Designing a Control Room to Support Manikin-Based, Standardized Patient, and Mixed Methods Simulations

Authors

Kelly C. Klerk, Ed.S., M.Ed., CHSE, CHSOS[1], Katie C. Branch, PhD, MSN, RN, FNAP, CHSE[2], John A. Sterling, BS[1]

[1]Grand Valley State University, Grand Rapids, MI
[2]University of Texas Medical Branch, Galveston, TX

Conflict of Interest Statement
The authors declare no conflict of interest.

Corresponding Author
Kelly C. Klerk, Ed.S., M.Ed., CHSE, CHSOS, Grand Valley State University, Interprofessional Simulation Center, Grand Rapids, MI
(Email: klerkk@gvsu.edu)

Brief Description

Designing a control room to ensure standardized healthcare simulation events involves a great deal of preparation. Every detail must be reviewed with engineers, construction managers, and internal and external stakeholders involved in the design of an effective control room.

Literature on healthcare simulation design, evaluation, and effectiveness is readily available, identifying best practices and successful approaches for different simulation centers. While there is literature about technology in healthcare simulation and information about control room setup, continued research is needed on effective control room design to support mixed method manikin-based simulation and standardized patient simulations in a central location.

Introduction

Simulation centers rely on a wide array of technologies to operate both behind the scenes as well as in the simulation room. When designing a simulation center, many considerations must be addressed to meet the educational goals for each discipline that will utilize the facility. Additionally, it’s important to keep in mind that new disciplines may use the simulation center in the future. An adaptable and flexible simulation center control room will help support changing technology and curriculum needs (Crofut et al., 2020). Before designing or revamping a control room, it is beneficial to visit nearby simulation centers and participate in healthcare simulation conferences. Interacting with personnel from other simulation centers at these events can provide valuable ideas and insights to determine the most effective approach.

An important aspect of the design process includes working with the institution’s Information Technology (IT) department to identify computer and network topology requirements, data and storage support, and equipment needs (Huang, 2020). By discussing the audiovisual (AV) components and computer needs, IT can direct all power and data outlet placement requirements with the engineering and building facilities team (Dleikan et al., 2020).

Control rooms can be designed in a variety of ways to meet the layout, functional, and budgetary needs of the simulation center. The authors of this article will explain how a central control room was planned, established, and operated to meet the needs of a variety of simulation scenario setups. By establishing uniformity in the control room configuration, there are dedicated locations for patient simulator laptops, tablets, and monitors. This eliminates the need to move equipment, reducing the risk of equipment damage and staff injury.

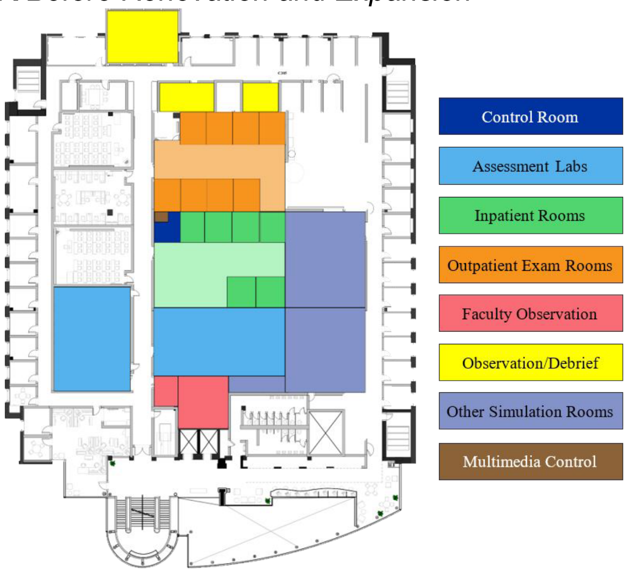
Simulation Center Renovation and Expansion

Over the past decade, Grand Valley State University's (GVSU) Interprofessional Simulation Center has grown from its original 6,409-square-foot space in one building (Figure 1A) to a 67,828-square-foot area spread across three buildings on the University's Health Campus (Figure 1B). During this time, the number of learners and academic programs utilizing the Center has grown exponentially. On average, the Center provides over 1,500 simulation-based events with over 8,000 total learners every year.

