

Article

Laboratory Science Students' Reflections on Clinical Educators and Clinical Training Experiences

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Abstract

A 39-question survey targeting recent graduates was deployed by the American Society for Clinical Pathology (ASCP) to its membership nationwide by email. Participants were prompted to reflect on clinical educators from whom they had learned the most and least. This survey was open for approximately six weeks with 177 respondents. Participants included medical laboratory scientists (71.8%), medical laboratory technicians (21.8%), phlebotomists (4.5%), blood bank specialists (0.9%) and laboratory administration (0.9%). This paper focuses on three survey questions. The first question asked participants to reflect on clinical educators from whom they had learned the most and explain why. Themes included teaching ability (37.2%), engagement (25.6%), passion (18.6%) and knowledge (16.3%). The second question asked participants to reflect on educators they had learned the least from and explain why. Themes included teaching challenges (48.8%), disengagement (29.3%) and unprofessionalism (19.5%). The third question asked about barriers to clinical training. Main themes included staffing shortages (25.8%), COVID-19-related issues (12.9%) and work culture (12.9%). Little research has been published on the student perspective of clinical training in laboratory sciences. This research provides insight into what students consider helpful in their training and what hinders their learning.

Keywords: barriers; challenges; clinical training; student training; preceptorship; medical laboratory professionals



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1. Introduction

Clinical training in laboratory professions has significant impact in advancing healthcare quality and the quality of medical laboratory professionals. It provides an understanding of patient care and enhances the laboratorians' practical skills and knowledge needed to perform tests and interpret results accurately. Thus, healthcare professionals depend on clinically trained laboratory professionals as an important axis of fast and accurate results for timely disease diagnosis in healthcare [1].

However, clinical training in laboratory sciences is not without barriers. Barriers to effective clinical training in laboratory professions can significantly impact healthcare delivery by hindering the development of competent professionals, potentially leading to errors in diagnosis and treatment [2]. Students usually encounter barriers that interfere with their performance, learning, and professional development during this period, which

if not addressed could lead to general inefficiency of healthcare delivery, not to mention potential future patient harm.

In this paper, we examine the barriers encountered by students during clinical training in laboratory professions. A proper understanding of these challenges is necessary for clinical supervisors and educators for enhancing the effectiveness of clinical training. This paper contributes to the preparation of skilled professionals who can uphold the standards of laboratory professions.

2. Materials and Methods

A Qualtrics survey was constructed consisting of 39 questions. The focus of this survey was on various aspects of the student clinical training experience. Survey questions were developed from the review of literature in various allied health fields. This survey was validated by students, faculty, and laboratory professionals. Reliability was determined by the Cronbach's alpha value of 0.951 to ensure the survey's internal consistency. Survey questions were a mix of rating scale, multi-select, yes/no, and open-ended responses.

The survey was accessible to participants from 1 November to 9 December 2022, approximately six weeks. An email link was sent to laboratory professionals in the following membership categories of the American Society for Clinical Pathology (ASCP), New Professionals, Doctor of Clinical Laboratory Science (DCLS), Clinical Laboratory Assistant (CLA)/ Medical Laboratory Assistant (MLA), Laboratory Information System (LIS) Personnel, Medical Laboratory Technician (MLT)/Clinical Laboratory Technician (CLT), Medical Technologist (MT)/Medical Laboratory Scientist (MLS)/Clinical Laboratory Scientist (CLS), Molecular Biologist (MB), Performance Improvement/Quality Assurance (PI/QA), Phlebotomist (PBT), Specialist in Blood Banking (SBB), and Point of Care Testing (POCT). A question on the survey verified that potential participants had graduated from a laboratory program within the previous twelve months. Individuals who were beyond one-year post-graduation were excluded as were individuals who did not provide informed consent. As outlined in Braun and Clarke's method for qualitative thematic analysis, open-ended responses were categorized into themes and subthemes [3]. Thematic analysis was performed by two researchers independently and reviewed by a third researcher. The Institutional Review Board at Austin Peay State University approved this research (IRB #21-029). Three open-ended survey questions are addressed in this paper. Other survey questions will be addressed in future papers. This paper will focus on responses to the following survey questions:

- Consider the clinical educators whom you learned the most from, please explain why you felt you learned from these clinical educators.
- Consider clinical educators whom you learned the least from, please explain why you feel you did not learn as much from these clinical educators.
- What, if any, barriers to your student training did you encounter?

