ORIGINAL RESEARCH

Post-licensure nurse training in U.S. health systems: Survey insights into modalities, effectiveness, and perceived gaps

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ABSTRACT

Background and objective: As the practice of nursing requires broad clinical skills, it demands a wide range of understanding across many disciplines. To address nurse training and competency needs, health systems have implemented varying methods of skill development, including advanced technologies and virtual immersion strategies, in addition to the continuation of more conventional methods. The current literature remains limited in substantiating the effectiveness of a particular method. The objective of the study was to provide insights into the current post-licensure nurse training practice within U.S. health systems, nurse perceptions of training effectiveness for the given methods, and perceived gaps in nurse education.

Methods: *Design:* A research survey of registered nurses across the United States. The survey was developed from published studies that describe the current training modalities deployed across U.S. health systems for nurses and based on direct feedback from practicing nurses. The survey was divided into the following sections: respondent demographics, commonly deployed training strategies, perceived effectiveness of different training methods, and perceived gaps in clinical practice training and competence.

Results: A total of 247 nurse survey responses were included in the analysis. The results suggest that there is a disconnect between commonly deployed post-licensure nurse training strategies and the strategies that are perceived to be most valuable. There were several perceived gaps in core clinical nursing skills, highlighting an opportunity to improve upon current training strategies.

Conclusions: This study provides insights into the current state of post-licensure nurse training and signals on where health systems may benefit from reassessing their educational strategies and where industry organizations may provide additional support by developing effective multi-modal education.

Key Words: Health systems education, Immersive technologies, Nursing practice, Post-licensure training

1. INTRODUCTION

Given the sustained systemic pressures on healthcare delivery in a post-pandemic era and the increasing complexity of patient care, it is becoming crucial that efficient and adaptable training methods for nurses are implemented.[1] As the practice of nursing requires broad clinical skills, including vascular access, urological drainage, medication management, specimen collection, and hemodynamic monitoring, among many others, nursing occupies a vital role that demands a wide range of understanding across many disci-

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plines.[2] Creating this foundational knowledge goes beyond nursing school, as registered nurses must continuously engage in practical experience and ongoing training for skill development and clinical competency. Further, surge capacity events such as the COVID-19 pandemic have highlighted the fact that patient outcomes can be affected by nurse workflow and care, therefore elevating the need for optimized and effective nurse training and support.[3]

To address the nurse training and competency continuation needs, health systems have implemented varying methods of skill development, including e-learning, simulation training, Virtual Reality (VR), and Augmented Reality (AR) in addition to the continuation of more conventional methods such as preceptor shadowing, live training sessions and reading materials.[4,5] Among these capabilities, Extended Reality (XR), a term that encompasses multiple immersive modalities, including VR, AR, and Mixed Reality (MR), has emerged as compelling technology in the clinical setting, enabling nurses to virtually gain deeper understanding and confidence of clinical scenarios through direct engagement and practice before physically arriving at the bedside.[6] While VR offers a fully simulated environment where users engage exclusively with virtual content, AR enhances the real world by overlaying digital elements onto the physical environment. Lastly, MR blends both approaches, enabling real-time interaction between digital content and the physical world.

Although preceptor mentoring and hands-on training remain the cornerstone of nursing skill development and retention, complementary advanced training technologies are needed to supplement these experiences, given the growing shortage of experienced nurse mentors.[7] Despite the increasing adoption of these training modalities, there remains limited consensus on which methods are most effective.[4,5] This survey-based analysis aims to provide insights into the current post-licensure nurse training practice within U.S. health systems, nurse perceptions of training effectiveness for the given methods, and perceived gaps in nurse education. By capturing these insights, we aim to inform future nurse training strategies within health systems and highlight areas where industry organizations can provide additional support and resources.

2. METHODS

A Qualtrics survey (Silver Lake; Seattle, WA, USA) was disseminated through the Becton, Dickinson, and Company (BD) customer database of nurse clinicians who opted in for communication for a four-week period in June 2025. The survey instrument was developed through an iterative, multiphase process to ensure content validity and clarity. Initially, items were generated and refined in collaboration with internal subject matter experts (SMEs) within our organization to align with the study objectives and nursing practice standards. Subsequently, the draft survey underwent external review by a panel of SMEs from outside the organization to evaluate item relevance, comprehensiveness, and wording. Based on their feedback, revisions were made to improve clarity and reduce ambiguity. To further assess face validity and usability, the revised survey was pilot-tested with a broader sample of nurses representing diverse practice settings across the U.S. Feedback from this pilot phase informed final adjustments to ensure that items were well understood and applicable across different respondent groups. The complete list of survey questions is available in the Appendix.