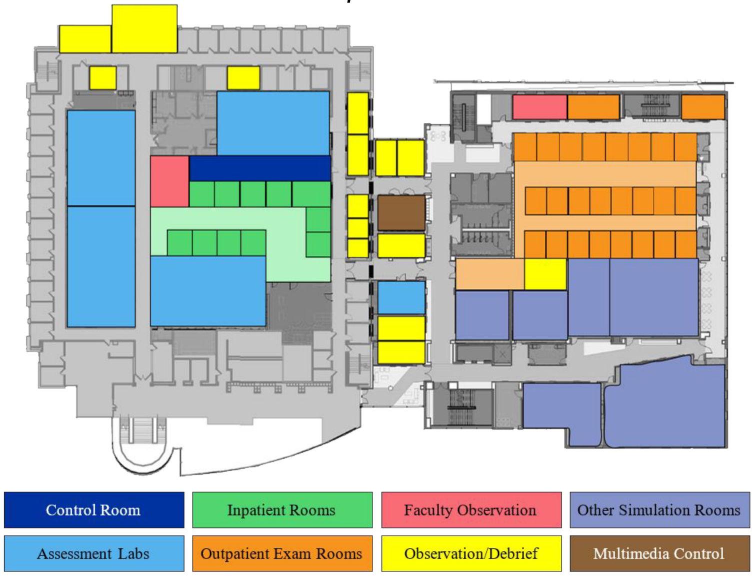
Figure 1

Simulation Center Layout Before and After Renovation and Expansion

A *Before Renovation and Expansion*



B *After Renovation and Expansion*

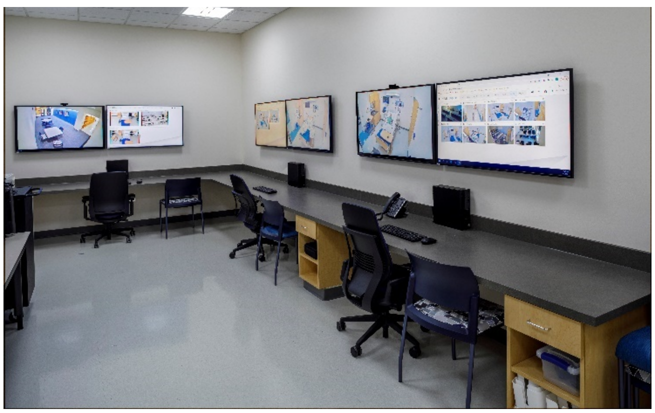


The renovated GVSU Interprofessional Simulation Center features 24 outpatient exam rooms, an in-patient hospital suite, a simulated operating room, an Interprofessional Simulation Training Lab with a three-bed ward and ceiling-mounted patient lift and ambulation systems, multiple assessment labs with varying capabilities, a Model Living suite, an anatomy lab, an Immersive Interactive technology suite, faculty observation rooms, student observation rooms, debrief rooms, and several other spaces to support simulation operations. The in-patient hospital suite contains nine medical-surgical rooms, one ICU room, and one maternity suite.

During the renovation, a dedicated multimedia control room (Figure 2) was created, allowing the center's multimedia managers to monitor all events from a central location near the control room between the inpatient and outpatient suites. The multimedia managers ensure student and faculty observation rooms stream the correct simulation room, manage the AV system, and ensure control room workstations have the correct microphone and monitor patched. Given the variety of simulation needs, the solution for this simulation center was one central control room with 12 individual workstations.

Figure 2

Multimedia Control Room After Renovation



Designing the Control Room

While there are benefits to having one central control room, some challenges include sound mitigation and individual space considerations (Sekandarpoor et al., 2019). At GVSU, standardized technical communicators (STC), part-time members of the interprofessional simulation staff, reside in the control room to operate patient simulators and communicate with faculty and students (Branch et al., 2023). Each STC workstation in the control room has soundproofing dividers and noise-cancelling headphones. These measures help prevent distracting sounds from interfering with their focus during scenarios. The workstations are spacious enough for the STC to sit comfortably without feeling crowded. With the STCs in one central location, the simulation technology managers and multimedia managers are close enough to help with scenario questions or technical issues with minimal delay.

