Cleveland Clinic

OFFICE OF CIVIC EDUCATION INITIATIVES

healthCARE™

(**C**ultivating **A**cceptance and **R**espect through **E**ducation)

Unit 5: Mobility Impairment

****

For information on the Cleveland Clinic Office of Civic Education Initiatives, please visit: http://www.clevelandclinic.org/CivicEducation

CONTENTS

Program Overview

healthCARE™ (**C**ultivating **A**cceptance and **R**espect through **E**ducation) is a dynamic educational program designed to teach children ages 5 through 10 about diversity and individual differences. Developed by the Cleveland Clinic Theatre Company and the Office of Civic Education Initiatives, the program provides free educational resources, including the script and the video of the award-winning children's play *Tall Tale*, as well as an accompanying lesson plan that meets state and national standards in a variety of subjects. healthCARE™ also offers disease-specific lessons so teachers can address diversity and individual differences as they relate to specific medical conditions.

The **Cleveland Clinic Theatre Company** is an award-winning theatre troupe devoted to educating and entertaining audiences of all ages through the use of the performing arts. Since it was established as a program of the Community Relations Department in the spring of 2004, the Company has written, performed and produced an impressive body of work, including interactive educational plays, radio and TV public service announcements, children's theatre programs, improvisational performances, and an educational CD. As a part of Cleveland Clinic's new Office of Civic Education Initiatives, the group has taken on even larger, more ambitious projects, including the video production of *Tall Tale.*

The **Office of Civic Education Initiatives** was established to fulfill the Cleveland Clinic's commitment to promote education throughout Northeast Ohio. In partnership with area schools, local businesses, and fellow nonprofit organizations, the Office creates innovative programs designed to enhance children's learning in the areas of math, science, health and wellness, the arts, and innovation.

Cleveland Clinic, located in Cleveland, Ohio, is a not-for-profit multispecialty academic medical center that integrates clinical and hospital care with research and education. Cleveland Clinic was founded in 1921 by four renowned physicians with a vision of providing outstanding patient care based upon the principles of cooperation, compassion and innovation. U.S. News & World Report consistently names Cleveland Clinic as one of the nation's best hospitals in its annual "America's Best Hospitals" survey. Approximately 1,500 full-time salaried physicians at Cleveland Clinic and Cleveland Clinic Florida represent more than 100 medical specialties and subspecialties. In 2005, 2.7 million patients came for treatment from every state and 100 countries. Cleveland Clinic's website address is www.clevelandclinic.org.

Mobility Impairment

Teaching a child with a physical disability in a regular education classroom can be a challenging and sometimes frustrating experience for the regular classroom teacher. Many classrooms in older buildings were not made to accommodate wheelchairs or walkers, and classmates of the student with a disability are sometimes unkind. This unit is designed to develop student awareness of the challenges a student with physical disabilities may face every day and to teach students how muscles and bones interact in our bodies to facilitate movement. This unit will also show students how changes to the physical environment can help those with special needs to interact freely with all other children.

Unit Objectives: *Students will*

- *Learn about the bones and muscles of the human body*
- *Develop an awareness of the challenges students with physical disabilities face*
- *Assess the accessibility of equipment on the school playground*
- *Design a school play area that can accommodate students of all ability levels*

Students will also meet many state and national standards in science, social studies, math, language arts and fine arts as listed at the end of this unit.

Introduction: What Does It Mean to be a Friend?

There are a number of suitable books that discuss the issue of physical disability in the classroom. Many are geared towards younger children, although the message would be appropriate for any age group. Reading a story about a child with a physical disability is a good way to foster open discussion and inform students. The following two choices are exceptional in that they involve children with a physical disability without making it the main focus of the story.

Choice 1: All Kinds of Friends, Even Green by Ellen B. Senisi. This story revolves around Moses, a boy with spina bifida, who has a hard time deciding which friend to write about in his Language Arts essay. The book talks about the qualities that make someone a "friend" and discusses physical differences. After reading the book, ask students to tackle the same writing assignment Moses struggled with in the story. Have students think about the most important qualities of a true friend.

Choice 2: Gun Lake Adventure Series books by Johnnie Tuitel. This series features Johnnie, a boy with cerebral palsy, who has a real taste for adventure. In each book, Johnnie solves another mystery while learning important lessons about self-reliance and teaching his comrades about what it's like to be physically disabled. While Johnnie's disability plays a part in every adventure, it is never the focus of the story, emphasizing that people with disabilities are people first.

Any of the books in the "Gun Lake Adventure" series would be appropriate for this lesson. You may want to have different groups of students read different books from the series and give a brief review of the book to the class. When students have finished their books, ask them to write about the friendships described in the book. What qualities make someone a good friend? How do the characters in the book show these qualities?

