature associated with phy chemistry, and biology and the treatm application of facts, principles, concept conventions associated with these dist TECHNOLOGY: Comprises the entire of people and organizations, knowled, processes, and devices that go into creat and operating technological artifacts, the artifacts themselves. ENGINEERING: Body of knowledge at design and creation of human-made p and a process for solving problems. The process is design under constraint. Or constraint in engineering design is the nature, or science, and time, money, at materials, ergonomics, environmental regulations, manufacturability, and repairability. MATHEMATICS: Study of patterns at	incli ysics ient ots, c cipli syst ge, eatir as w bou brodu iis ie law avail	uding , or nes. rem ng rell as t the ucts s of able	Participants will learn finishes. Participants will learn finishes to fabric.	the	Chemistry behind fabric technology used to apply		
SCIENCE: Study of the natural world, the laws of nature associated with phy chemistry, and biology and the treatm application of facts, principles, concept conventions associated with these dis TECHNOLOGY: Comprises the entire of people and organizations, knowled processes, and devices that go into creat and operating technological artifacts, the artifacts themselves. ENGINEERING: Body of knowledge at design and creation of human-made p and a process for solving problems. The process is design under constraint. Or constraint in engineering design is the nature, or science, and time, money, at materials, ergonomics, environmental regulations, manufacturability, and repairability. MATHEMATICS: Study of patterns at relationships among quantities, numb	inclu ysics eent ts, c cipli syst ge, eatir as w bou produ nis e law avail nd ers,	uding or nes. em rell as t the ucts s of able and	Participants will learn finishes. Participants will learn finishes to fabric.	the the	Chemistry behind fabric technology used to apply		
SCIENCE: Study of the natural world, the laws of nature associated with phy chemistry, and biology and the treatm application of facts, principles, concept conventions associated with these dist TECHNOLOGY: Comprises the entire of people and organizations, knowled, processes, and devices that go into cru- and operating technological artifacts, the artifacts themselves. ENGINEERING: Body of knowledge and design and creation of human-made pricess is design under constraint. Or constraint in engineering design is the nature, or science, and time, money, and materials, ergonomics, environmental regulations, manufacturability, and repairability. MATHEMATICS: Study of patterns a relationships among quantities, numb shapes.	inclu ysics eent cipli syst ge, eatir as w bou bou bou is e law avail and ers,	uding or or nes. em ell as t the ucts s of able and	Participants will learn finishes. Participants will learn finishes to fabric.	the the	Chemistry behind fabric technology used to apply		

STEM Activity Lesson Plan STEM A	ctivity 9 Co	ont.			
Assessment:		The completion of the experiments using various			
(How will you know if the objectives have		finishes.			
been met?)					
Reflection and Application:		Questions are asked (within the activity/lesson) during			
Technique(s) you will use to have		and at the end of each experiment. These should be			
participants reflect on:		used if doing these activities as a group.			
-what they have learned					
-process involved and					
-how they can apply what they lea	rned to				
other activities/projects or career					
possibilities					
Resources Needed:					
Technology (computer):	None ne	eded			
Space/location and room set up:	Room wi	th tables and chairs and water source			
Materials: (Mobile Learning Kit	1. Exam	ples of fabric with special finishes			
containing materials needed for	2. Large	squares of muslin for Scotchgard <sup>™</sup> and Starch tests			
activities [including examples of	3. Large	e squares of polyester and nylon to compare muslin			
fabrics with special finishes,	samp	ble			
fabrics to test, various sprays] is	4. Spray	ybottle			
available through Regional UT	5. Scoto	chgard™ spray			
Extension Offices to check out	6. Starc	h spray			
for use. Contact your 4-H agent	7. Smal	I squares of fabric for wrinkle test			
for more information.)	8. Ballo	ons			
	9. Copy	of experiment instructions within lesson			
Volunteers:	1 to 2 vo	olunteers for 7-15 participants			