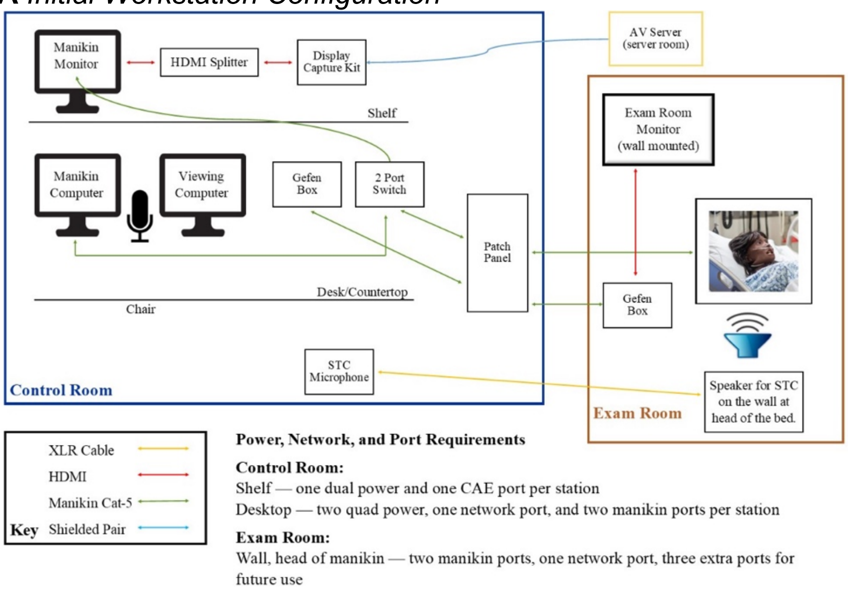
To support simulations in the inpatient suite, outpatient exam rooms, operating room, and the ward, there are 12 individual workstations in the control room. Each workstation has a desktop, a microphone, the simulator operator's laptop/tablet, and the simulator's vitals monitor. This setup supports multiple simulation modalities needed to meet the learning objectives for patient simulator, standardized patient, or mixed method events ("Healthcare Simulation Dictionary," 2020). This control room provides support to run 12 simulation rooms simultaneously, each operated by an STC.

During the early design stages, a wiring diagram was established to identify the needs both in the control room and patient care rooms (Figure 3A). As the renovation planning continued, the control room diagram was revised to streamline equipment needs (Figure 3B). The purpose remained the same, but input from expert collaborators led to adjustments. For example, additional power and Cat5 ports were included to accommodate future growth (Sekandarpoor et al., 2019). Also, a dedicated network was established for all wireless patient simulator devices and other simulation equipment.

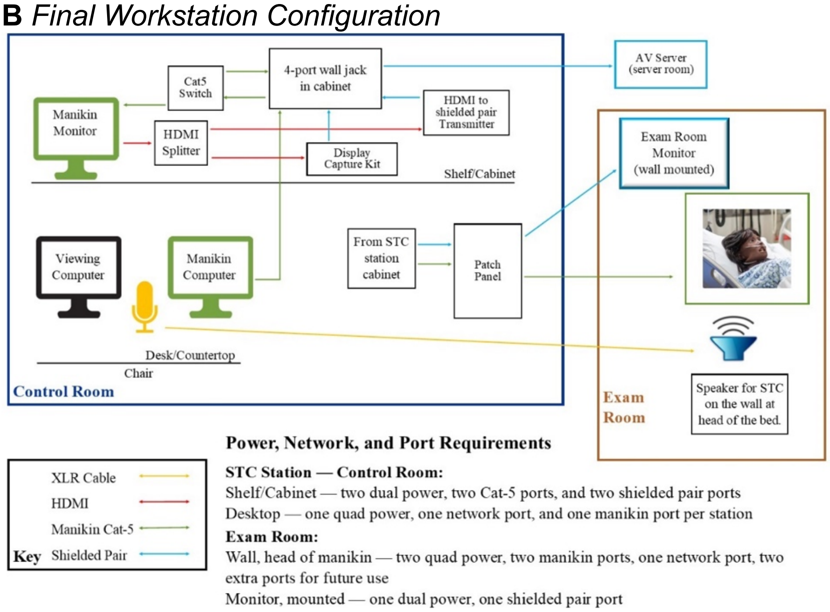
Figure 3

Initial and Final Workstation Configurations in the Control Room

A *Initial Workstation Configuration*



B *Final Workstation Configuration*



Note. HDMI: high-definition multimedia interface; AV: audio-visual; STC: standardized technical communicators.