Other Appropriate Books:

- Howie Helps Himself by Joan Fassler, for grades K - 3
- Rolling Along: The Story of Taylor and His Wheelchair by Jamee Riggio Heelan, for grades K - 3
- Princess Pooh by Kathleen M. Muldoon, for grades 3 – 6
- Alesia by Eloise Greenfield and Alesia Revis, for grades 5 – 8

Extension: In the "Tall Tales" play, could Duke ever be a good friend? How might Duke treat a physically disabled classmate? What would you say to Duke to teach him to be more considerate of those with physical disabilities?

Resources for Teachers:

- http://www.lehman.cuny.edu/faculty/jfleitas/bandaides/sitemap.html
  A goldmine of information for teachers and students dealing with medical issues in the classroom. Contains many poems and stories.
- www.kidsource.com/kidsource/content2/at.ease.html
  Information sheet advising how to interact with handicapped children
- http://specialed.about.com/od/physicaldisabilities/Physical_Disabilities.htm
  General information about children with physical disabilities in the classroom.
- www.palaestra.com/featurestory.html
  Ideas for games and activities with mobility-impaired students

Lesson 1: Learning about our Muscles

Objectives: *Students will*

- Make a model of a muscle system
- Critique the model and suggest ways to improve it
- Demonstrate an understanding of how muscles work in the human body

Materials: *For each group of students* - Anatomical illustration of the muscles of the arm (handout 1), 5-7 pound dumbbell or gallon milk jug filled with water, 2 plastic 12-inch rulers with pre-formed holes, 2 long balloons of the sort used to make balloon animals, rubber bands

Pre-Assessment: Have students study the illustration of the arm muscles (handout 1). Distribute one dumbbell to each group of students. Have students practice doing forearm curls with the weight and ask them what muscles are doing the work. The biceps flexes (contracts) when the arm bends up. To work the triceps, have students stand holding the weight with their arms at their sides, elbows bent. As they straighten their arms out behind them, the triceps will flex.

The biceps and triceps work as a pair – when one flexes the other extends (or relaxes). Ask students to exercise each muscle separately, doing ten repetitions of each exercise. Ask students which muscle feels stronger, or is less tired after the exercises. In most people, the biceps is stronger than the triceps.

Children with cerebral palsy often have trouble with spasticity in their muscles. In these children, the dominant muscle (the biceps in the arm) tends to remain flexed throughout the child's waking hours, resulting in weakening of the opposite muscle (the triceps). Daily physical therapy is necessary to combat this problem. Children with muscular dystrophy have troubles with general weakening of the muscles and children with spina bifida may have partial paralysis. These students also require daily physical therapy. Modify the exercises in this lesson as needed to allow the student with a disability to take part. Students unable to do the exercises could count and record the repetitions for each student.

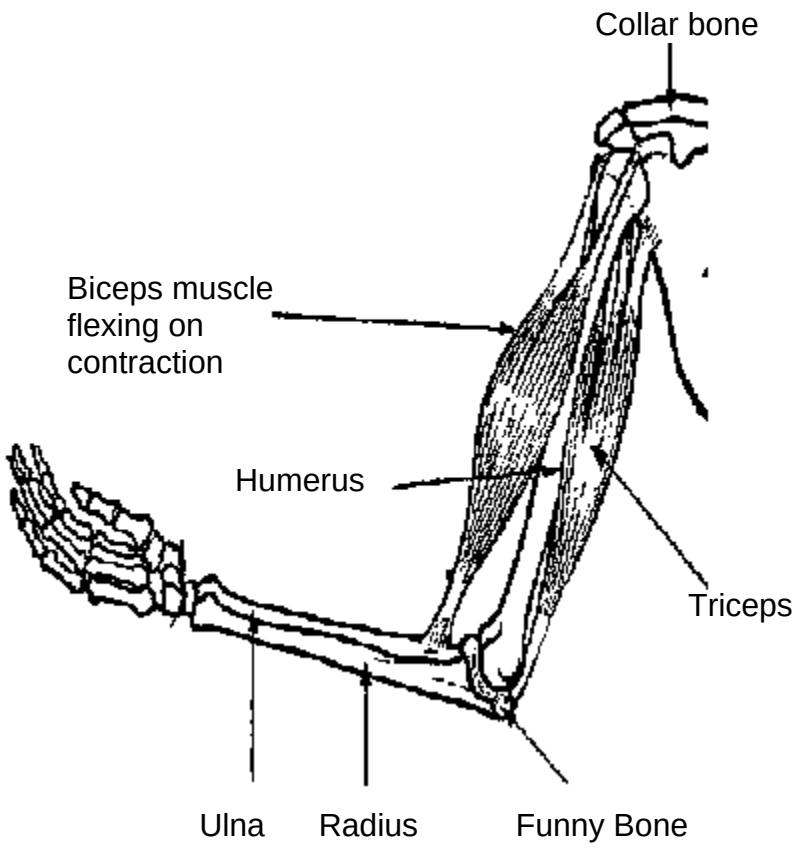
Activity: Tell students they are going to make a model of the arm. Scientists often use models to learn about biological systems. For example, biomedical engineers can learn about how mechanical forces affect the arm by using a well-designed model so that they do not have to experiment on a living being. Distribute a copy of handout 2 to each student.