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Name of Activity: STEM Activity 10	) – S	MART Appa	arel Products to M	leet	the Needs and Desires of		
Today's and Tomorrow's Consumer							
General Description: Participants	General Description: Participants will learn about technology and equipment used to make clothing						
for monitoring the body, exercising, and entertainment purposes.							
Hands-on Activities:							
1. Researching one SMART clothing idea from activity/lesson.							
<ol><li>Research how to use LED's to light up clothing and possibly apply techniques.</li></ol>							
3. Create presentation (poster or PowerPoint) from lesson and present to others.							
Performance Objectives/Outcome	es		Know: How tech	nolo	gy is used in clothing to ma	ke	
(What will all students KNOW and	be a	able to DO	life safer and eas	sier,	monitor various body		
as a result of this activity?)			functions, and m	iake	clothing creative (light up,		
			change color)				
			<u>Do</u> : Buy and use	SMA	ART clothing based upon		
			knowledge gaine	ed.			
Skills that student	s wi	Il practice in	n this activity* CH	ECK	all that apply::		
Accessing and Analyzing	Х	Innovatior	and Creativity	Х	Team work and		
information					collaboration		
Use Curiosity and Imagination	Х	Critical Th	inking and	Х	Make appropriate use of	Х	
		Problem S	olving		equipment, tools,		
		(identify/c	larify/define a		technology		
		problem o	r situation)				
Effective oral and Written	Х	Compare a	and select the	Х	Make the needed effort	Х	
Communication (Communicate		best alterr	native for a		to carry out a task or a		
effectively)		given prob	olem.		plan.		
*Selected 21 <sup>st</sup> Century Skills and T	PPS	- Tennesse	e's Innovative Pro	gran	nming Priorities		
Definition			Connection with Activity (What will participant				
			learn in this STEM area?)				
SCIENCE: Study of the natural world,	inclu	uding the					
laws of nature associated with physics	s, ch	emistry,					
and biology and the treatment or app	licat	ion of					
facts, principles, concepts, or convent	ions	associated					
with these disciplines.		<u> </u>	Darticinant will learn the technology and				
<b>TECHNOLOGY:</b> Comprises the entire	syst	em of	Participant will learn the technology and				
devices that go into creating and oney	pio	and a set of the set o	equipment used to make various clothing for				
technological artifacts, as well as the	artifa	5 acts	monitoring the body, exercising and entertainment				
themselves.			purposes.				
ENGINEERING: Body of knowledge a	bou	t the					
design and creation of human-made p	rod	ucts and a					
process for solving problems. This pro	cess	is design					
under constraint. One constraint in er	igine	ering					
design is the laws of nature, or science	e, an	d time,					
money, available materials, ergonomi							
	cs,						
environmental regulations, manufacto	cs, Irab	ility, and					
environmental regulations, manufacture repairability.	cs, urab	ility, and					
environmental regulations, manufacture repairability. MATHEMATICS: Study of patterns a relationships among quantities numbers and the second	cs, urab nd	ility, and					
environmental regulations, manufacturepairability. MATHEMATICS: Study of patterns a relationships among quantities, numb shapes.	cs, urab nd ers,	ility, and					
environmental regulations, manufacture repairability. <b>MATHEMATICS:</b> Study of patterns a relationships among quantities, numb shapes.	cs, urab nd ers,	ility, and					