Prior to analysis, survey data were screened for completeness and quality. Responses were excluded if less than 50% of the survey items were completed, as partial data could compromise the validity of findings. For surveys meeting the 50% threshold, missing values were addressed using pairwise deletion for optional questions. This criterion ensured that only sufficiently complete responses were included in the final dataset, enhancing the reliability and interpretability of results.

The survey was divided into the following sections: respondent demographics, commonly deployed training strategies, perceived effectiveness of different training methods, and perceived gaps in clinical practice training and competence. Efforts were made to mitigate potential response bias by ensuring that the sample included a diverse range of hospitals based on size, geographic region, and hospital type.

The WIRB-Copernicus Group (WCG) Institutional Review Board (IRB) approved this study and found this research meets the requirements for a waiver of documentation of consent.

3. RESULTS

A total of 271 responses were received, of which we excluded twenty-four surveys due to incompleteness (defined as less than 50% of questions answered). Of the 247 surveys included in the analysis, 174 were 100% completed.

3.1 Patient demographics

Among 247 respondents, the most common role type was staff nurse (42.1%), followed by nurse educators (18.6%), nurse managers (14.2%), and charge nurses (8.5%); a complete list is available in Table 1. The majority of respondents work at a single facility (81.8%) while the remainder serve in system-level roles. Of the 202 respondents who work at a single facility, most were employed at an academic medical

center (31.7%) or community hospital (27.7%), followed by government hospital (14.9%), critical access hospital (9.4%), or other settings such as ambulatory care clinics. The respondents represented a diverse geographic sample given that all nine regions were included; however, the most responses were from the South Atlantic (18.2%), Middle Atlantic (16.2%), and the Pacific (16.2%) (see Figure 1). The majority of respondents reported their degree in nursing to be either a Bachelor's (45.7%) or Master's (30.4%), and nearly one-third completed a nursing residency or fellowship program. Finally, there was broad representation for years of nursing tenure, spanning from new nurse graduates to nurses with over 30 years of experience, as well as broad practice specialties. A complete breakdown of respondent demographics is provided in Table 1, Figures 1 and 2.

Table 1. Survey respondent demographics

Respondent Demographics	Number	Percentage (%)
Number of Respondents	247	100
Role/Job Title (n = 247)		
Charge Nurse	21	8.5
Chief Nurse Executive/Officer	10	4.0
Infection Preventionist	2	0.8
Nurse Director/Associate Director	8	3.2
Nurse Educator/Clinical Nurse Specialist	46	18.6
Nurse Manager	35	14.2
Nurse Navigator/Coordinator	3	1.2
Staff Nurse	104	42.1
Other*	18	7.3
Single Facility or Systemwide Role (n = 247)		
Single Facility	202	81.8
Systemwide Role	45	18.2
Single Facility Type (n = 202)		
Academic medical center	64	31.7
Ambulatory care/clinic/infusion	25	12.4
Community hospital	56	27.7
Critical access hospital	19	9.4
Government hospital	30	14.9
Long term care/rehabilitation facility	3	1.5
Other**	5	2.5
Single Facility Bed Size (n = 202)		
< 100	33	16.3
101-300	60	29.7
301-500	36	17.8
> 500	45	22.3
Not applicable (ambulatory/clinic)	28	13.9
Highest degree Achieved (n = 230)		
Associates	43	18.7
Bachelors	105	45.7
Masters	70	30.4
Doctorate	12	5.2
Years of Nursing Experience (n = 228)		
0 – 5	17	7.5
6 – 10	22	9.6
11 – 15	35	15.4
16 – 20	34	14.9
21 – 25	20	8.8
26 – 30	37	16.2
> 30	63	27.6
Completion of Nursing Residency/Fellowship (n = 229)		
Yes	74	32.3

*Other roles include nurse consultant, certified nurse assistant, research/home care; **Other facility types include short term acute care, distribution, behavioral health.

