

A Guide for Bringing Knitting and Spinning into Elementary through High School Classrooms

by Cat Bordhi

When I first decided to incorporate spinning and knitting into my seventh grade humanities classes in Friday Harbor, Washington, I began without asking permission from the administration, because I didn't want to take the chance of getting no for an answer. And so a month or two later, when the district superintendent popped through my closed door to find youngsters draped all over the furniture, some spinning, others winding yarn, and most of them cheerfully knitting in small clusters while an audio tape of a Sherlock Holmes story played, in other words, with no obvious signs of normal education going on, I thought I might be done for. I managed to keep drifting to the opposite end of the room our visitor, helping students as far away from him as possible just so I wouldn't have to explain myself until I had time to think of what to say. When he finally caught up with me, I asked, "So, want to learn to knit?" He replied, "What makes you think I already don't know how?" and popped out the door as quickly as he had arrived.

Later that day an email arrived. "Great class! Which Sherlock Holmes mystery was that anyway?" I replied with the name of the story, added that we had already read and discussed it and students had written essays on it, and then went into a long explanation of how I had incorporated spinning and knitting into my lessons on ancient history, aiming to convince him that my unusual choice of activities would actually support the curriculum and state testing requirements. I ended my email with, "So, when did you learn to knit?" It turned out he hadn't, but in later conversations he told me that what struck him first as he came through our door was that every single student was productively and positively engaged as a member of a thriving community of learners, and that he had rarely seen a classroom so attentive on so many levels: listening, working with the hands, and helping one another. The unusual fact that almost no one had been distracted by his entrance (except for me) confirmed that students were exceptionally absorbed.

After that I decided to test my luck by inviting my principal to visit our classroom while I led a class discussion on ancient Mesopotamia and my students knit. He had frequently teased me about knitting during staff meetings ("Socks! I can't believe you're knitting socks!" he'd say . . . not knowing that a few years later I would be able to retire before him because of the success of a book I would write on the subject.). A good friend and a man with the highest professional expectations, I knew he would use his eagle eyes to scan every student for signs of inattentiveness, and that he would expect to find plenty signs. Instead, he soon realized that even those students who were regular visitors to his office for chronic disciplinary issues were now giving me their full attention, and that when I asked the class to break into small groups to discuss questions and then report back to the whole group, students made the transitions easily, with unusual harmony. It was as if though the knitting was a vehicle carrying them from one learning task to another, lulling the usual fidgety mischief (or worse) that normally interferes with classroom learning. I made sure to randomly quiz individual students on details of our discussion to prove to my principal that they were digesting everything I taught even while knitting. He left the room surprised and convinced.

Later in the year, he allowed me to offer a school-wide class on knitting for one period a week, and we had serious discussions about designing a year-long class, for academically challenged students, using knitting to support their learning in all areas of the curriculum. I wrote up a detailed plan on how I would teach math, language arts, science, and more through knitting.

Unfortunately, scheduling difficulties made it impossible for us to carry out the plan.

One of my fondest memories is of proctoring our state mandated testing, a week-long and grueling marathon for students. Picture about a hundred anxious seventh graders, four at each table, filling the school commons. They're bending over test booklets, working on demanding essays or solving challenging mathematical challenges or answering comprehension questions on dry prose, for hour after hour. Meanwhile, I'm slowly walking about, weaving in between the tables, a ball of yarn stuffed in my pocket and a sock rocking back and forth as it grows in my hands. Again and again a student raises his or her weary head, then catches a glimpse of me knitting – a familiar sight, and one that reminds them of peaceful, happy school activities. Again and again I watch an anxious face relax, hear a sigh, and see the youngster's shoulders drop in relief as happy memories wash over them, and then they turn back to their tests, with refreshed confidence. Our school placed fourth in the state that year, and I like to think it was partly because of the knitting, and partly because of the rigor of our teaching and students.

The knitting fever spread from my classrooms to much of the rest of the middle school, and several elementary school teachers began to teach knitting too. A substitute teacher at the high school started a knitting club for teenagers, and a friend who taught at a local private school integrated knitting into her English classes. In every setting, initially skeptical administrators and staff were won over by the results: attention-deficit (ADHD) students who seemed transformed, evaporating management problems, increased engagement in learning, in some cases more regular attendance, and a beneficial atmosphere of alert, peaceful contentment and community in the classroom.

