# The Applicability and Potentiality of Classroom Modernization in the Military Learning Environment with Army University

## Jason Abbott, Dayton Baugh, Alexander Meredith, Ian Winch, Daniel Finch, and Ahmed Bahabry

Department of Systems Engineering United States Military Academy, West Point, NY 10996

Corresponding author's Email: <u>ian.c.winch.mil@army.mil</u>

Author Note: Jason Abbott, Dayton Baugh, Alexander Meredith, and Ian Winch are senior Cadets at the United States Military Academy and part of West Point's Department of Systems Engineering. CDT Abbott and CDT Baugh will be commissioned as Armor Officers, CDT Meredith as an Infantry Officer, and CDT Winch as an Air Defense Artillery Officer. The views expressed herein are those of the authors and do not reflect the position of the United States Military Academy, the Department of the Army, or the Department of Defense.

Abstract: The U.S. Army is working to develop and upgrade classroom learning environments by implementing technologies to best educate current and future army Soldiers. These innovative classroom conditions will integrate learning science with enabling technologies that empower and enable learners through a culture of persistent and tailored development to optimize their knowledge, skills, and behaviors to serve as members of highly effective teams. In support of this objective, the project team collected data through a survey administered to Cadets at the United States Military Academy, which will inform the Army University classroom requirements. This survey allowed for analysis through value-based modeling which provided an assessment of the nuanced technologies that can and should be integrated into the classroom.

Keywords: Modernized Classroom Environment, Virtual Reality, Army University, AI and Cloud Learning, Future Learning

## 1. Introduction

The U.S. Army is currently in a transition period of developing modern classrooms to educate Soldiers more efficiently to better prepare them for future complex missions and operations. The introduction of innovative technology in these classrooms will assist in providing a higher level of education for both educators and learners throughout the Army University system. A key Army University requirement is the evaluation of simulation-based technologies including virtual reality, augmented reality and experienced reality. The key to developing classrooms for the Army is the ability to maintain pace with technology as it becomes publicly available while balancing cybersecurity necessities (Gilli, 2021). It is relatively easy for classrooms to keep pace with integration with Moore's law, where transistors on a microchip double every two years with minimal cost implications, but it is far more challenging to integrate more nuanced technologies like virtual reality. This has led the project team at West Point to research two overarching tasks: first analyze and recommend the optimal user-friendly modernized classroom set up and second, research and provide recommendations for potential technological-based solutions for integration of virtual space in the classroom, be it virtual reality or cloud environments. By completing these tasks, the capstone team will provide Army University with an analysis of the optimal learning technology currently available, and how it can be integrated into the Army classroom.

## 2. Background

The conceptualization of the modern Army University started in 2015 "to realign and maximize the potential of the Army institutional education and training elements to…prepare today's leaders for tomorrow's complex operating environment" (Army University Press, 2023, p. 7). Army University is a subcomponent of Training and Doctrine Command (TRADOC) which is responsible for managing the Centers of Excellence (COE) where all the Basic Officer Leadership Courses (BOLC) take place as well as a dozen specialty schools like Command and General Staff School (CGSC) and the Sergeants Major Academy. Army University was established to accomplish many of the core functions of learning through the office of

the Provost directorates (Army University Press, 2023). Army schools can deliver education through innovation and promote lifelong learning. This is critical to the Army of the future as it will best enable our leaders to maintain and develop digital literacy through modernizing the classroom or "learning space."

## 2.1 Learning Science

Modernizing and developing learning spaces for all Soldier-learners in the Army is a significant task, one of which requires understanding the needs of learners and how students best adapt to teaching styles. The three types of learning styles are Auditory, Visual, and Kinesthetic (Willingham, 2005). Mastering the effective utilization of various learning styles is paramount in teaching, as it ensures that students with diverse learning preferences are catered to, thereby facilitating comprehensive understanding and absorption of the material by all students (Hatami, 2013). Understanding the learning styles for the student is critical to successful individualized learning as seen in the desired end state of Army University's Line of Effort 2 (LOE 2). This line of effort focuses on classroom modernization which consists of the following subtasks:" Data Integration, Policy and Governance, Infrastructure and Modernization, Concept and Capability Development/Integration" (Army University Press, 2023, p. 54). These learning styles are most effectively taught in tandem to encourage Soldier-learners to approach problems from diverse perspectives and enhance their problem-solving abilities. This line of effort requires balancing modern technology and the student's needs.

#### 2.2 Modern Learning Technology

The Army is not designed to cater to the individual, due to its vast size, limited resources, and emphasis on a single standard. However, the integration of current educational technology in the classroom or learning space aids in fostering a more individual-centric approach (TRADOC, 2017). Presently virtual space and simulation technologies are not widely utilized in classrooms but could potentially add educational value. These technologies include but are not limited to Artificial Intelligence (AI), Virtual Reality (VR), Augmented Reality (AR), and cloud-based offline learning databases. These technologies are on the leading edge of development of most major technology companies, which is critical for their implementation into a classroom, as it assists in the ability to keep pace with Moore's Law. However, the use cases for the simulation-based technology (VR, AR) are not currently suitable for pure learning in the classroom. There are numerous advantages to using these in a training environment but not classroom learning (Bell and Regieluth, 2014). Conversely, AI and cloud-based offline learning databases are highly desirable as they provide portability and are quite robust in their potential applications in every classroom. The Army has even developed cloud-based capabilities endogenously, with support from the Army Enterprise Cloud Management Agency (ECMA), thereby enabling easier access to the cloud. With these capabilities, the Army University can work towards better enhancing the potential for individual distanced-standard learning.

