

Health Care Teamwork: Augmented Training Assessment in a Simulated Operating Room (OR) Environment

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ABSTRACT

Wearable technology has great potential to transform the healthcare industry. Research has also shown that the use of checklists is effective in improving patient safety during surgery, and for navigating complex tasks. This study assesses the utility and effectiveness of using wearable technologies to incorporate and display checklists in a medical training simulation. The use of commercially available head- or wrist-worn devices (e.g. Google Glass or Galaxy Gear, respectively) as tools to perform post-operative action review of team-based operating room (OR) procedures is assessed using two conditions: one using a shared checklist, and one without a checklist. The experiment consists of a team-based simulated operating room scenario for a mock code event, aided by healthcare providers simulating the tasks of health professionals, including doctors and nurses. Quantitative evaluations performed include assessments of latency and performance of near real-time video transfer over Wi-Fi and/or Bluetooth communication, quality of the capture feed for post-operative review, evidence of overheating and battery issues, and the use of screen cast mirroring to display video captured by Google Glass units onto screens of various sizes. Qualitative evaluations performed include attitudes towards simulators with respect to system performance lag and delay, levels of distraction caused by the heads-up display, perceived utility of checklists in training environments or in OR environments, feelings of cognitive overload, and user interface/user experience reactions or recommendations. Frequency analysis revealed no issues with audio quality, battery, or overheating, and the wearable devices were not distracting for task completion. However, there was lag in video mirroring and audio capture for smart watch users. The checklist application did not distract participants, but the extra step contributed to a higher mental effort. Results warrant further exploration and could impact training by allowing the user an iterative instructional approach while potentially providing support to the provider during difficult or uncommon operative procedures.

ABOUT THE AUTHORS

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David S. Metcalf, Ph.D., has more than 20 years of experience in design and research of web based and mobile technologies converging to enable learning and healthcare. Recent efforts include the development of mobile technology strategies for Tufts University and University of Central Florida medical schools. He combines an academic grounding and continued university involvement with a strong history of industry-centered training and simulation, providing learning innovations for Google, Johnson & Johnson, Microsoft, Tyco and many others. As a research faculty member with the University of Central Florida's Institute for Simulation and Training and head of the Mixed Emerging Technology Integration Lab, which he founded in 2006, Dr. Metcalf continues to bridge the gap between corporate learning and simulation techniques and non-profit and social entrepreneurship. Simulation, mobilization, mobile patient records and medical decision support systems, visualization systems, scalability models, secure mobile data communications, gaming, innovation, management and operational excellence are current research topics. Dr. Metcalf frequently presents at industry and research events, shaping business strategy and use of technology to improve learning, health and human performance.

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INTRODUCTION

Purpose

The purpose of this research effort was to assess the utility and evaluate the performance of wearable technology in a collective team environment. The initial study was conducted with medical practitioners to assess the impact of using these devices in the OR. Specifically, the team evaluated the effectiveness of head-worn and wrist-worn wearable devices in a simulated OR scenario for a mock code event (i.e., heart condition). The use and performance of the technologies were assessed in two conditions which involved a team of doctors and nurses working collectively to complete the mock code scenario. This exercise confirmed that integrating wearable technology and checklists for training purposes and for use in the OR could be very effective.

Background

Applications of Wearable Devices in Healthcare

Healthcare providers are embracing wearable technology as tools to improve and facilitate their work in various areas of care. Wearable devices are being used to – among others - increase efficiency (Muensterer, Lacher, Zoeller, Bronsten, & Kubler, 2014), facilitate telecommunication in the Operating Room (OR), provide quick access to Electronic Medical Records, and to supplement procedural training.

Recent literature on the use of wearable devices in the OR show its potential as a tool for collaboration in the OR environment. Peregrin (2014) studied the use of Google Glass' video camera to facilitate guiding trainees through OR procedures where the senior surgeon was able to communicate with and provide guidance to a junior surgeon during a medical procedure. Further, Armstrong, Rankin, Giovinco, Mills, & Matsuoka (2014) applied the use of Google Glass as a tool for team collaboration. O'Connor (2014) demonstrated the use of Google Glass as a tool for collective training at Duke Medical Center. The Google Glass was used by surgeons to stream live video of surgeries to other surgeons and to medical students for training. In addition, the Google Glass was used as a tool to record and archive surgeries for future training opportunities. Furthermore, Lindique et. al. (2014) demonstrated the use of Google Glass in combination with an augmented reality device allowing for remote communication during surgery and transmission of hand movements viewable on the Google Glass device.