STEM Activity Lesson Plan STEM A	ctivity 10 Cont.				
Assessment:		The completion of the research and activities.			
(How will you know if the objectives have been					
met?)					
Reflection and Application:		Reflection will be done through the participant			
Technique(s) you will use to have p	participants	determining which SMART clothing to research and			
reflect on:		applying what they have learned when buying			
-what they have learned		SMART products. Volunteer leader should ask			
-process involved and		questions when reviewing information in a group			
-how they can apply what they lea	rned to other	project meeting.			
activities/projects or career possib	ilities				
Resources Needed:					
Technology (computer):	Computer				
Space/location and room set up:	Table with cha	airs			
Materials:	Group activity				
	1.Possible exa	imples of SMART garments or video clips of SMART			
	technology.				
	2.Instructions	for using LED technology to light up clothes (explore			
	on internet to	nina) ded te melke sizevit te illuminete e neekst en			
	Materials nee	ded to make circuit to illuminate a pocket on			
	garment.	atton, Haldara			
	1. COIII Cell B	atterior			
	$2 \downarrow ED'c 2mm$				
	A conductive	Throad			
	4. Conductive	lineau			
	6 needle nos	se pliers			
	7 sewing ner	adla			
	8 scissors				
	NOTE: Volum	teer should try out experiment before doing with			
	group, Small f	ee may be assessed to cover cost.			
Volunteers:	2 volunteers f	or 7-15 participants			

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Name of Activity: Stem Activity 11 - Know Your Sewing Machine and How it Works							
General Description: The participa	nt w	vill lea	rn the various parts of	the s	ewing machine and how it		
operates with the end result of making a decorative pillow.							
Performance Objectives/Outcome		Know: The parts of th	e se	wing machine, how they			
(What will all students KNOW and	be a	ble	function, and how to	use	a machine to make an item.		
to DO as a result of this activity?)			Do: Sew a pillow and/	'or si	milar item.		
Skills that student	s wi	ll prac	tice in this activity* CH	IECK	all that apply:		
Accessing and Analyzing	Х	Inno	ation and Creativity		Team work and		
information					collaboration		
Use Curiosity and Imagination		Critic	al Thinking and	Х	Make appropriate use of	Х	
		Probl	em Solving		equipment, tools,		
		(iden	tify/clarify/define a		technology		
		probl	lem or situation)		0,		
Effective oral and Written		Com	pare and select the		Make the needed effort	х	
Communication (Communicate		best	alternative for a		to carry out a task or a		
effectively)		given	problem		plan.		
*Selected 21 <sup>st</sup> Century Skills and T	IPPS	- Tenr	pessee's Innovative Pro	gran	nming Priorities		
Definition			Connection with Activity (What will participant learn in				
Deminion			this STEM area?)				
SCIENCE: Study of the natural world,	inclu	Iding					
the laws of nature associated with phy	vsics	, 0					
chemistry, and biology and the treatm	ient (	or					
application of facts, principles, concep	ots, o	r					
conventions associated with these dis	ciplir	nes.					
TECHNOLOGY: Comprises the entire	syst	em	The participant will learn the technology of the parts of				
of people and organizations, knowled	ge,		a sewing machine and how the sewing machine works.				
processes, and devices that go into cre	eatin	g	0				
and operating technological artifacts,	as w	ell as					
the artifacts themselves.							
ENGINEERING: Body of knowledge a	bout	the	The participant will learn the engineering of making 2-				
design and creation of human-made p	orodu	ucts	dimensional fabric into a 3-dimensional item.				
and a process for solving problems. The	nis						
process is design under constraint. On	ie						
constraint in engineering design is the	laws	s of					
nature, or science, and time, money, a	availa	able					
materials, ergonomics, environmental	l						
regulations, manufacturability, and							
repairability.							
MATHEMATICS: Study of patterns and	nd		The participant will le	arn	the math of using exact		
relationships among quantities, numb	ers,	and	measurements to cre	ate/	sew an item.		
shapes.							

STEM Activity Lesson Plan STEM Activity 11 Cont.						
Assessment:		The completion of sewing a decorative pillow.				
(How will you know if the objectives have						
been met?)						
Reflection and Application:		The participants will be asked to complete a crossword				
Technique(s) you will use to have		puzzle on the parts of the sewing machine and how				
participants reflect on:		they work.				
-what they have learned		The participants will practice using the sewing machine				
-process involved and		through following lines and rectangles on paper.				
-how they can apply what they lea	rned to	The participant will sew and complete a decorative				
other activities/projects or career		pillow. Volunteer leaders will assess their success and				
possibilities		work with them to improve their sewing as needed.				
Resources Needed:						
Technology (computer):	Sewing N	Лаchines				
Space/location and room set up:	Room wi	th tables and chairs and electrical strip for plugging in				
	sewing n	nachines				
Materials:	Copy of A	Activity; Fabric, thread, shears, pins, hand sewing needle,				
	pillow fo	rm or fiberfill, iron and ironing board				
Volunteers:	2 volunte	eers for every 5 participants				