Procedure:

1) Have students attach the two rulers with a rubber band using the holes nearest the ends of the rulers as shown in handout 2 to create a model of the arm. One ruler is the upper arm bone (humerus) and the other is the lower arm bone (radius). (Note that the ulna is not represented in this model).
2) To create the muscles, students must tie balloons to holes C and D at the far end of the humerus, near where the shoulder would be. One balloon represents the biceps and one represents the triceps. If possible, use different colored balloons.
3) Now tie the triceps balloon to a hole in the ruler representing the lower arm, as close to the elbow as possible (hole B). The triceps runs along the back of the elbow. Tie the biceps balloon to the next closest hole along the front of the lower arm (hole A).
4) Have the students flex and extend their models to see how the muscle moves.

Conclusions: Have each student list the differences and similarities between their models of the arm and a real arm. Compare the lists made by the students. Have students write in their science journals or on a piece of paper what they think of the models they made and answer the following questions:

1) What can be learned from my model of the arm?
2) How can my model be improved?
3) What questions could I answer with my improved model that cannot be answered with the model as it is now?



One muscle extends the arm and the other flexes it

Try flexing your muscles!

Biceps Muscle

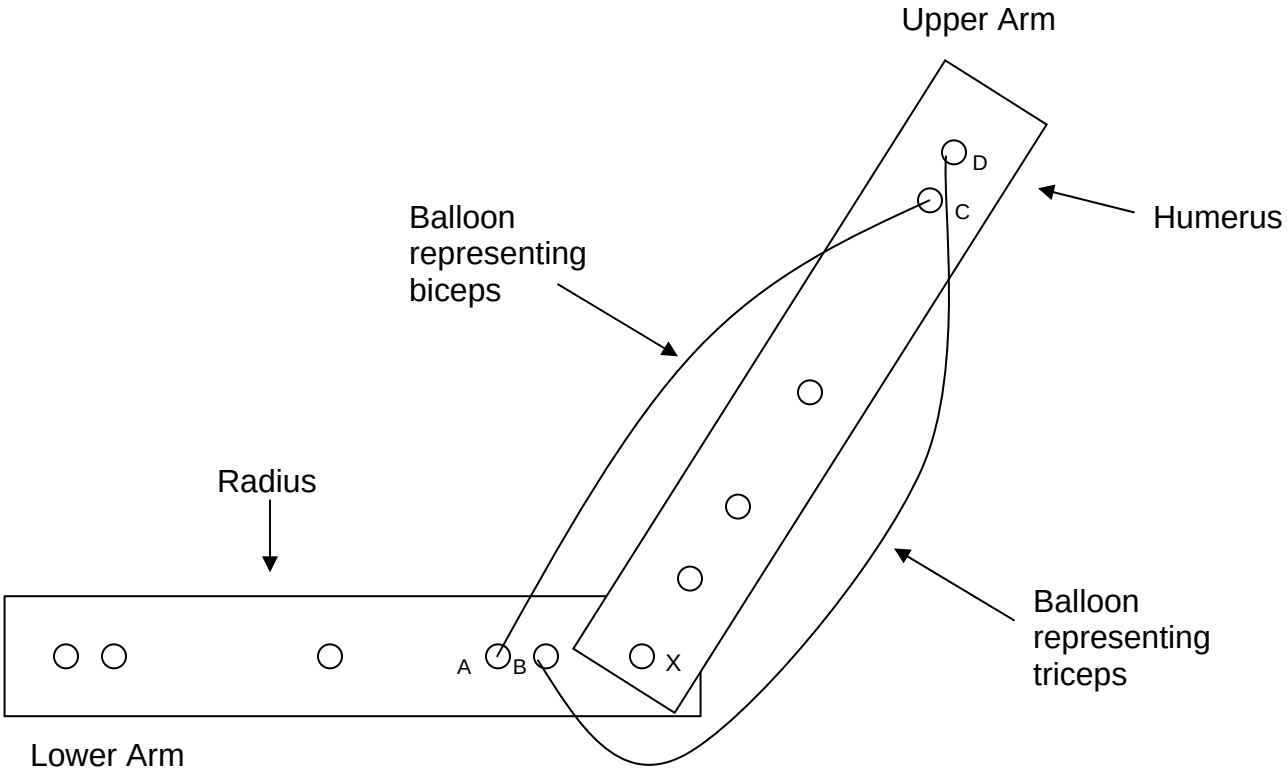
1) Hold the weight down by your side.
2) Bend you elbow and lift it up to your shoulder.
3) Repeat ten times.