3. Results

Survey response rate was 8.7%. Survey participants ($n = 177$) within or up to one-year post-graduation at the time of survey completion included a majority of medical laboratory scientists (71.8%) and medical laboratory technicians (21.8%) followed by phlebotomists (4.5%), blood bank specialists (0.9%) and administration (0.9%).

Survey participants were asked to reflect on their experiences with clinical educators from whom they had learned the most and to articulate why. Common emerging themes included teaching ability, engagement, passion and knowledge. Subthemes, statistics, and selected representative participant responses can be read in Table 1. As described by participants, teaching ability encompassed clarity of explanations, organization in

presenting material, making connections between lab results and patient conditions, and allowing for sufficient hands-on training. Teaching ability was the most prominent theme at 37.2%. Engagement was ranked second highest for clinical educators from whom students had learned the most at 25.6%. From the students' perspective, their interpretation of engagement is emotional intelligence on the part of the clinical educator, availability and interaction with the student, and frequent feedback on performance. The third most prominent theme was passion. From the participants' perspective, passion was reflected in professional pride in their role within the laboratory, in a sincere desire to pass on knowledge and wisdom gained from experience, and in dedication to the profession and the patients. A little over eighteen-and-a-half percent (18.6%) of participants included passion as a reason for learning from their clinical educators. The last theme to emerge from this survey question was knowledge. Students equated a clinical educator's knowledge with mastery of the subject. A little over sixteen percent (16.3%) of participants indicated that the clinical educators they learned the most from displayed an in-depth knowledge of their subject.

Table 1. Clinical educators learned from most. Selected open-ended responses.

Themes	Subthemes & Categories	Participant Responses	% of Participants
Teaching Ability	• Explanation • Organization • Makes connections • Hands-on training	"Explained as thoroughly as possible, simplified info, organized info, knew we all learn a little differently and have different backgrounds."	37.2%
		"They explained the whole picture, connecting results to what is actually happening physically to the patient."	
		"They prioritized student education and explained both the process and theory."	
		"They often had real-life stories or case studies with applicable test results and/or patient conditions. Things like this really helped connect the dots with a lot of the didactic portion of the program."	
		"They took time to write out notes and help visualize the big picture of medical conditions."	
		"They love their subject, care about their students, and have clear and organized lesson plans and hands on time."	
		"They let me work hands-on, engaged me with questions and were approachable for help."	
		"They fully explained things and saved the unusual samples for me to look at."	
		"They reviewed the previous lesson before starting the new lesson, they related new information to previous concepts, they had assignments that made you practice interpretations and application of knowledge."	
		"Those educators allowed time for hands on teaching rather than verbal explanation alone. The clinical educators had strong communication skills and could reinforce main concepts through multiple explanations."	
		"Help relate lab work to things we learned in school."	
		"They were very clear in their communication and explanation. They offered constructive feedback. They set clear goals and deadlines and stuck to them."	
		"These clinical educators were very clear in what content was required and were able to relate the material in understandable ways to patient care."	
		"Thorough lectures with an emphasis on real-world application of the things being taught, along with assignments that pushed students to seek out research and answers for case studies independently."	
		"They thoroughly explained everything they did and were a wealth of knowledge."	
		"Clear concise teaching."	

Table 1. Cont.