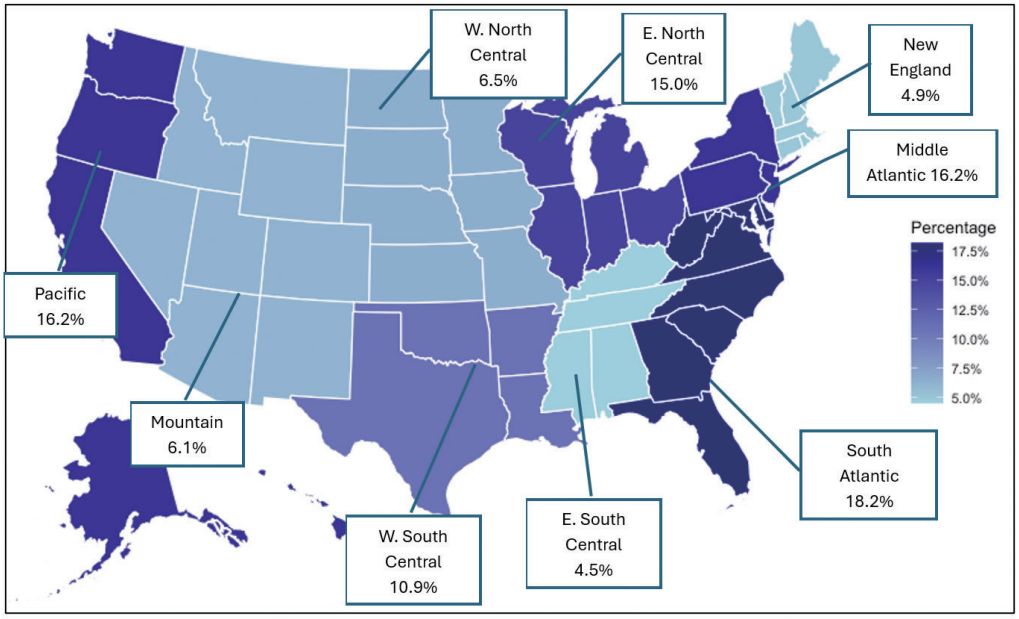

Figure 1. United states region representation for respondents (n = 247)
These are the 9 U.S. divisions as outlined by the Center for Disease Control and Prevention, National Center for Health Statistics

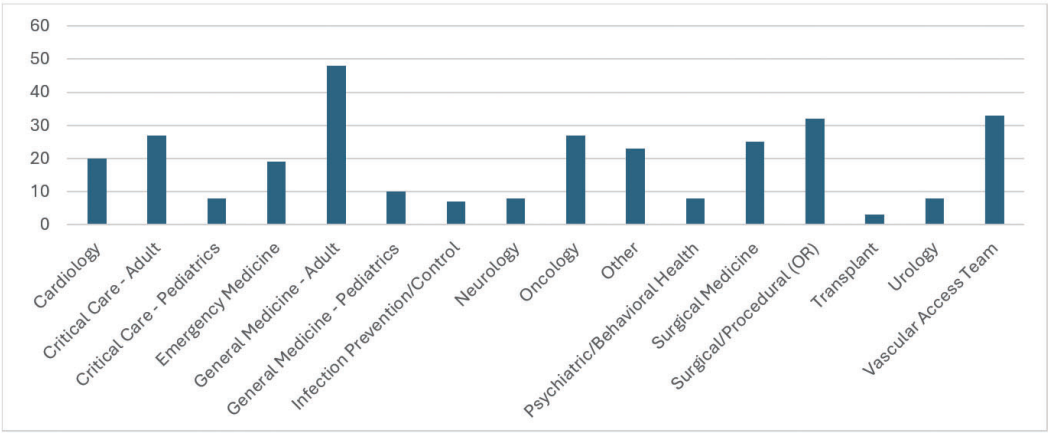

Figure 2. Number of nurses each practice area (n = 190)
Others include specialties such as dialysis, informatics, research, walk-in clinic, labor, and delivery.

3.2 Current deployment of post-licensure training and education modalities

There were two survey questions to assess the current deployment of nurse training modalities – one pertained to new nurse hire training (see Figure 3) and the other was focused on ongoing training, such as annual competencies (see Figure 4). For both scenarios, e-learning developed by the health system was the most commonly deployed training modality. Preceptor shadowing was the second most common practice for new nurse hires and the third most common for ongoing education. Reading materials were reported as the third most common modality for new nurse hires and the second most common for ongoing education. On the other hand, Virtual Reality and Augmented Reality were most often reported as "never" used or "I don't know" for both scenarios. The full list of modalities is provided for both scenarios in Figures 3 and 4.

