



# Comparing Learning Experiences for Virtual Reality and Manikin Simulation for ACLS Education in Medical Students: A Randomized Controlled Trial

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## Background

Advanced Cardiac Life Support (ACLS) is a course that teaches clinical algorithms for emergent treatment of life-threatening cardiovascular emergencies. It is currently taught in-person, requires manikins and proctors – a method that can be time consuming and expensive.

Virtual reality (VR) has been demonstrated as an alternative to high fidelity simulation, including in medicine. Previous studies have looked at ACLS VR education compared to the traditional method with an in-person manikin. However, these studies included participants who had received ACLS training in the past, they did not assess the educational experience of VR or manikin education in individuals who have not had any prior ACLS training.

## Objectives

The objective of this study was to introduce ACLS concepts through either VR or manikin simulation education to 1st and 2nd year medical students and to gauge their learning experience immediately after the simulation education and approximately 2-3 weeks afterwards.

## Methods

First and second year medical students at Stony Brook School of Medicine were invited to participate in the study. They were randomly assigned to a group: VR ACLS education of manikin ACLS education. Participants were introduced to the ACLS algorithms using AHA educational materials. The proctors who guided participants through the study were a board-certified Emergency Medicine attending physician and several resident physicians in Emergency Medicine.

The participants completed a simulation in which the patient was in ventricular fibrillation and, either using the manikin or the VR, were guided by the proctor through the appropriate ACLS algorithm. The manikin ACLS education was performed with the Life/form® Basic Buddy Manikin. The VR ACLS education was performed with the Oculus Quest 2® headset and the VR software was designed by Health Scholars® (Denver, CO).

Immediately after completing the ACLS education (manikin or VR) participants completed an online anonymous survey hosted on Qualtrics® to assess the participants' experience with the teaching modality.

Approximately 2-3 weeks after completing the training, participants were sent an anonymous survey hosted on Qualtrics® assessing their perceived level of retention of ACLS concepts as well as their likelihood to recommend their simulation method to others.

Statistical analysis was performed using Fisher's Exact test on Microsoft Excel® and Likert scale responses were assigned to a numerical scale to calculate mode and mean (Strongly Agree (5), Somewhat Agree (4), Neither Agree nor Disagree (3), Somewhat Disagree (2), Strongly disagree (1).

## Results

There were a total of 21 participants, 9 randomly assigned to VR ACLS and 12 to Manikin ACLS training; two participants within the VR group and one within the Manikin group had previously had ACLS training, all remaining have not. 11 Participants were 1st year medical student and 10 were 2nd year medical students. Baseline characteristics were otherwise similar for both groups.

In the immediate post-training survey both the VR group and the manikin group responded Strongly Agree when asked if they enjoyed the activity ( $p = .045$ ). When participants in the VR group were asked whether the activity helped them practice team-based ACLS, both the median and mode response was Strongly Agree when compared to the Manikin group which had a median and mode response of Somewhat Agree ( $p = .04$ ) (Figure 1).

When asked about significant mental demand, the VR ACLS group revealed a median/mode response of Strongly Agree when compared to the Manikin ACLS group which had a median response of Neither Agree nor Disagree and a mode response of Somewhat Disagree ( $p = .510$ ). When asked if they were frustrated by the activity, the median and mode response for the VR group was somewhat disagree and strongly disagree for the manikin group ( $p = .046$ ) (Figure 1).

Of the 21 participants, 20 completed the follow up survey 2-3 weeks after the initial session, 1 participant in the manikin group did not complete the survey. In the follow up survey when asked if they recall the concepts taught in the ACLS training both the VR group and the manikin group had a median and mode response of Somewhat Agree ( $p = .220$ ). When asked whether they recommend this method of simulation for future ACLS education, the median and mode response for the VR group was Strongly Agree ( $p = .008$ ) (Figure 2).