Themes	Subthemes & Categories	Participant Responses	% of Participants
Engaged	- Emotional intelligence - Interaction - Feedback	“They helped me by giving feedback on how to improve my skills as I practiced.”	25.6%
		“The instructor I have in mind was incredibly passionate about what he did (Hematology), and was very friendly. He was always involving us in his teachings, asking us questions about the differentials we were doing and quizzing us (without pressure) on what we were seeing.”	
		“Willing to communicate, recent lab experience.”	
		“Because they were paying attention to me and guided me along the way.”	
		“Always able to explain things in more than one way, gave different methods for memorizing (pictures/charts . . . mnemonics, study guides with questions from both ends of the same problem, posted notes online with chapter references to look back in book).”	
		“They were always supportive and encouraging. Very organized and always pointed out reference material, as well as how results tied into patient diagnosis.”	
		“Willing to impart knowledge, easy to get along with, exhibit patience.”	
Passionate	- Professional pride - Desire to teach - Dedication	“They were willing to help and if they didn’t know the answer to a question they would look it up and get back to me.”	18.6%
		“The clinical educators that I learned the most from were calm and knowledgeable. They were able to read the student and the student’s needs. They provided a comfortable environment to learn and ask questions without being critical.”	
		“Approachable, explaining mistakes for improvement.”	
		“Person that loved their subject and made sure you saw connections between disease state and patients, connections to other areas, the big picture and how small things make a difference. And mostly connecting theory to practice.”	
		“They were interested in teaching the wealth of knowledge they have gained and they still enjoyed their job and it showed.”	
		“The educators I learned the most from were those who took pride in their work and were excited to teach. The best educators clearly understood where students were coming from (both in an educational background sense and in the sense of generally being overwhelmed and exhausted).”	
		“She was very passionate about teaching, had lots of experience, and used a variety of teaching methods and resources.”	
Knowledgeable	Subject mastery	“Very passionate about their work and educating new students. They clearly planned to teach and wanted to help you learn.”	16.3%
		“Enthusiastic and knowledgeable.”	
		“They take the time to put in the work to teach.”	
		“They truly loved the topic.”	
		“They were well educated in what they were teaching, they had a passion for lab, and they were willing to push us to make sure we were learning whilst also being fair.”	
		“They were very knowledgeable about their subjects and excited to teach/share their knowledge.”	
		“They had mastered the subject.”	
Miscellaneous		“They were very knowledgeable about the topic and able to communicate the material to a student.”	2.3%
		“Knowledgeable.”	
		“They are knowledgeable.”	
		“Really understood the material.”	
		“I learned equally from my clinical educators.”	

Similarly, the survey participants were also asked to reflect on their experiences with clinical educators from whom they had learned the least and to explain why. Three themes

were detected among participant responses. Selected representative participant responses are seen in Table 2. The most frequent reason (48.8%) participants gave for learning the least from clinical educators was teaching challenges. Teaching challenges took the form of a lack of ability to teach, a lack of subject matter mastery, not closing gaps between theory and clinical practice, an inability to assess the degree of student competence, not including enough hands-on training to become proficient, a disorganized or scattered presentation of content, and “occupying” rather than instructing. The second most frequently encountered theme for not learning as much was a disengaged clinical educator (29.3%). Various factors in the work environment and clinical educator behaviors resulted in a perception of disengagement. Work environment factors included being short-staffed and having time constraints. Clinical educator actions that communicated disengagement were a lack of feedback, minimal explanations, and minimal effort in training. The third theme was unprofessional behavior summarized as a lack of interpersonal skills and a negative mindset. Nearly twenty percent (19.5%) of participants noted a lack of professionalism as a reason they did not learn as much from some clinical educators.

Table 2. Clinical educators learned from least. Selected open-ended responses.

Themes	Subthemes & Categories	Participant Responses	% of Participants
Teaching Challenges	• Lack of teaching ability • Lack of content mastery • Inability to connect theory with practice • Unaware of student competency level • Minimal hands-on training • Disorganized • Busy work	“Not knowledgeable in subject, inconsistent, scattered, no people/soft skills.”	48.8%
		“Didn’t care if I was actually learning, assumed info was easy to memorize or that everyone already should know the material, or that their presentation of the material was enough, basically I had to teach myself and hope I understood the info the way the teacher would test for it.”	
		“Lack of knowledge on the topic and lack of knowledge about how to educate others.”	
		“They seemed too busy to teach or just did not know a lot about their field.”	
		“They didn’t connect results to what was going on with the patient.”	
		“Educators who do a lot of lecturing can lose me, I think linking the lab work with the lectures can be very helpful.”	
		“Stuck with one way of thinking education wise, no real world experience or correlation.”	
		“They had not mastered the subject of which they were teaching.”	
		“They kept me busy with routine work instead of letting me learn what they were doing or (in lecture) jumped into complex topics (like antibody panels) without checking for understanding.”	
		“Taught the material as if the students had worked in the field for 5+ years. They weren’t able to teach at a basic level.”	
		“They lacked direction and didn’t explain as much.”	
		“They did not engage the class, they just kept talking and reading the PowerPoint, the assignments were just busy work and not engaging/practicing skills.”	
		“Put a lot of information into their lectures so there wasn’t much time for questions during class, office hours were inconvenient and emails may not have been answered for a few days.”	
		“They themselves did not seem to know the material thoroughly.”	
		“These educators did not provide an environment that was supportive of questions or repetition of procedures. Discussions of procedures would be in broad terms with important details left out entirely or conveyed too late. Most importantly, these educators would make assumptions that a new individual in the field had the experience and skill level equivalent to their own.”	
		“The content was confusing and attempts to ask questions often did not help.”	