Incidentally, we had virtually no gender issues around knitting. The lesson plans I include guide students in actually inventing spinning and knitting, much as their ancestors might have, sparking the thrill of invention, creativity, and survival. Initial projects include a fishing net, a model of a tree house knitted directly into a tree, and small bags. Boys and girls alike light up with excitement at the chance to pursue these goals.

When knitting is integrated into the curriculum (see lessons that follow) and integrated into the daily routine of class (for instance, when students are encouraged to take out their knitting projects during class discussions or other times when hands and eyes are free), an alert peacefulness arises in the room, opening a window for education. Many students told me that knitting had made them feel differently about school – it had become a haven instead of a burden. I watched tentative friendships develop between students from widely differing social groups, chronically inattentive students become intellectually engaged in class discussions, and marveled at the dramatic drop in classroom management. In my opinion, knitting is one of the cheapest and most effective ways to improve educational engagement and foster a positive social environment for learning that I have ever experienced.

Knitting develops fine-motor skills, hand-eye coordination, math skills, and what Multiple Intelligences educational researcher Dr. Howard Gardner calls “Bodily-Kinesthetic Intelligence”. Since both hands hold needles and each hand has its own job, both sides of the brain are engaged and performing an internal rhythmic patterning that underlies the development of language skills, particularly reading, and also math. A classroom community of knitters frequently makes great strides in what Dr. Gardner calls “Interpersonal Intelligence,” as they mentor one another, share conversation while working productively, encourage one another, and enjoy the calming yet challenging task of knitting. In addition, knitting develops key habits that lead to success in academics and in careers: persistence, concentration, and collaboration.

The series of lessons that follow can be adapted for students from about third or fourth grade all the way through high school, and will fully engage students of widely varying abilities. The activities are captivating, hands-on, and awaken a sense of wonder, excitement, and intrigue in students who may have always found history and social studies dull. The lessons appeal equally to boys and girls, and if a teacher wonders if boys will want to knit, these lessons, alive with the thrill of invention, survival, and practical application, will make the answer yes. If the full sequence of lessons is followed, all major areas of the curriculum, from science to math to language arts, will be involved. Some lessons may be spread over two to three sessions, depending on time available. An extensive bibliography appears at the end.

And so you can see why I want to promote knitting in schools. Here you will find directions for starting a program, whether you are a teacher or a yarn shop owner. I hope you and your students will experience your own unique version of the benefits I and others have enjoyed.

Quick Glance: steps for teaching knitting in a school

1. Line up volunteers and initial supplies
2. (see lesson plans) The adventure and excitement of discovery, survival, and invention captures the attention of both boys and girls, making them eager to learn to knit.
3. Volunteers help teach students to knit; soon students begin to teach other students
4. Choose among the suggestions for ways to integrate knitting into curricular areas (math, science, social studies, language arts)

Detailed steps for teaching knitting in a school

Gather volunteer knitting instructors

Begin to make a list of volunteer knitting instructors ahead of time, so they will be ready when the students are. Contact senior centers, knitting guilds, churches, and your regular customers, explaining your goals and asking for their help. Describe the rewards of being a volunteer: the opportunity to enjoy the company of several youngsters, passing on the traditions of an ancient craft, experiencing first-hand a local learning community, and positively contributing to the school environment. Explain that volunteers would be working with a few students at a time under the supervision of the classroom teacher. Once you have a classroom teacher ready to start the program, ask them to inquire among the students' families (including grandparents) and older students for more volunteer instructors.

Handmade and free materials to start with – or some yarn shop support

If there are funds available to purchase initial supplies, I suggest that all students begin with very light colors of worsted to heavy-worsted weight yarn (a single ply wool is easiest to knit with, if available) and short wooden needles. If funds are not available, it is almost better, because the process of making needles from dowels or chopsticks immediately invests the students in learning to use them. Information on making needles is available in *Kids Knitting* by Melanie Falick as well as on-line sources and other books. Free yarn can usually be found in former knitters' closets – ask for yarn and needle donations at the same time that you put out a call for knitting instructors. If yarn must be purchased, suggest the students put on a bake

sale to earn the funds. Or, if unspun fleece can be obtained, have the students start with a little hand-spinning. (See lesson plans for all these activities)

Use lesson plans and integrate knitting into the curriculum

Teachers can modify the detailed lesson plans as suits their needs. The lessons included in this packet are extensive enough to use over several months' time, and the suggestions for integrating knitting into other areas of the curriculum could spread over an entire year.