Finally, as part of Advanced Medical Applications' (AMA) participation in the Glass Explorer program, Google granted early adopters the opportunity to buy a Google Glass device in an effort to explore how the device would be utilized. This resulted in a live surgery conducted between the CHP (Centre Hospitalier Privé) St-Gregoire in Rennes (France) and Nagoya (Japan). During the surgery the physician was able to demonstrate his technique to the Japanese team and answer their questions via the Google Glass interface.

Effectiveness of the Use of Checklists in the OR

Healthcare providers, use medical checklists in an effort to improve patient safety. Patient safety checklists guide providers through vital procedural steps enabling them to successfully navigate complex medical tasks with accuracy, consistency and integrity. The use of a checklist grants healthcare providers the opportunity to *pause* and assess a particular medical situation before proceeding to the next step.

The effectiveness of using checklists before, during, and after team-based OR procedures is evident in recent literature. Porter, Narimasu, Mulroy, & Khoeler (2014), used checklists to assess compliance, improve team participation, and to ensure completion of all the critical steps before an OR procedure, and demonstrated an improvement from 78% to 96% in pause compliance. It also showed an improvement in OR teamwork participation from 44% to 94% by incorporating the use of a pre-procedural checklist. Bliss, Ross-Richardson, Sanzari, Shapiro, Lukianoff, Bernstein, & Ellner (2012) indicated a significant reduction in post-operative complications and fatality from the use of a checklist during team training. They also observed a decrease in the rate of adverse events from 15.90% to 8.20%.

Finally, Sibbald, de Bruin, & van Merriënboer (2013), revealed the advantages of using checklists in medicine. The checklists were provided to cardiologists in an attempt to minimize physician errors while reading an electrocardiogram (ECG).

Wearables and Checklists

Studies investigating the integration of wearable devices and checklists for use in healthcare are limited. However, Peregrin (2014) presents the potential use of Google Glass with a hands-free safety checklist application that can potentially help reduce errors in the OR.

Bang, Solvenik & Eriksson (2015) presented the design and evaluation of a smart watch system for monitoring vital signs and sending to-do reminders via an automated checklist to Intensive Care Unit (ICU) nurses. Results showed the subjective usefulness of displaying checklist task reminders on a smart watch.

METHODOLOGY

Participants

The collective healthcare team was comprised of six medical professionals, including doctors and nurses (4 females and 2 males) from the University of Central Florida College Of Medicine and the Osceola Medical Center. Their ages ranged from 30 to 48. All six participants had previous experience participating in a mock code simulation event and had treated the heart condition simulated in this study.

Materials

Wearable Devices

Five commercially available head-worn and wrist-worn wearable devices were utilized during the experiment: Google Glass, Pivothead SMART Glasses, Apple Watch, Samsung Galaxy Gear S watch, and the MeCam HD (see Figure 1).

Pivothead SMART Glasses is a head-worn device featuring a high definition (HD) camera that allows for high quality live video streaming, simple touch gestures for user control, and a battery boost add-on for extended battery life.

Google Glass is a head-worn wearable device that runs on an Android operating system (OS). It displays information within the viewers' line of sight. Features include voice-enabled



Figure 1. Wearable devices used in the study

commands, gesture controls, audio and video recording, and image capture.

Samsung Galaxy Gear S is a wrist-worn smart watch that runs on an Android OS. Features include a built in sim card (which allows the user to make or receive calls and messages), 3G network capability, Wi-Fi, Bluetooth connectivity, and it is voice-controlled using S-voice.

Apple Watch is a smart watch that runs on Apple's OS. It requires pairing with an iOS mobile device in order to make/receive calls and send/receive messages. It also includes voice-controlled activation via Siri, as well as, Wi-Fi and Bluetooth connectivity.

MeCam HD Camera is a mini hands-free High Definition (HD) camera that can be worn on a shirt, as a necklace, or mounted on other objects. Features include: Wi-Fi connectivity to other Wi-Fi enabled devices.

Additional Devices

In addition to the wearable devices, this experiment utilized a Nexus 7 tablet and an HD monitor with Chromecast application to support the scenarios.

Checklist Application

A simple shared checklist application was created based on a framework developed at UCF Institute for Simulation and Training (IST). The checklist was converted to a web application for use on the Nexus 7 tablet and a platform specific application for the Samsung Galaxy Gear S.