Table 2. Cont.

Themes	Subthemes & Categories	Participant Responses	% of Participants
Teaching Challenges	• Lack of teaching ability • Lack of content mastery • Inability to connect theory with practice • Unaware of student competency level • Minimal hands-on training • Disorganized • Busy work	"Slow lectures and vague answers when questions were asked. Upon any student questions, they were instructed to consult the textbook or lab procedure." "They didn't know what was going on and didn't remember any theory." "Too much information in one unit and just trying to get past it." "Unorganized not prepared only had remote knowledge of material."	48.8%
Disengaged	• Short staffed • Time constraints • No feedback • Minimal explanations • Minimal effort	"They treat students as techs and don't consider that how their priorities are different (most students' primary focus is on studying and passing the board exam)." "They had no time to teach and had no clear objectives." "They felt as though having a student was a burden and therefore showed us the bare minimum for that rotation. It was also due to the hospital being short staffed, which led to the techs being very busy with their own work and not having a lot of time, if at all, to slow down and explain things to the students." "Going through the motions, they taught you how to work there not to learn more about the profession." "Didn't talk about applications (just do the test and get the result, no talk about a patient on the other end)." "They were checked out nearing retirement, or had an inadequate understanding of the subject material and conveyed it poorly or inaccurately." "Because they let me do whatever and never/rarely pay attention." "Reluctant to communicate, does not go above and beyond to teach much." "Didn't explain much of what's going on." "They did not offer feedback. They said they would provide information and then had to be asked many times for it." "They were unwilling to help and did not care to answer questions they didn't know the answer to." "Not willing to further explain."	29.3%
Unprofessional Behavior	• Lack of interpersonal skills • Negative disposition	"They spent more time complaining than teaching." "They were rude and uncooperative in learning and I dreaded attending those clinicals." "Educators who were arrogant or resented having to teach were by far those who contributed the least to my education. Many educators at the bench were also themselves exhausted and overwhelmed which made it difficult for them to focus on teaching." "Arrogant." "Was too caught up in her perceived self-importance." "Were not approachable and were very critical. Did not include students in high pressure situation." "Some were short and even mocked students making it uncomfortable to ask questions or make connections between theory and the clinical setting. All you could think about was how much more time you had to put in before you could move to the next department. Surviving was the goal rather than growth and learning."	19.5%
Miscellaneous		"N/A."	2.4%

The final survey question considered in this paper asked the participants to explain any barriers they had encountered in their clinical externship training. Responses were categorized into three main themes: staffing shortages, COVID-19-related issues, and the work culture. Staffing shortages were reported by 25.8% of participants as a barrier to their clinical training. Staffing shortages resulted from not having enough employees to cover the

patient workload, clinical educators with divided attention from the College of Pathologists (CAP) surveys, and training new hires. The second theme at 12.9% was COVID-19-related issues. This survey was deployed in November of 2022 and contained retrospective questions overlapping the latter months of the COVID-19 pandemic. Participants listed illness from COVID-19, hospital and laboratory COVID-19 restrictions, shortages of supplies for training and staff shortages. The third theme (12.9%) was related to the work culture and included the clinical educator's demeanor and interpersonal relationships within the laboratory. The final category comprised miscellaneous comments, such as "not applicable" or life issues outside the laboratory. Selected representative, open-ended responses to learning barriers can be seen in Table 3.