As the program becomes established, positive results are observable

As a classroom of students begin to knit regularly, the atmosphere and community within a classroom usually becomes more positive, sometimes dramatically. Formerly antagonistic cliques of students begin to merge as they share a common fascination. Students who are academically challenged are often at the top of the class in learning to knit, and are able to help teach their normally advanced peers. Students with ADHD (Attention Deficit Hyperactive Disorder) may suddenly become attentive, thoughtful students while their hands are occupied with the rhythms of knitting. In my classroom, I allowed students to knit any time their hands and eyes were not required for other tasks, and it dramatically increased the attention and engagement in class discussions, lectures, and most of all, in creating a positive atmosphere for learning and treating others with respect and kindness.

James Krag, M.D., explains why he supports knitting in the classroom

"I am a psychiatrist working as Medical Director of a Community Mental Health Center in Virginia. I am also the psychiatric consultant for our child and family team and for our in-school programs. I strongly support knitting as an activity for all children but I think that it has added benefit for children with Attention Deficit Hyperactivity Disorder. For them, it can be very helpful to have a project going that they can be busy with between assignments. In fact, many with ADHD are actually able to listen better to lectures or classroom discussion if they are also knitting. This may not work for all students but over my years of work in both out-patient and residential programs I have learned that some people listen better when they are "using up" some of their hyperactivity. The soothing and repetitive quality of knitting can occupy just enough of their attention so that they are not as distracted from listening. Knitting also helps children learn the skill of focusing, and they may be less likely to bother other students while knitting. Knitting also gives children a sense of completion that is very tangible. Once learned, there is a feeling of mastery that can be generalized to other aspects of their lives. I strongly encourage more teachers to experiment with encouraging students to learn and practice knitting at school."

LESSON PLANS FOLLOW ON NEXT PAGE

A Whirlwind Journey Through Early Civilization — The advent of spinning and textiles, and discovery of knitting

Lesson One: The discovery of spinning

Before teaching this lesson, practice finger-spinning, then spinning with a rudimentary drop spindle (see lesson two for directions to make one of a stick and a potato). Expertise is not necessary, just the ability to make a length of string. This web site offers comprehensive instructions: http://www.interweave.com/spin/resources/spinning_brochures.asp

The discovery of spinning would have been made by thousands of people over thousands of years. If you have ever picked up something and begun twisting it or bending it, then you can easily imagine a primitive person picking a tuft of fur, wool, or hair caught on a thorn bush, and pulling the fibers apart and twisting them. The discovery that fragile, single fibers become strong and powerful when twisted in groups would have kept a prehistoric tribe's attention. Over time, a variety fibers would have been identified and experimented with, from wool, hair, vines, and the strong fibers left in rotting bast fibers, such as nettles and flax.

Materials: Ask students to bring in combings from family pets and hair from family brushes. Obtain enough unspun fleece (ask your local yarn shop to find a supply if they don't carry it) to supplement what the students bring. You might also ask your local dog groomer for combings. If the materials are not very clean, soak them for half an hour in warm soapy water, lift out gently, and soak in several warm rinse waters. Do not agitate or the fibers may clump and felt. Press between dry towels and then let dry on another dry towel.

Step One: Give each student a small fiber supply, and ask them to imagine they are a prehistoric wanderer. They just found a bit of a wild animal's wool that had got caught on a thorn bush. Ask them to break one single fiber, to see how strong it is. Then ask them to line up a group of about five fibers and try breaking them. Then students should try twisting a group of five fibers and try breaking them. Ask them to compare the strength of a single fiber to that of five untwisted, to that of five twisted together. Now that the magic of twisted fibers has been discovered, students can experiment with ways of twisting groups of fibers together into as long a strand as possible, first alone, and then with a partner. After a period of time, ask students to write a description of what they have discovered and the techniques that work best, or for young children, to tell the class.

Step Two: Ask students to brainstorm a list of wild animals whose fur or wool might be caught on thorn bushes or made available in a hunt, as well as plant fibers that offer long fibers (someone may recall the fairy tale of the eleven brothers who turn into swans and must be saved by their sister, who is spinning and knitting nettle shirts for all of them). Their ideas may include: Mountain goat, yak, wild horses, wild sheep, camels, wolves, big cats, foxes, raccoons, skunks, possum, beavers, human hair, moth cocoons (silk), nettles, flax, hemp, vines.