The mock code procedure consisted of a collection of steps that the participants were asked to perform. These steps were displayed on the checklist applications (see Figure 2). The applications were designed to promote team-work in clinical settings; a checklist, as well as checked items, can be viewed simultaneously by all team members.

Participants wearing the Google Glass and the Apple Watch devices were presented with a non-interactive image based version of the checklist, which was synchronized with the checklist applications in the Nexus 7 and the Samsung Galaxy Gear S tablets.

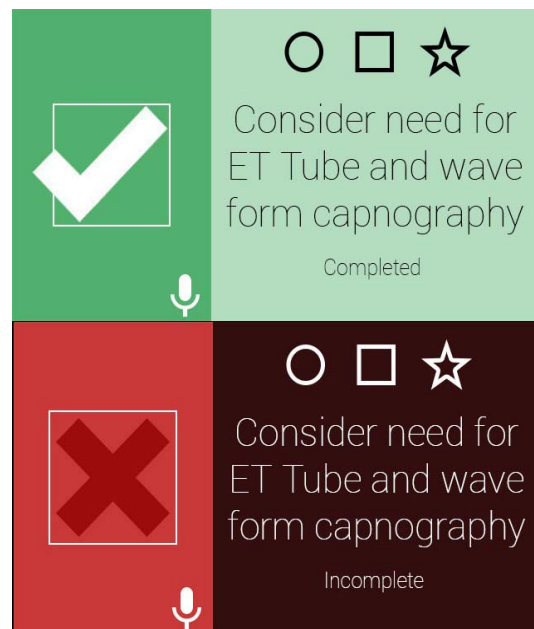


Figure 2. Mockup of Google Glass checklist application

Instruments

Demographics Survey

The survey collected participants' information in regards to age, type of wearable device assigned (if they were assigned one), and gender.

System Performance Assessment

A survey was used to collect participants' perceptions/opinions about the use of wearables in the simulated mock code team-based OR scenario. The survey included questions to assess different constructs to include the following: utility of the wearable device for performing tasks during the procedure, experience of lag and delay between the monitor in the room and the display on the wearable device, level of distraction caused by the wearable, evidence of overheating, battery issues, usefulness of simultaneous display of content on the wearable device, perceived utility of direct line of sight, audio quality, and cognitive overload. The checklist condition also included items to collect User Interface (UI)/User Experience (UX) reactions of the checklist application.

User Feedback

Three questions were used to collect participants' recommendations of the utility of wearable devices for medical simulation procedures.

Technology Acceptance Model

The Technology Acceptance Model (TAM) questionnaire (Davis, 1989) consisted of 12 statements to assess perceived ease of use and usefulness of the technology. Participants were asked to rate their experience on a 7-point Likert scale ranging from 1 (extremely likely) to 7 (extremely unlikely).

Procedure

Participants were recruited from UCF College of Medicine (CoM) and Osceola Medical Center. The experiment was conducted at the UCF Clinical Skills Center at UCF CoM in Lake Nona, FL in the spring of 2016.

Participants were asked to complete tasks in a simulated mock code team-based OR procedure. Team roles were assigned prior to receiving the wearable device. The experiment consisted of two conditions, each with a different simulated mock code procedure. The simulated mock code in Condition 1 was performed without the use of the checklist applications and utilized the wearable devices solely for their recording ability. In Condition 2, the wearable devices were used with the checklist applications without recording capability.

The experiment was presented in four phases. At the start of the first phase, each participant was given an informed consent document to sign and then provided with an introduction to the experiment. Participants were told that the entire experiment was being video recorded and that some of the wearable devices would be recording their actions during the experiment. A verbal acknowledgement was required from each participant prior to commencing the experimental condition.

After the conclusion of each phase, the participants were asked to provide feedback of their experience by completing the system performance assessment survey. Additional user feedback was documented by open-ended questions. The Technology Acceptance Model survey was administered to participants at the conclusion of the fourth phase of the experiment.

The conditions were conducted in the order as follows:

- Phase 1: Scenario 1, Condition 1
- Phase 2: Scenario 1, Condition 2
- Phase 3: Scenario 2, Condition 2
- Phase 4: Scenario 2, Condition 1

Scenario 1

The first mock code scenario utilized a medical human patient simulator (HPS) which simulated an unconscious 74-year-old woman. Following a fixed progression, doctors and nurses assessed the patient and were presented with 3 stages that needed to be addressed in order. At the beginning of the scenario the patient showed signs of 2nd degree Type II bradycardia rhythm. Next the patient went into ventricular fibrillation, and after 3 rounds of cardiopulmonary resuscitation (CPR) and shock the patient returned to spontaneous circulation.