3.3 Perceived value by nurses of different training modalities

There were two survey questions to assess the perceived effectiveness of nurse training modalities – one pertained to new nurse hire training (see Figure 5) and the other was focused on ongoing training, such as annual competencies (see Figure 6). For both scenarios, AR, VR, and simulation lab training were most often scored as highly effective. The one

modality that ranked higher for new nurse hire training was preceptor shadowing; this modality was ranked fourth for ongoing education. The remaining modalities were ranked as highly effective with approximately the same frequency. The complete list of modalities and the perceived values of highly effective, somewhat effective, or not effective are listed in Figures 5 and 6.

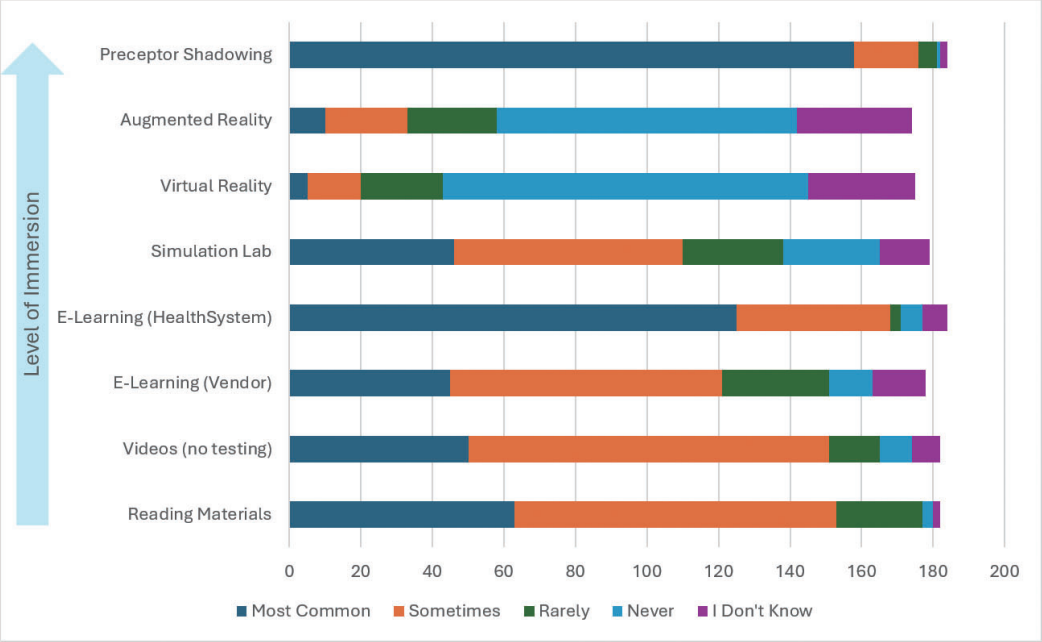

Figure 3. Most commonly deployed training modalities for new nurse hire (n = 185)
Augmented reality (enhances real setting - e.g., digital images displayed on mannequin); Simulation lab (without virtual/augmented reality); Virtual reality (fully immersive experience - e.g., wearing a headset to simulate a patient care experience).