Step Three: Ask students to brainstorm primitive uses for this new invention (point out that everything from sewing thread to heavy rope is now possible), such as: dragging home large game, securing a container to shoulders or forehead for carrying, closing a bladder or stomach sack of food, tying hair out of face, hanging food from trees so bears won't eat it, climbing trees to get away from bears, sewing garments out of skins, building skin tents – joining skins to make larger dwellings, tying bundles of greens together to bring home, making nets for catching fish, nets for carrying fruits, nuts, etc., ability to tie skins on feet as shoes, and finally

– when someone fiddles around enough to produce the first knitting (or weaving or felting) the invention of fabric – an alternative to those heavy animal skins!

Lesson Two: I need four hands to make really long rope or yarn, but only have two!

A spinner of long cords must continually manage four operations: hold the fiber supply and feed (draft) it evenly, manage the twist point so it doesn't move into the fiber supply, twist the drafted fibers, and store the twisted fibers so they don't unwind. For a single spinner to succeed, two of these operations must be "automatic" or independent of the hands. The invention that solved this problem, which is at least 20,000 years old, is a drop spindle. This wondrous tool allows the twisting and storage jobs go on automatic for long enough to make progress with the other two tasks. Before teaching this lesson, go to this web site to learn how to use a hand spindle. Depending on the age of your students, you may want to print the beautifully written and illustrated brochures for them to read.

http://www.interweave.com/spin/resources/spinning_brochures.asp. For instructions on making perfectly decent drop spindles from discarded CD's, go here:

<http://www.interweave.com/spin/files/CDspindles.pdf>

Materials: For the spindle shaft: 1/8" dowels, or chopsticks, or pencils, or straight sticks; for the whorl: clay or round firm fruits/vegetables such as apples or potatoes (may be sliced into circles), unspun wool for spinning

Step One: Demonstrate that it is hard for one person to spin a really long strand and continue spinning, because four things must happen: one, the fiber supply must be available and fed evenly (called drafting), two, the twist must be controlled by pinching it off so it doesn't rise up and entangle the whole fiber supply, three, the fiber must be twisted, and four, the twisted fiber must be stored so it doesn't unwind while the next section is being spun. Ask two students to demonstrate the four jobs using their four hands. Explain that the challenge will be to invent a tool that allows one person instead of two to spin long lengths of rope or yarn.

Step Two: Ask students: which of the four jobs would be easiest to replace with a tool (probably storage)? Ask for ideas and methods and list on the board. Assuming the storage device is "invented", ask students how many hands are now required (three). They may suggest winding the fiber onto a stick as a storage device, and then having the second person twist the stick while the first person drafts fiber and manages the point of twist. This takes care of *one* job. If class does not choose twisting as the next job to replace, lead them in this direction.

You may eventually have to demonstrate that a stick (spindle shaft) suspended by a string with a round centered weight (whorl) at the bottom of the stick may be set to spin for anywhere from a few seconds to up to a minute. This primitive drop spindle can be made of a stick inserted through a whorl made of clay, or a potato (choose very round potatoes) or slice of a potato or apple. A notch at the top allows the yarn to be looped around and stay put (the spun yarn can be wound around the stick beneath the whorl). A lesson on the physics of spinning fits in here. Briefly, heavy mass (for instance, a thick or large whorl) causes more inertia in a rotating object than light mass, meaning the heavy mass will slow the momentum of the spinning rapidly. Where the mass (of the whorl) is located in relationship to the center (the shaft) of the rotating object affects the duration of spinning – if the mass is closer to the center, the spin is shorter and faster. If the mass is farther from the center, the spin will be longer but slower. When the mass is farther from the center this also has a stabilizing influence, so that the spindle wobbles less. Experiments to demonstrate or discover these principles may be carried out, measured, discussed, and recorded. Consider using several sizes of apples or potatoes, so that a wide whorl and a narrow whorl can be used together, to

increase the center mass. To increase outer mass, an apple or potato will need to be carved thinner at the center.

Step Three: Assist students to make the drop spindle of their choice (after completing the physics experiments) and actually try spinning. It would be helpful to have some skilled volunteers to help individuals succeed, and you might also want to have a few manufactured spindles to show students and use for demonstration.