Scenario 2

In the second scenario, the same HPS was dressed as a 45-year-old male who just experienced a seizure ceasing thirty seconds before the participants' arrival. He showed signs of sinus rhythm bradycardia and then proceeded to ventricular fibrillation. After 3 rounds of CPR and shock, the patient showed signs of return of spontaneous circulation (ROSC).

Condition 1 (video and audio recording only)

The Google Glass was worn by the participant in the respiratory support role. The Pivothead SMART Glasses and MeCam Mini Camera were given to the participant in the team lead role. These two roles were determined prior to the experiment to provide the best vantage points of the simulation.

Condition 2 (shared checklist only)

Devices were handed to individuals whose role assignment best fit the intended use of the device. Since the team lead was entirely hands off throughout the scenarios, they were given the Nexus 7 tablet and were asked to check items off the list as the scenario progressed. Just like in Condition 1, the participant on respiratory support was given the Google Glass. The participant who selected the CPR role was given the Galaxy Gear S. The participant in charge of the crash cart was given the Apple Watch.

The inclusion of the checklist in the mock code scenarios was the main focus of Condition 2. As such, the checklist was the main control device for the experiment. A live feed from the checklist was displayed on the HD television to allow everyone in the room a view of the checklist even if they were not wearing a device. The Galaxy Gear S was also configured to run a custom version of the checklist that synchronized with the tablet view. A technician remotely controlled the images being displayed to the participants on the Google Glass and Apple Watch.

Each phase ran for approximately 30 minutes and included: device and mannequin setup time, participant instruction, and mock code scenario. The total runtime for the experiment was approximately three (3) hours which included initial orientation, informed consent, experimental condition, additional time for completing surveys, and debriefing.

RESULTS**System Performance****Phase 1**

Frequencies were computed for the system performance assessment (Table 1). The participant that wore the Google Glass felt that the wearable and the HD monitor were not useful for performing tasks during mock code scenario procedures. The participant that wore the Pivothead/MeCam responded with neutral and felt that the simultaneous display was very useful. The participants were satisfied with the utility of simultaneous display on the wearable device's screen. The participant that wore the Pivothead/ MeCam reported being slightly more able to pay attention to the tasks, as opposed to the participant that wore the Google Glass. The participant that wore the Google Glass, felt less frustrated using the wearable device than the participant wearing the Pivothead/MeCam. Participants wearing the devices reported neither high nor low mental effort. Two participants that were not wearing devices reported experiencing a rather high level of mental effort. Both participants did not report any experience of lag or delay, audio quality issues, issues with overheating, or any issues with batteries.

Table 1. Phase 1 System Performance Assessment

Statement	Strongly Disagree (%)	Disagree (%)	Neutral (%)	Agree (%)	Strongly Agree (%)
Wearable useful for ED tasks	17	0	83	0	0
HD monitor useful for ED tasks	17	0	83	0	0
Wearable simultaneous display useful	0	0	83	17	0
Able to pay attention to task	0	0	0	17	83
Frustrated with wearable	17	0	83	0	0
Experienced lag in audio	33	0	67	0	0
Experienced lag in video mirroring	33	17	50	0	0
Experienced wearable overheating	17	0	83	0	0
Experienced battery issues	17	0	83	0	0
Audio quality of wearable satisfaction	0	0	100	0	0

User reactions

The participant using the Pivothead/MeCam thought that wearable devices would be useful for an experiment with paramedics in the field to facilitate clinician assistance and for transmitting EKG data to the hospital. Additionally, the participant thought that wearable devices would be useful for simulations involving all code situations, including (Advanced Cardiac Life Support (ACLS), Acute Radiation Syndrome (ARS), Cerebrovascular Accident (CVA) alert, sepsis alert, and ST-Segment Elevation Myocardial Infarction (STEMI) alerts. Finally, recommendations for future large scale experiments include telemedicine for neurological evaluation of stroke patient, student evaluations of clinical skills, and student evaluations of code simulations.

Phase 2

The majority of the participants did not agree or disagree ($n = 4$) that the use of wearable devices and HD monitor was useful during mock code scenario procedures, with four participants reporting no lag or delay in video mirroring or in audio capture (Table 2). However, there was one participant that did agree with the utility. There were two participants that reported usefulness of simultaneous display of content on the wearable device's screen. The participant wearing the Samsung Gear did not find simultaneous display to be useful. Participants wearing the Samsung Gear S and Apple Watch reported experiencing slight lag in video mirroring. The participant that wore the Samsung Gear reported experiencing lag in audio capture. Overall, participants felt that the wearable devices did not distract them from their tasks and experienced no issues with overheating, audio quality, or battery life.

