



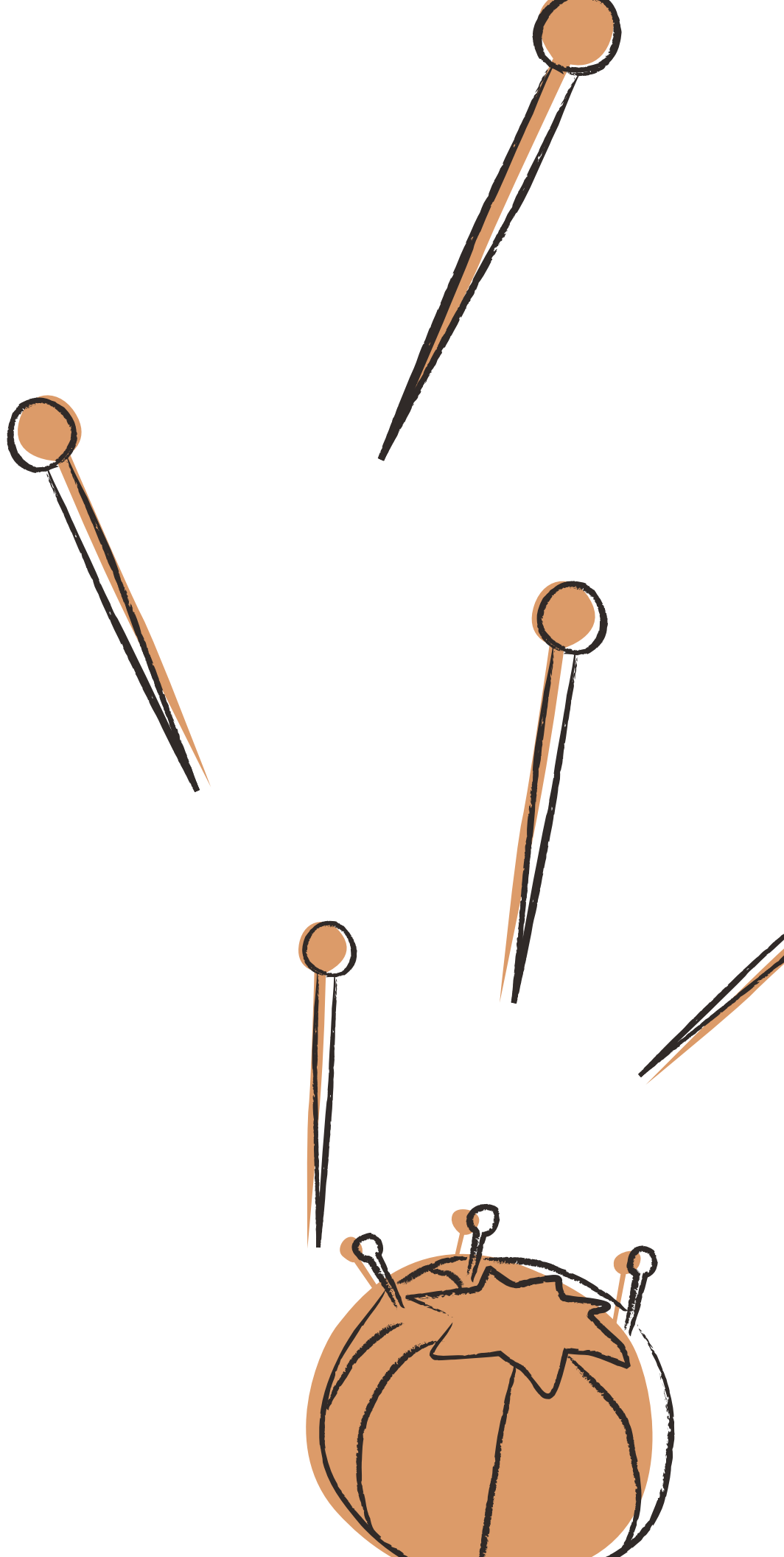
Ideal for
Ages 8-10

STEAM Clothing 1

FUNDamentals

Science
Technology
Engineering
Art
Math







Acknowledgments

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The Nebraska 4-H Statewide Youth Curriculum Committee was formed in 2007 to provide youth perspective to all aspects of the curriculum development and promotion process. When you see the “Youth Reviewed” logo on the cover of a Nebraska 4-H curriculum, you are reading a publication that has included youth input from this specially selected team of 4-H members.

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The 4-H Youth Development program abides with the nondiscrimination policies of the University of Nebraska–Lincoln and the United States Department of Agriculture.

Welcome,

How would you feel if someone said about you, “That gal (or guy) really has style!”? Like most people paid such a compliment, you’d likely feel flattered. You’d have been recognized for your aesthetic sense, for your ability to put together a “look”, or for your awareness of trends and your ability to combine them in a way that’s uniquely yours.