Lesson Three: Knitting useful items, before the invention of needles

Now that the tribe has discovered how to manufacture lengths of string, rope, and yarn, they will be inventing ways to use it. Up until now, when they wanted “fabric,” they’ve had to kill an animal and prepare the skin. Can the invention of string create a new kind of fabric? Knitting a string or rope tree house is actually a great way to learn the rudiments of knitting. (Note: teacher must try knitting a tree house on the Y-shaped branch before teaching this lesson.)

Materials: 100 yards of heavy string, a Y-shaped branch with limbs 15” – 30” in length; if possible, enough Y-shaped branches and string so that each group of 3-4 students can work with one; and printed handout of tree-house knitting instructions, which may be downloaded at: http://catbordhi.com/downloads/treehouse_knitting.pdf

Step One: If you live in a region with dangerous animals who want to eat you, it would be helpful to climb trees quickly and make yourself comfortable up there until the animal leaves. A long rope would help you climb a tree quickly. How about using a rope to build a platform where you can safely sleep with no fear of falling? Teacher, with assistance from a student or two, demonstrates tree house knitting in a Y-shaped branch. If enough materials are available, students work in small groups to knit tree houses. Note how quickly and easily the tree house goes up and comes down – very helpful for a nomad.

Step Two: An alternative project is to knit a string net: two students may also knit a long rectangle by using one arm for the cast-on and another for the new stitches, while the second student maneuvers the string. This can become a fishing net or a bag for hauling things.

Step Three: Final challenge (extra credit?): ask students to try to figure out how to knit with sticks and string, alone (only two hands) and demonstrate to class next time.

Historical note:

The earliest textile artifacts found were not knitted, but woven, and are fossilized impressions, because the fabric itself disintegrated. The earliest knitted artifacts are about a thousand years old and are the actual textiles. Many historians believe that knitting was a much later development than weaving. However, I question that conclusion, for the following reasons: One, not finding fossilized impressions of knitting does not mean it did not exist in an earlier time. Two, knitting is more portable, requires less equipment, and less preparation than weaving, and early tribes were nomadic. Three, the basic operation of knitting, pulling a loop through a loop, is not sophisticated and might happen spontaneously, just as the first spinning must have happened spontaneously. There are many plausible scenarios which support the possibility of knitting having arisen spontaneously anywhere there was fiber to work with. I believe that the rudiments of knitting, like spinning, must have been invented many times in many places. Perhaps someday more historical evidence of these events will come to light.

Lesson Four: Invention of knitting needles – let's begin knitting!

With this lesson, some real knitters who can help teach skills will be very helpful, although the previous lesson will have taught students a great deal about the basic moves of knitting. Ideally the students will make their own knitting needles, or if time is short, prepare the needles ahead of time. (*Note: this lesson is designed to extend over several weeks' time*)

Materials: pointed branches; or chopsticks or 1/8" dowels cut to about 10" and pencil sharpener; large beads or self-hardening clay and glue, paraffin melted with mineral oil and cooled, fine sandpaper, real yarn for students to work with, a small supply of blunt-tipped tapestry needles for sewing up knitting projects

Step One: Make needles by sharpening dowels or chopsticks at one end, sanding until smooth and until the point is rounded, gluing a bead or clay ball on the blunt end, and rubbing with the paraffin-mineral oil mixture. Each knitter needs a pair. Students may make their own, which gives them a sense of pride and ownership, and invests them in learning to use the new tools. (*Note: regular pencils, sharpened, written with enough to wear the tips smooth and round, and then dipped in shellac and allowed to dry, make decent beginner's knitting needles. A rubber band around the eraser end will keep stitches from slipping off.*)

Step Two: Teaching new knitters is easiest if an experienced knitter casts on 10 stitches and knits the first two rows. Then a mnemonic device (for instance, "In through the front door/ Once around the back/ Peek through the window/ And off jumps Jack.") and the help of an experienced knitter working with 2-4 students at a time, will get the class started. Ask students to count at the end of each row to be sure they still have 10 stitches. Expect a great deal of variation in the ease or difficulty of learning, and allow several sessions for students to become comfortable with the new movements. Explain that a choice of knitting projects will soon follow.