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Name of Activity: STEM Activity 12 – The Nitty Gritty of Stains							
General Description: Participants	<b>General Description</b> : Participants will learn about the nature of stains, the different types, how stains						
happen, and how to remove stains.							
Hands-on Activities:							
Experiment in removing stains							
Performance Objectives/Outcome	es		Know: Participants wi	ill kn	ow the chemistry behind ho	w	
(What will all students KNOW and	be a	able	stains happen and ho	w to	remove them.		
to DO as a result of this activity?)			<u>Do</u> : Participants will b	e ab	le to assess the types of sta	ins	
			and use the proper pi	rodu	ct for stain removal.		
Skills that student	s wi	ll prac	tice in this activity* CH	IECK	all that apply:	1	
Accessing and Analyzing	Х	Innov	Innovation and Creativity		Team work and		
information					collaboration		
Use Curiosity and Imagination	Х	Critic	al Thinking and	Х	Make appropriate use of	Х	
		Prob	em Solving		equipment, tools,		
		(iden	tify/clarify/define a		technology		
		prob	em or situation)	~		~	
Effective oral and Written		Compare and select the		х	Make the needed effort	х	
communication (Communicate		best	alternative for a		to carry out a task or a		
effectively)		given	problem.		pian.		
Selected 21 <sup>er</sup> Century Skills and Ti	442	- Tenr	Connection with Activity (M/bet will perticipent loom in				
Definition			this STEM area?)				
SCIENCE: Study of the natural world	inclu	ıding	The Participants will learn the Chemistry behind why				
the laws of nature associated with phy	/sics	unig	stains appear on clothing and the Science behind				
chemistry, and biology and the treatm	ent	, or	treatments that will remove stains				
application of facts, principles, concep	ots, c	or					
conventions associated with these dis	cipli	nes.					
TECHNOLOGY: Comprises the entire	syst	em					
of people and organizations, knowled	ge,						
processes, and devices that go into cre	eatir	ıg					
and operating technological artifacts,	as w	ell as					
the artifacts themselves.							
ENGINEERING: Body of knowledge a	bou	t the					
and a process for solving problems. The	noui	JCIS					
process is design under constraint. On	e P						
constraint in engineering design is the	law	s of					
nature, or science, and time, money, a	vail	able					
materials, ergonomics, environmental							
regulations, manufacturability, and							
repairability.							
MATHEMATICS: Study of patterns and	nd	I	Participants will use n	nath	ematics skills to measure		
shapes.	ers,	and	Tabric size and use vo	iume	e measurements.		

STEM Activity Lesson Plan STEM A	ctivity 12 (	Cont.			
Assessment:		Completion of the Experiment on stain removal.			
(How will you know if the objectives have					
been met?)					
<b>Reflection and Application:</b>		Questions are asked throughout the activity/lesson.			
Technique(s) you will use to have		Observing the participants completing the experiment			
participants reflect on:		on stain removal			
-what they have learned					
-process involved and					
-how they can apply what they lea	rned to				
other activities/projects or career					
possibilities					
Resources Needed:					
Technology (computer):	None				
Space/location and room set up:	Tables ar	nd water source			
Materials:	-Newspa	apers or plastic to protect surface			
	-Perman	ient pen/marker			
	-100% cc	otton fabric			
	-Cotton t	ip swabs			
	-2 1-Gall	on Plastic bags			
	-Deterge	nt without enzyme and bleach (Arm & Hammer or Ivory			
	Snow)				
	-Deterge	nt with enzyme and bleach (Tide with bleach)			
	-Plastic s	poon			
	-Hot Wat	ter			
	-Dishpan	of cool water			
	-Paper to	owels			
	-Ketchup				
	-Mustard	)			
	-Grape ju	lice			
	-Soy sauc				
volunteers:	1 to 2 vo	iunteers for every 8-15 participant			

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Name of Activity: STEM Activity 13 – What's in That Detergent

**General Description**: Participants will learn the types of energy needed to clean clothes, the chemistry behind how detergent components work, and the science behind the effect of types of water on the use of detergents to clean.