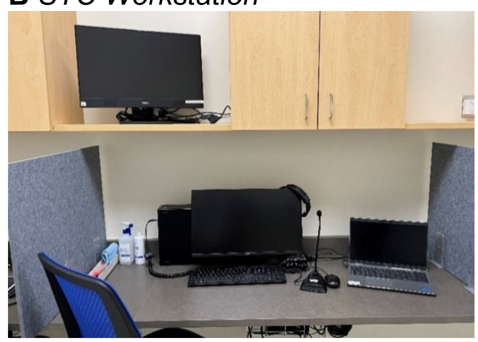
In the control room (Figure 4A), the STC workstation (Figure 4B) is set up to allow STCs to view the simulation room through the desktop via live stream, speak as the patient in an exam room through a microphone, control the vitals monitor for both manikin-based scenarios and standardized patient scenarios, and communicate via Zoom chat with the faculty observation room. All 12 workstations are identical and can be patched to any room in the inpatient suite, four of the outpatient exam rooms, the operating room, and the three-bed ward in the Interprofessional Simulation Training Lab (Figure 4C-E). This setup ensures STCs and simulation staff operate in an environment with adequate lighting. This eliminates the necessity to work in dimly lit control rooms designed with one-way observational windows. This setup also eliminates the need to move patient simulator vitals monitors from room to room, reducing the risk of equipment damage or staff injuries.

Figure 4

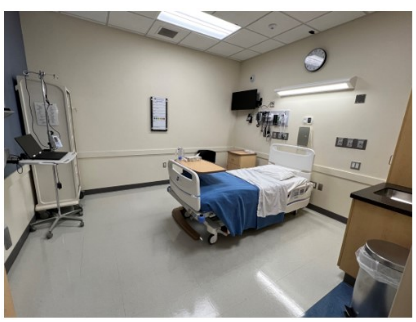
Control Room with STC Workstations and Various Simulation Room Designs After Renovation

A *Control Room*

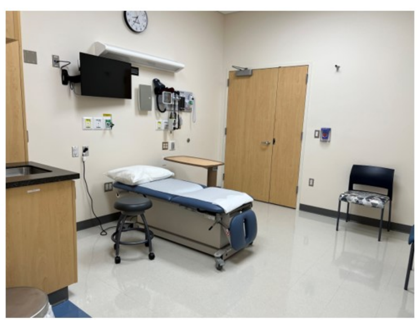
B *STC Workstation*



C *Inpatient Room*



D *Outpatient Exam Room*



E *Three-bed Ward in the Interprofessional Simulation Training Lab*

Power and Cat5 ports were an important design consideration. On the shelf above each STC workstation, there is a dual power outlet and patient simulator vitals monitor. Next to the patient simulator vitals monitor, the cabinet houses a Cat5 switch, a high-definition multimedia interface (HDMI) switch, a display capture kit, a transmitter, two Cat5 ports, two shielded pair ports, and a dual power outlet (Figure 6).

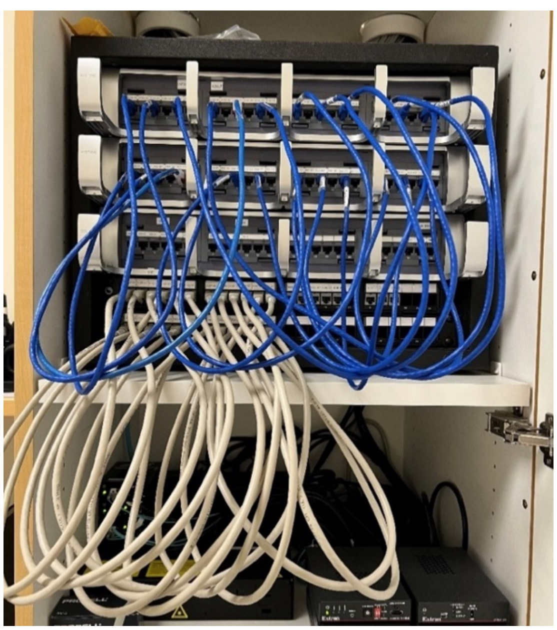
Figure 6

Control Room STC Station Cabinet

Any STC workstation can control any of the simulators in the eleven inpatient rooms, the four connected outpatient rooms, the operating room, or the three beds in the ward through the patch panel located in the control room. Patient simulator laptops/tablets at the workstations are connected to the patient simulator via Cat5 through the patch panel (Figure 7). Patient simulator vitals monitors are patched with shielded pair to the vitals monitor mounted in the simulation room. The patient simulator vitals monitor signal is sent via the AV server for observers to view the vital signs as well as the simulation room.