Having style is more than what appears on the surface – it’s more than skin deep. Someone with style knows how to navigate the world with awareness and caring. Awareness is especially important: knowing what’s going on around you, knowing what quality is, whether it’s in the clothing you construct or the relationships you invest in and nourish, and knowing how all of your choices and decisions impact others. In some ways, these qualities are all part of what we think of as “lifestyle”. Your personal lifestyle reflects how you put it all together: the fabrics you purchase and use, the relationships you develop and grow, the plans you hatch and the goals you aspire to. Style extends to just about every part of you – it’s part of your identity and it’s part of what makes you unique.

We faculty, staff and students who work in the Department of Textiles, Merchandising & Fashion Design at the University of Nebraska–Lincoln are committed to making a difference in the lives of individuals, families and communities. In our textile science program we are heavily involved in research into and development of new fibers with novel applications. For example, we are engineering new fibers from agricultural byproducts such as cornhusks. We are also engineering unique drug delivery methods using nanofibers which are extremely small fibers that can be produced using a number of processes, including electrospinning.

Math figures critically in both our textile science and our merchandising programs. Faculty and students explore product development, sourcing and distribution systems that demand precise and up-to-the-minute accounting of all of the quantifiable variables that are at play in the lifecycle of a pair of jeans or a T-shirt or a set of bed linens or any of the many hundreds of thousands of products that we group under the heading of “soft goods”.

To appeal to consumers and their senses, those soft goods need to be as pleasing to the eye as they are satisfying to our sense of touch. Not only must they feel good, they must also look good. This is where a well-developed and critical design eye comes into play. Our textile and fashion design faculty and students apply their own unique problem-solving strategies to this challenge of bringing a measure of artfulness to the products that they create.

So, we work in an integrative collaboration in which science, technology, engineering, art and math form the scaffold for all of the creativity and innovation for which our program’s teams are responsible. Clearly, there are wonderful synergies at work in the world of textiles and fashion, and this *STEAM Clothing 1: FUNdamentals* curriculum will introduce you to some of them. I hope they ignite your passion!

One look could change everything!





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Welcome to STEAM Clothing

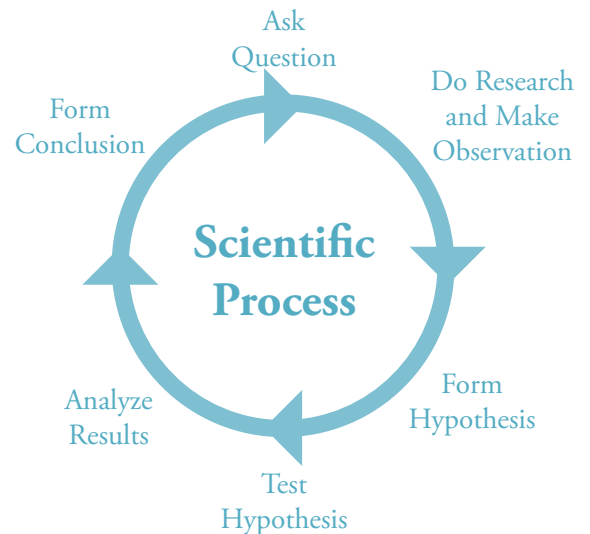
Sewing is a skill, and it is lots of fun to learn how to do it. Sewing involves creativity, good technique, and patience. There is a lot more to sewing than you might think! In this new 4-H project, *STEAM Clothing 1: FUNdamentals*, you will learn about how Science, Technology, Engineering, Art, and Math are required to create clothing and other textile products. Even if you just wrap a piece of fabric around yourself without sewing a stitch, you're still engineering a garment to solve a problem (clothing your body). As you begin to find out more about sewing, you'll discover why it is important to understand a bit of the science behind textiles. You need to know which type of fiber will be best suited to the type of clothing you want to create. If you make the wrong choice, the garment might not perform the way you thought it would.

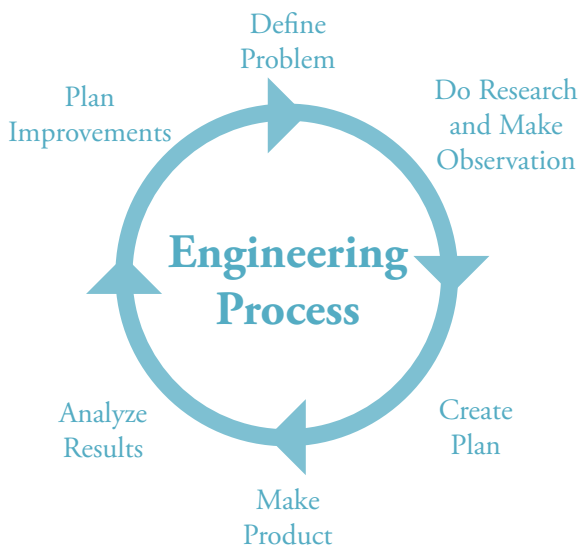
Science

It will be fun and interesting to experience the process of Science as you: 1.) Try to answer a question, 2.) Do some research about ways others may have answered the question, 3.) Form a hypothesis about what you expect the answer will be, 4.) Test your hypothesis by doing an experiment, 5.) Analyze the results of your experiment; and 6.) Form your conclusions – understand more about the answer to your question. Science is about discovering answers about the natural world. The scientific process can be cyclical – in other words, the answer to one question might lead to another question.