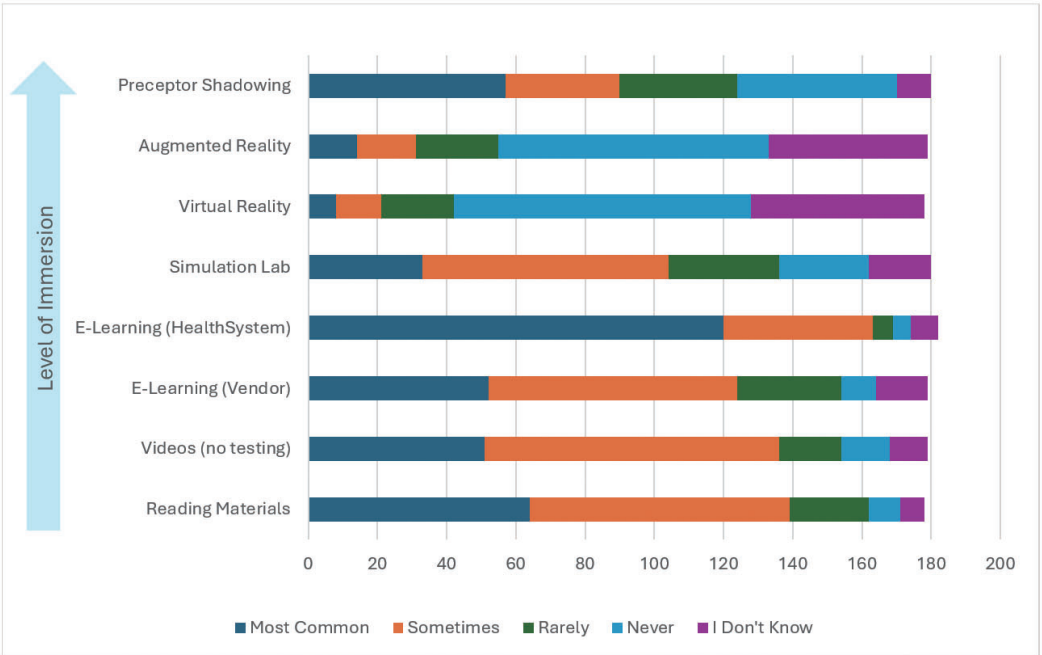

Figure 4. Most commonly deployed training modalities for ongoing education (e.g., annual competencies) (n = 185)
Augmented reality (enhances real setting - e.g., digital images displayed on mannequin); Simulation lab (without virtual/augmented reality); Virtual reality (fully immersive experience - e.g., wearing a headset to simulate a patient care experience).

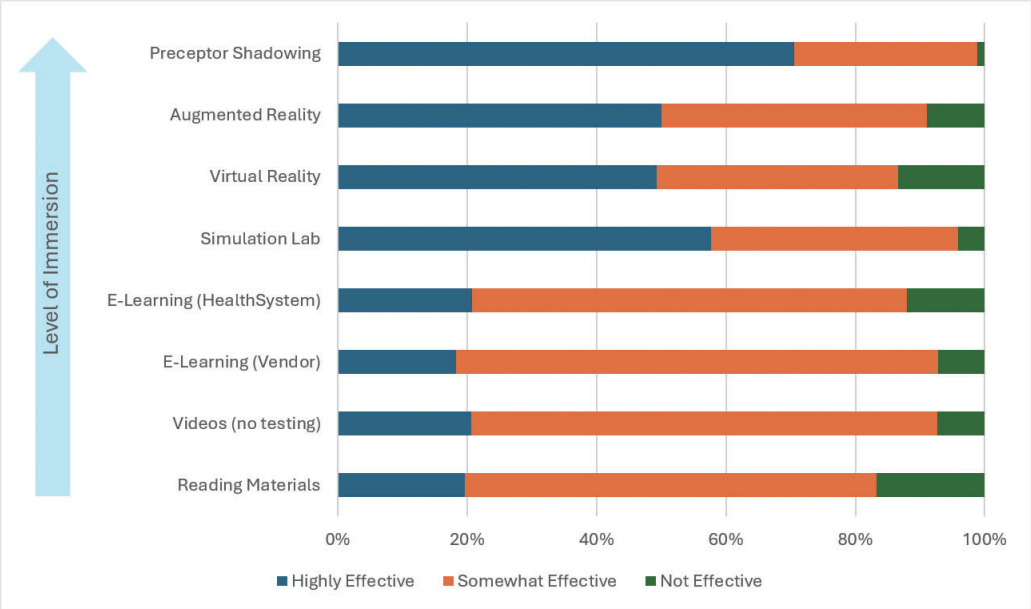

Figure 5. Perceived effectiveness of training modalities for new nurse hires (n = 185)
Augmented reality (enhances real setting - e.g., digital images displayed on mannequin); Simulation lab (without virtual/augmented reality); Virtual reality (fully immersive experience - e.g., wearing a headset to simulate a patient care experience).