Step Three: (Make sure volunteer instructors are still here for this part of the lesson.) Once students can knit 10 rows of 10 stitches each without significant mistakes, they are ready to choose a small project. First however, teach the basics of stitch gauge, using their practice pieces for analysis. Ask students to measure the number of stitches in 2" of width and the number of rows in 2" of length, and record this information. If all students have used the same yarn and the same size needles, note the wide range of gauge differences and point out that knitting is very individual, and that with practice their gauge will become regular and predictable. Present the following project ideas and ask students to determine reasonable dimensions, then calculate the number of stitches they would need to cast on at their gauge to make each one:

- Knitted bag – knit a rectangle, sew into bag
- Knitted leg or wrist-warmers – knit long rectangles and sew one side
- Knitted hat – rectangle sewn and gathered at top
- Fishing net (knit of string on large needles) which may be sewn onto a branch bent into a hoop shape

Step Four: Students write about, sketch, graph, and present to each other what they have learned while learning to knit and creating their projects. This represents the beginning of the transmission of patterns and skills through generations.

Lesson Five: In the 21st Century – are we still wearing the same basic technology?

Materials: Magnifying glasses

Step One: Students examine their clothing with magnifying glasses and identify knitted fabric and woven fabric, making sketches of the path the spun fiber takes in knitting and in weaving. Have students list those garments or accessories that are knitted and those that are woven and analyze why they group as they do. Ask: what are the advantages of knitted versus woven fabric in terms of comfort, durability, etc.? If a prehistoric tribe was skilled in both technologies, where might they have used knitting and where weaving?

Step Two: If there is time to extend this lesson, research may be done (see bibliography) to trace what is known of the history of knitting and weaving, and essays may be written discussing the historical facts and how this aligns with the student's own insights into how textile technology might have evolved over time.

Lesson Six: Design Teams

Groups of 2 – 4 students work together to design a knitted project which would be useful to a 21st century person as well as to a prehistoric person. Depending on the inclinations and skills within the group, they may choose to spin the fiber and make the needles, or use manufactured yarn and needles. Requirements of the project:

- Thoughtful teamwork – using each member's talents fully and positively
- Recording of design process through brainstorming and implementation, including written descriptions, directions, and illustrations (a graphic design and publishing program, and digital photography would be wonderful)
- Presentation of project to class
- Demonstration of usefulness of finished design
- Evaluation includes reflection on process – strengths as a group and as individuals, learning that would enhance next group project, alternative paths design might have followed, and what finished design suggests for further evolution

Ongoing Lesson and Activities, integrated into curricular areas

Technical writing and editing:

Once basic knitting skills are established, a small team of students may be asked to innovate simple designs and write patterns, then exchange patterns with another team to test-knit the patterns. Students will be evaluated on both the original patterns and their clarity as well as the collaborative teamwork and editing resulting from discussions between the teams during the test-knitting.

Narrative and descriptive writing:

Students may be asked to compose introductory narrative to their patterns (either their original pattern or one they have followed) describing its winning elements and advantages. Encourage use of sensory vocabulary and require a "hook" in the first sentence.

Literature

See bibliography for extensive list of knitting and fiber-related books, mostly for young children. *Treasure Forest*, a Nautilus Award winning novel by Cat Bordhi, offers middle and high school readers a complex tale with elements of spinning and knitting woven through its foundations.

Reading to follow directions

Pattern reading and then following the directions is an excellent practice and the results are self-evaluating.

Vocabulary

Ask students to use a thesaurus as well as the Internet to collect examples of the verb “knit” used not to describe textiles, but for other purposes, such as “knitting the brows together in concentration”, etc. After compiling a list with as much variety as possible, students can write reflections on how the word knit might have evolved into each usage.

History

At least one historian (Elizabeth Wayland Barber, author of *Women’s Work: The First 20,000 Years*) claims that the invention of twisted cordage is one of the most revolutionary factors in human civilization. Ask students to reflect on, research, and analyze this claim and present their well-supported conclusions in either an essay or class presentation.

Math

Knitting offers wonderful opportunities for learning math in a hands-on way (and is ideal for writing about and illustrating mathematical understanding), for curious math learners of all ages and levels. Consider the simple counting of stitches or rows, or the proportions of stitch gauge (compare, for instance, the row-stitch proportions of garter stitch to stockinette, or the significance of gauge being off by a half stitch per inch in something small like an eyeglass case as opposed to a large sweater, or the geometric possibilities of shaping (see <http://www.woollythoughts.com/index.html> - Pat Ashforth and Steve Plummer’s website – a treasure trove for educators! Enough geometric and other mathematical applications of knitting and crocheting to keep any classroom going for a year or two), or the topological adventures presented in Cat Bordhi’s two **Treasuries of Magical Knitting**, where the mysterious Moebius strip appears in vivid reality when knitted.