## 2.3 The "Modernized" Learning Space

The classroom design and learning space has stayed the same in the United States for many years. The Army needs to modernize and enhance learning spaces for its Soldiers to create competent units and cohesive teams. New techniques along with innovative technology can modernize these learning environments. Soldiers are continuously learning; therefore, these learning spaces are vital to their development. A few techniques that can be used to modernize the learning environment are the implementation of background music, optimal lighting in a classroom, and classroom configuration. Studies show that soft music in a classroom is beneficial to learning environments. Active music can impact a student's brain and enhance language and speech thus improving communication between others (Foran, 2009). Another technique that enhances a learning environment is the consideration of natural light. Natural light improves students' attention and overall mental health (Heschong et al., 2002). Designing classrooms that have large open windows and opportunities to enhance the natural light within a learning space can positively impact student learning (*Optica Publishing Group*, n.d.). Lastly, instructors can personalize learning spaces that fit the needs of their students and use these techniques to enhance learning performance.

## 3. Methodology

#### 3.1 Method of Gathering Data

For the aim of this project the researchers bifurcated the stakeholders between Cadets at the United States Military Academy (USMA) and the client, Army University. The researchers then conducted literature reviews to better understand where value could be added, and designed a survey based on Army University's requirements. The survey assessed sixteen key value measures, shown below in Table 1 that directly or indirectly addressed each of the identified value measures. The survey was then distributed, and data was collected from a total of one hundred cadet responses. While the survey was designed to capture the essence of the sixteen value measures it more broadly addressed our research question of: What value do cadets place on innovation and recent technologies in the classroom? The purpose of this study is to determine the state of technology that is being used within the "Army Classroom" to support Army University in developing a solution for modernizing the Army Classrooms across all TRADOC installations. The survey contains questions that are all on a scale from Strongly Disagree to Strongly Agree, with a neutral option. From this survey, the research team developed a value function seen below in Equation (1).

$$Value = \frac{-2*(strongly \, disagree) - 1*(disagree) + 0*(neutral) + 1*(agree) + 2*(strongly \, agree)}{100}$$
(1)

#### 3.2 Value Based Modeling for Survey Analysis

Value-based modeling can be used to quantify survey responses and provide insightful relations for further analysis and application to the classroom. By focusing on respondents' core values and preferences, it provides a deeper, more nuanced understanding of why people think and act the way they do. This method goes beyond traditional statistics to reveal the human motivations behind the numbers, making survey insights richer and more actionable. Incorporating value-based modeling leads to more accurate predictions. It helps forecast future trends and behaviors by understanding the values driving decisions. This is crucial for businesses and organizations looking to stay ahead of the curve and make informed strategic choices. Moreover, value-based modeling improves survey engagement. It encourages questions that resonate more deeply with respondents, leading to higher quality responses. This approach not only enhances data reliability but also strengthens the connection between organizations and their audiences by addressing what truly matters to them. Additionally, value-based analysis enables personalized strategies. Recognizing different value drivers across segments allows for tailored offerings and communications, boosting satisfaction and loyalty.

#### 4. Perceived Desired End State from a User's Perspective

#### 4.1 Analysis of Current Classroom

There are certain areas of the current classroom design that are beneficial; however, some areas need improvement. Material visibility is an element in the current classroom design that plays a significant role in student learning and performance (Rand & Gansemer-Topf, 2016). Lighting and background music are also criteria not used well in the current classroom design that can impact the learning environment. As stated earlier, research has shown that classroom lighting and background music are beneficial in a learning space. It is important to integrate these criteria in the new classroom design to enhance student performance.

#### 4.2 Prospects for Future Learning Technology

The analysis of the survey data indicates that there are significant opportunities for enhancing the current classroom environment. Strengths were identified in the acoustic design and the instructors' use of cloud-based platforms. Conversely, there are notable deficiencies that require attention, such as the visibility of teaching materials and the existing layout of classroom desks. The data suggest that addressing these fundamental aspects is essential for achieving an effective learning space. Furthermore, the integration of technology in the classroom yielded unexpected insights. While students recognized the

potential for incorporating docking stations and simulation software, they expressed reservations about the use of VR and showed a lack of strong preference for AR applications. Additionally, the preference for traditional teaching tools was evident, with a slight majority favoring chalkboards over smart boards, with forty against versus thirty-one in favor of smartboards. Additionally, a clear opposition to the inclusion of personal monitors within the learning environment exists. These findings highlight the need for a nuanced approach to technology adoption that aligns with student preferences and educational efficacy.