Triceps Muscle

1) Hold the weight at your side with your elbow bent.
2) Straighten your elbow back up behind you.
3) Repeat ten times.

Which muscle got more tired during the exercises?

Which muscle do you think is stronger?



To Make Your Model:

1) Tie rulers together at hole “x”.
2) Tie a balloon to hole “A” and connect it to hole “C”
3) Tie a balloon to hole “B” and connect it to hole “D”
4) Move your model arm back and forth to see how the muscles extend and contract. Can you see why your elbow is called a “hinge joint”?

How is this model like a real arm?

_____

_____

_____

How is this model different from a real arm?

_____

_____

_____

Lesson 2: The X-Ray ID Game

Learning the bones of the body can be fun if you make it into a game. This lesson helps students match the major bones in their bodies to their medical names. If you feel this will be too difficult for your students, you can have them concentrate on the more common names of their bones. The worksheet for this lesson includes both common and medical names.

Pre-Assessment: To familiarize students with the names and locations of the bones in their body, send them on a webquest to visit the internet sites referenced below or allow them time to study the labeled skeleton included in Appendix 1. Have students work with a partner to complete the skeleton worksheet (handout 3). Give extra credit if they can identify any bones beyond the ones listed on the sheet!

Resources:

- http://sv.berkeley.edu/showcase/pages/bones.html
  Site where students can put together a skeleton and learn the medical names of the bones. Very fun!
- http://www.medtropolis.com/VBody.asp
  Another "build a skeleton" game. Narrates info about human skeleton.
- http://www.kidshealth.org/kid/body/bones_SW.html
  Good site to learn about bones and muscles
- http://www.sad34.net/webquests/SkeletonQuest/
  A fun, independent website that sends kids on a webquest to many other sites to learn about the skeletal system.

Activity: After students have learned the locations of the bones listed on their worksheet, they are ready to play the x-ray ID game, using x-ray images from the Cleveland Clinic online x-ray library. Click on the link below to visit the library:

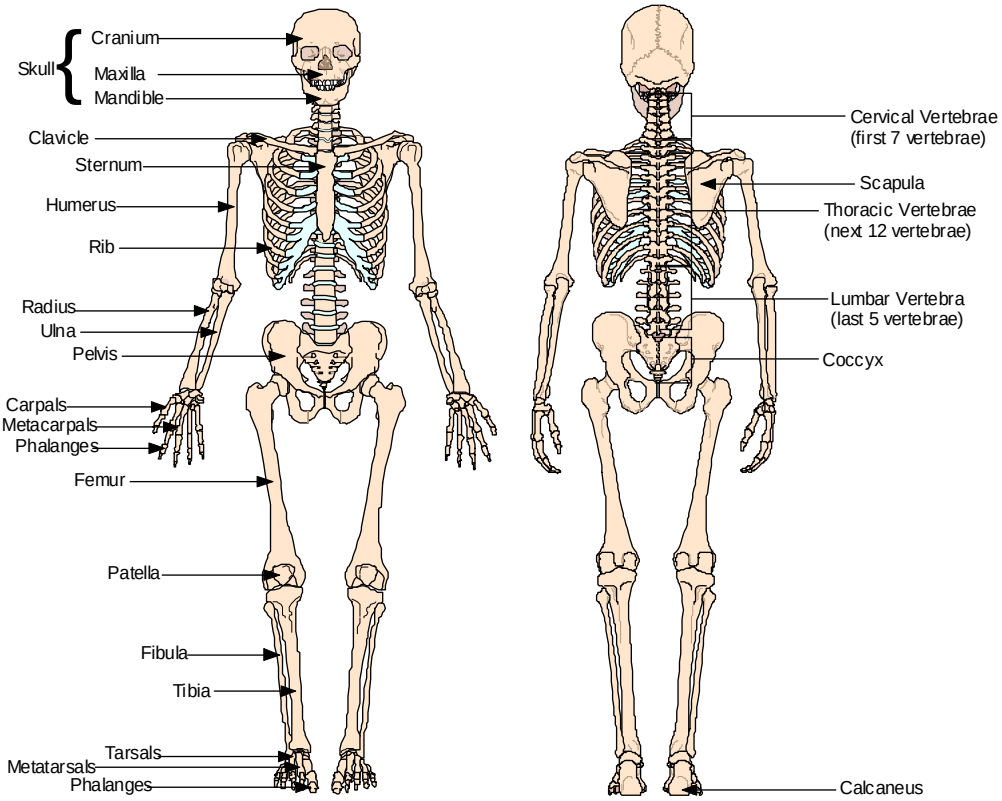
http://www.clevelandclinic.org/civiceducation/xray_library.asp

Show students an x-ray from the online x-ray library on a video screen or computer monitor. Have students try to guess which part of the body is being shown. Start with easy x-rays, such as a hand or foot x-ray. Progress to more difficult x-rays, such as the spine or pelvis. If your classroom does not have a suitable computer monitor, print out a series of x-ray pictures ahead of time to use in class.