Science

In addition to the physics of spinning, many science investigations can be done with fiber. The chemistry of dyeing, techniques for identifying unknown fibers, the botany of bast fibers, the physics and calculus of elasticity are but a few.

Consumer and environmental issues

The above activities help teach students about textile production, global resources, industrialization, and third world handwork methods.

Evaluating the Success of an Academic Knitting Program

The following elements (as well as individual projects found in lesson plans, etc.) may be evaluated according to a teacher’s customary method.

- Focus and concentration
- Persistence
- Improving math, writing, and reading skills
- Critical thinking and problem-solving
- Creative innovation and synthesis
- Quality of engagement in curricular areas integrated with knitting
- Positive social behaviors
- Mentoring, especially as it crosses social groups
- Hand-eye coordination and small motor skills
- Project completion
- Presentations

- Teamwork

Bibliography

Books and web sites on teaching children to knit

- <http://www.woolworks.org/kids.html> - directions for teaching kids to knit
- http://www.education-world.com/a_curr/profdev/profdev100.shtml - excellent article on teaching knitting in schools with good links
- <http://www.sethboydenpta.org/KnittingTogether.html> - description of a school knitting program
- <http://cerebro.cs.xu.edu/~smbelcas/math-knit.html> - comprehensive links to mathematical knitting
- <http://www.woollythoughts.com/index.html> - Pat Ashforth and Steve Plummer's website – a treasure trove for educators! Enough geometric and other mathematical applications of knitting and crocheting to keep any classroom going for a year or two.
- <http://www.detnews.com/2005/metro/0503/25/D01-128659.htm> - great article on knitting in schools and medical benefits for adults
- <http://www.millennialchild.com/Handwork01.htm> - handwork and intellectual development
- <http://www.boloji.com/wfs4/wfs426.htm> - article about boys learning to knit
- http://www.pburch.net/dyeing/chemistry_reactivedyes_lesson.shtml - a lesson adaptable for elementary through high school on the chemistry of dyeing.
- Kids Knitting: Projects for Kids of All Ages** by Melanie Falick ISBN 1885183763
- A First Book of Knitting for Children** by Bonnie Gosse and Jill Allerton ISBN 0946206368 (available from www.knittersbookshelf.com)
- Knitting for Children - a Second Book** by Bonnie Gosse & Jill Allerton ISBN 094620653 (available from www.knittersbookshelf.com)

Books and web sites on knitting and spinning

- <http://www.saburchill.com/history/chapters/IR/010.html>
- <http://www.alitadesigns.com/knitting.php>
- http://www.apparesearch.com/Definitions/Fabric/Knitting_history.htm
- http://en.wikipedia.org/wiki/History_of_knitting
- A History of Handknitting** by Richard Rutt ISBN 1931499373
- No Idle Hands: The Social History of American Knitting** by Anne Macdonald ISBN 0345362535
- The Alden Amos Big Book of Handspinning** by Alden Amos ISBN 1883010888

Children's Books with Knitting and Fiber Related Subjects

The following lists were compiled by Myrna Stahman (author of Stahman's Scarves and Shawls), who explains: "A request for information on knitting "legends" sent me to my book shelves to review some of the children's books I have collected. When my children, who are now 23 and 28, graduated from elementary school I began volunteering in a kindergarten classroom of a low income school, reading to the class about once a week (or as often as my work schedule permitted). I would pick story books that related to the letter of the alphabet they were studying that week, trying my best to have the books also relate to knitting or a fiber related activity so that I could bring additional things to show and share with them."

