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Featured Article

# Validating Eye Tracking as an Objective Assessment Tool in Simulation

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## KEYWORDS

simulation;  
nursing education;  
eye tracking;  
nursing assessment;  
high stakes testing;  
heart failure;  
simulation;  
point of view video

## Abstract

**Background:** Standardized, objective measures of performance in a simulated experience are lacking. As eye tracking glasses (ETG) provide video, audio, and data capture of a simulation event and quantitative data of participant actions, this technology is well suited for assessment. Therefore, this study sought to begin validating ETG as an adjunct, objective performance assessment tool in simulation.

**Method:** This was a prospective, validation study with a two-group, convenience sample of novice and expert nurses who participated in a heart failure (HF) simulation scenario to validate ETG using a known-groups approach. A HF scenario designed to elicit seven basic nursing tasks was followed by a knowledge test and demographic questionnaire.

**Results:** The groups were equivalent in basic HF knowledge as related to the care of a dyspneic patient. Of the seven tasks, all novices completed only one, while in the expert group, all participants completed four of the seven. Significance was found between groups for time to task in five of seven tasks and eye fixation times in key areas.

**Conclusions:** This pilot study begins the validation process of ETG technology as an objective assessment method as significant differences were elicited between known groups. ETG technology also provides meaningful data and visual images that can be used to inform nursing education in simulation. Additional research is needed to further establish the validity and reliability of ETG technology as an assessment tool in clinical simulation.

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Patient safety relies on health care educators to train and certify safe, competent practitioners. This is especially important as the number of premature deaths related to preventable causes in U.S. hospitals has increased to >400,000 annually (Watling & Lingard, 2012). Efforts to confirm competency in entry-level nursing education

include knowledge and skill tests, but there is a lack of standardized assessment. For decades, educators in nursing and medicine have used expert opinion (Watling & Lingard, 2012) and oral examinations (Littlewood, Shilling, Stemland, Wright, & Kirk, 2013), but these types of subjective assessments have problems with interrater reliability and validity (Bensfield, Olech, & Horsley, 2012; Matsell, Wolfish, & Hsu, 1991) and lack standardization between groups and institutions. The use of Objective Structured

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Clinical Examinations (OSCEs) is an improvement over previous assessment methods, but this form of assessment, while objective, is predominately task related (Cazzell & Howe, 2011; Sellu, Davis, & Vincent, 2012) and is not well suited for evaluation of a subject in a simulation which is event based.

#### Key Points

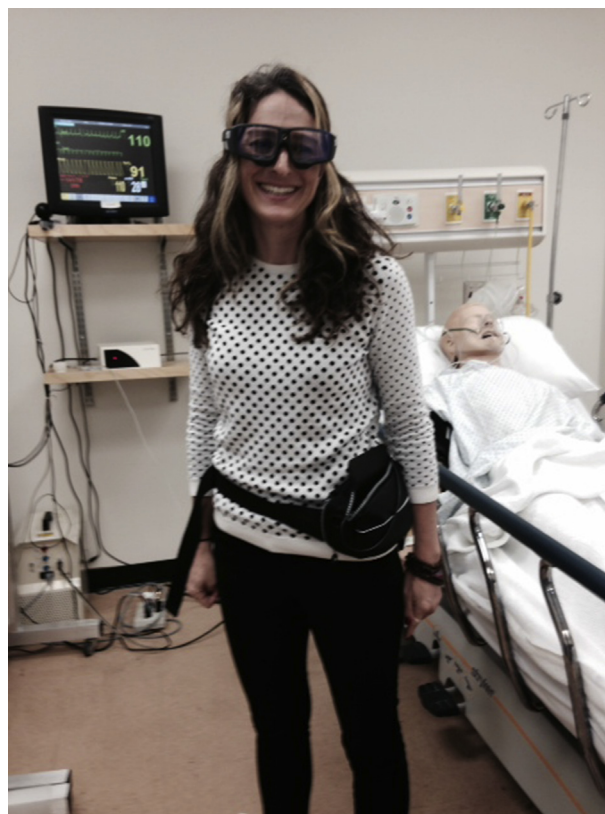
- Objective measures of performance in simulation are lacking.
- Eye tracking glasses provide a birds eye view of all performance actions.
- Eye tracking glasses may be used with other assessment methods for optimal performance evaluation.

Assessment of performance using simulation may be “low stakes” such as evaluating learning for development reasons or “high stakes” to determine competency. Therefore, since realistic, reproducible situations can now be accurately simulated, the next logical step is to follow the field of aviation in using simulation for testing following formative teaching (Petrusa, 2009). This move has already begun as

seen in specialty areas such as anesthesia credentialing (Gallagher & Tan, 2010; Jeffries et al., 2011; Kesten, Brown, & Meeker, 2015; Mudumbai, Gaba, Boulet, Howard, & Davies, 2012).

Despite the popularity of simulation in nursing, there is a large gap in the ability to objectively assess performance during a simulation event. This may be due to the often complex, time sensitive, sequential actions that are difficult to assess, and score (Boulet, Murray, Kras, & Woodhouse, 2008). In addition to a lack of valid and reliable instruments designed for simulation assessment (Mudumbai et al., 2012), other reasons may include the lack of complete visualization of the individual’s performance as it is often hampered by the type of equipment used and their placement (microphone placement, camera view, blocked areas or blind spots). Therefore, fine details of student actions could easily be missed, especially if the learner is bent over the “patient” performing a task (i.e., maintenance of sterility in changing a central line dressing or swabbing a port before injection; Henneman & Cunningham, 2005). Problems with audio capture can add frustration in gauging the performance and cause a less than accurate assessment. A possible solution to these issues which may be used as an adjunct to standardized assessment are eye tracking glasses (ETG) as they can overcome many of these difficulties.

Eye tracking technology is based on the features of eye movement and the assumption that eye movements and attention are linked as it traces where attention is being directed (Popa et al., 2015; Rayner, 1998). ETG is a technology already used in other fields such as psychology and marketing research to assess cognition and performance (Jarodzka et al., 2012; Longman, Lavric, & Monsell, 2013; Moacdieh, Prinnet, & Sarter, 2013). Eye tracking technology has greatly evolved with imbedded



**Figure 1** Model wearing eye tracking glasses and fanny pack.

audio and video capture such that blind spots and audio gaps are eliminated. What differentiates ETG from other mobile video sources (i.e., Google Glass), is the extensive, quantitative data capture, and “birds-eye” view of the learner’s attention. ETG are now available in lightweight, nontethered glasses (Figure 1). They are also able to produce a video, audio, and eye scanning record of the visual track of the subject’s iris with a small “target” placed by the software in the exact location of the subject’s gaze. Since the video and visual target follows the subject’s gaze and head movements, a “birds-eye” view of all actions and items in the subject’s line of sight is available, thus providing an unprecedented observation which even the best simulation center cameras cannot capture. These visual scanning data can be uploaded into computer programs such as Microsoft Excel or IBM SPSS (Bojko, 2013) and provide quantitative data of the visual, cognitive, and attention features of subject performance.

Eye tracking technology has been used in service-related fields such as aviation and medicine to determine competency, improve training, and determine differences between skill levels of pilots, surgeons, and cardiologists (Breen, Bond, & Finlay, 2014; Chetwood et al., 2012; Fisher, Pollatsek, & Pradhan, 2006; Sarter, Mumaw, & Wickens, 2007). Nursing research has reported on students reviewing the ETG simulation video with the goal of performance improvement in

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