

## COMPUTERS IN MEDICINE

<b>Course</b>	<b>Rationale</b>
<i>Practicum in Health Science</i>	In order to ensure the best care for their patients, health care professionals need to stay informed of the latest advances in medicine.
<b>Unit VII</b> <i>Career Preparation and Employability</i>	<p><b>Objectives</b></p> <p>Upon completion of this lesson, the student will be able to:</p> <ul style="list-style-type: none"> <li>• Explore and analyze emerging technologies in health science</li> <li>• Recognize and plan on the continuing need for education advancement and training to keep up with new discoveries and technology in medicine</li> </ul>
<b>Essential Question</b> <i>What's new in medicine?</i>	<p><b>Engage</b></p> <p>Ask students to write as many answers they can think of in 1 minute to the following question: "How are computers used each day in your life?" Then list on the board the different answers they came up with. After getting the basic answers begin giving them additional possibilities they most likely did not put on their list; examples might be traffic lights, heating and air conditioning at the school, their car, school attendance and grade book.</p>
<b>TEKS</b> <i>130.205 (c) 1A,B,C 3B,E 4B 7B,C</i>	<p><b>Key Points</b></p> <p>I. In the United States computers are used in everyday life so seamlessly that we don't even give them a second thought. Advances in medicine have also seen an incredible amount of growth in the last 30 years because of computer advances. For many students, all their memories of going to a physician include medical personnel using computers; however, some elderly patients do not always trust computers or understand how they work. Regardless of which type of patient you are working with, it is important for health care workers to keep up with new advances being made in medicine as well as having a basic understanding of how computers work in order to help your patients comfort zone.</p> <p>II. While it would be difficult to find an area of medicine not touched by the computer age certain areas are seeing really rapid growth:</p> <p>A. Medical Information systems -- patient record keeping</p> <ol style="list-style-type: none"> <li>1. Accessibility of records from multiple locations and professionals</li> <li>2. Access and storage to large files</li> <li>3. Files are more updated with treatments and diagnostics</li> <li>4. Increased ease in coding and billing</li> </ol> <p>B. Computer-assisted surgery</p> <ol style="list-style-type: none"> <li>1. Microscopic/ Minimally invasive surgery reducing healing time and pain</li> </ol>
<b>Prior Student Learning</b> <i>None</i>	
<b>Estimated time</b> <i>2-6 hours</i>	

- a. Endoscopy -- an instrument used to examine the interior of a hollow organ or cavity of the body; it consists of a flexible or rigid tube containing a light source, camera and medical instruments
  - b. Laparoscopy -- allows physicians to perform both minor and complex surgeries with a few small incisions in the abdomen using a miniature video or digital cameras and surgical instruments
2. Image Guided Surgery -- used on the sinuses
3. Computers assisted -- heart/lung machines, cauterizing to regulate bleeding
- C. Bloodless surgery
  1. Interventional radiology -- performed using needles and catheters, rather than by making large incisions into the body Examples: stents, angioplasty
  2. Stereotactic radiology surgery -- use of gamma knife to remove tumors
  3. Focused ultrasound surgery -- uses high doses of focused ultrasound waves to destroy tissue Example: uterine fibroids
- D. Prosthetics
  1. Myoelectric limbs -- bionics
  2. Microprocessors -- internal organs
  3. Computer technology for vision and hearing
- E. Pharmacy
  1. Computers and drug errors
  2. Automated community pharmacy
  3. Hospital pharmacy robot and barcodes
  4. Point-of-use drug dispensing
- F. Radiology and Digital Imaging
  1. X-rays
    - a. traditional x-rays use electromagnetic gamma waves
    - b. new imaging uses computers to produce digital x-rays using mathematical information
    - c. physicians are using a combination -- while mammography is still being done as a screening, ultrasound is being added to distinguish between cyst and tumors
  2. Ultra-sound uses high frequency sound waves to form a picture; big benefit -- no gamma radiation
  3. Digital Imaging
    - a. Computerized tomography (CT or CAT) scan -- uses x-rays along with digital technology to produce cross-sectional images of the body. May be enhanced by using contrast dye
    - b. Magnetic resonance imaging -- produces images of soft tissue within the body using a magnetic field that is 25,000 times stronger than the earth's magnetic field rather than gamma rays