Technology

There is a lot of Technology involved in sewing. Long ago, before Elias Howe invented the sewing machine (1846 – U.S. Patent 4,760 – the first patent for a lock stitching sewing machine), all garments were constructed by hand. Think what it must have been like before needles and pins were available! Early man had needles made of bone as early as 61,000 years ago. Pins didn't come on the scene until about 4,000 years ago. Although spring scissors have also been around for nearly 4,000 years, the pivot type scissors we use today didn't exist until about 1,761 AD. How do you suppose anyone cut out fabric to sew garments before there were scissors? As you proceed through the pages of this curriculum, you'll discover even more technology used to make sewing possible. We will also use a lot of Information Technology as we get video instruction from the Internet.





Engineering

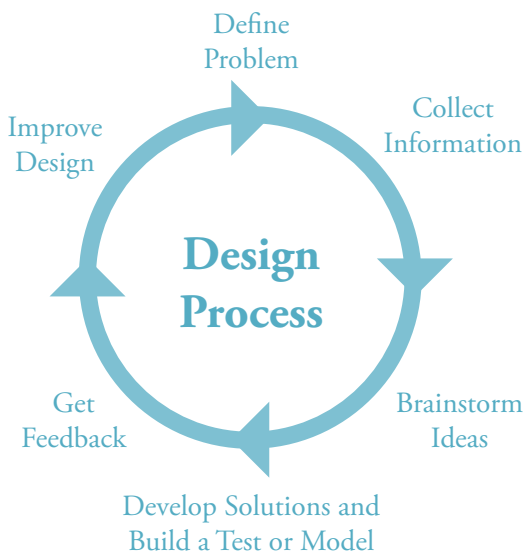
Engineering is the application of scientific, economic, social, and practical knowledge to design, build, and maintain products. As you learn about techniques for sewing clothing, you will learn about the process of engineering that includes: 1.) Definition of the problem (what do you want to do); 2.) Background research 3.) Planning; 4.) Creating solutions; 5.) Building the solution using processes and technology; and 6.) Fine tuning or improving the solution through critical analysis.

“Scientists discover the world that exists; Engineers create the world that never was.” – Theodore Von Karmen, Aerospace Engineer

Art

Many of the decisions you make as you plan a sewing project have to do with the elements and principles of Art. You consider line, shape, and form as you think about what type of garment you’d like to make. The next decisions you need to make revolve around color and the texture of the fabric you’ll choose. Principles that make some patterns appealing and others unappealing include harmony, variety, emphasis, rhythm, balance, proportion, and scale.

The Design process looks very similar to the Scientific and Engineering processes. It is also a cyclical process.



Math

It would be impossible to determine how much fabric to use to create a garment without Math. In this curriculum, you’ll discover how a project might be affected if seam allowances are increased or decreased. You’ll use your math skills to calculate adjustments to patterns based on your body measurements. Precision is important for successful sewing projects, and you’ll use math as you go along to help measure and keep your garment precise.

Besides, Science, Technology, Engineering, Art, and Math, you will also consider the possibility of creating a business from the products you sew. You will think about ways other businesses sell similar products, and how you might price your products to be competitive.

As you can probably already see, *STEAM Clothing 1: FUNdamentals* has a lot to offer. We’re excited that you’re going to learn to sew with STEAM Clothing!

Dear Leader,

You are about to embark on a new adventure teaching young people about how to construct clothing from textiles. This new STEAM clothing curriculum looks at clothing in a whole new way – from the points of view of Science, Technology, Engineering, Art, and Math. In other words, as processes all dedicated to one end – garment construction.

In the introduction to the manual, please take some time to familiarize yourself with the various STEAM processes. The manual is organized into four chapters that focus on traditional topics for any beginning sewing manual.

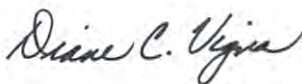
- Chapter 1** helps youth gather the tools they'll need, both technological tools and art and design tools.
- Chapter 2** helps youth understand textiles and is full of fun science projects to help them do just that.
- Chapter 3** is focused on the math and engineering techniques garment engineers need to make clothes that fit a human form. Remember, textiles are two-dimensional, and the human form is three-dimensional.
- Chapter 4** goes beyond construction to end results – perhaps a business to sell the things they sew, perhaps a service learning project to give it away, and of course modelling what they've made to show their products off to others.

Please note the orange corner on some of the pages. These pages are designed to be copied and printed out for youth to complete the activity. These pages consist of data collection sheets, quizzes, handouts, and patterns. Youth can then include these pages in their portfolio to document his or her progress in clothing construction. The first activity, *Sew & Tell*, provides instructions on creating a portfolio.