With regard to the checklist, a majority of participants reported that using the checklist did not distract them from conducting their tasks. However, the participant who used the Google Glass and Apple Watch felt that having to check off items on the checklist was an extra step to an already complex task. The participant who used the Google Glass/ Nexus 7 tablet felt that mental effort was rather high.

Most participants did not have negative reactions regarding the UI/UX of the checklist application. In particular, participants reported that the applications were easy to use and the interface was clear and intuitive (except for participants wearing the Samsung Gear and the Apple Watch). System performance assessment results for Phase 2 are summarized in Table 2.

Table 2. Phase 2 System Assessment Results

Statement	Strongly Disagree (%)	Disagree (%)	Neutral (%)	Agree (%)	Strongly Agree (%)
Wearable useful for ED tasks	0	17	67	17	0
HD monitor useful for ED tasks	0	17	67	17	0
Wearable simultaneous display useful	20	0	40	40	0
Able to pay attention to task	0	20	20	60	0
Frustrated with wearable	50	0	50	0	0
Experienced lag in audio	83	0	0	0	17
Experienced lag in video mirroring	0	67	33	0	0
Experienced wearable overheating	40	60	0	0	0
Experienced battery issues	40	0	60	0	0
Audio quality of wearable satisfaction	20	0	80	0	0
Checklist interaction too frequent	33	17	33	17	0
Checklist is easy to use	0	17	67	17	0
Checklist interface clear and intuitive	0	0	50	50	0

User reactions

The responses indicate that using smart watches for certain medical procedures is not recommended. In the case of the Samsung Gear S, the participant was not able to use it to its full potential due to the auto sleep features that turned off the screen before the participant had a chance to look at the checklist. The Apple Watch did not properly alert the participant to look at the watch causing the participant not to use it while conducting his/her tasks. Nevertheless, the participant wearing the Apple Watch thought that it has potential for a larger experiment in a mock code scenario setting. The participant that wore the Google Glass recommended its use for simulation procedures involving code situations (ALCS, ARS, STEMI, Stroke alerts).

Phase 3

Participants ($n = 4$) felt that using the wearable device and heads-up display was useful during mock code scenario tasks. All participants reported that having simultaneous display of content on the wearable devices screen is useful. They felt that the wearable device did not distract them from their task and they were able to pay attention to what they were doing. Furthermore, participants wearing the Samsung Gear S and Apple Watch reported experiencing lag in video mirroring. Participants did not report any issues with overheating, battery life or audio quality.

Participants mainly thought that the checklist apps were easy to use ($n = 3$), but the participant wearing the Samsung Gear S thought that the checklist application did not have an intuitive interface. All participants thought that the checklist application did not distract them from conducting their tasks and the interaction with the checklist was not frequent. However, the participants that wore the Apple Watch and Pivothead/Tablet felt that it was an extra step, and reported experiencing an increased level of mental effort. These Phase 3 system performance assessment results are summarized in Table 3.

Table 3. Phase 3 Performance Assessment Results

Statement	Strongly Disagree (%)	Disagree (%)	Neutral (%)	Agree (%)	Strongly Agree (%)
Wearable useful for ED tasks	0	0	33	67	0
HD monitor useful for ED tasks	0	0	33	67	0
Wearable simultaneous display useful	20	0	40	40	0
Able to pay attention to task	0	0	0	33	67
Frustrated with wearable	33	33	33	0	0
Experienced lag in audio	17	0	83	0	17
Experienced lag in video mirroring	17	0	83	0	0
Experienced wearable overheating	50	0	50	0	0
Experienced battery issues	33	0	67	0	0
Audio quality of wearable satisfaction	0	0	100	0	0
Checklist interaction too frequent	0	17	50	33	0
Checklist is easy to use	0	0	50	33	17
Checklist interface clear and intuitive	17	0	50	33	0

User Reactions

Participants recommended using wearable devices for various hospital procedures. Recommendations included using Google Glass for: code situations experiments, CPR with children, ACLS with medical students, BLS with general population; using Pivothead/Tablet for sepsis protocol adherence; and using Apple Watch for experiments with trauma patients, and with pediatric patients. The participant wearing the Google Glass and Apple Watch felt that these devices are suitable for code simulations. One participant thought that using a wearable device would be an extra step (Samsung Watch Gear S).

