Development of an introductory course in assistive technology

Joseph W. Gross

The University of Toledo

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Development of an Introductory Course in Assistive Technology

Joseph W. Gross

Capstone Mentor: Dr. Martin S. Rice, PhD., OTR/L

Department of Occupational Therapy

Occupational Therapy Doctorate Program

The University of Toledo Health Science Campus

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Instructor: Joseph Gross
Faculty Office: University Hall – Clock Tower Rm.1
Faculty/Department website: http://utoledo.edu/hshs/index.html
Office Hours: MW 9:00-11:30 a.m.
Phone: 419-383-5555
Email: joseph.gross@utoledo.edu
Class Meetings: T, Th 10:00 a.m. – 12:00 p.m.

Course Description:
This course is designed for undergraduate students intending to enroll in a graduate program of a field which utilizes or develops assistive technology. These fields include occupational therapy, speech language pathology, physical therapy, recreational therapy, special education, or rehabilitation engineering. It will address basic information for assistive technology and devices for use with individuals with disabilities. Content will also include fabrication of simple assistive devices, use of pre-made assistive device as well as assessment and implementation of devices.

Course Prerequisites: In order to be eligible to enroll in this course, a student must have completed the introductory level of courses relevant to his or her particular major. This will be verified through a signed waiver from the Program Director.

Course Objectives
1. The student will attain a basic knowledge of the various types of assistive technologies presented during the course content.
2. The student will be able to fabricate a simple assistive device utilizing the assistive technology process as indicated by the HAAT model.
3. The student will participate in a community activity with individuals who utilize assistive devices.
4. The student will be able to functionally utilize various assistive technology devices presented to them during the lab portion of the course.

Required/Recommended Textbooks: *Required


**Teaching Methods**

This course will be lecture and experiential based. Students will actively interact with various forms of assistive technology, visit sites where assistive technology is used, hear from actual assistive technology users, and learn through fabricating simple assistive technology devices.

**Classroom Procedures**

**Attendance, Absences, and Tardiness** – Students are expected to attend every class and arrive on time. If absent, contact Mr. Gross via E-mail. Students are responsible to make up any missed lab time as well as attain copies of course content distributed missed by from classmate or Mr. Gross

**Policies on Late Work** – Late work without and acceptable reason will be reduced in grade 10% for every day late. Electronic copies of work are accepted if student can not attend class on due date.

**Drop/Withdrawal** – Students may drop/withdrawal from course by date assigned. I will not sign drop slips after this date without extenuating circumstances at my discretion.

**Academic Dishonesty** – Academic dishonesty will not be tolerated and will result in automatic failure of the course.

**Outside Reading/Ancillary Material** – Throughout this course, students will be required to read assigned chapters and provided materials. Students are encouraged to read ancillary materials as provided. Required readings will be noted on the course schedule.

**Classroom Courtesy** – Students are expected to be respectful of each other and myself. Cell phones are to be silenced. Students are expected to participate and contribute to classroom discussions.

**Quizzes and Exams** – Aside from assignments students will be evaluated of their knowledge of the subject matter with two quizzes, a midterm, and a final exam. These are dispersed evenly throughout the duration of the course. The midterm and the final are comprehensive of material covered to that date.

**Grading Policy**

Students will be graded based on their performance on the quizzes, midterm and final exams. In addition, students will be graded on participation and contribution to the class as well as on projects assigned

<table>
<thead>
<tr>
<th>Component</th>
<th>Weight</th>
<th>Grade Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quizzes 1 &amp; 2</td>
<td>15%</td>
<td>A 90-100%</td>
</tr>
<tr>
<td>Midterm Exam</td>
<td>20%</td>
<td>B 80-89%</td>
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<tr>
<td>Final Exam</td>
<td>20%</td>
<td>C 70-79%</td>
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<tr>
<td>Switch</td>
<td>10%</td>
<td>D 60-69%</td>
</tr>
<tr>
<td>Low-Tech AT</td>
<td>10%</td>
<td>F 59% and Below</td>
</tr>
<tr>
<td>Reaction Paper</td>
<td>5%</td>
<td></td>
</tr>
<tr>
<td>Participation</td>
<td>5%</td>
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</tbody>
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Academic Support Services: Notify me if you require any specialized support services or accommodations.
Assignments

Switch
Student will be required to fabricate a simple switch using items purchased from an electronics store.
Requirements:
1. Must have on/off control
2. Required parts must be fabricated for less than $10.00
3. Must contain the following parts: Load, Power Source, Conductor
4. Bonuses: Resistors, Variable Control, Purposeful Application (aside from turning on a light or moving aimlessly)

Low-Tech Device
Student will be required to fabricate a low-tech assistive technology device to be used by another classmate within the classroom. The assistive device must make some aspect of his or her daily existence in the classroom easier. Partners may not fabricate the same device.
Requirements
1. Cost lest than $10.00 to fabricate
2. Must be usable on due date
3. Student must make use of device in a non simulated manner

Reaction Paper
Student will be required to write a reaction paper in response to the ATP guest speaker. The reaction paper must be at least 2 pages long and reflect on your opinion of the profession and information obtained during the presentation.