Table 3. Selected open-ended responses to barriers.

Themes	Subthemes & Categories	Participant Responses	% of Participants
Staffing	- Shortages - Other work duties	"Staffing." "Short staffing." "Short staffing and training hires." "Staffing shortages were hugely detrimental in a lot of departments. Lack of communication between program coordinators and educators at the bench made it difficult to understand expectations." "CAP surveys taking educators away, lack of staffing at clinical rotation sites." "Short staffing levels." "Low staffing sometimes left us with no one to train us." "Patient workload and low staffing were the biggest barriers to everyone—students and staff alike."	25.8%
COVID-19-related issues	- Illness - Restrictions - Supply shortages - Staff shortages	"Repeated, severe illness. COVID restrictions." "Having no study time and not even being able to use the break room during COVID peaks. Also dealing with staff and supply shortages due to COVID."	12.9%
Work culture	- Clinical educator demeanor - Interpersonal relationships	"Issues with some clinical educators not being super inviting or willing to teach." "Disorganized." "Lab politics, cliques, feeling excluded." "The environment created by my clinical educator pretty much determined how comfortable students were and how well students were able to learn. The snarky and critical environments made it almost impossible to focus."	12.9%
Miscellaneous	- Personal concerns - Other issues	"Housing and cost of living." "Being at a very large hospital, it was daunting trying to find everything and get to know so many different people. I was with a new person almost every single day in many of my rotations." "Wish I had more time training in certain areas and less time in others."	25.8%
No barriers		"None." "N/A."	22.6%

4. Discussion

The foremost characteristic of clinical educators that enabled participants' learning in this survey was the ability to teach (37.2%). This finding is consistent with the literature. On an open-ended survey question, Sweet and Broadbent reported that nursing students desired clinical facilitators who provided appropriate direction and active support while learning clinical nursing skills [4]. Additionally, Sweet and Broadbent asked nursing students to rank the importance of 19 positive clinical facilitator qualities [4]. Three of the top five qualities involved the integration of nursing theory, academic knowledge and hands-on skills into practice, as well as enhancing critical thinking skills for optimal patient care [4]. Similarly, on this survey, one characteristic of teaching ability was the correlation of laboratory results with disease states. Survey participants rated clinical educators favorably who interpreted and explained laboratory results within the context of the greater clinical picture. Clinical educators rated favorably were also organized and clear in their presentation of material. Another commonality among the best clinical educators was ensuring there was enough time for students to become comfortable running the tests and asking questions. Teaching ability then can be summarized as clarity of explanations, organization in presentation, connecting theory and practice and inclusion of sufficient hands-on training. Given that teaching ability ranked first among clinical educators that survey participants learned the most from, it is not surprising that survey participants reported learning the least from clinical educators with teaching challenges. Survey participants' ability to learn was hindered by clinical educators who lacked the ability to teach. In fact, this was the most commonly reported (48.8%) reason for not learning as much from a clinical educator. Survey participants did not learn as much from clinical educators who did not have a thorough understanding of the laboratory test, methodology or disease state correlations. Similar types of complaints exist in the nursing literature with reports of nurses from one specialty training students in an area that is not their specialty or an area where they do not have recent experience [5]. If a clinical educator was not able to translate classroom theory to clinical practice, student learning was fragmented at best. Other teaching challenges included not being able to assess student performance in order to know if more practice was required or if the student was competent enough to move on. While the standard procedure is to proceed through the checklist of skills/tasks provided by the academic program, in some cases, for the struggling student, it may be necessary to consult with the academic faculty to obtain a better sense of the student's capabilities or unique challenges in order to better accommodate the needs of the student. Other hindrances to student learning included disorganization and minimal hands-on performance of laboratory tests.

