

Chapter 21

Effects of Assistive Technologies Combined with Desktop Virtual Reality in Instructional Procedures (2)

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ABSTRACT

Twenty-four practical nursing and health careers students were introduced by random assignment to the four treatments. Specifically, the study compared the learning effects on an instrument connection procedure used in a medical setting of four different learning treatments: text-only instruction, image-only instruction, desktop virtual reality (DVR) with assistive technologies (ATs) (i.e., audio combined with closed caption) instruction, and hands-on demonstration instruction. This study used descriptive statistics, analysis of variance (ANOVA), and qualitative comments and observation to discover important design and implementation challenges for DVR.

INTRODUCTION

In this chapter the methodology, results and findings, discussion, future research directions, and conclusion are presented as a follow-up to Chapter 20.

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METHODOLOGY

Sample

Twenty-four subjects from Northeast Technology Center in Oklahoma (USA) participated in this study. They were post-secondary Practical Nurs-

ing students and Health Careers Occupations students aged 18 years or older, and were selected to participate based on the criterion of having no previous interaction with an electrocardiography machine (ECG or EKG).

Testing Instruments and Procedures

Subjects were randomly assigned to one of four web-based treatments: (a) text-only that included only text with no visual aides; (b) image-only that included visual imagery with no supportive text; (c) DVR/ATs that included a QuickTime Virtual Reality (QTVR) Movie, audio with closed captioning and text-based support for documentation; (d) hands-on instructional training that included instructor-presented instructional demonstration supported by text-based documentation. Figures 1, 2, and 3 illustrate the three media-based treatments. These treatments were presented via desktop computer. All four treatments were presented to subjects individually by the researcher.

Students assigned to image-only and DVR/ATs treatment were given a video to train them on interaction and navigational tools used by the QTVR Player. These subjects were allowed to view the instructional training video as long as they wanted. All students were individually given their assigned instructional presentation on

to how to hook up an EKG. Upon completion of their training treatment, students were individually shown the actual EKG, lead cables, sensors, and electrical power cord and ask to successfully hook up the machine to a mannequin according to what they learned from their treatment. Subjects were given a maximum of ten minutes to complete this task. This performance test was the source of the quantitative data for the study. Additional qualitative data were recording subjects' verbal comments and researcher observations.

RESULTS AND FINDINGS

Analysis of the number of correct responses on the hands-on EKG exercise was done with descriptive statistics and one-way ANOVA. Descriptive data are shown in Figure 4.

ANOVA results are shown in Figure 5. There was a significant difference among the four instructional treatments ($F = 31.43$; $df = 3$; $p = .000$) with a very large effect size ($\eta^2 = .97$) and a large corrected $R^2 (.80)$. These results allowed rejection of the null hypothesis that learners receiving text-only, image-only, DVR/ATs, and traditional hands-on instruction perform no differently.

To locate the sources of significant differences among the four instructional treatments, post-hoc

Figure 1. Screen shot of the text-only instrument

INSTRUCTIONAL TEXT TREATMENT

Procedural steps for proper connecting of power cable, ECG patient cable, and leads for the EK10 Electrocardiograph.

Use of multiple electrical apparatus

If the EK10 is to be connected to a patient who also has other electrically operated devices attached to or close to the body, care must be taken to ensure a safe patient environment. This is particularly important when using cardiac catheters.

The EKG leads are electrically isolated from ground to ensure patient safety; however it is important to ensure that any other equipment in the immediate vicinity is properly grounded - unless it is double insulated - and operated strictly according to manufacturer's instructions. All requirements and wiring should be visually inspected for safety on a regular basis.

Grounding

Maximum patient and operator safety is ensured when the EK10 is properly grounded. This is normally achieved automatically when the 3-conductor power cable is connected as described above under "Power Connection". An auxiliary ground lead is also provided. This may be used to connect a mannequin to a metal table in the grounding rack. This is in effect a procedure whenever optional AC electrification is used in the source. It can also be used to ground the EK10 in the event of inadequate grounding through the normal electrical supply outlet. In this case make sure the spring tip is connected to make a positive connection to a well grounded object, such as a cold water pipe. The ground wiring is designed to accept an additional ground wire should multiple grounding be required.

Setting up Equipment

Disposable Sensors Application

- Remove individual sensors from the package liner card and position on the patient.
- First apply the limb positions sensors, preferably locating them on the inside and generally hairless areas of the arms and legs.

Note: For very hairy patients, any one of the following techniques may be employed to ensure good contact and adhesion of the electrodes:

- Grasp the hair between thumb and forefinger; apply the sensor to the exposed skin.
- Use a water dampened towellette to moisten the skin area to enhance the adhesive tack prior to applying the sensor.
- If method(s) are) do not work, shaving may be necessary. In any case the sensor may be repositioned to the shaved area without significant loss of lead.

Next apply the sensors to the chest area

- V1 Brown Lead Handle Yellow Label and Stripe
- V2 Brown Lead Handle Yellow Label and Stripe
- V3 Brown Lead Handle Green Label and Stripe
- V4 Brown Lead Handle Blue Label and Stripe
- V5 Brown Lead Handle Orange Label and Stripe
- V6 Brown Lead Handle Violet Label and Stripe

Attach alligator adapter clips to the apex of each sensor

- At this time perform any other preparation tasks to allow the patient a short time to relax and also to give the recorder-system time to stabilize.
- When the ECG record is completed, simply remove and discard the sensors. There is no cleanup.

Power Connection

- The EK10 is supplied with a 3-Prong-Conductor power cable. Connect the cable to the power jack located on the side back panel of the EK10 and to a properly maintained and grounded electrical wall outlet to automatically ground the unit.

Caution: the unit must only be operated at the voltage and frequency specified.

LEAD ARRANGEMENT AND CODING CHART

Limb Leads

LEAD	SENSORS CONNECTED	CODE	COLOR
LEAD 1	IA and RA	RL	BROWN
LEAD 2	II and RA	IL	GREEN
LEAD 3	III and LA	LA	RED

CHEST LEADS

LEAD	SENSORS CONNECTED	CODE	COLOR
V1	V1 and (LA RA LL)	V1	BROWN
V2	V2 and (LA RA LL)	V2	BROWN
V3	V3 and (LA RA LL)	V3	BROWN
V4	V4 and (LA RA LL)	V4	BROWN
V5	V5 and (LA RA LL)	V5	BROWN
V6	V6 and (LA RA LL)	V6	BROWN

CHEST LEADS PLACEMENT

- V1- Fourth intercostal space at right margin of sternum
- V2- Fourth intercostal space at left margin of sternum
- V3- Midway between position 2 and position 4
- V4- Fifth intercostal space at junction of left midclavicular line
- V5- At horizontal level of position 4 at left anterior axillary line
- V6- At horizontal level of position 4 at left midaxillary line

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