ACOTE Standards Addressed
Though this course is open to students listed above in the as well as the prevalence of students indicating pursuing a degree in occupational therapy is such that it warrants addressing the accreditation standards met for the doctoral degree in occupational therapy. These standards are listed below.
B.5.8, B.5.9, B.5.11, B.5.20

ADA Statement:
If you require special accommodations because of a condition that meets the requirements of the Americans with Disabilities Act, please see the instructor. Special accommodations are made only with documented need and with institutional approval. Please see the instructor or Department Chair for more information. Faculty expect and encourage students to inform them at the beginning of the semester of any individual learning needs related to classroom participation and performance evaluations (i.e. exams, presentations, demonstrations). Accommodation of individual requests will be based upon appropriate documentation in keeping with the Americans with Disabilities Act, institutional policies, and the discretion of the faculty.
## Course Schedule

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<th>Week</th>
<th>Material</th>
<th>Assignments</th>
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<tbody>
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<td>Week 1</td>
<td>Lesson 1: Intro to AT</td>
<td>T: Read: C&amp;H Ch. 1 &amp; 2</td>
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<td></td>
<td>Lesson 2: Practice in AT</td>
<td>Th: Read C&amp;H Ch. 4</td>
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<tr>
<td>Week 2</td>
<td>Lesson 3: AT Assessment</td>
<td>Th: Read: C&amp;H Ch. 6</td>
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<tr>
<td></td>
<td>ATP Guest Speaker</td>
<td>Reaction Paper Due Week 5</td>
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<td>Week 3</td>
<td>Lesson 4: Seating and Positioning Lab</td>
<td>Th: Read: C&amp;H Ch. 14</td>
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<td>Week 4</td>
<td>Lesson 5: Self Care Lab</td>
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<tr>
<td></td>
<td>Fieldtrip to Seating Clinic</td>
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<tr>
<td>Week 5</td>
<td>Quiz I Low Tech Invention Assignment</td>
<td>T: Reaction Paper Due</td>
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<td></td>
<td></td>
<td>Th: Read: C&amp;H Ch. 7</td>
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<tr>
<td>Week 6</td>
<td>Lesson 6: Switches Lab/Switch Assignment</td>
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<td>Week 7</td>
<td>Lesson 7: Computers and AT Lab Time</td>
<td>Th: Read: C&amp;H Ch. 8 &amp; 9</td>
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<tr>
<td>Week 8</td>
<td>Lesson 8: Vision and Hearing AT Lab Time</td>
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<td>Week 9</td>
<td>Mid Term</td>
<td>T: Switch Due</td>
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<td></td>
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<td>Th: Read: C&amp;H Ch. 10</td>
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<tr>
<td>Week 10</td>
<td>Lesson 9: Cognitive Prosthetics Lab</td>
<td>Th: Read: C&amp;H Ch. 14</td>
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<td>Week 11</td>
<td>Lesson 10: Environmental Control Units</td>
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<td></td>
<td>Community Project TBD</td>
<td>Th: Read: C&amp;H Ch. 11</td>
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<td>Week 12</td>
<td>Lesson 11: AAC AAC Guest Speaker</td>
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<td>Week 13</td>
<td>Quiz II Free Day</td>
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<tr>
<td>Week 14</td>
<td>Switch and Low Tech Invention Demonstration</td>
<td>Low Tech Invention Due</td>
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<td>Week 15</td>
<td>Review for Final Practicum</td>
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<tr>
<td>Week 16</td>
<td>Final</td>
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Course Philosophy

This course is designed for undergraduate students who are considering pursuing a graduate degree in a profession where assistive technology is commonly used. These may include: occupational therapy, speech language pathology, physical therapy, rehabilitation engineering, or special education. At the University of Toledo, students may enroll in this course from any College. However, given the nature of the content the course will be taught following the mission of the College of Health and Human Services which reads. “The College of Health Science and Human Service is dedicated to provide quality Undergraduate and Graduate Programs in the Professional Fields of Health Science and Human Service through continuous commitment to education, utilizing existing research in the field as a teaching method, service to the community through participating in community events, as well as maintaining a high standard of academic credit.”

Educational Philosophy

The educational philosophy which influenced this course is that of experiential learning. This philosophy compliments many of the academic fields of which the students who enroll in this course are involved in, especially in the rehabilitation and educational fields. This philosophy has its roots within the educational philosophy of John Dewey. Dewey rejected the notion of the mind as a passive vessel for which another was to put information into. Rather, he encouraged the use of individual experiences both past and present as a large aspect of a successful learning process.
This philosophy will be reflected in the course content through various methods of experiential learning. A lab format where students obtain hands-on experience with the assistive devices will supplement the lecture portion of the curriculum. In itself, the lecture aspect of the course content will be that of an interactive nature, where the students are engaged in the learning process through discussion, debate, and critical analysis.
Lesson 1: Intro to AT

Objectives

The student will be able to:

- Define assistive technology
- Define assistive technology service
- Compare and contrast
  - High tech v. Low tech
  - Hard v. Soft technologies
  - Appliances v. Tools
- Identify and describe legislation related to assistive technology

Teaching Methods

- Lecture format supplemented with Power Point Presentation
- Handouts – Class Notes

Associated Assignments

- Read Associated chapter(s)
**What is AT?**

- "Any item, piece of equipment or product system whether acquired commercially, off the shelf, modified or customized that is used to increase, maintain or improve functional capabilities of individuals with disabilities."
- Assistive Technology Act (1998)

**What is AT service?**

- Any service that directly assists in the selection, acquisition, or use of an assistive technology device.
- Evaluating needs and skills for AT
- Acquiring AT
- Selecting, designing, repairing and fabricating AT
- Coordinating services
- Training both individuals with disabilities and those working with them to use AT

**Common Terms**

**Hard v Soft Technologies**

- Hard Technologies – Readily available component that can be purchased and assembled into AT systems
- Soft Technologies – Human areas of decision making, strategies, training concept and service delivery

**High v Low Tech**

- High Tech
  - More expensive, difficult to make, and harder to obtain.
- Low Tech
  - Less expensive, easier to make, and easier to obtain.
**Appliances v. Tools**

- **Appliances** – require no skill to operate, perform function for you.
  - Refrigerator, blender, etc.
- **Tools** – Aid you in performing function and requires skills to operate.
  - Hammer, Paintbrush, etc.