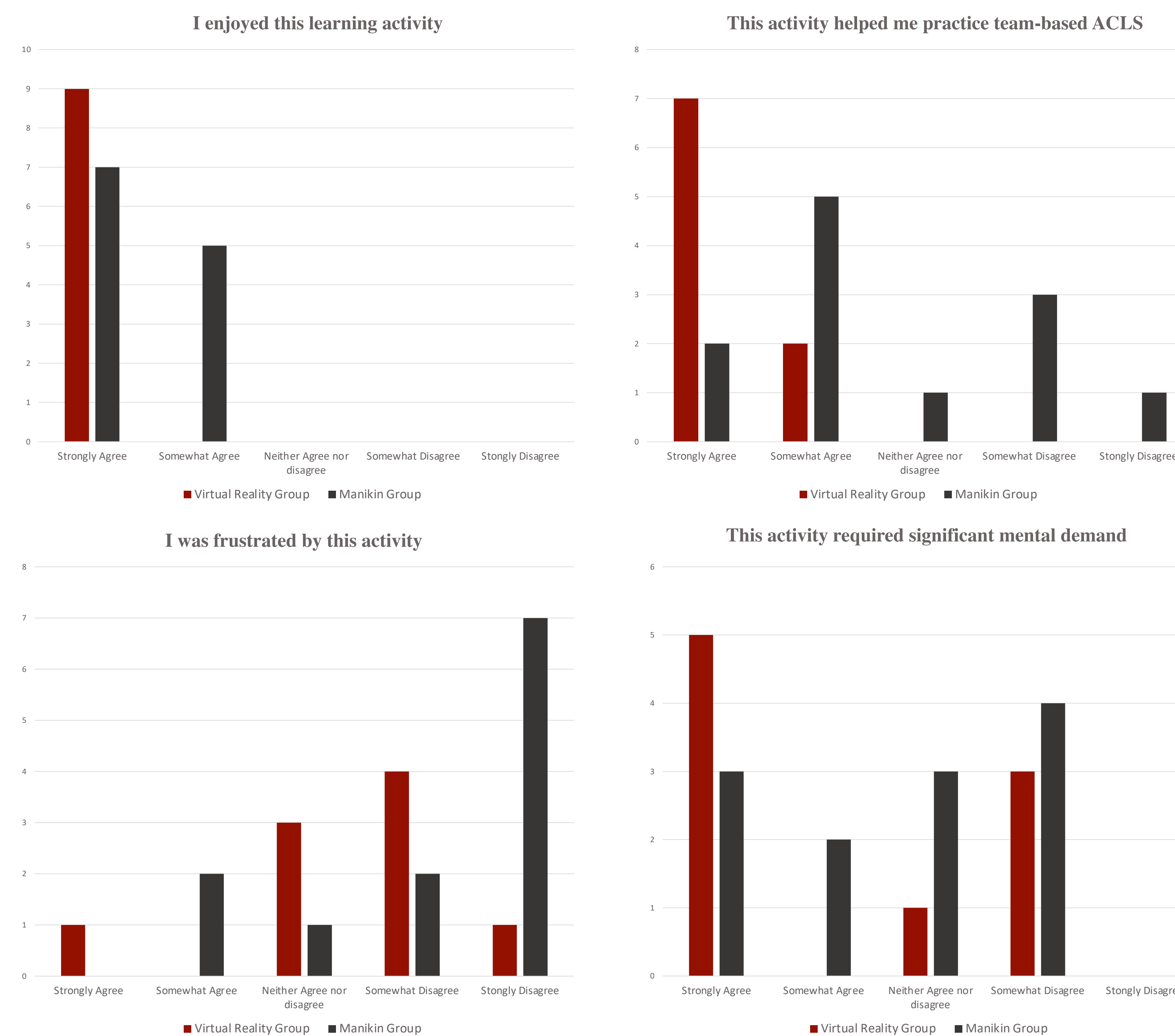