Picture books:

- A Gift From the Lonely Doll** by Dare Wright, no ISBN located; published by Random House, Inc., copyright 1966
- Angelita's Magic Yarn** by Doris Lecher ISBN 0-374-30332-0

Boys Don't Knit! by Janice Schoo, illustrated by Laura Beingessner ISBN 0-88961-107-6
Claire and the Friendly Snakes by Lindsey Tate, illustrated by Jonathan Franklin 0-374-31337-7
Daisy and her Needles by Keith Balding ISBN 0-7181-3333-1
Derek the Knitting Dinosaur by Mary Blackwood, illustrated by Kerry Argent ISBN 0-87614-400-8
Jeremy's Muffler by Laura F. Nielsen, illustrated by Christine M. Schneider ISBN 0-68980319-2
Knitted by Grandma by Ruth Hearson ISBN 0-8037-2689-9
Mr. Nick's Knitting by Margaret Wild, illustrated by Dee Huxley ISBN 0-15-200518-8
The Long Red Scarf by Nette Hilton, illustrated by Margaret Power ISBN 0-87614-399-0
The Winter Mittens written and illustrated by Tim Arnold ISBN 0-689-50449-7

Story book for preteens:

Knit Wits by William Taylor, ISBN 1-86943-114-6 Charlie, whose mother is a fashion model but rather odd, and whose grandmother is a feminist weight lifter, decides that he will have to knit a baby present for his new sibling.

A few knitting books for kids and kids at heart:

A Lamb's Tale by Lucy Langford, photography by Mike Langford ISBN 0-85921-220-3
Amanda the Amazing Merino by John Parker, illustrated by Jeffrey Parker ISBN 0-908670-27-3

Fiber related kids' picture books:

How a Shirt Grew in the Field by Konstantin Ushinsky, adapted from the Russian by Marguerita Rudolph, illustrated by Erika Weihs 0-395-59761-7
How to Spin a Rabbit by Helen von Ammon, illustrated by Erin Mauterer ISBN 0-9647756-3-8
Kids Knits ISBN 0-9520872-0-0
Mary Had a Little Lamb by Sara Josepha Hale, illustrated by Salley Mavor ISBN 0-531-08725-5
Milton and Matilda - The Musk Oxen Who Went to China by Nancy Best, illustrated by Robert McClay, no ISBN, copyright 1982
Octavia Warms Up by Barbara Beak, illustrated by Lynne Farmer ISBN 0-85953-785-2
Rumpelstiltskin's Daughter by Diane Stanley ISBN 0-688-14327-X
Sheep in Wolves' Clothing by Satoshi Kitamura ISBN 0-374-36780-9
Sheep Station by Philip Holden ISBN 1-8694-8977-2
Smudge, the Little Lost Lamb by James Herriot, illustrated by Ruth Brown ISBN 0-31206406-7
Sunny's Mittens: Learn-to-knit Lovikka Mittens by Robin Hansen, illustrated by Lois Leonard Stock ISBN 0-89272-290-8
The Chief's Blanket by Michael Chanin, illustrated by Kim Howard ISBN 0-915811-78-2
The Keeping Quilt by Patricia Polacco ISBN 0-689-82090-9
The Long Silk Strand, A Grandmother's Legacy to Her Granddaughter by Laura E. Williams, illustrated by Grayce Bochak ISBN 1-56397-236-0
The Mary Frances Knitting and Crocheting Book by Jane Eayre Fryer ISBN 0-915896-90-0
The Mitten adapted and illustrated by Jan Brett ISBN 0-399-21920-X
The Mitten by Alvin Tresselt, illustrated by Yaroslava ISBN 0-590-33562-6
The Spider Weaver - A Legend of Kente Cloth by Margaret Musgrove and Julia Cairns ISBN 0-590-98787-9

The Winged Tiger and The Lace Princess by Phil Yeh and Lieve Jerger ISBN 0-9644149-4-5

Walter Worm's Good Turn by Barbara Beak, illustrated by Lynne Farmer ISBN 0-85953-785-4

Warm as Wool by Scott Russell Sanders, illustrated by Helen Cogancherry ISBN 0-02-778139-9

When Sheep Cannot Sleep - the Counting Book by Satoshi Kitamura 0-374-48359-0

Novels for older students:

Treasure Forest by Cat Borsht ISBN 0968236480, which recently won the Nautilus Award for Young Adult Fiction. As Cat wrote to me, "If you want to knit a tree house directly into a tree, this is the book that will teach you how! It also includes spinning and sock knitting . . . and a golden thread that runs through everything in the most mysterious yet familiar way. The book is suitable for readers from about age 9 on up to 109 . . ." I own this book, have read it, and highly recommend it.

What I Call Life by Jill Wolfson, ISBN 0805076697 is a new book I just read, which I believe belongs in the company of every foster child. One of the characters in the book is simply the "Knitting Lady".