**Commercial v. Custom**

- **Commercial**
  - Mass produced with each unit being the same.
  - Universal design
- **Custom**
  - Engineered for a particular person or to solve a particular problem.
  - Generally more expensive because of being made individually.

**AT & the LAW!**

Since the disability rights movement of the 1970’s assistive technology has been worked into the disability legislation.

**Rehabilitation Act of 1973**

- Mandated reasonable accommodation in all federally funded programs.
- Requires assistive technology devices and services to be part of state vocational rehabilitation services.

**IDEA Amendments 1997**

Recognized a child’s right to a least restrictive environment, accommodation, and assistive technology services.
**AT Act of 1998**
- First assistive technology specific legislation
- Mandated expansion of AT services, capacity building, advocacy activities and statewide system change.
- [www.atohio.org](http://www.atohio.org)

**Americans With Disabilities Act 1990**
- Prohibits discrimination based on disability for employment, state and local government, public accommodations, commercial facilities, transportation and telecommunications.
- Reasonable Accommodation
- Undue hardship
- All involve AT

**Medicaid/Medicare and AT**
- Medicaid
  - Largest funding source for AT
  - Varies from state to state
- Medicare
  - Provides AT for permanently disabled over 65

Lesson 2: Practice in AT

Objectives

The student will be able to:

- Define, compare and contrast adaptation versus compensation
- List the four components of the HAAT Model
- Describe the four components of the HAAT Model
- Identify players in assistive technology service
- Describe the assistive technology process

Teaching Methods

- Lecture Format supplemented with Power Point Presentation
- Handouts – Class Notes

Associated Assignments

- Read associated chapters
Practice in AT

Theory and Framework

Adaptation v. Compensation

- Compensation
  - Altering the environment to remove a barrier to function
- Adaptation
  - Changing an aspect of the person to enable function

Which is AT?

BOTH!

Often times AT is thought as a compensatory method, however adaptation is an enabling factor to allow the compensation to occur. They are both part of the intervention process.

For example: Communication Devices

- Adaptation
  - Learn to use the device
  - Acquire the knowledge to use the symbolic language
  - Muscle memory to input communication
- Compensation
  - The use of device as a replacement of the vocal cords

Human Activity/Assistive Technology Model (HAAT)

- Who – Cook and Hussey
- When – 1990’s
- Why – To understand process of assistive technology in research and the clinic

“We are not concerned as much with remediation of a disability as we are enabling functional results as helping the individual to achieve what he or she wants to accomplish.”

(Cook & Polgar, 2008, p. 35)

Introduction to Assistive Technology  13
**4 Components**

- **Human**
  - Physical, cognitive and emotional
- **Activity**
  - Self care, productivity, and leisure
- **Assistive Technology**
  - Intrinsic and extrinsic enablers
- **Context**
  - Physical, cultural, social, and institutional

**The activity**

- The process of doing something and it represents the functional result of human performance.
- Divided into productive activities, play and leisure activities, and activities of daily living.
- Activities can be broken down into tasks

**The Human**

- **Physical**
  - Strength, coordination, range of motion, balance, etc.
- **Cognitive**
  - Attention, judgment, problem solving, concentration, alertness, Affect (emotion)

**Contexts**

- **Physical**
  - Tangible attributes of the context
- **Cultural**
  - May influence their acceptance of AT
  - Amish person and a power wheelchair
- **Social**
  - Attitudes of others, social norms
- **Institutional**
  - Larger organization within society
  - Legal, economic, and political systems

**Assistive Technology**

- The extrinsic enabler
  - Allows improvement of human performance in the presence of disability

"Consideration of each of these elements and their interaction is necessary for design, selection, implementation, and evaluation of appropriate assistive devices."
Players
- Assistive Technology Practitioner
- Assistive Technology Supplier
- Funding source

ATP
- ATP is a certification from the Rehabilitation Engineering Society of North America (RESNA)
- ATPs can be OT, PT, SLP, educators, engineers, etc

ATS- Assistive Technology Supplier
- A certified (through RESNA) supplier of assistive technology devices.
- Not supposed to evaluate for need based on conflict of interest.
- Most commonly vendors.

Funding Sources
- Medicare/Medicaid
- BVR
- State/County MR/DD Boards
- School districts
- VA
- ETC.

The Assistive Technology Process
- Referral and Intake
- Initial Evaluation
- Recommendation and Report
- Implementation
- Follow-up
- Follow-along

Lesson 3: Assistive Technology Assessment

Objectives

The student will be able to:

- Describe the various means of assessment
- Identify and describe the three parts of an initial evaluation
- Identify the four parts of a skills evaluation
- Identify and describe important areas to evaluate in a skills evaluation and methods to do so.

Teaching Methods

- Lecture format supplemented with Power Point presentation
- Handouts – Class Notes, Sample Evaluation, Reaction Paper Assignment
- Guest Speaker

Associated Assignments

- Read associated chapters
- Complete Reaction Paper on Guest Speaker
There are various means of evaluation. Standardized assessment, checklists, clinical observation. Depending on the setting some or all methods may be used.

Initial Evaluation
- Needs Identification
- Skills Evaluation
- Device Characteristics

Needs Evaluation
- The most important aspect of evaluation
- Determines the entire AT process and outcome
- Ask what the need is before what the problem is.
- Don’t attempt to solve a problem that you can’t identify the source.
- If its not broke…. DON’T FIX IT.

What’s the need?
- It is reported that Michael is having trouble using his mouse at work. He frequently misclicks items within the program. His boss calls his local ATP and tells him Michael needs help “working his mouse”
- Need is – To help Michael perform better at work.

Skills Evaluation
- Sensory
- Physical
- Cognitive
- Language
What is Michael’s Skill deficiency?
- He is unable to perform well because...
- Guess! (Like his boss did)
- After a comprehensive skills evaluation Michael was found to have no fine motor problems... hmmm
- BUT he was found to have significant deficits in vision.