Hands-on activities:

- 1. Complete experiment, testing the difference in natural and synthetic detergents.
- 2. Research special topics including: how enzymes work; the effects of using petrochemicalbased detergent on environment; or how soap was made in the mid-1900's.
- 3. Create a poster about what is learned in activity/lesson.

Performance Objectives/Outcomes				Know: How clothes get clean and how			
(What will all students KNOW and be able to DO as a result				components of detergent work.			
of this activity?)			<u>Do</u> : I	dent	ify the different ingredients	in i	
			laun	dry d	letergent, their purposes, a	nd	
				your	clothes get clean.		
Selected 21 <sup>st</sup> Century Skills and	d TII	PPS*(Skills that studen	ts will	ts will practice in this activity)CHECK:			
Accessing and Analyzing	Х	Innovation and Creati	vity		Teamwork and	х	
information					collaboration		
Use Curiosity and Imagination	Х	Critical Thinking and		Х	Make appropriate use of	Х	
		Problem Solving			equipment, tools,		
		(identify/clarify/defin	e a		technology		
		problem or situation)					
Effective oral and Written	Х	Compare and select t	he	Х	Make the needed effort	Х	
Communication (Communicate		best alternative for a			to carry out a task or a		
effectively)		given problem.			plan.		
*Tennessee's Innovative Programme	ning	g Priorities					
Definition			Connection with Activity (What will				
			participant learn in this STEM area?)				
SCIENCE: Study of the natural world, including the laws of			Participants will learn the types of				
nature associated with physics, chemistry, and biology and			energy needed to clean clothes, the				
the treatment or application of facts, principles, concepts,			chemistry behind how detergent				
or conventions associated with these disciplines.			components work, the science behind				
			the effect of types of water on the use				
			of detergents to clean, and the				
			different types of detergent.				
<b>TECHNOLOGY:</b> Comprises the entire system of people and			Participants will learn about the				
organizations, knowledge, process	ies, a	and devices that go	agitation of clothes by washing				
into creating and operating technological artifacts, as well			machines as part of what helps clean				
as the artifacts themselves.			clothes.				
<b>ENGINEERING:</b> Body of knowledge about the design and creation							
of human-made products and a process for solving problems. This							
process is design under constraint. One constraint in engineering							
design is the laws of nature, or science, and time, money,							
available materials, ergonomics, environmental regulations,							
manuracturability, and repairability.				cina	ate will use measurements	and	
auantities numbers and shapes			considered with the measurements and				
quantities, numbers, and snapes.			specific volume measurements to carry				
				out experiment.			

STEM Activity Lesson Plan STEM Activity 13 Cont.					
Assessment:	Participants will have successfully				
	and aspect of cleaning clothes, and				
	created a noster				
Reflection and Application:		Completing the Experiment and			
Technique(s) you will use to have	answering questions after experiment				
-what they have learned	is complete				
-process involved and					
-how they can apply what they lea	rned to other				
activities/projects or career possib	ilities				
Resources Needed:					
Technology (computer):	None needed				
Space/location and room set up:	n: At least 2 tables for 4-Her's: one to fill out experiment page a				
	one to do experiment				
	Warm Water source				
Materials:	terials: -Copies of experiment page for each 4-Her				
	-Pencils -Newspapers or plastic to protect surface				
	-Bath towel				
	-Permanent pen/marker				
	-100% cotton muslin fabric				
	-Two 1- quart plastic containers				
	-Plant based (natural) detergent (Mrs. Meyer's Laundry				
	Detergent; Charlie's Soap)				
	-Petrochemical-based detergent (Tide, Cheer)				
	-Warm Water				
	-Substances to stain fabric:				
	-Ketchup				
	-Butter -Orange juice -Make-up				
Volunteers:	At least 2 volunteers need	ded (Ideal group size = 5-10)			