Conclusion: Test students' knowledge of the bones by playing "Anatomy Simon Says". Choose one student to be the "caller" and call out "Simon says, point to your (name of bone)". Students then have to point to that bone. Students who point to the wrong bone are out. If the caller does not say "Simon Says" in front of their directive, students must remain still or they are out of the game. The last student remaining is the caller in the next round.

Appendix I **Teacher Resource**

Human Skeletal Structure



The skeletons above may be too detailed for student use. Use the skeleton in Student Handout 3 to guide student learning about the skeleton. Send students on an internet search, using the sites referenced in the lesson above, to learn about the human skeleton. If you do not have internet access, supply each group of students with a book about the human body (see suggested books below).

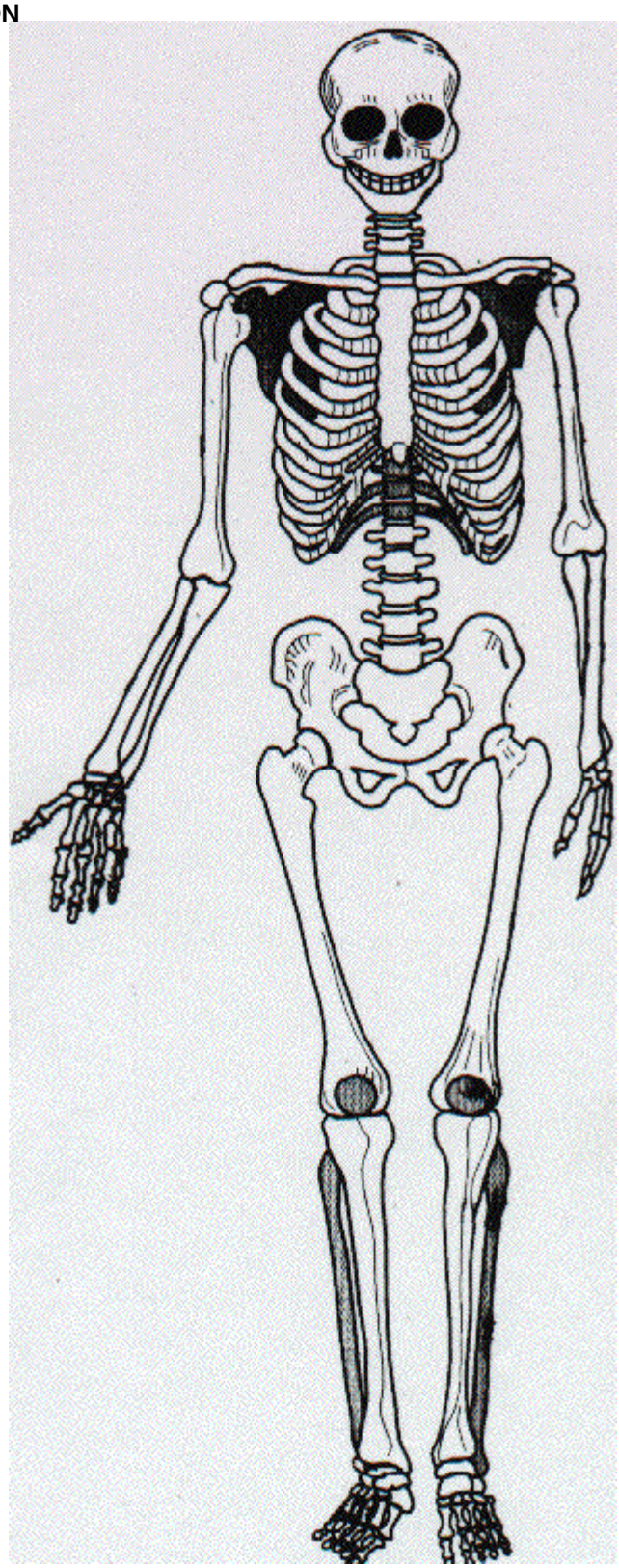
Books and Models:

1) Movers and Shapers, a book in the Bodyscope series by Patricia MacNair shows students how bones and muscles work together to help us move. Exceptional Illustrations.

2) Eyewitness: Skeleton, a Dorling Kindersley book by Steven Parker gives a unique look at the human skeleton and how it compares to skeletons of other animals. Stunning photographs.

3) Simply Skeletons Building Set available from scholastic for 19.95. Includes four eight-inch skeleton models with labeled bones, a chart and an anatomy guide.