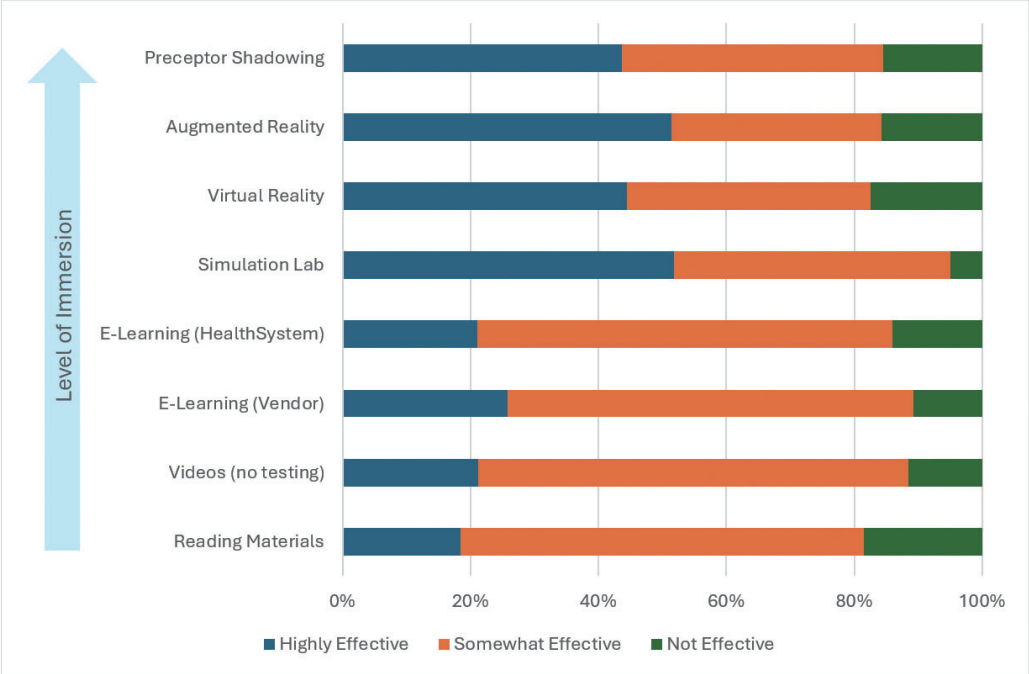

Figure 6. Perceived effectiveness of training modalities for ongoing education (e.g., annual competencies) (n = 185)
Augmented reality (enhances real setting - e.g., digital images displayed on mannequin); Simulation lab (without virtual/augmented reality); Virtual reality (fully immersive experience - e.g., wearing a headset to simulate a patient care experience).

3.4 Perceived gaps in nurse training

Nurse respondents were asked to identify gaps in nurse training and rate whether each competency experienced significant gaps, somewhat of a gap, or no gap (see Figure 7). The top three skills that were most commonly thought to have a significant gap were central venous access management, peripheral vascular access placement, and peripheral vascular access management. Skills that exceeded the 80% threshold of combined significant gap and somewhat of a gap included hazardous medication administration and disposal,

central vascular access management, fluid status monitoring, and blood specimen collection. All skills exceeded the 50% threshold of combined significant gap and somewhat of a gap, except for automated dispensing cabinet (ADC) operations. The skills most commonly thought to have no gap in training were ADC operations, urine specimen collection, and urologic drainage management. The complete list of skills and corresponding perceived gaps in training is provided in Figure 7.