Engagement was the second most frequently (25.6%) reported characteristic of clinical educators from whom participants learned the most. Engaged clinical educators were described as having good relational skills which made them approachable. The most impactful clinical educators were not only approachable but actively involved throughout the training process asking critical thinking questions and offering suggestions for improvement. Survey participants recognized and appreciated the benefit of feedback provided by these clinical educators. Unfortunately, not every clinical educator is an engaged clinical educator. Just under thirty percent (29.3%) of survey participants reported not learning as much from disengaged clinical educators. A number of factors may result in a disengaged clinical educator, some of which may be beyond the control of the clinical educator. High patient sample volume with limited laboratory staff can result in time constraints on training. Other factors creating a disengaged disposition involve clinical educator behaviors. An unprepared or minimally prepared clinical educator communicates disengagement. Short, curtailed explanations when a more in-depth explanation is warranted also communicate

disengagement. Not complimenting noticeable progress or not correcting errors negatively impacted survey participants' ability to learn. In addition, unprofessional behaviors such as complaining, incivility, arrogance, impatience and an unpleasant disposition were reported as barriers to learning in this survey (19.5%). These clinical educator behaviors repelled students and prevented them from asking questions or engaging any more than was necessary. In a questionnaire-based study of recent graduates ($n = 33$), Hickey reported unprofessional behaviors of nursing preceptors resulting in relational strain to include being discourteous and condescending [6].

Passion was the third highest-ranking attribute shared by clinical educators from whom participants reported learning the most (25.6%). In a study by Phillips, Jator, Latchem et al. (2023), clinical educators who completed a survey to describe what made a good clinical educator identified enthusiasm as the second most commonly listed attribute of a good and effective clinical educator [7]. Enthusiasm often stems from passion. While distinct, passion and enthusiasm are closely related. Passion reflects an intense internal commitment or an intense feeling for something, whereas enthusiasm is an outward expression of that passion showing eagerness and excitement. Passion often fuels enthusiasm, and in turn, enthusiasm becomes a visible manifestation of passion. The alignment between educator's passionate and enthusiastic behavior and students' perceptions suggest that learners place as much value on these traits as clinical educators believe they do.

Participants' motivation to learn was positively impacted when they observed their clinical educators competently representing the laboratory while interacting with other healthcare professionals. They were able to witness firsthand the laboratory's, and, by extension, their own importance in patient care. By modeling professional, competent interactions with colleagues and other healthcare workers, the clinical educator transmits an attitude of professional pride to the student in real time. Clinical educators' work ethic and dedication to the students' training also motivated the participants to learn well. In the minds of the students, professional pride and competence, work ethic and dedication to training were characteristics embodying the passionate clinical educator which was a motivating factor in their learning. A qualitative study based on observations and interviews of medical laboratory science (MLS) externship students ($n = 14$) by Isabel in 2016 emphasized that student learning and confidence were greatly influenced by the quality of the student-clinical educator interaction [8]. Isabel further noted that clinical educators often provided the same kind of encouragement and instruction as a coach would offer to a player during training [8]. Niederriter et al., in a 2017 interview-based study ($n = 14$) reported that nursing students in the study unanimously agreed that their clinical educators should display desirable characteristics of a competent nurse [5]. Niederriter also reported the nursing students' desire for supportive assistance throughout the training process [5].

The fourth quality of effective clinical educators was knowledge (16.3%). Survey participants expected their clinical educators to have a solid base of laboratory knowledge and willingly share it with them. Survey participants were inspired to learn by the clinical educators' wealth of knowledge in the subjects they taught. Clinical learning is best served when the clinical educator's experience and knowledge are current. Niederriter et al., in the same nursing study mentioned previously, reported that nursing students learned more and were more confident when trained by a nurse whose specialty aligned with what was being taught [5]. In a questionnaire-based study, Hickey reported negative feedback from recent graduates ($n = 33$) regarding clinical educators with insufficient clinical knowledge or adherence to obsolete practices [6].

For the open-ended barriers to learning question, the most frequently reported barrier was staffing shortages (25.8%). Nationwide laboratory workforce shortages are well