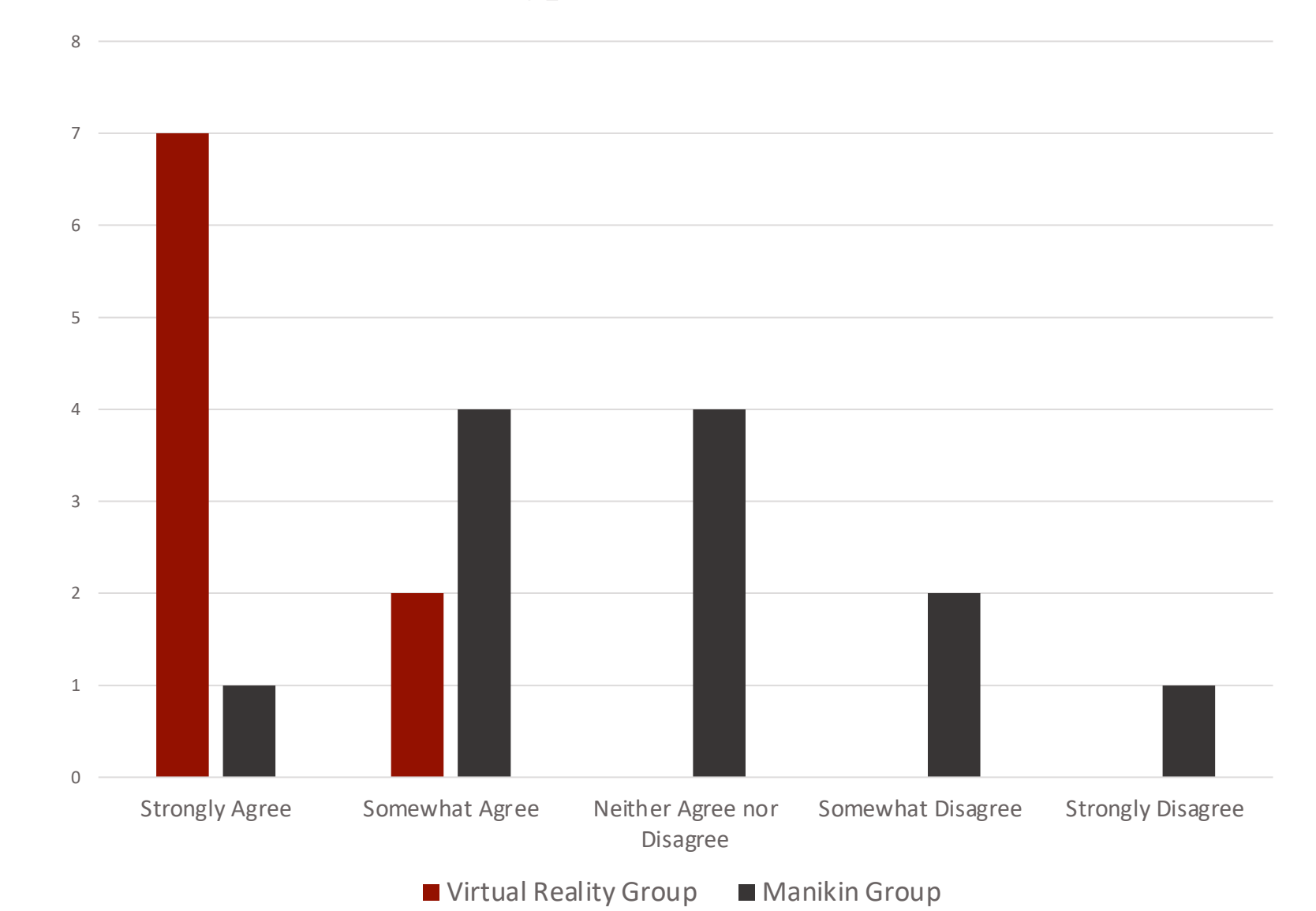