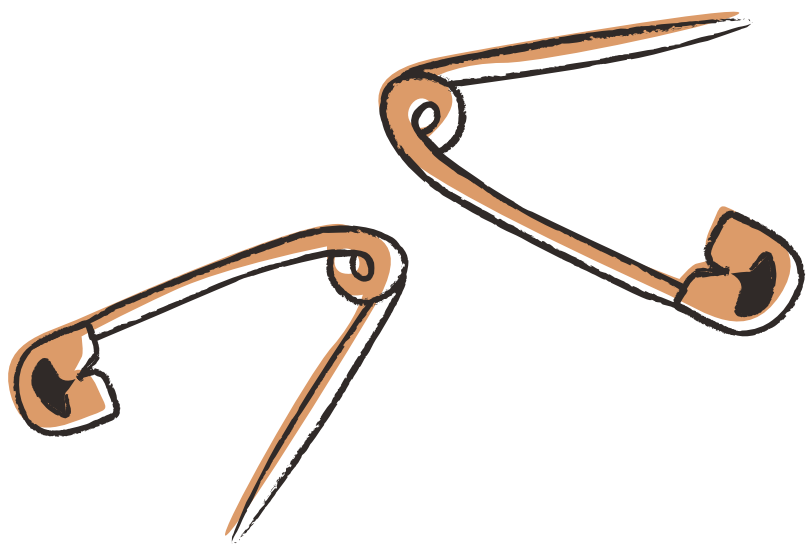
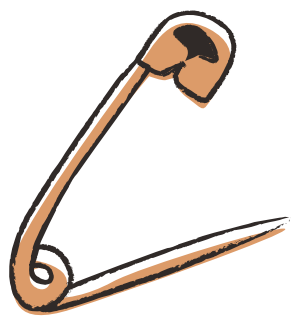
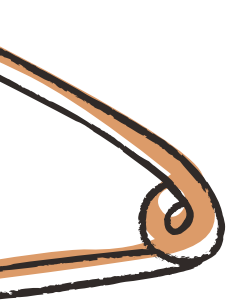
Vocabulary words are included in most of the activities to introduce youth to the proper terminology in textiles and clothing construction. These words are the color blue in the manual's text and can be located in the margins under "Words to Know" and at the end of the manual in the Glossary.

Finally, this, like any 4-H curriculum, teaches youth by encouraging them do activities as the first step of the learning process. The manual was written to youth, but is designed to be led by you, the leader. Be sure to help youth complete the experiential learning process by discussing the "Share what you did," "Process what's important," "Generalize to your life," and "Apply what you learned" sections at the end of each activity. Youth can fill in answers on the printed sheets, or you can discuss the questions as a group following the activity.

I hope you enjoy teaching STEAM Clothing curricula! It will open your eyes to the complicated process we call clothing construction!



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Getting Prepared

Chapter One



Sew & Tell

Success Indicator

Through this activity you will build a portfolio that records your success.

Life Skills Practiced

Keeping Records, Planning/Organizing, Marketable Skills

Project Skill Practiced

Building a portfolio

What Youth Will Do

Create and learn about the importance of a portfolio

What You'll Need

- 2" Binder with clear sleeve on front
- Clear plastic sleeves
- Dividers
- Scissors
- Glue
- Paper
- Computer
- Creative embellishments to make it your own

Sometimes the best part of creating something is showing it off. Throughout this book and series you will be able to show off what you have learned and created in the portfolio you will make in this activity. A portfolio is a great way to display your creations along with reviewing your work and reflecting on your progress.

- 1 Gather your materials and create a cover page that illustrates your personality and the purpose of the portfolio. This will go in the front pocket of your portfolio. Be sure to include a title such as "4-H Clothing Construction Portfolio", and your name because remember: This portfolio is all about you!
- 2 Create dividers that will help you organize your work so that it is easy to find. Label each of the dividers with the sections listed below such as "Sewing Samples." As you collect your work put it in order by date in each section. All of your "FUNdamentals" sewing samples should be placed before the "Simply Sewing" samples.
- 3 It is very important to make sure your portfolio is neat, and be sure to check your spelling.
- 4 As you collect your work, put it in clear plastic sleeves and place it in the correct section of your portfolio.

What goes inside?

Sewing Samples – Put all of the sewing samples in your portfolio to show your progress and refer back to them when you have questions.

Science Activities – Add in any science activities you have completed from this book to present your knowledge of textiles.

Other Activities – Include other activities that you feel are important.

Technical Flats and Fashion Illustrations – Include a final technical flat or outline of each of your garments you have created for a competition, such as the 4-H Clothing Construction Contest, on a white sheet of paper with the title of the project and year. A **Technical Flat** is an outline of your garment's shape like the ones shown in your pattern guide of the front and back of each garment. The purpose of a technical flat is to illustrate how the garment is constructed and how it functions by showing where the seam lines

are and the shape of the garment. Your lines on this should be very clean with no shading. Then you can show off your drawing abilities and creativity by creating a final fashion illustration or drawing of your ensemble on a white sheet of paper with the title of the project and year. A **Fashion Illustration** is a drawing that presents a clothing ensemble in an artistic form. Have fun with this drawing and include color if you wish.