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Name of Activity: STEM Activity 14: To Make or Buy Your Clothes?							
General Description: Participants	will	learn c	riteria to consider whe	n de	termining whether to make	e or	
buy clothes and how to invest in cl	othi	ing tha	t will last for a long tim	ne.			
Hands-on Activity:							
Calculate the actual cost o	fma	aking v	s. buying a garment.				
Deufermenes Ohiestives (Outeene				. + .			
(What will all students KNOW and	es es	blo	Know: Various criteria to consider when deciding				
(What will all students KNOW and be able			Whether to buy or make clothing.				
to DO as a result of this activity?)			<u>DO</u> . Participants will be able to calculate the actual cost of making vs. huwing a garment				
Skills that students	s wi	ll pract	of making vs. buying a garment.				
Accessing and Analyzing	X	Innov	vation and Creativity		Team work and		
information	~	millor			collaboration		
Use Curiosity and Imagination		Critic	al Thinking and	х	Make appropriate use of	х	
		Probl	em Solving	~	equipment, tools.		
		(iden	tifv/clarifv/define a		technology		
		probl	em or situation)		07		
Effective oral and Written		Com	pare and select the	Х	Make the needed effort	Х	
Communication (Communicate		best a	alternative for a		to carry out a task or a		
effectively)		given	problem.		plan.		
* Selected 21 <sup>st</sup> Century Skills and	TIPP	S -Ten	nessee's Innovative Programming Priorities				
Definition			Connection with Activity (What will participant learn in				
			this STEM area?)				
SCIENCE: Study of the natural world,	inclu	uding					
the laws of nature associated with physics,							
chemistry, and biology and the treatment or							
application of facts, principles, concepts, or							
conventions associated with these disciplines.			Participants will learn to use calculators (or function on				
of people and organizations knowled	JP JP	em	ratucipants will learn to use calculators (or function on				
processes, and devices that go into cre	eatir	ng	their phones) to add, multiple, subtract and divide.				
and operating technological artifacts,	as w	ell as					
the artifacts themselves.							
ENGINEERING: Body of knowledge a	bou	t the					
design and creation of human-made products							
and a process for solving problems. This							
process is design under constraint. One							
nature or science and time money available							
materials, ergonomics, environmental							
regulations, manufacturability, and							
repairability.							
MATHEMATICS: Study of patterns and			Participants will use math skills to calculate the cost of				
relationships among quantities, numbers, and			making a garment, understand the economic factors to				
snapes.			consider when buying a garment, and understand				
			investment buying.				

STEM Activity Lesson Plan STEM Activity 14 Cont.						
Assessment:		Completion of exercise calculating cost of making vs.				
(How will you know if the objectiv	ves have	buying clothing. Completing an inventory of closet and				
been met?)		determining classic items needed.				
Reflection and Application:		Leader will have participants discuss the various criteria				
Technique(s) you will use to have		to consider when making vs. buying a garment and				
participants reflect on:		decide which criteria are most important to them.				
-what they have learned						
-process involved and						
-how they can apply what they lea	rned to					
other activities/projects or career						
possibilities						
Resources Needed:	1					
Technology (computer):	Calculato	or				
-						
Space/location and room set up:	Tables ar	nd chairs for participants to sit around.				
Materials:	Example	of store-bought garment with price tag; Example of sewn				
	garment	with cost of fabric/notions.				
	Copies of	f form to complete when comparing sewn to bought				
	item.					
	Pencils					
Voluntoorg	1.)/01/04	aar far over ( F participants				
volunteers:	1 volunt	eer for every 5 participants				

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