CRANIUM	SKULL
CLAVICLE	COLLAR BONE
HUMERUS	UPPER ARM
RADIUS	LOWER ARM
ULNA	LOWER ARM
PELVIS	HIP BONE
FEMUR	UPPER LEG
PATELLA	KNEE CAP
TIBIA	LOWER LEG
FIBULA	LOWER LEG



Draw a line from each label above to the proper bone. Can you name some additional bones? Use the internet or a book to help you.

Lesson 3: Learning Through Animation

Medical researchers often use computer animations to predict the consequences to the body of certain actions. For example, a doctor who is studying sports injuries may want to know how certain movements are likely to affect the knee joint in order to predict which movements are most likely to result in a sprained knee. In this lesson, students learn about a doctor at the Cleveland Clinic who has created an Oscar-winning computer animation program that is so lifelike that has been used by Hollywood filmmakers to make major motion pictures such as "I - Robot" and "Matrix: Reloaded".

Pre-Assessment: Read to students the following information about Dr. van den Bogert, a biomedical researcher at the Cleveland Clinic.

Dr. van den Bogert at the Cleveland Clinic has created a computer program that uses animation to study human movement. This research scientist is trying to learn how injuries occur by making animated models of our muscular and skeletal systems on the computer. Using these animations, Dr. van den Bogert can study which movements are most likely to cause injury to our joints and muscles. His animations are so lifelike that they have been used to create animations for many movies and video games, and he even won an Academy Award for his work!

Students can watch the video referenced below to see Dr. van den Bogert's animation techniques in action.

- www.clevelandclinic.org/healthedge999/media/news/womenacl.mp4
  This video podcast shows CCF researchers using Dr. van den Bogert's animation techniques to study knee injuries in female athletes.

Activity: Distribute Handout 4 to students and explain that they are going to make their own animations. Show students how to draw a sequential series of stick figures, changing the posture of the figure only slightly from one frame to the next. Have students cut out and staple the frames together to make a mini-book. Then, to create the illusion of motion, flip through the pages quickly. The stick figure should appear to move as the pages are flipped.

Conclusion: Computers have changed the way medicine is performed around the world. Have students look into other ways computers are used in medicine.

You can create your own animations by making a flipbook!

1. Draw a stick figure in each of the squares below.
2. Vary the position of the stick figure slightly from one square to the next.
3. Cut out the squares and staple them together along one side.
4. If you need more squares, just copy some on another piece of paper.
5. Can you make your figure do some wild and crazy things? Just use your imagination!

S T A P L E H E R E			

Lesson 4: Social Studies/Math - A Playground is for Everyone

Introduction: Divide the class into teams of three to five students. Tell the teams that they are to design a park or playground that will allow students with various mobility restrictions to play side-by-side with their classmates using all the same equipment. Students will complete scale drawings of their playgrounds and describe the advantages of their design. A student worksheet (handout 5) and grading rubric are provided for guidance. This lesson will require a measuring device (measuring tape, meter sticks or yard sticks), quarter inch or half-inch graph paper and rulers.

Pre-Assessment: Bring the class outside to their existing play area. Ask students to point out aspects of the playground that may pose a problem to students with physical disabilities. Point out barriers to free access to play equipment that students may have overlooked. Brainstorm ideas with the children for design improvement that would allow all students to use the playground equipment students.

To introduce students to the idea of drawing a plan to scale, have students use a measuring tape or series of meter sticks to measure the actual size of their play area. Measure the distances between landmarks in the area, such as trees, benches, swing sets, etc. Copy down all measurements to bring back to the classroom.

Once back inside, hand out graph paper and show students how to recreate the play area using a simple scale, such as one meter (metric measurements) or one foot (English measurements) equals one square on the graph paper. An overhead projector with a graph paper transparency would be very useful here. When students create the scale drawings of their designed playgrounds, have them use the same scale as they are using in this introductory activity.

Activity: Hand out the student worksheet provided. Tell students to spend several minutes deciding how they would like their play area to look and what equipment it might include. If students have computer access, have students spend time reviewing the web resources listed below to get an idea of how to redesign standard playground equipment to be more accessible to students with mobility restrictions. Students may want to come up with a theme for their play area.

Once students have decided which equipment they would like to include, they need to consider how that equipment will fit in the existing play space. Students must remember to leave enough room between play fixtures to accommodate a wheelchair. If ramps are to be used, student must be sure they do not exceed a 1:12 ratio; ie. 1 inch of rise for every 12 inches (one foot) in length. Thus a ramp to cover a 20-inch rise would need to be 20 feet long. Studying playground designs at one of the suggested websites may help give students ideas of how to integrate the wheelchair ramps into the play structure.

Rubric:

90 - 100	Student work is thoughtful and creative. Playground has plenty of space and support for wheelchairs or walkers. Drawing is neat and scale is correct.
80 - 90	Student work is interesting. Playground has adequate space and support for wheelchairs or walkers. Drawing is relatively neat, scale is mostly correct.
70 - 80	Student work is somewhat mundane. Playground has adequate space and support on most play structures. Drawing is a little sloppy or scale is incorrect.
60 - 70	Student work is unoriginal. Playground cannot support a wheelchair or walker in more than one spot. Drawing is messy or not to scale.
> 60	Student work is very inadequate in many ways.