Awards and Judges' Comment Sheets – Make sure to include any awards and comment sheets from judges that you have received from competitions such as the 4-H Clothing Construction Contest and Fashion Show.

Photos – It would be pretty difficult to fit each of your garments in this portfolio so the next best thing is to take pictures of your work. When photographing your work, have someone take a picture of you in your garment against a background that does not distract from how amazing your ensemble looks. The best place to start is against a white wall. You may want a couple views of your garment such as front and back. If there is a special detail you want to show off, take a close-up. Paste these pictures on a sheet of card stock paper. Title the page with the project and year.

Reflections – A great way to track your progress is to reflect on your work as you go along. For each of the garments you create for a competition, write a reflection on the process of making your garment. Describe what you enjoyed, what problems you ran into, and how you solved them. Discuss the strengths of your garment and what skills you can improve upon in the future. Also think about your judges' comments and describe how these will be helpful in your future projects. Title the page with the project and year.

Sew You Know

A **Portfolio** is a collection of work that represents a person's skills and knowledge. By creating this portfolio you are making a portable album that can go anywhere to show anyone in minutes what you are capable of doing. Later on in life when you are looking for a job, this will be a great way to show an employer all of your abilities. The portfolio you are creating here shows your knowledge of textiles and clothing construction. There are many types of careers that use portfolios such as artist, journalist, teacher, and architect. Portfolios are not only for the workforce. Throughout school you will be making various portfolios in class to show what you have learned. With the portfolio that you are creating now it is important that you plan how you are going to complete each of the activities and entries. Set goals and make a timeline for when you are going to complete each entry.

Words to Know

Technical Flat

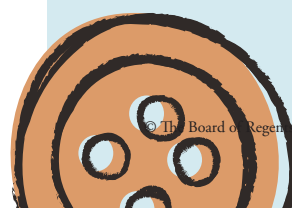
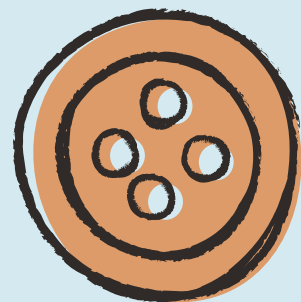
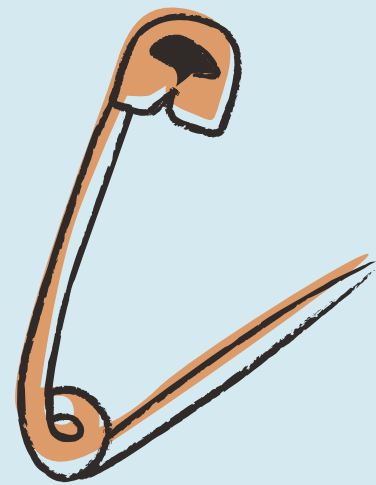
A line drawing that communicates how the garment is constructed and how it functions by showing where the seam lines are and the shape of the garment.

Fashion Illustration

A drawing that shows a clothing ensemble in an artistic form.

Portfolio

A collection of work that represents a person's skills and knowledge.



Share What You Did

1. What did you put on your cover page to make it special for you?
2. When you finished your portfolio for this book, how did you feel looking through it?
3. What was your favorite part?

Process What's Important

1. How many times have you looked at your portfolio for help on other projects?
2. Why is it important to keep a collected record of your work?

Apply What You Learned

1. Who would you show this portfolio to?
2. When in the future do you think you will need to make other portfolios?

Generalize to Your Life

1. How do you plan on completing the items that will go in your portfolio?
2. Why is it a good practice to reflect on your work?

More Challenges

- Present your portfolio to someone else. It could be a parent or friend, or enter it in a competition. Practice what you want to say about your portfolio and how you will present it.



Get the Notion to Sew

To begin crafting garments, you will need to start at the beginning: the tools and supplies of sewing. By making up your own sewing box, you will have all the tools to create a wonderful garment right at your fingertips. Sometimes tools will be expensive, so you might have to share these with others.

Activity One

- 1 Gather and identify all of the tools listed on pages 12-16 from your sewing tools at home. Draw a star by the ones that you think you will use the most. If you do not have a tool at home, purchase that tool at your local fabric or craft store.

Activity Two

- 1 Experiment with the tools on scrap pieces of fabric.

Sew You Know Scissors or Shears?

There are several different types of tools used to cut; for sewing you will be using a pair of scissors called shears. **Shears** are used for cutting fabric and not paper. You want to be sure they are sharp and stay sharp – this may require having them sharpened every once in a while. Often a 7" length is best for beginners. Shears have a small ring handle for your thumb and a large loop for the rest of your fingers, while regular scissors have two round holes.

Scissors are used for snipping threads, cutting corners, and trimming seams. They are no longer than 6" in length and, as mentioned before, have two round holes for your fingers.

Another type of scissors used in sewing is **Pinking Shears**. This particular type of scissor creates a zigzag pattern when it cuts. In beginning sewing, you can use these shears to finish your seams instead of using other seam finishes (which will be covered in later sections).