Figure 7

Control Room Patch Panel



Faculty and Student Observation Rooms

The faculty observation room is located between the control room and the inpatient hospital suite. There are 11 identical faculty observation workstations (Figure 8) each with a desktop, headphones, and internal phone connected to the inpatient simulation rooms. Faculty can view the simulation room and vitals monitor through the AV system. The headphones are equipped with a microphone to communicate with students through the overhead speakers. The phone allows students to call faculty who can portray a provider, pharmacy, or other healthcare professional during the simulation. Faculty can communicate with the STC via Zoom chat to answer questions or request a change in vitals.

Figure 8

Faculty Observation Workstation

There are ten student observation rooms with varying occupancy capacities (Figure 9). Each room is equipped with a monitor that enables students to observe the simulation room and vitals monitor. Students and faculty meet in an observation room with their small group to pre-brief the scenario and assign roles, alternating roles between simulations. After students complete the scenario, faculty inform the students via intercom to review key points and return to the observation room for debriefing.

Figure 9

Student Observation Rooms

A *Five-seat capacity* **B** *10-seat capacity* **C** *13-seat capacity*

Conclusion

Control rooms and simulation centers are all unique and should be designed to meet the needs of the programs they support. As technology progresses and educators modify their use of technology in classrooms, labs, and simulation spaces, it is essential to design control rooms that can accommodate upgrades and enhancements. In the process of designing the simulation center at GVSU, an open line of communication was maintained with both internal and external stakeholders, as well as staff from other simulation centers, were consulted.

Centralizing operations offers advantages such as improved coordination and immediate technical assistance. Each STC workstation is equipped with soundproofing barriers and noise-canceling headphones to help mitigate distractions. The design enables simultaneous management of 12 simulation rooms using 12 workstations, equipped with desktops, microphones, patient simulator laptops/tablets, and vitals monitors. This setup enables STCs to remotely monitor and control simulations, using live streams and Zoom to communicate with faculty. This integrated method not only boosts operational efficiency but also enriches the learning experience by offering a reliable, adaptable infrastructure for various simulation modalities.

The control room design strikes a strategic balance between technical functionality, ergonomic considerations, and operational efficiency, customized to support various simulation scenarios. The creation of a space that streamlines operations, caters to current and future programming needs, is flexible, and is ready to support a broad range of programs throughout the University was a significant focus in the design of this Center. Standardizing the control room, simulation room, and observation rooms ensures that STCs, students, faculty, and simulation staff have consistent and effective simulation experiences.

References

Branch, K. C., Ayers, D. J., & Baker, S. K. (2023). *Standardized technical communicators: A novel simulation center staffing model*. The Society for Simulation in Healthcare, Simulation Spotlight. https://www.ssih.org/Home/ctl/ArticleView/mid/54750/articleId/2521/Standardized-Technical-Communicators-A-Novel-Simulation-Center-Staffing-Model

Crofut, J.A., Kopp, S., & Walston, C.D. (2020). Designing Simulation Centers for Health Education. In Palaganas, J., Ulrich, B., Mancini, M. (Eds.), *Mastering Simulation: A Handbook for Success* 2e (pp. 277–296). Sigma Global Nursing Excellence. https://apn.mhmedical.com/content.aspx?bookid=3169&sectionid=265359726

Dleikan, C. T., Lakissian, Z., Hani, S., & Sharara-Chami, R. (2020). Designing a simulation center: an experiential guide. *Journal of Facilities Management*, 18(5), 487–504. https://doi.org/10.1108/JFM-02-2020-0011

Huang, L. (2020). Audiovisual and LMS. In Seropian, M., Keeler, G., Naik, V. (Eds.), *Comprehensive Healthcare Simulation: Program & Center Development* (pp. 69-80). Springer, Cham. https://doi.org/10.1007/978-3-030-46812-5_11

Healthcare Simulation Dictionary. (2020). In Lioce, L. (Ed.), *Agency for Healthcare Research and Quality eBooks* (2nd ed.). https://doi.org/10.23970/simulationv2

Sekandarpoor, F., Luevano, E. R., & Crawford, S. B. (2019). Infrastructure and Simulation Center Design. In Crawford, S., Baily, L., Monks, S. (Eds.), *Comprehensive Healthcare Simulation: Operations, Technology, and Innovative Practice* (pp. 111-144). Springer, Cham. https://doi.org/10.1007/978-3-030-15378-6_9