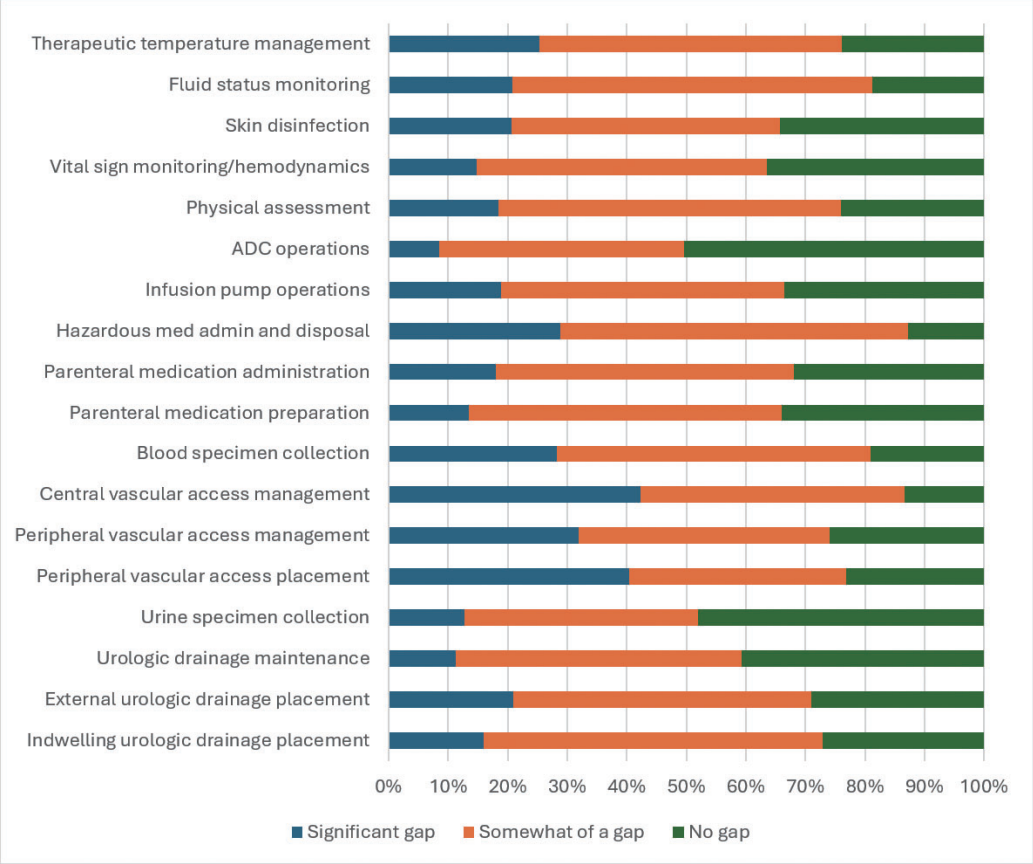

Figure 7. Perceived gaps in nurse training (n = 185)

4. Discussion

The survey included a diverse representation of nurses based on geography, facility type, bed size, practice area, and role. The responses revealed a discordance between the most commonly deployed training modalities (e-learning, preceptor shadowing) and the methods perceived as most effective (simulation lab, AR, and VR). One reason for this may be due to the challenges surrounding accessibility, up-front investment, and implementation strategy for advanced training technologies, including VR and AR.[8] Another factor for this discrepancy may be limited capacity and high burnout among key clinical stakeholders and decision-makers; these factors in aggregate likely represent the major challenges when health systems try to prioritize advanced technology training and new program pilots.

However, some of the newer teaching modalities may offer as of yet unrealized benefits in overcoming those same challenges to nursing time and bandwidth. For example, VR, AR, and other immersive technologies ostensibly provide on-demand, physically interactive learning in a short amount of time, which may also facilitate stronger engagement and retention, enhanced muscle memory, and may also be more clinically intuitive than passively watching a didactic video or watching a preceptor.[9,10] One study highlights how simulation-based education aligns closely with Kolb's Experiential Learning Theory, which describes that learning occurs through a four-stage cycle: concrete experience, reflective observation, abstract conceptualization, and active experimentation.[11] In immersive technology training, learners engage in realistic clinical scenarios which provide concrete experience and active experimentation, often supported by real-time feedback and remediation, to enhances critical thinking, confidence, and clinical competence. While preceptor shadowing remains a fundamental and highly valued

modality for practical nurse training and education, supplementing that experience with immersive technology appears to be desired for effective training. One study demonstrated the long-term cost-effectiveness of VR and live exercise training, which is dependent on factors such as the number of participants needed to train over time; as such, health systems with large numbers of staff may find that investment in these technologies are beneficial in a relatively short time period.[12] Further studies may be warranted to evaluate the return on investment for adopting these augmented or newer training technologies.

E-learning (generated by the health system) was reported as the most commonly administered training modality for both new nurse hires and ongoing education; however, it has lower perceived effectiveness compared to other methods. Given the advantages of e-learning, such as remote deployment, scalability, and content standardization, it is common for this training approach to be implemented across healthcare settings. A recent study highlighted the need to refine various factors of e-learning modules to improve effectiveness, given their common use in healthcare provider training.[13] Given the resource-intensive nature of e-learning module development and maintenance, it is noteworthy that the perceived value of e-learning generated by either health systems or vendors was similar in this study. This may highlight an area where industry organizations can further support the education and training needs within healthcare settings, reducing the technical workload burden of hospital education administrators. An additional benefit may be that vendor-based education typically highlights the FDA-approved, optimal Instructions for Use (IFU) of the product as originally designed, which may, in turn, enhance patient outcomes further downstream. Indeed, even The Joint Commission guidance champions, in certain clinical segments, a strict following of FDA IFU product guidance to support accepted patient safety quality metrics.[14]