Therefore...
- Michael’s problem wasn’t that he “couldn’t use the mouse” but rather that he couldn’t see the very small icons well enough to click on them with accuracy.
- Lesson learned – Do not assume you know what is causing the problem before evaluating all the potential causes.

Skills Evaluation
- The ATP is not expected to diagnose any impairments.
- Records or reports should be available to them.
- IF NOT
- Make a referral to an appropriate source.

Sensory Evaluation
- The ATP is expected to identify sensory functions that are available.
- Functional Vision
  - Visual field
  - Visual tracking
  - Visual scanning
  - Visual acuity
  - Visual accommodation

Auditory Assessment
- If suspected hearing loss is found refer to an audiologist.
- Assess for
  - Response to auditory stimuli
  - Ability to distinguish sounds
  - Amount of distractibility by sound
  - Ability to respond appropriately to an auditory stimulus
**Physical Assessment**
- To determine the most functional position for the individual and their ability to access the device.
  - Include:
    - Range of motion
    - Strength
    - Muscle tone
    - Obligatory movements
    - Balance
    - Gross and Fine motor skills

**Physical Assessment**
- Identify anatomical points for control
- Preferred sites of control in order
  - Hands and fingers
  - Head and mouth
  - Foot
  - Legs and arms
- Assess range of motion & strength as well as sensory aspects while making this decision.

**Range and resolution board**
- Measures the min-max range of an anatomical site.
- Also measures an individual’s accuracy (or resolution) with an anatomical site.
- These are not mutually exclusive
  - Good range does not equal good resolution
  - Good resolution does not equal good range

**Selecting Control Interfaces**
- Measure the individuals speed and accuracy with the interface using different access points.
- Access points can be modified with a tool such as a mouth stick or head pointer.
- Compare different combinations to determine the most efficient AND comfortable situation for the INDIVIDUAL.

**Cognitive assessment**
- While the use of standardized tests are helpful it is often impractical or invalid to use these to determine success in AT use.
- Clinical observation is the most reliable and valid source of cognitive assessment when assessing for AT use.
- Can they or can they not is important here not so much why. Go back to compensation v. adaptation.

**Cognitive Assessment**
- Pay attention to
  - Memory
  - Attention
  - Understanding of cause and effect
  - Problem solving ability
- Experience and attention are important in determining a person’s ability to cognitively process assistive technology.
Language Assessment

- Language plays a large role in AT (Augmentative Communication)
- Speech and language can also be used as an input method for various types of assistive technology
- Evaluate for:
  - Categorization
  - Sequencing
  - Matching
  - Social communication skills
  - Receptive language skills
  - Motor speech skills
  - Pragmatic skills

Delivering assistive technology services to the consumer. In Assistive Technology: Principals and Practice (pp.91-134). St. Louis, MO: Mosby Elsevier.
Lesson 4: Seating and Positioning

Objectives

The student will be able to:

- Identify the three reasons to assess seating and positioning
- List important areas to identify while evaluating seating
- List areas of skills evaluation important for seating and positioning and sub-factors within
- List levels of postural control
- Identify factors contributing to postural control
- Prioritize and describe the different areas contributing to postural control and means of correcting them

Teaching Methods

- Lecture format supplemented with Power Point presentation
- Trip to seating and positioning clinic
- Handouts - Classnotes

Associated Assignments

- Read associated chapters
Seating and Positioning

First things first.

How well a person performs while using AT is often affected by their seating and or positioning in respect to the device they are using.

Case in point do you type better sitting up or laying down?

3 reasons to assess seating and positioning

- Postural control
- Tissue integrity
- Comfort

Framework for seating/positioning assessment – Outcome of needs assessment

- ID Context and related concerns
  - Setting, caregiver support, physical contexts, accessibility, transportation
- ID of previous seating system
- ID goals for consumer, family and caregiver

Framework for seating/positioning assessment – Outcome of skills evaluation

- Physical skills
  - Orthopedic factors – ROM, skeletal deformities, skeletal alignment
  - Neuromotor factors – muscle tone, reflex patterns, postural control, voluntary movement
  - Respiratory factors

Framework for seating/positioning assessment – Outcome of skills evaluation

- Sensory Skills
  - Vision, perception, tactile sensation
- Cognitive/Behavior skills
  - Safety awareness, motivation
- Functional Skills
  - Transfers, selfcare, mobility/propulsion, communication, bowel and bladder function
Matching
- Using the information obtained match the person with the most suitable system or position. Taking in account the need for postural control, pressure management and comfort.

Postural Control
- Levels of postural control
  - Hands free sitter: Able to sit for long periods of time without using hands for support
  - Hands dependent sitter: One or both hands is used for support
  - Propped sitter: Lacks any ability to support self in sitting (often found in cerebral palsy, high level SCI, and other neurological disorders)

Factors dependent for postural control is sitting
- Most important factor is proximal control
- Center of gravity
- Pelvis and lower extremities
  - Provides base of support for COG
- Trunk
  - Provides stabilization for use of arms, head and neck

Pelvis and Lower extremities
- Desired position neutral or slight anterior tilt
- Hips flexes about 90 degrees

Problems with pelvis/lower extremities
- Posterior tilt or excessive anterior tilt
- Pelvic obliquity
- Pelvic rotation
- Windswept hips

Cushions
- Planar
- Prefabricated
- Custom
- Can address all aspects of pelvic deformity listed
Pressure Mapping

- Pressure mapping is a technique used to identify areas at risk for pressure sores.
- Pressure sores are often associated with pelvic deformity.
- Cushion can be designed to disperse pressure safely.

Pelvic belts

- Can keep someone in neutral and good position and prevent thrusting of pelvis due to posterior tilt.
- Should be secure and at a 45 degree angle from the ASIS.