- c. Positron emission tomography -- uses a nuclear medical imaging technique that produces a three-dimensional image of tracer concentrations within the body; used to study brain disorders such as Parkinson's and Alzheimer's
  - d. Capsule Endoscopy -- records digital images of the digestive tract: patient swallows a tiny camera that is the size and shape of a pill; the pill can examine areas that cannot be seen by other types of endoscopy
  - e. Advantages to digital imaging -- no developing process, copies are as good as originals, viewed on computer screen, can be transmitted over phone lines, less radiation, more flexible, can be highlighted and/or enhanced
- G. Telemedicine- the use of computers, the internet and other communication technology to provide medical care to patients at a distance
- 1. Forms of telemedicine:
    - a. voice
    - b. data
    - c. stills images
    - d. motion pictures
  - 2. Current usage
    - a. diagnoses
    - b. patient monitoring
    - c. treatments
    - d. education
  - 3. Advantages of telemedicine
    - a. brings high quality medical care to anyone regardless of distance
    - b. Medical Assistants at the remote sites may be useful
    - c. in prisons, telemedicine has led to decreased costs and improved health care for inmates
    - d. decreases patient wait time
    - e. decreases patient travel time
  - 4. Branches of Telemedicine
    - a. Teleradiology -- using computers and telecommunications
    - b. Interactive video conferencing -- allows professionals and patients to consult in real-time, using telephones and video screen
    - c. Telepathology -- transmission of microscopic images over telecommunications lines allowing the pathologist to view images on a monitor instead of under a microscope
    - d. Telepsychiatry -- uses teleconferencing to deliver psychotherapy. May not be suitable for some types of mental illness
    - e. Remote monitoring devices -- example: *Telespirometry* used with asthma patients; information is transmitted over phone lines to remote location. *Arrhythmia monitoring* ECG telemetry.
    - f. Cell phone scanners -- cell phone scanner apps can be used in

- mass casualty events to identify patients and treatments that have been performed
- g. Emergency medicine -- data can be transmitted from the ambulance to ER
  - h. Home health -- elderly (homebound) and patients with chronic illnesses can receive medications reminders at home or be monitored using electronic devices
  - i. Neonate -- allows families of high risk newborns to watch babies' hospital care from home
5. Disadvantages of Telemedicine
    - a. Examining the patient at a distance is not the same as examining that patient face to face
    - b. Small hospitals and clinics may find hardware costs prohibitive
    - c. Insurance may not cover all telemedicine
  6. Technical issues
    - a. Appropriate telecommunications infrastructure must be in place
    - b. Not available in some rural and urban areas
    - c. Requires high bandwidth (cable modem)
  7. Legal and Privacy Issues
    - a. Licensing laws differ in each state
    - b. Liability is not clear
    - c. Electronic medical record subject to misuse
    - d. HIPPA requirements harder to protect

### **Activity**

- I. Complete the "Introduction to Medical Computers" Work Sheet
- II. Complete the "Use of Computers in Health Care-Interview." See Teacher Guidelines.
- III. Students choose one of the different technologies to research further and make a "Brochure" or "Multimedia Presentation" to present to the class.

### **Assessment**

Successful completion of the "Introduction to Computers in Medicine" Work Sheet.  
Successful completion of the "Use of Computers in Health Care-Interview."  
Brochure Rubric  
Multimedia Rubric

### **Materials**

Copy of the "Introduction to Computers in Medicine" Work Sheet for each student and copy of Keynotes  
Copy of the "Use of Computers in Health Care-Interview"  
Copy of either Brochure Rubric or Multimedia Rubric and computers

## **Accommodations for Learning Differences**

For reinforcement, the student will find pictures of the different types of technology discussed and present to class.

For enrichment, the student will partner with an engineering or digital graphic student to produce a futurist machine to be used in medicine.

## **National and State Education Standards**

National Health Science Cluster Standards

HCL 10.01 Technical Skills

Healthcare workers will apply technical skills required for all career specialties. They will demonstrate skills and knowledge as appropriate.