The results of the survey indicate that there is a perceived gap in training in nearly all core nurse activities (skills rated as at least somewhat of a gap by at least 50% of respondents), with the area of vascular access placement and management being of the most significant concern. This perceived training gap may in part be due to the utilization of specialized vascular access teams who often perform this patient care activity in hospitals.[15] With this likelihood in context, the vascular teams typically index on central and midlines; however, the sheer variety of other intravascular devices and ubiquitous use of even peripheral IVs warrant the exploration of more accessible and engaging training modalities, given that the majority of patients require intravenous access in some form during hospitalization. Another area where a significant gap was perceived was for hazardous medication administration and disposal training; given that regulations require that nurses receive ongoing training on these standards, it is ideal for hospitals to assess the perceived effectiveness of the current training method and whether a new direction is warranted.[16] Although urine specimen collection is viewed as a less significant gap, data suggests otherwise. For instance, a recent inpatient study of over 40 hospitals analyzed positive urine cultures for CAUTI and hospital-onset UTIs and reported that up to one-third of urine cultures were likely false positives.[17] Given the subjectivity of surveys, it is possible that a gap may be reported as a perceived lower rank if the severity of the associated downstream clinical outcome is lower: this may explain why vascular access skills ranked as a high gap with the associated fear of a high mortality condition such as a bloodstream infection, compared to the low gap appraisal of urine specimen practices and the relatively lower mortality of a UTI. Other areas that ranked high for perceived gaps in training may be due to low frequency of use, such as therapeutic temperature management. For patient care activities where frequency is low and risk is high, leveraging ongoing as well as on-demand or just-in-time training with Virtual Reality may assist with gaps in skills, as immersive, contextual-based training forms longer-lasting memory, potentially enabling better clinical outcomes.[18,19]

There were limitations in this study that should be acknowledged. First, the results reflect a convenience sample of 247 responses. While the response rate does not allow us to generalize the findings, we had representation from different nursing roles, facility types, and geographic regions. Second, the research was conducted through a self-reporting survey, which introduces subjectivity and potential bias based on the respondent's interpretation. Nevertheless, health systems may consider using these results as a signal to assess further the skills gaps within their organizations and the effectiveness of their various training modalities. Third, given the anonymity of the survey, we were unable to ensure that there were not multiple responses from a given hospital, thus skewing the responses toward an organization's culture. Finally, new nurse graduates may be underrepresented in this study, given that nurses with less than five years of experience represented less than 10% of the respondents. A subgroup analysis was performed to determine if the responses for new nurse graduates differed from the entire cohort, and we found that preceptor shadowing was determined to be highly effective for 75% of respondents, followed by simulation lab (55%). Reading and videos ranked very low, and e-learning was regarded as somewhat effective. Most responses for VR and AR in this subgroup indicated that they did not know about the modality and therefore could not provide a ranking.

5. Conclusion

This research survey highlights a discordance between the training modalities most commonly deployed in post-licensure nursing training and those perceived as most effective by nurses. While e-learning and preceptor shadowing remain the primary methods for new hire and ongoing education, advanced, immersive technologies such as VR, AR, and simulation labs may be underutilized given their perceived value and effectiveness. The results also underscore widespread perceived gaps in core nursing competencies, and therefore, current training approaches may not adequately address training needs. Although the study does not represent U.S. nurses fully, it provides valuable insights into the current state of nursing training and presents signals on where health systems may benefit from reassessing their educational strategies and where industry organizations may provide additional support by developing effective multi-modal product-based education. Future research should focus on the clinical impact and cost-effectiveness of advanced (and more immersive) training technologies and the optimal training modalities for specific core competencies.

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Authors contributions

All authors were responsible for study design and revision. Dr. Bastow was responsible for data collection. Dr. Bastow drafted the manuscript and all authors performed revisions. All authors read and approved the final manuscript.

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Conflicts of Interest Disclosure

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper. All authors are employees and shareholders of Becton, Dickinson and Company.

Informed consent

Exempted.

Ethics approval

The Publication Ethics Committee of the Association for Health Sciences and Education. The journal's policies adhere to the Core Practices established by the Committee on Publication Ethics (COPE).

Provenance and peer review

Not commissioned; externally double-blind peer reviewed.

Data availability statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Data sharing statement

No additional data are available.

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