SubASIS bar

- Prevents excessive anterior pelvic tilt.
- Bar gets placed underneath the ASIS and blocks anterior tilt.

Trunk Stability

- To be considered after pelvic stability is obtained.
- Desired position is upright and midline.
- Level of support depends on how much control and individual has over their trunk.
Trunk deformities
- Lordosis – Excessive curvature of the lumbar spine
- Kyphosis – Excessive curvature of the upper spine
- Scoliosis – Combination of the two
- Trunk muscles could also simply be weak from congenital or acquired neurological impairment

Correction of spinal deformities
- Altering the back of the seat
  - Recession – kyphosis (so they aren’t leaning forward)
  - Lumbar support for lordosis
  - The less support needs the lower the back of the chair.

Correction of spinal deformities
- Lateral supports – push against the deformity and may actually aide in correction of deformity
- Strapping systems
- Shoulder supports

Neck and Head
- Most common problems are...
  - Hyperextension of the neck, weak musculature, lateral flexion, neck rotation.
- Can be fixed using
  - Head rest, lateral supports, head bands

Lesson 5: Assistive Technology for Self care

Objectives

The student will be able to:

- Define activity of daily living
- List the five basic ADLs described in the lecture
- Identify issues important to successfully complete ADLs
- Describe assistive technology solutions for the ADL areas discussed in class

Teaching Methods

- Lecture format supplemented with Power Point presentation
- Hands on lab experience
- Handouts – Class notes, Low Tech assignment

Associated Assignments

- Read associated chapters
- Low Tech AT fabrication assignment
**Activities of Daily Living**
- The basic things we throughout our day.
- Include
  - Dressing
  - Bathing
  - Grooming
  - Eating
  - Toileting

**Simple Solutions**
- Often times simple, low tech solutions are the key to increasing an individual's independence.
- Have relevance in a multitude of environments (home, work, school, and places of leisure)

**Dressing Aides**
- Dressing is a common problem for the elderly and individuals with physical disability.
- Requires range of motion, flexibility, strength and coordination.
- Dressing aides reduce the need to rely on these areas.

**Dressing aides**
- Sock aide
- Dressing stick
- Button Fastener
- Shoe horn

**Bathing Aides**
- Bathing is often a high risk activity for individuals with disability.
- Requires balance, flexibility, strength, and endurance.
Bathing Aides
- Tub and tub transfer benches
- Long handled sponges
- Detachable shower heads

Grooming Aides
- Individuals with poor grasp or decreased range of motion or control of their upper extremities often have difficulty with grooming.
- Long handled brush
- Towel Mitt
- Wide handled tooth brush
- Automatic faucets

Grooming Aides

Eating Devices
- In order to eat independently an individual requires good range of motion as well as sensation, strength and endurance.
- Cuffed utensils
- Universal cuffs
- Thick handled utensils
- Scooping Spoons
- Rimmed plates
- Pronged Plates

Toileting Aides
- Grab bars
- Adaptive wipers
- Raised toilet seats
Lesson 6: Switches

Objectives

The student will be able to:

- Identify the four types of switches described in class and what they may be used for
- Define:
  - Circuit
  - Load
  - Conductor
  - Resistor
  - Source
- Be able to label a simple circuit diagram
- Describe the properties of circuits

Teaching Methods

- Lecture format supplemented with Power Point presentation
- Hands on Lab Experience
- Handouts- Class notes, Switch assignment

Associated Assignments

- Read associated chapters
- Simple Switch Fabrication Assignment
Switches

4 Common Types of Switches

- **Toggle**
  - Actuated by a lever located in two or more positions. (e.g., light switch)

- **Push Button**
  - Activated by the pressing of a button. Can be momentary (only activated while it is depressed) or non-momentary (once it's pressed it's activated and deactivated by being pressed again.)
  - (Blender = momentary while speaker phone button = non-momentary)

- **Selector**
  - Rests in one position like a toggle switch and can be in two or more positions. (e.g., hair dryer or iron)

- **Joystick**
  - A joystick switch is actuated by a lever free to move in more than one axis of motion. One or more of several switch contact mechanisms are actuated depending on which way the lever is pushed, and sometimes by how far it is pushed.

Circuits

- **A switch is part of a circuit**
- **A circuit is an electrical system that controls the flow of electrons along a conductor**
- **Parts of a circuit**
  - Conductor
  - Electrical source
  - Resistor
  - Switch
  - Load

Circuits key concepts

- **A circuit works like a hydraulic system**

Circuits – key concepts

- **The flow of electrons is uniform throughout, therefore amount of energy leaving equals energy entering circuit**
- **The electricity will follow the path of least resistance**
- **Electricity flows by a gradient of potential difference**
Electric Source & Conductors
- The electric source provides the electrons for the circuit as well as controls the input (outlet or battery).
- Conductors contain the flow of electrons and are passive in the circuit.

Resistors & switches
- A resistor resists the flow of electricity through the conductor.
- Since electricity follows the least restrictive route a resistor can redirect the flow of electrons.
- Resistance is measured in Ohms.
- A switch can break or open flow through a conductor.

Load
- The load is the power consumed by a circuit.
- In a completed circuit the electrons will flow from the source to the load using the least restrictive path.