Figure 1: Participant responses to the survey immediately after the learning experience

I would recommend this type of simulation for future ACLS education



I remember the concepts taught in the ACLS study

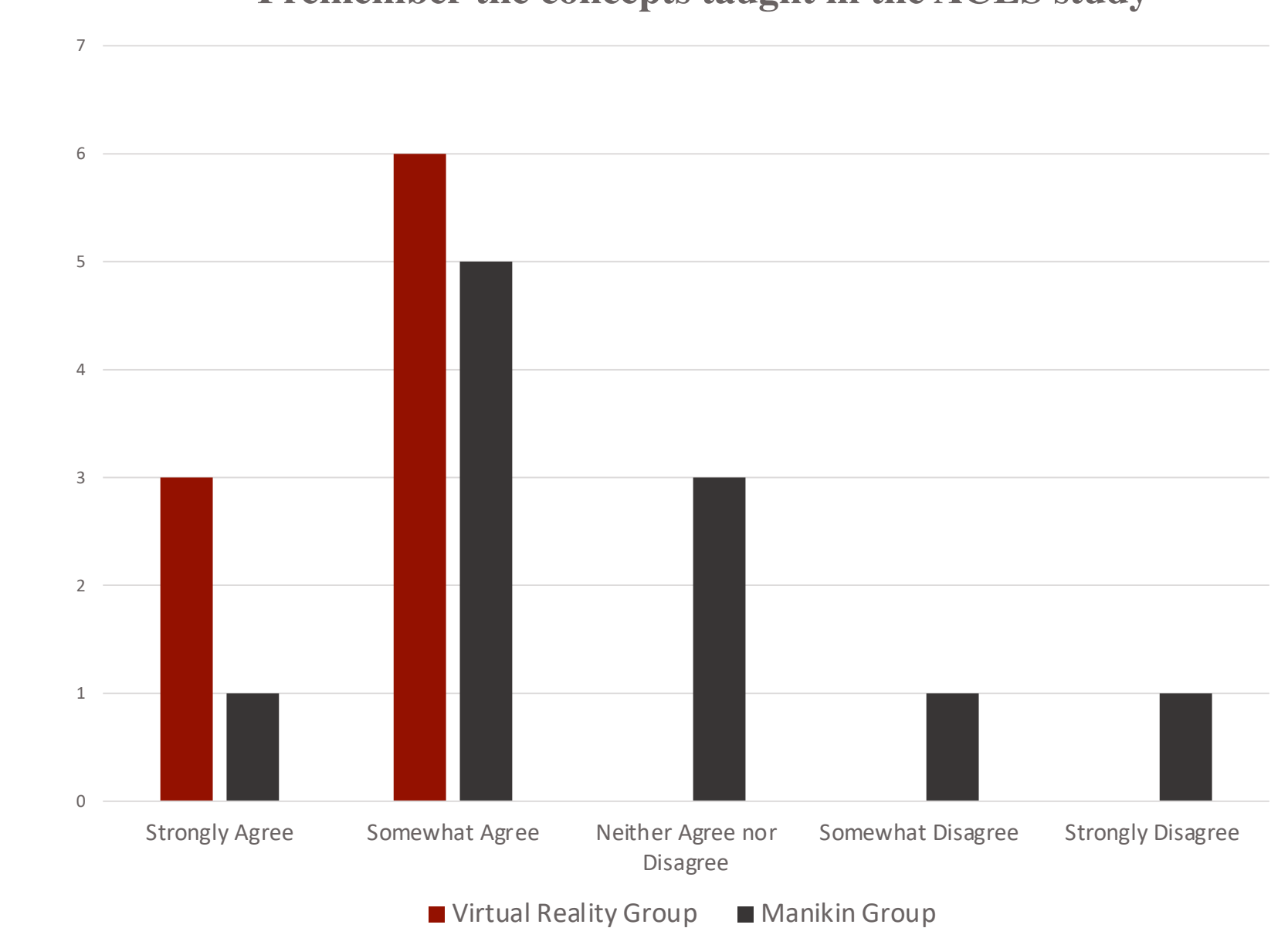


Figure 2: Participant responses to the follow-up survey

## Discussion

This study demonstrates that both methods of teaching ACLS provide favorable learning experiences, both groups felt the activity helped them practice team-based ACLS. However, the VR group had a more favorable response and were more likely to recommend ACLS education through VR.

For individuals who have not had prior ACLS training, VR simulation can be a comparable method of training and assessment to traditional manikin training. VR training can have advantages over manikin training such as a stronger team-based practice and is a method that can be less expensive, less time consuming and has less demand on ACLS proctors.

Participants in the VR group reported increased cognitive demand compared to the manikin group and was found to be more frustrating for the participants. These responses may be related to frustrations with the VR technology and troubleshooting issues.

This study was limited by a small sample size. Future studies with larger sample sizes should implement new learning modalities for new ACLS learners, to assess experience and retention of knowledge to further improve ACLS education. This can include high fidelity manikins, low fidelity manikins, different VR headsets and a training using a hybrid of these modalities.

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