Phase 4

The participant that wore the Google Glass felt that the wearable and heads-up display was useful for performing tasks during mock code scenario procedures. Half of the participants felt that wearable device did not distract them from their task and they were able to pay attention to what they were doing ($n = 3$). Participants wearing the Pivothead/Tablet reported high mental effort while conducting tasks. Participants reported no lag or delay in video mirroring, audio capture, did not report issues with devices overheating, or any issues with batteries, or audio quality. These Phase 4 system performance assessment results are summarized in Table 4.

Table 4. Phase 4 System Performance Assessment Results

Statement	Strongly Disagree (%)	Disagree (%)	Neutral (%)	Agree (%)	Strongly Agree (%)
Wearable useful for ED tasks	0	0	83	17	0
HD monitor useful for ED tasks	0	0	83	17	0
Wearable simultaneous display useful	0	0	50	33	17
Able to pay attention to task	0	0	50	17	33
Frustrated with wearable	17	0	83	0	0
Experienced lag in audio	0	0	100	0	0
Experienced lag in video mirroring	0	0	100	0	0
Experienced wearable overheating	0	0	100	0	0
Experienced battery issues	0	0	100	0	0
Audio quality of wearable satisfaction	0	0	100	0	0

User Reactions

The participants that wore the devices did not provide recommendations. One participant that did not wear a device thought that these devices could be useful in healthcare.

Technology Acceptance

Overall, the results indicate that participants perceived using wearable devices during mock code scenario procedures as being useful. Out of six total participants, more than half of the participants thought that using wearable devices: improves the quality of work ($n = 5$), gives them more control over their work ($n = 4$), supports critical aspects of their tasks ($n = 4$), are useful for their tasks ($n = 5$), and allows them to have greater control over their tasks ($n = 5$). Half of the participants ($n = 3$) thought that using wearable devices improved their job performance, enhanced their effectiveness on the job, and made it easier to do their jobs. There were two participants who did not think that the wearable devices enabled quicker task completion.

Results indicate that, overall, the participants thought that the wearable devices were easy to use. More than half of the participants thought that learning to operate wearable devices would be easy ($n = 5$), a wearable would be adaptable to operate with ($n = 5$), the interaction with the wearables is clear and understandable ($n = 4$), and that it would be easy to become skillful at using a wearable device ($n = 4$). Participants thought that it would be easy to become skillful at using the wearable device and that the device was easy to use. Half of the participants ($n = 3$) thought that it would not be easy to get the wearable device to do what they needed it to.

DISCUSSION**Principal Findings**

This experiment assessed the utility and evaluated the performance of wearable devices in a collective team environment. Overall, participants did not experience issues with audio quality, the wearable device's battery running out before the experiment completed, and any issues with devices overheating. Additionally, participants were able to pay attention to their tasks while using the devices. On the other hand, Samsung Gear S and Apple Watch users experienced lag in video mirroring and audio capture. The utility of the wearable devices in the mock code scenario and the use of an HD monitor is unclear, except for what was observed during Phase 3 (checklist only) where the majority of participants thought that they were useful.

Overall, the use of the checklist during the experiment was not distracting. However, Apple Watch, Pivothead/Tablet, and Google Glass users found interacting with the checklist was an extra step in an already complex task, which led to an increase in mental effort.

The TAM revealed that participants thought the wearable devices in the mock code scenario were both useful and easy to use. This implies that the use of wearable devices could be incorporated in mock code scenario training.

Future Experiments

The initial phase of the study was to validate a reliable experimental design that could be used with various simulated medical trauma procedures, interchangeable wearable devices/technologies, and different roles in inter-professional teams. The research findings show some preliminary results that warrant further exploration.

It is expected that the increased use of wearable devices by healthcare professionals for personal use (e.g. monitoring activities, communications, etc.) may foster user acceptance in the collective healthcare team environment.

The preliminary study with a small population validated the protocols for a future larger sample size study. Also, our study design evaluating the team-based use of multiple wearable devices of various types and form factors, can influence additional control states in future studies. This also sets a long-term research agenda as new wearable technologies for use in clinical settings and situations are coming out weekly if not daily. Having a structured approach for evaluation and a framework for integration is a compelling long-term research agenda, and we hope to continue to provide evidence and advance the state of the art along with other partners and colleagues across the globe including the Army Research Laboratory and the Veteran's Administration.

This discovery could impact training by allowing the user an iterative instructional approach while potentially supporting for the provider during rare operative procedures.

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