Switch Assignment
- Groups of 2
- Rules
- Tools
- Demonstration

McWhorter, G., & Evans, A.J. (1994). Basic electronics: Electronics devices and circuits, how they work and how they are used. Lincolnwood, IL: Master Publishing.
Lesson 7: Computers and Assistive Technology

Objectives

The student will be able to:

- Define:
  - Control Interface
  - Selection Set
  - Selection Method
  - Processor

- Describe and contrast direct versus indirect selection methods

- Describe Coded Access

- Identify things needed in order to use a switch as a control interface

- Identify important areas of assessment for computer based assistive technology

Teaching Methods

- Lecture format supplemented with Power Point presentation

- Hands on lab experience

- Handouts – Class Notes

Associated Assignments

- Read associated chapters
Elements of human technology interface

- Control Interface – The hardware being used to input information
- Selection Set – Items available to choose by the person
- Selection Method
- The processor – Interprets the input by the user into the technology

Common Control Interfaces

- Keyboard
- Mouse
- Joystick
- Switch
- Microphone/Sound

Cool Control Interfaces

- Tongue touch keyboard
- Eye controlled features
- Tracking body features
- Brain-computer interfaces

Direct versus Indirect Selection

- Direct Selection
  - Pressing ‘A’ gets you ‘A’
  - As in a keyboard
  - GIDEIs
- Indirect selection
  - Use a switch to maneuver through intermediary steps to make a selection
  - Scanning
  - Directed scanning
  - Coded access

General Input device emulating interfaces (GIDEIs)

- Methods of direct selection which mimic that of a keyboard or other direct selection method
  - Onscreen keyboards activated with a mouse
  - Onscreen calculators
  - Etc
**Scanning**

- “the selection set is presented on a display and is sequentially scanned by a cursor or light on the device. When the particular element that the individual wishes to select is presented a signal is generated by the user,” (most often by a switch).

**Direct scanning**

- The user directs a cursor horizontally or vertically to reach their desired selection.
- Think of entering your name as a high score in an arcade game.

**Coded Access**

- An individual uses a distinct sequence of movements to input a code for each item of the selection set.
- Morse code is a type of coded access.

**To use a switch as a control interface for indirect selection...**

- Can the user activate the switch?
- Can the user wait for the appropriate selection?
- Can the consumer activate the switch at the right time?
- Can the user maintain switch activation?
- Can the user release the switch on command?
- Can the user repeatedly carry out the steps necessary for selection?

**Assessment**

- Assign specific input devices to meet a specific need.
- Identify anatomical site for device control (fingers, head, etc.)
- Assess for function (resolution, efficiency, speed, etc) as well as ease of use and comfort.
- A person will not use a device if it is uncomfortable to too difficult.


Lesson 8: Vision and Hearing Assistive Technology

Objectives

The student will be able to:

- Diagram a sensory system
- Compare and contrast existing versus alternate pathways
- Identify areas of vision which may effect a person’s ability to see discussed in class and AT solutions to remedy them.
- Define optical and non optical aids
- Identify computer based low vision remedies
- Identify areas of hearing which may affect a person’s ability to hear discussed in class and AT solutions to remedy them
- Describe the two types of hearing aids

Teaching Methods

- Lecture format supplemented with Power Point presentation
- Handouts – Class Notes
- Field trip to low vision center
- Hands on lab experience

Associated Assignments

- Read associated chapters
AT for people with Vision and Auditory Issues

Existing v. Alternate Sensory Pathway
- Must identify if primary pathway is able to be enhanced to provide functionality
- If not an alternative sensory system must be applied
  - Tactile Substitution (braille)
  - Auditory Substitution (screen readers)
  - Visual Substitution (closed captioning)

Augmenting Existing Pathway
- Some vision is present but limited in one or more areas
  - Intensity – something is too small to be seen
  - Frequency or wavelength limitation – Unable to discern colors
  - Field limitations – Person is unable to process entire visual field

Sensory System

Low vision technology
- Determine level of impairment
- Determine need: Reading, computer use, environmental safety
- Identify device

Intensity
- Most often corrected through magnification
  - Optical aides
  - Non-optical aides
  - Electronic Aides

Visual Substitution (closed captioning)

Optical aides

Most often corrected through magnification

Non-optical aides

Electronic Aides

Some vision is present but limited in one or more areas

Intensity – something is too small to be seen

Frequency or wavelength limitation – Unable to discern colors

Field limitations – Person is unable to process entire visual field

**Intensity**

**Optical Aides v Non-optical Aides**
- **Optical Aides**
  - Simple – hand held magnifier
  - Glasses
  - Provide consistent visual aide
- **Non-optical aides**
  - Large print books, menus
  - High intensity lamps
  - Limited to one or few specific tasks

**Electronic Aides**
- Overcome the limitations of optical and non-optical aides
- Closed Circuit Television (CCTV)
- Sense-view
- Screen magnifiers

**Intensity**

**Frequency and wavelength**
- Increasing Contrast

**Field limitations**
- Simple Low-tech Anchors
  - Item at functional boundary which person can locate
  - Red Stripe at the edge of a counter
  - Red Stripe at the edge of a menu

**Alternate Sensory Pathways**
- **Auditory**
  - Alarms
  - Reading pens
  - Speech feedback (phone, microwave, ect.)
- **Tactile**
  - Braille
  - Canes

**Low vision and Computer**
- The recent prevalence of computer technology has led to new difficulties for individuals with visual impairments
- Various technologies have been created to aide individuals with low vision to be able to use a computer
## Low Vision and Computers
- **Screen Readers**
  - JAWS
  - A computer program which uses a computer voice to read the information on the screen to the user.
- **Screen Magnifiers**
  - Zoom Text, Big Shot, etc
  - Magnify the screen up to 32x the original size

## Low Vision and Computer
- **Text to Speech**
  - Repeats the characters and words typed for auditory feedback.
- **Changing Computer Settings**
  - For Windows XP – “Universal Access”
    - Adjust color contrast, size of text, icons, and cursors, blink rate of cursors, etc

## Auditory Problems and AT
- **Can the person hear at all?**
- **What is the problem?**
  - Insufficient intensity
  - Narrow range of audible frequencies