## **TEKS**

130.205(c)(1)(A) interpret data from various sources in formulating conclusions;

130.205(c)(1)(B) compile information from a variety of sources to create a technical report;

130.205(c)(1)(C) plan, prepare, and deliver a presentation;

130.205(c)(3)(B) research academic requirements for professional advancement such as certification, licensure, registration, continuing education, and advanced degrees;

130.205(c)(3)(E) evaluate performance for continuous improvement and advancement in health science.

130.205(c)(4)(B) integrate legal and ethical behavior standards such as Patient Bill of Rights, Advanced Directives, and the Health Insurance Portability and Accountability Act into the scope of practice;

130.205(c)(7)(B) plan academic achievement for advancement in the health science industry; and

130.205(c)(7)(C) analyze emerging technologies in the health science industry.

## **College and Career Readiness Standards**

English/Language Arts -- V. Research

A. Formulate topic and questions

2. Explore a research topic

3. Refine research topic and devise a timeline for completing work

B. Select information from a variety of sources

1. Gather relevant sources

2. Evaluate the validity and reliability of sources

3. Synthesize and organize information effectively

4. Use source material ethically

C. Produce and design a document

1. Design and present an effective product

2. Use source material ethically

## INTRODUCTION TO COMPUTERS IN MEDICINE WORK SHEET

1. Traditional x-rays use \_\_\_\_\_ to make pictures. New imaging techniques use \_\_\_\_\_ to generate pictures of internal body organs.
2. Computers can make \_\_\_\_\_ using mathematical information.
3. Examples of how computers are used in the pharmacy include:  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
4. Advantages of digital imaging include:  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
5. A major imaging area currently dominated by traditional x-rays is \_\_\_\_\_. However, \_\_\_\_\_, which can distinguish between cysts and tumors, is being used along with \_\_\_\_\_.
6. Ultrasound (does, does not) use radiation, but uses \_\_\_\_\_.
7. Computerized tomography (CT) uses x-rays and digital technology to produce a \_\_\_\_\_ image of the body. Enhanced CT's use \_\_\_\_\_.
8. Magnetic Resonance Imaging (MRI) produces images of soft tissue within the body. The image is produced by a computer and a \_\_\_\_\_ that is 25,000 times stronger than the earth's magnetic field. MRIs (do, do not) use radiation.
9. Positron emission tomography (PET) scans use \_\_\_\_\_ technology. Images are (two, three) dimensional. PET scans have been used to study \_\_\_\_\_ and \_\_\_\_\_. PET scans produce pictures of activity and function.
10. Some surgical biopsies have been replaced with needle biopsies. This is called \_\_\_\_\_.
11. The gamma knife is a painless device used in stereotactic \_\_\_\_\_.
12. Focused ultrasound surgery use \_\_\_\_\_ waves, which create a powerful ultrasonic beam.
13. Three advantages of Telemedicine include:  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

# INTRODUCTION TO COMPUTERS IN MEDICINE WORK SHEET

## KEY

1. Traditional x-rays use electromagnetic waves to make pictures. New imaging techniques use computers to generate pictures of internal body organs.
2. Computers can make pictures using mathematical information.
3. Examples of how computers are used in the pharmacy include:  
Computers and drug errors, Automated community pharmacy, Hospital pharmacy robot and barcodes, Point-of-use drug dispensing
4. Advantages of digital imaging include:  
No developing process, copies are as good as originals, viewed on computer screen, can be transmitted over telephone lines, less radiation, more flexible, can be highlighted and/or enhanced
5. A major imaging area currently dominated by traditional x-rays is mammography. However, ultrasound, which can distinguish between cysts and tumors, is being used along with mammograms.
6. Ultrasound (does, does not) use radiation, but uses high frequency sound waves .
7. Computerized tomography (CT) uses x-rays and digital technology to produce a cross-sectional image of the body. Enhanced CT's use dye.
8. Magnetic Resonance Imaging (MRI) produces images of soft tissue within the body. The image is produced by a computer and a magnetic field that is 25,000 times stronger than the earth's magnetic field. MRIs (do, do not) use radiation.
9. Positron emission tomography (PET) scans use radioscope technology. Images are (two, three) dimensional. PET scans have been used to study Alzheimer's and Parkinson's Disease. PET scans produce pictures of activity and function.
10. Some surgical biopsies have been replaced with needle biopsies. This is called interventional radiology.
11. The gamma knife is a painless device used in stereotactic radiosurgery.
12. Focused ultrasound surgery uses sound waves, which create a powerful ultrasonic beam.
13. Three advantages of Telemedicine include:  
Brings high quality medical care to anyone regardless of distance  
Medical Assistants at the remote sites may be useful