Extension - Economics/Math: Have students make a budget for their play area. Give the class a limit to the amount of money they can spend, and have each group calculate all the costs for their building project. Students need to consider the cost of materials, labor and specialty equipment for each area of the playground. You may want students to consider how money could be raised to fund the project. Would parents and students be asked to volunteer their time to build such a project? Are there school or community funds that could be used?

Resources:

- http://www.cdc.gov/ncbddd/kids/kmalpage.htm
  Web activity for kids teaching about disabilities and mobility issues
- http://www.inspirationplayground.com
  Shows a variety of accessible playgrounds to inspire student designers
- http://www.treehouses.org/
  Shows spectacular accessible tree houses
- www.specialneedstoys.com
  Source for prices and pictures of accessible playground equipment.
- www.ncaonline.org/products/index.php4?cat=Playground%20Equipment
  Site showing many different kinds of accessible playground equipment with links to manufacturers.
- www.hasbro.com/playskool/default.cfm?page=bp_essaycontest
  Students can visit this site to learn about an essay contest to win a playground for their school.
- www.boundlessplaygrounds.com
  A non-profit organization that helps communities build accessible playgrounds. Their website discusses playground theory and budget consideration in a way that is informative for the teacher but too sophisticated for students to read on their own.

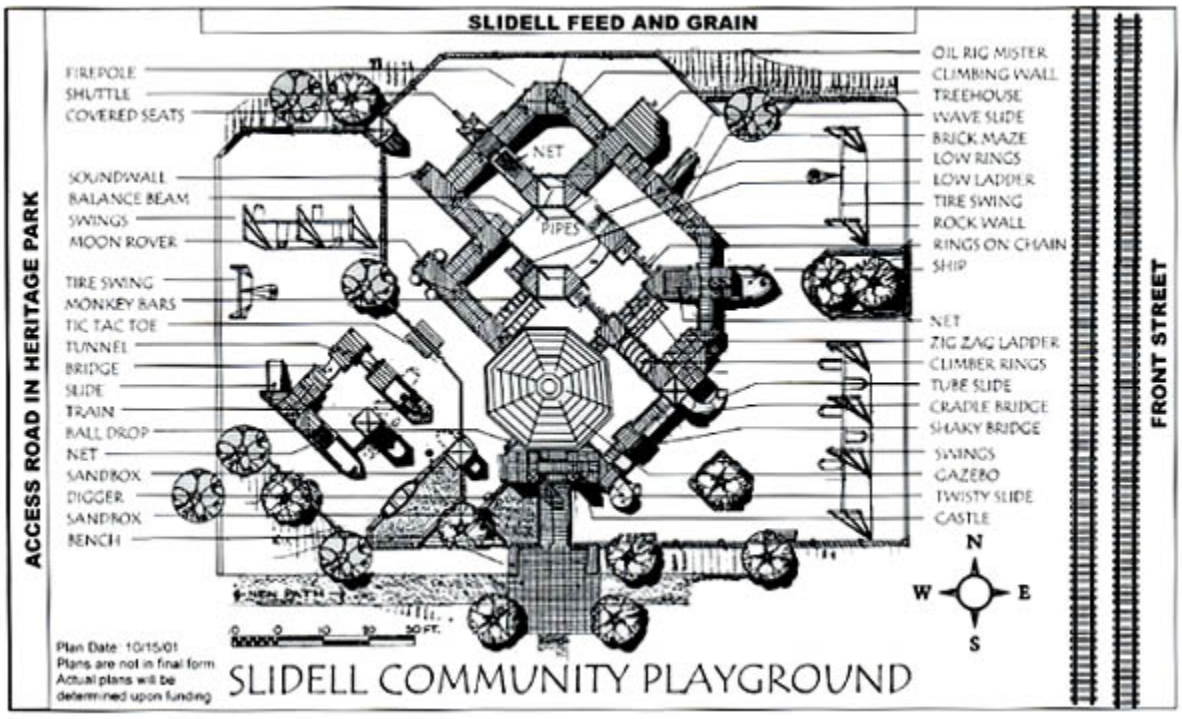
CREATE YOUR OWN PLAYGROUND! **HANDOUT 5**

1. Decide what you want to have on your playground. Here are some ideas:
   - a swing that could hold a wheelchair
   - slide with a ramp to the top
   - wheelchair accessible fort
   - four square, tether ball
   - raised garden
   - Carrom board or Nok hockey table
   - Tree house

2. Think about where to put each play piece. Leave at least 3 feet (or one meter) between pieces of equipment to allow room for a wheelchair.