## Altering the existing pathway
- **Hearing aids**
- **Cochlear Implants**
- **Assistive listening devices**

## Hearing Aides
- **Amplifies sounds or increases auditory frequency range**
- **Two types**
  - Air conduction – delivers the output into the listener’s ear canal
  - Bone conduction – sound is transferred into mechanical vibrations that shake the skull (screws into skull)

## Cochlear Implants
- **For use when the cochlea of inner ear is damaged (common cause of congenital deafness)**
- **Electrically stimulates the inner ear for auditory sensation**
**Assistive Listening Devices**
- Sound amplifiers
  - Amplifies sound much like a hearing aide, intended for those with minor hearing loss
- Voice recorders
  - Enables an individual to record a voice to listen to it later in a quieter environment

**Using Alternate Pathway**
- TTY
  - First device to allow individuals to communicate over phone lines
  - Typed letters transferred over phone lines and typed onto receiver on the other end
- Video relay service
  - New generation of TTY
  - User uses sign language to speak to a remote interpreter using a web cam
  - The interpreter then speaks the information over a phone line to the listener and translates back
  - Currently offered by most major phone companies

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Lesson 9: Cognitive Prosthetics

Objectives

The student will be able to:

- Identify potential causes of cognitive disability
- Identify areas which may be affected by cognitive disabilities
- Define cognitive prosthetic
- Describe how advancements in consumer technologies have affected the development of cognitive prosthetics
- Describe cognitive prosthetics for memory, perception/attention, noise reduction, visual field manipulation, problem solving, decision making, and concept organization
- Describe how media presentation can decrease the need for cognitive prosthetics

Teaching Methods

- Lecture format supplemented with Power Point presentation
- Hands on lab experience
- Handouts- Class Notes

Associated Assignments

- Read associated chapters
Cognitive Prosthetics

Cognitive Disabilities
- Can be acquired or congenital
- Include:
  - TBI, CVA, Dementia, Autism, ADHD, MR/DD

Cognitive Disabilities can effect
- Perception
- Attention
- Memory
- Orientation
- Problem Solving
- Language and Learning

What is a cognitive prosthetic?
- An entire system of hardware, software, and personal assistance that is individualized to meet a need of a person with a cognitive disability.

Advancements
- With advancements in consumer electronics, many of these technologies are able to transcend from tools of the general population into tools for use as cognitive prosthetics.
  - IE, iPhone, PDA's, etc.

Memory, Time Management & Orientation Aides
- Memory is one of the most common cognitive disabilities.
- Memory aides can be low tech or high tech.
- Memory greatly effects how well an individual is able to manage their time.
Considerations for Memory Aides

- A prevalent problem in effective memory aids is the individual's ability to effectively use the technology.
- Often times a PDA or other high tech device is simply too difficult for an individual to use.
- In addition, compliance is a large limiting factor in memory aids as well as all AT.

In order for a memory aide to be effective, the user must be able to understand the prompts provided.

- For a user with a learning disability, use simple commands. IE: “Go to bathroom before lunch.” rather than “Use lavatory prior to eating lunch.”

Simple Memory Aides

- These in effect do not require very much interaction by the user. A one-way approach
  - Daily Planner
  - Posted Reminders
  - Alarm clock/watch
- Draw back – Are less specific and versatile as higher tech solutions

More complex Memory aids

- Often times customizable and versatile.
- Require a higher level of understanding by the user.
- In some cases enables user to provide feedback to the system once reminder is completed.

- Personal Digital Assistant (PDA)
  - Programmable prompting/reminder system
  - Programmable and interactive calendar
  - User is able to initiate use of system
  - IE: Opening a word document that explains how to perform a task or how to react in a certain situation

- Memory Message System
- WatchMinder
- The Quarter Hour Watch
### Perception/Attention

- **Stimuli Control**
  - Three Types
    - Noise reduction
    - Visual field manipulation
    - Media presentation

### Noise Reduction/Visual Field Manipulation

- **Noise Reduction**
  - For use when an individual has difficulty discerning sounds or is easily distracted by multiple sounds
  - Such as a student/teacher transmitter and receiver for a student that is hard of hearing
- **Visual Field Manipulation**
  - Often as simple as supplying a prism or glasses to correct for double vision or neglect

### Media Presentation

Through altering media presentation (websites, computer monitors, etc) one may be able to greatly decrease the amount of distractibility and increase attention.

### Problem Solving, Decision Making, & Concept Organization

- **Inspiration**
  - Software which helps organize thoughts around a central theme
- **Compass**
  - Uses graphic and audio prompts to guide a user through a decision making process.
- **Planning and Execution Assistant and Trainer**
  - Uses artificial intelligence to automatically generate plans and also revise plans when a change occurs

Lesson 10: Environmental Control

Objectives

The student will be able to:

- Define environmental control units
- Identify what makes up an ECU
- Label diagram of simple ECU
- Describe output distribution methods for ECU
- Compare remote links options and weigh the pros and cons of each
- Describe assessment techniques unique to ECU implementation

Teaching Methods

- Lecture format supplemented by Power Point presentation
- Handouts – Class Notes
- Hands on lab experience

Associated Assignments

- Read associated chapters
- Participate in community project
Environmental Control Units

- AKA Electronic aides of daily living
- “Device that allows control of appliances (e.g., radio, television, CD player, telephone) through the use of one or more switches”

Aspects of ECUs

- Same components of computer interface
  - Control Interface
  - Selection Method
    - Direct, indirect, coded access
  - Selection Set
    - Which appliance, which control (up, down, on, off, volume, channel, temperature)
  - Processor
    - The selection set in combination with the output distribution

Basic ECU Format

- Easy to use
- Can be programmed
- More cost effective and practical

Output Distribution

- Hardwired
  - While possible, hardwiring devices to the ECU is often impractical because of the direct wiring requires the components to be close together
- Remote Link
  - More cost effective and practical. No physical attachment and can be controlled from a distance