Success Indicator

You will be able to select the correct tools to use for your sewing project.

Life Skills Practiced

Planning/Organizing, Decision Making, Wise Use of Resources, Personal Safety

Project Skill Practiced

Locating and identifying specific sewing tools, and deciding which tool to use to achieve the intended outcome

What Youth Will Do

Put together a sewing kit and learn about the various tools used in sewing

What You'll Need

- Box or basket to hold the sewing tools
- Dressmaker shears
- Small pair of scissors
- 60" tape measure
- Seam gauge
- Seam ripper
- Fabric marking tools: Tailor's chalk, carbon paper and tracing wheel, dressmaker's pencil, water-soluble marker
- Point turner
- Threader
- Thimble
- Dressmaker's pins
- Safety pins
- Pin cushion
- Needles - size 7 or 8 crewel needles or sharps
- Sewing machine needles (size 12 universal – good for medium fabrics)
- Cotton-wrapped polyester thread
- Bobbins

Words to Know

Shears

A type of scissors used for cutting fabric, not paper. They have one small round hole for thumb and large oval hole for rest of fingers.

Scissors

Used for snipping threads, cutting corners, and trimming seams. They have two small ring handles the same size.

Pinking Shears

A type of shear that creates a zigzag pattern when it cuts.

Tape Measure

A long, flexible form of a ruler.

Seam Gauge

A small ruler that has an adjustable marker used to measure the depth of a seam or hem.

Seam Ripper

A small tool used for undoing stitches.

Marking Chalk

Used to transfer or mark seam allowances or darts onto fabric.

Point Turner

Tool used to turn the corners of a pillow or garment.

Thimble

A cover for the middle finger to protect it when you push the needle through the fabric.

Straight Pins

Sharp pins with a stop on one end, used to hold fabric together.

Safety Pins

Pins that have a hood on them, good for long-term use.

The Essentials

Tape Measures are one of the most important tools used in sewing. It is way better than a ruler since it is flexible. When you are measuring your body, it can wrap around you. It is usually coated in plastic and comes in a range of sizes. For basic sewing, a 60" tape measure will get the job done.



A **Seam Gauge** is another great tool that will be used often, especially in garment sewing. This is a short ruler used for marking and checking the width of a seam or hem. One that is 6" long is a good size.



A **Seam Ripper** is an essential tool you cannot live without. As a beginning sewer, more often than not, you will make a mistake that you need to rip out. A seam ripper is the ultimate tool for this very purpose! This tool allows you to clip threads easily without hassle. To get the most out of this tool without tearing or distressing your fabric, slip the seam ripper point under every second or third stitch, cut with the edge, and then tug the stitches from the fabric.



When sewing with a pattern you will want something to mark the fabric with. There are tons of options to accomplish this task: **Marking Chalk**, Disappearing Ink Pens, Water-Soluble Ink Pens, Dressmaker's Pencils, or Chalk Cartridges can be used. Each of these has its own advantages as well as disadvantages. When using marking chalk, make sure that the color you are using will be able to be seen on the fabric you are using. Whenever using any sort of disappearing pen, try a test sample first before trusting that the ink will go away. You also have a very short work time with disappearing ink, so work with speed. When using water-soluble inks, determine if your fabric can be washed or not. Some fabrics like silk will spot if you put water on them, creating a more obvious stain than the marking pen.



A **Point Turner** is an excellent tool if you are constructing a pillow, vest, or jacket. This is a flat tool with a pointed end for pushing out corners, points, and curves.

Thimbles can be used to protect your middle finger when you push your needle through your fabric.

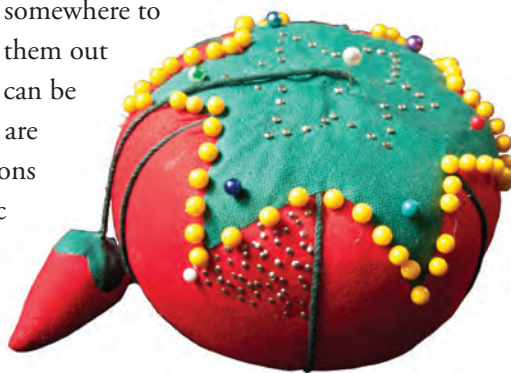
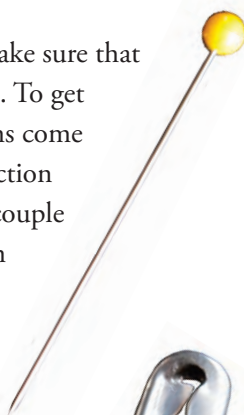
On Pins & Needles

There are several different types of pins that can be used for sewing. As a basic sewer, you will need two basic types: Straight and Safety Pins.

As you are sewing your fabric, you will want to make sure that the two layers of fabric don't move around on you. To get around this problem, use **Straight Pins**. These pins come in several varieties and different lengths. Your selection of pins will depend on your project. For the first couple of units, you will need a universal pin: 1½" - 2" in length. You want to look for pins made of steel rather than nickel, since nickel can corrode and damage your fabrics.