3. Draw each piece of equipment on the graph paper, using the scale your class agreed on. For example, if the scale you're using is 1 square = 1 foot, and you want to draw a sandbox that is 4 feet wide and 6 feet long, the picture on your paper must be 4 squares wide and 6 squares long.

The picture below is called a blueprint. People use blueprints when they are designing buildings, parks and other places. Your playground will not be this big. This picture is a blueprint for a whole city park!



Additional Information about Specific Disabilities:

- www.clevelandclinic.org/health/health-info/docs/2000/2021.asp?index=8717
  Info about cerebral palsy
- www.clevelandclinic.org/health/health-info/docs/2100/2112.asp?index=8877
  Info about muscular dystrophy
- www.clevelandclinic.org/health/health-info/docs/2000/2035.asp?index=8719
  Info about Spina Bifida
- http://www.bced.gov.bc.ca/specialed/awareness/31.htm
  Information about children with Cerebral Palsy
- http://www.bced.gov.bc.ca/specialed/awareness/59.htm
  Information about children with Muscular Dystrophy
- http://www.bced.gov.bc.ca/specialed/awareness/63.htm
  Information about children with Spina Bifida

EDUCATIONAL STANDARDS MET

LANGUAGE ARTS

Ohio Language Arts Standards:	**GRADES K – 2**	**GRADES 3 - 4**	**GRADES 5 - 7**
Writing Processes	A - G	A - I	A - H
Writing Applications	A, B	A, B	D
Writing Conventions	A - D	A - D	A - C
Acquisition of Vocabulary		A - F	A - F
Reading Process		A - D	A - D
Reading Applications: Literary Text		A - D	A - D

National Language Arts Standards:

Standard 1: Reading for Perspective
Standard 2: Understanding the human experience
Standard 3: Evaluation Strategies
Standard 4: Communication skills
Standard 5: Communication strategies
Standard 6: Applying Knowledge
Standard 9: Multicultural Understanding
Standard 12: Applying language skills

SCIENCE

Ohio Science Standards:	**GRADES K – 2**	**GRADES 3 - 5**
Life Sciences	A, B, C	B
Physical Sciences	B, C	C
Science and Technology	A, B	A, B
Scientific Ways of Knowing	B, C	D

National Science Standards:	**GRADES K – 4 and 5-8**
Unifying Concepts and Processes	Evidence, models and explanation Form and function
Physical Science	Position and motion of objects (K-4) Motions and forces (5-8)

Life Science	Characteristics of organisms (K-4) Structure and function in living systems (5-8)
Science and Technology	Abilities of technological design Understanding about science and technology
Science in Personal & Social Perspectives	Science and technology in local challenges (K-4) Science and technology in society (5-8)
History and Nature of Science	Science as a human endeavor

Technology

Ohio Technology Standards:	**GRADES K – 2**	**GRADES 3 - 5**
Nature of Technology	A, C	A, C
Technology and Society Interaction	C	C, E
Technology for Productivity Applications	A, B	A, B
Technology and Communication Applications	C	C
Technology and Information Literacy	A, B, C	A, B, C, D

National Technology Standards:

Basic Operations and Concepts
Social, Ethical and Human Issues
Technology Productivity Tools
Technology Research Tools
Technology Problem-Solving and Decision-Making Tools

MATHEMATICS

Ohio Math Standards:	**GRADES K – 2**	**GRADES 3 – 4**	**GRADES 5 - 8**
Number, Number Sense and Operations	A, B, F	A	
Measurement	A – E	A – D	A - G
Geometry and Spatial Sense	A - G	A, D, E, I	D, E, F, I
Mathematical Processes	A - G	A - I	A - I

National Mathematics Standards:

Standard 1: Number and Operation
Standard 2: Patterns, Functions and Algebra
Standard 3: Geometry
Standard 4: Measurement
Standard 6: Problem Solving
Standard 8: Communication
Standard 9: Connections
Standard 10: Representation

FINE ARTS

Ohio Fine Arts Standards: Visual Art	**GRADES K – 4**	**GRADES 5 - 8**
Creative Expression and Communication	B	B, C
Connections, Relationships and Applications	A, B, C, D	A, C, D

National Fine Arts Standards: Visual Arts, Grades K - 4, 5 - 8
Standard 2: Using knowledge of structures and functions
Standard 3: Choosing and evaluating a range of subject matter, symbols and ideas
Standard 6: Making connections between visual arts and other disciplines

SOCIAL STUDIES

Ohio Social Studies Standards	**GRADES K - 2**	**GRADES 3 - 5**
Economics	A, C	A
Citizenship Rights and Responsibilities	A, B	A, B
Social Studies Skills and Methods	A - D	A - D

National Social Studies Standards: All Grades

Civics:	Values and Principles of Democracy
	Principles of Democracy
	Roles of the Citizen
Economics:	Effective Decision Making
	Money