ECUs

- Switches are most commonly used because they allow for one or few access points.
- For individuals with disability this can greatly increase their independence.
- ECUs enable an individual to control a number of devices from one single point.
Remote Links

- X-10
  - Uses existing AC wiring to communicate with appliances
  - Distribution and control unit plugs into an outlet
  - Appliances to be controlled are plugged into a module which is plugged into an AC outlet

Remote Links – Ultrasound

- Uses ultrasound waves (~40,000 Hz typically)
- Ultrasound waves sent from control interface to coded receiver
- Ultrasound is mechanical energy which can be blocked by solid material, so a direct line is needed

Remote Links – Infrared and Radio

- Infrared is most commonly used in household remote control
  - Easy to use and install
  - But can be easily blocked and line of sight is required to use
  - Also are light sensitive
- Radio Frequency
  - Used most commonly in garage door openers
  - Able to penetrate solid objects but lacks privacy
- Both of these remote links are mostly used for one appliance therefore not as good of options for ECU

Remote Link - Ultrasound

- One distribution center connected to an AC wall outlet can be used to distribute messages to appliances out of line of site
Assessment for ECU assessment include:
- ID of control sites
- Determination of cognitive abilities
- Listing functions desired
- Evaluate users motivation
- Listing other electronic devices the consumer uses
- ID environment which ECU will be used

Lesson 11: Alternative and Augmentative Communication

Objectives

The student will be able to:

- Define AAC and compare and contrast aided v. unaided ACC
- Identify the purposes of communication in daily life
- Identify common disabilities associated with communication difficulty
- Identify the three types of communicators
- Describe the importance of a communication partner
- Describe the AAC assessment process
- Identify low tech methods of AAC
- Identify high tech methods of AAC and specific systems
- Identify the benefits to high tech AAC
- Define: Semantic encoding, Minspeak, Bliss

Teaching Methods

- Lecture format supplemented by Power Point presentation
- Handouts – Class Notes, Example Minspeak Board & Bliss Board
- Guest Speaker with AAC device
- Hands on lab experience

Associated Assignments

- Read associated Chapters
Augmentative and Alternate Communication (AAC)

What is AAC?
- Alternative or augmentative is simply a different mean of communicating with people
- Unaided
  - Pantomime, facial expression, gestures, pointing, eye-gaze, manual signing or finger spelling
- Aided
  - Pen & paper, letter or picture board, computer, cell phone, or a speech generating device (SGD)

What do we use communication for?
- Expression of needs and wants
- Information transfer
- Social closeness
- Social etiquette

Common causes of communication problems
- ALS
- Cerebral Palsy
- CVA
- TBI
- Autism

Three types of communicators
- Emergent Communicator
  - Have no reliable method of symbolic expression, and are restricted to communicating about here and now
- Context dependent communicators
  - Have reliable symbolic communication, but they are limited to specific contexts because they are either intelligible to familiar partners or have insufficient vocabulary
- Independent communicators
  - Are able to communicate with unfamiliar and familiar partners on any topic

Communication Partners
- Partners is communication are just as important as the AAC itself.
- If the partner is not willing to acknowledge the AAC process (ie look at a picture book) communication will not happen
- Types of partners
  - Lifelong (family), close friends, acquaintances, paid workers (SLP, OT), and unfamiliar partners (strangers)
Assessment for AAC
- Identify the goals and needs of the person.
- Evaluation of contexts in which communication will occur
- Identify the communication partners of the user
- Evaluate the user’s ability to utilize low-tech or high-tech

Low Tech AAC
- Letter board
  - The individual can spell out words
- Pen & Paper
  - The individual simply writes out what he or she wish to say
- Picture Board
  - The user points to pictures

High Tech AAC – Control Interfaces
- Keyboards
- Single or dual switches
- Joysticks
- Mouse
- Alternative pointing devices
- Either use direct or indirect selection methods

High Tech AAC – Selection Sets
- Most often visual symbols
  - Letters, pictures, graphic or glyph symbols
- For individuals with low vision auditory scanning methods may be used.

High Tech AAC
- Often times utilize rate enhancement technology
  - Word completion
  - Abbreviation expansion
  - Word prediction
- May have preset phrases
  - “I need to use the restroom please.”
Semantic Encoding
- The coding of words, phrases and sentences based on their meaning.
- Can be pictorial and each picture can have multiple meanings.
- Apple (can be "red", "food", "fruit")
- Sun (can be "sun", "morning", "light")
- Apple + Sun can equal "breakfast"

Bliss Symbols
- Originated as a means for war refugees to communicate when they didn't speak the same language.
- A standard set of shapes is arranged to form symbols which represent meaningful words.
- Much like the Chinese language

Bliss symbols for FOOT, KITE, DOG, AND MUMMY

Minspeak
- A common semantically encoded language used for AAC.
- Depending on age and experience of the user, Minspeak can have 4, 8, 15, 32, 45, 84, or 128 pictures with the capability of vocalizing 4,000 words.
- Requires hundreds of hours of practice to master.

To say "food" – red apple + "noun" button
To say "eat" – red apple + "verb"
To say "red" – rainbow + apple + "adjective button"
To say "fruit" – red apple + red apple + "noun button"
To say "apple" – red apple + red apple + red apple
Other AAC systems

- Dynavox
  - Another common used AAC tool
  - Based on the typical language development of children
- Word Power
  - Combines a core vocabulary of 100 words which represents about 50% of spoken language.

Implementing High Tech AAC

- Must consider the physical and cognitive disabilities of the individual
  - Cognition is a common rate limiting factor for success while using these systems
- The individual’s ability to access and interact with the system
- Developmental Considerations
  - Gradually upgrade the technology to match the natural development of language as closely as possible.