Safety Pins have a point that allows them to work the same way as a straight pin; however, they have an enclosed hood that locks the point in place when closed. Safety pins are great for long-term use – if you have to step away from your work for a while, or if you are clumsy and poke yourself a lot when you are sewing.

While sewing you will want somewhere to put your pins after you take them out of the fabric. A **Pincushion** can be used for this purpose. There are two main types of pin cushions available in stores: the classic poke cushion and the magnetic dish that catches your pins.



Words to Know

Pincushion

A place to store your pins after you remove them from fabric.

Hand Sewing Needle

A long, slender tool with a sharp point on one end and an eye on the other, used to carry thread through fabric.

All-Purpose Thread

A cotton or polyester thread that can be used for many different sewing tasks. All-purpose threads vary by manufacturer.

Upholstery Thread

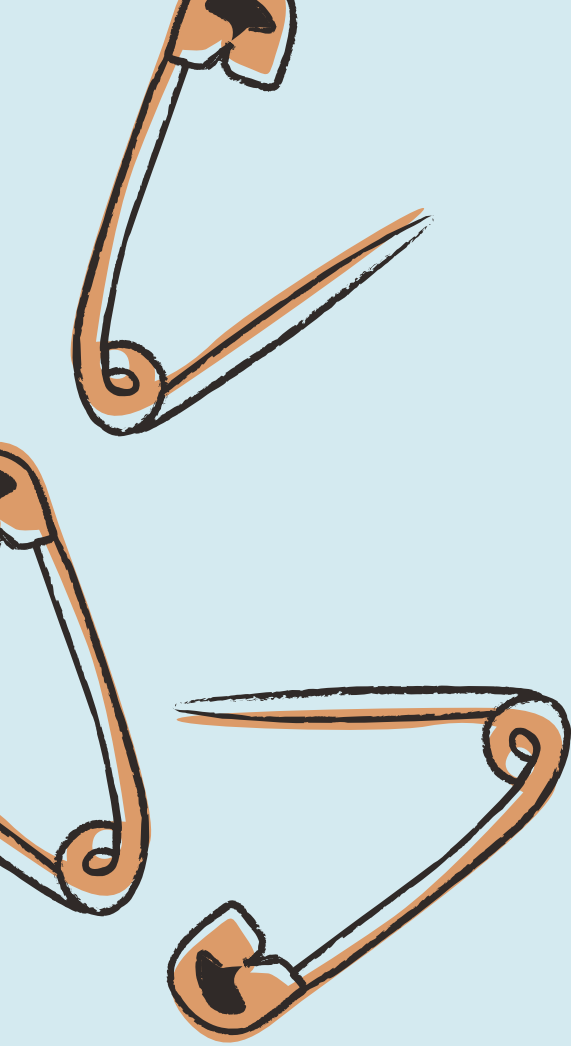
Extra strong, heavy duty specialty thread that is ideal for both hand and machine sewing heavyweight fabrics such as upholstery fabric. Upholstery thread has a weight of 30, which indicates that 30 kilometers of thread will weigh one kilogram. The higher the weight of the thread, the finer or lighter the thread. An everyday sewing thread weight is 60.

Embroidery Thread

Thread that is spun specifically for embellishment. Typically, embroidery thread is used in machine embroidery while embroidery floss is used for hand embroidery.

Embroidery Floss

Cotton yarn composed of six plies that is used for hand embroidery.



Most of us are familiar with **Needles for Hand Sewing**: They have a pointed end, a smooth shank, and an eye for carrying thread. Many sizes and varieties are available for purchase and having a few different options isn't a bad idea. When choosing your needle for your project, the needle should be small enough to slip through the fabric easily. Crewel needles have long, slender eyes for easier threading. A size 7 or 8 will be best while you are learning to sew.

Another type of needle is a sewing machine needle. Unlike hand sewing needles, these have a shank that fits into your sewing machine. Like your hand sewing needles, they have eyes at the end, but the eye is at the sharp point, which is where you put your thread. These needles also come in various sizes – fine, medium, and heavy duty. The size of the needle depends on the weight of the fabric you will be sewing. The bigger the number, the bigger the needle. A size 14 (European Size 90) is best for medium-weight fabric such as cotton, size 16 is good for jeans.



On a Thread

There is more to picking your thread than just getting a good color match. It is important to realize that different threads are made for different purposes.