## 5. Manifesting Desired End State

#### 5.1 Model Analysis:

Utilizing the insights garnered from the survey data for the model, it is discernible that there exist identifiable areas for enhancement that can significantly augment the efficacy of the classroom environment. An illustrative example pertains to the substantial impact that enhanced visibility of materials can exert on the overall rating of the classroom environment, a fact that our redesign initiative prioritizes. Conversely, certain domains, such as sound design, have been optimized to their maximum potential, where further improvements are likely to yield diminishing returns. In aggregate, the analysis reveals considerable opportunities for improvement across multiple facets, which, if addressed, could markedly facilitate student engagement, and enhance knowledge retention.

		Current Classroom		Redesigned Classroom	
		Raw	Weighted		Weighted
Value Measures	Weight	Score	Score	Raw Score	Score
Material Visibility	9	0.34	3.06	0.95	8.55
Sound Design	5	0.9	4.5	0.9	4.5
MS Teams Integration	5	0.52	2.6	0.7	3.5
Canvas Integration (cloud)	5	1	5	0.7	3.5
Reliability	7	0.78	5.46	0.8	5.6
Lighting	7	0.84	5.88	0.9	6.3
Background Music	6	0.2	1.2	0.7	4.2
Student Teacher Ratio	8	1	8	0.9	7.2
Desk Arrangement	5	0.47	2.35	0.6	3
Configurability	8	0.83	6.64	0.9	7.2
VR Integration	2	0	0	0	0
AR Integration	3	0	0	0	0
Simulation Program	6	0	0	0.1	0.6
Docking Station	7	0	0	0.7	4.9
Personal Monitors	1	0	0	0	0
Smartboards	4	0.4	1.6	0.7	2.8
	Total	7.28	46.29	9.55	61.85

Table 1: Value Measures and Weights used in the model.

In the process of determining model parameters, insights derived from comprehensive research conducted by the team, were integrated with the client's project scope. This involved engaging in detailed client discussions and analyzing the outcomes of targeted surveys. The primary objective delineated by the client was to facilitate the seamless integration of contemporary technological advancements within educational settings, benefiting both students and educators alike. Subsequently, survey responses were evaluated to ascertain students' values and perceptions, focusing on areas necessitating enhancement and their prioritization of various classroom elements. Keeping the weights on a scale of 1 to 10, the raw scores being from 0 to 1, and the weighted score being from 0 to 10. This evaluation enabled the refinement of model parameters, considering the empirical data gathered from research, to accurately assess the significance and potential impact of fundamental classroom components, such as lighting and the visibility of materials.

## 5.2 New Classroom Designs



Figure 1: Google Sketchup Computer Aided Designed (CAD) Classroom

As seen in Figure 1, our classroom design revitalizes the current classroom design through various upgrades to the technology as well as an improved user experience grounded in learning sciences. The current classroom design revolves around the stereotypical lecture hall design or smaller, more classic classrooms that utilize chalkboards and whiteboards. The modern classroom will be designed to have unlimited arrangement capabilities and support modern docking and mirroring technologies for better workflow. These docking and screen mirroring technologies will be available and accessible to the individual student at any given table. The goal with the upgraded technology and emphasis on mirroring/screen sharing technologies coupled with many large screens is to enhance work sharing across a classroom. Additionally, these tables will serve as whiteboards themselves, so notes can be saved via pictures and put on the students' cloud storage, OneDrive for the Army through the Army Virtual Desktop (AVD). As discussed above, students are not necessarily willing to transition to the completely modernized classroom just yet. The survey states that most students are attached to the idea of having whiteboards or chalkboards and using them in some capacity. This new classroom holds many fundamental design ideas constant to not overwhelm the teacher or the student. Thus, this classroom is a better solution because it is modular, it is equipped with enough modern technology to balance Moore's law and technological literacy, and it answers most of the desires of the student.

## 5.3 New Classroom Design vs. Survey Results

As mentioned earlier, results of survey data are not reflected in the classroom designed by the project team. Project classroom design is based on client requirements not yet informed by end user (student) survey responses. This discrepancy is an area requiring further research and analysis. Army University should consider gathering user input through more wide-ranging research that surveys a larger population and diverse Army demographic. This design and survey combination sought to verify the congruence of Army University's LOE 2, Modernization, with student desires. While it did not show congruence, it provides an opportunity for future research to assess if classroom modernization priorities match teacher, faculty, and student needs across the Army.

## 6. Conclusion

Through examinations of cadet feedback and assessments of learning environments, the project team has created a strategy for revitalizing Army University classrooms. The approach strikes a balance between time-honored educational principles and technological innovations. By aligning technological integration with Moore's Law and catering to diverse learning styles, the team's proposed classroom design represents a forward-looking solution that embraces digital literacy and fosters an environment conducive to effective learning. More importantly, the results of this project's research demonstrate a need for further inquiry into student perceptions of what a modernized classroom should provide. Further gathering of end-user input to inform Army University classroom requirements is recommended.

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