**In prisons, telemedicine has led to decreased costs and improved health care for inmates**

**Decreases patient wait time**

**Decreases patient travel time**

**USE OF COMPUTERS IN HEALTH CARE INTERVIEW TEACHER GUIDELINES**

Choose one of the following options:

1. Take a fieldtrip to a local hospital and meet with various professionals to learn about the uses of technology in medicine:
  - A. Biomedical Equipment technician -- What are examples of computerized medical instruments and equipment?
  - B. Medical Records/Health Information Manager -- How do computers improve the patient record?
  - C. Computer programmer from Information Technology -- How are various computer applications used in this agency? How do these applications improve healthcare for patients?
  - D. Hospital Administrator -- How has the use of computer technology in this area changed over the last 15 years? What are the advantages to the agency and to the patients?

Students should be prepared to discuss their reaction to the activity in class.

2. Visit a medical office and have students compare what they have learned about computers in health care with their use of computers in the office
3. Ask students to interview three to five health care employees using the Use of Computers in Health Care Interview Guide. They should summarize their findings in a short essay or PowerPoint presentation.



# USE OF COMPUTERS IN HEALTH CARE

## INTERVIEW GUIDE

	Interview #1	Interview #2	Interview #3
<b>Type of Job</b>			
<b>Type of Facility</b>			
<b>Use of Computers in this Job</b>			
<b>Effects on Patient Care</b>			
<b>Most Significant Computer Advancement</b>			
<b>Predict future advancement in this type of facility</b>			
<b>What additional training or education is needed to operate this technology</b>			

## BROCHURE RUBRIC

CATEGORY	4	3	2	1
<b>Writing - Organization</b>	Each section in the brochure has a clear beginning, middle, and end.	Almost all sections of the brochure have a clear beginning, middle and end.	Most sections of the brochure have a clear beginning, middle and end.	Less than half of the sections of the brochure have a clear beginning, middle and end.
<b>Content - Accuracy</b>	All facts in the brochure are accurate.	99-90% of the facts in the brochure are accurate.	89-80% of the facts in the brochure are accurate.	Fewer than 80% of the facts in the brochure are accurate.
<b>Graphics/Pictures</b>	Graphics go well with the text and there is a good mix of text and graphics.	Graphics go well with the text, but there are so many that they distract from the text.	Graphics go well with the text, but there are too few and the brochure seems "text-heavy".	Graphics do not go with the accompanying text or appear to be randomly chosen.
<b>Spelling &amp; Proofreading</b>	No spelling errors remain after one person other than the typist reads and corrects the brochure.	No more than 1 spelling error remains after one person other than the typist reads and corrects the brochure.	No more than 3 spelling errors remain after one person other than the typist reads and corrects the brochure.	Several spelling errors in the brochure.
<b>Attractiveness &amp; Organization</b>	The brochure has exceptionally attractive formatting and well-organized information.	The brochure has attractive formatting and well-organized information.	The brochure has well-organized information.	The brochure's formatting and organization of material are confusing to the reader.

# MULTIMEDIA RUBRIC

Student: \_\_\_\_\_ Class: \_\_\_\_\_

Title: \_\_\_\_\_ Other Group Members: \_\_\_\_\_

Date: \_\_\_\_\_

Scoring criteria	5 Excellent	4 Good	3 Needs Some Improvement	2 Needs Much Improvement	1 N/A
Clearly and effectively communicates an introduction of the theme/objective of the project.					
Clearly and effectively communicates the content throughout the presentation.					
Integrated a variety of multimedia resources to create a professional presentation (transition, graphics).					
Presentation holds audience attention and relates a clear message.					
Timing between slides is beneficial for the viewer to read or observe content.					
Each image and font size is legible to entire audience.					

## Scale:

26-30 A Excellent

21-25 B Good

16-20 C Needs Some Improvement

11-15 D Needs Much Improvement

6-10 F Not Appropriate

**TOTAL=**

Comments