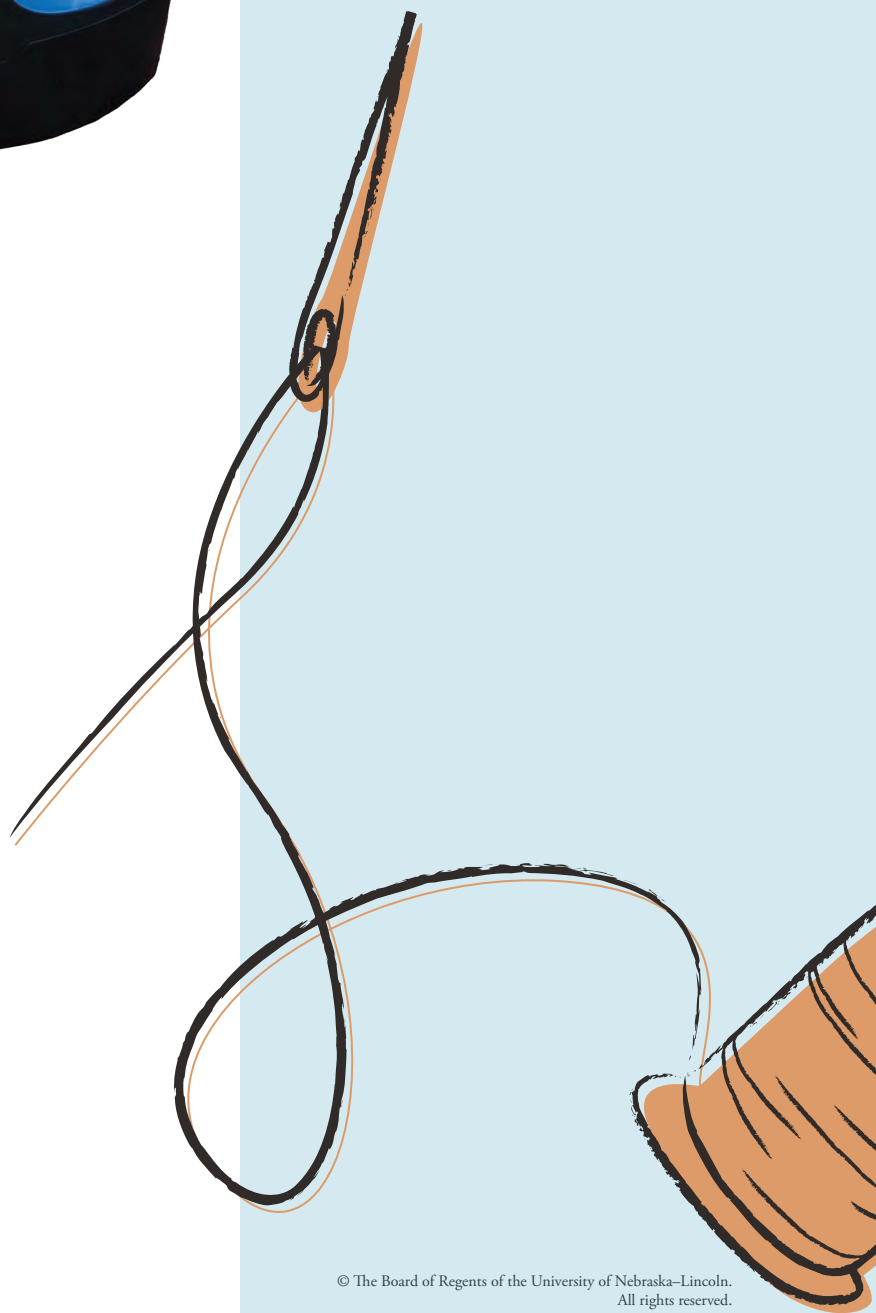
All-Purpose Thread is used for many fundamental tasks. This thread is highly durable and is washable, but beware, it may have a cotton overwrap so it may shrink a little. 100% Polyester Thread will not shrink or stretch. It is slightly less durable than the cotton-wrapped polyester thread, but still a good all-purpose thread. Silk thread is very durable and beautiful to look at because of its natural luster. This thread is often used for machine quilting and crafting. **Upholstery Thread** is very heavyweight, designed to handle stress and abuse. This thread is much too heavy for most garment construction, but perfect for sewing heavy fabrics. **Embroidery Thread** is specifically designed for machine embroidery use.



There are numerous color choices available in this primarily rayon based thread. Because of its fiber content, embroidery thread is unsuitable for garment construction but can be used for applique or other surface techniques.

Iron Irony

When purchasing irons, it is important to consider the weight. In today's world, lighter is better. But when purchasing an iron, you want the opposite. A heavier iron will allow you to use less elbow grease to get the same (if not better) results. You will want to use a steam-dry iron and make sure it has different settings for different fabric types.



Share What You Did

1. What tools were the most difficult for you to find (either at home or in the store)?
2. What tools do you think you will use the most? What are some reasons you think this?
3. When experimenting with the tools, did you find a tool that did something you weren't expecting? What was this?

Process What's Important

1. While organizing your sewing box, what are some strategies you will use to find your most important tools later on?
2. How will you decide which tools to use for a specific task when you create with fabric?

Generalize to Your Life

1. Are there any tools that you use for sewing and for everyday life?
2. Compare cooking tools with sewing tools. Are there similarities? How about differences?

Apply What You Learned

- What are some of the tools that could possibly have dual purposes? An example of this would be using a knitting needle to push out a pillow corner.