documented [9]. The American Society for Clinical Pathology 2022 Vacancy Survey of Medical Laboratories in the United States showed an increase in vacancies in all regions of the United States [9]. The greatest increase (6.0%) in vacancies occurred in the south-central Atlantic region while the central southwest region saw the smallest increase (4.6%) in vacancies [9]. When the number of laboratory employees is inadequate for the patient workload, each employee has more samples to process resulting in less time for training students. Staff shortages can have a detrimental impact on student learning. Increased workloads were reported as a critical factor affecting student learning by Isabel in her 2016 study ($n = 14$) of MLS students at clinical externship [8]. Sweet and Broadbent's 2017 survey-based research revealed that nursing students felt increased time with clinical instructors was the most effective way to strengthen their learning [4]. In a literature review, Halstead and Sautter compiled a comprehensive list of proposed solutions for an increased and sustained laboratory work force. Strategies revolved around the profession's public profile, recruitment of qualified laboratorians and increased retention [10]. Suggestions included, among many others, professional society outreach geared towards students and utilizing social media platforms for increased public awareness of the profession [10]. To attract new students, online courses and flexibility in schedules and training methods were highlighted [10]. Various types of incentives and the avoidance of burnout were emphasized as key strategies to maintain longevity in the field [10].

Some survey participants (12.9%) reported COVID-19-pandemic-related issues as barriers to learning. By the beginning of 2022, the Omicron variant of severe acute respiratory syndrome coronavirus (SARS-CoV-2) superseded the Delta variant and came to prominence in the United States [11]. This survey was deployed in November 2022 to recent graduates, defined as up to one-year post-graduation, asking them to reflect back on their time in clinical externship which may have coincided with the latter phase of the COVID-19 pandemic for some participants. During this time, hospitals and laboratories were enforcing COVID-19 prevention policies such as minimal or no patient contact, mask-wearing requirements and social distancing requirements. One participant on this survey cited COVID-19 restrictions as a hindrance to clinical training. Laboratory staff shortages and supply shortages related to supply chain issues during the COVID-19 pandemic were noted by one individual while illness from COVID-19 disrupted another participant's training.

Work culture was also reported as a barrier to learning by some participants (12.9%). Clinical educators with unfriendly, negative or standoffish demeanors, or ones lacking interpersonal skills, were considered hindrances to learning by survey participants. One participant reported a lack of socialization with laboratory personnel as a feeling of exclusion. Socialization promotes professionalism and a positive work culture contributing to the student's sense of professional identity. Isabel noted the importance of a welcoming work environment to the successful learning of laboratory students ($n = 14$) [8]. In an interview and focus-group-based study, Martinez-Linares et al., found that fourth year nursing students and newly qualified nurses ($n = 24$) expected effective preceptors to serve as intermediaries facilitating student interactions with colleagues [12]. Niederriter also reported the nursing students ($n = 14$) in her study had an expectation for social cohesion among colleagues [5]. Nearly all of the remaining comments to this open-ended question were reports of no barriers and were grouped into a miscellaneous category (25.8%).

One limitation to this study is that members of only one professional group, the ASCP, were invited to participate in this survey. Future studies should determine effective interventions to address teaching challenges among clinical educators.

5. Conclusions

This research helps fill the gap in the literature regarding student perceptions of the impact of clinical educators on their learning during clinical training in laboratory sciences. This research provides insight into what students consider helpful in their training and what hinders their learning. This is valuable information for those responsible for training students and seeking optimal outcomes as clinical training is vital to the technical and professional transition of laboratory students into laboratory professionals. In this survey, the most significant support and the most significant hindrance to student learning centered on the teaching ability of the clinical educator. A clinical educator who supports student learning is best described as having teaching ability, engaging with the student, possessing a depth of knowledge and being passionate about his or her subject. On the other hand, certain attributes of clinical educators hinder student learning. These include a lack of teaching ability, disengagement from the student and the training process and unprofessional behavior. Other barriers to clinical training included staffing shortages, COVID-19-related issues and an uninviting work culture.

Based on findings from the students' perspective on barriers in clinical training, academic institutions and clinical management can help alleviate barriers by encouraging and equipping clinical educators in multiple ways. Clinical educators' teaching abilities and knowledge can be enhanced through workshops or by taking free courses on pedagogy offered by academic institutions. Academic institutions can also provide clinical educators with access to library resources to keep the educators motivated and to encourage engagement. These professionals may need to be incentivized and recognized to foster passion for training students. Check-ins with clinical educators from management can go a long way, and they may be perceived as support for training the next generation of professionals. Instituting a clinical educator mentorship program can also be helpful to less-experienced, detached clinical educators. All these strategies may help alleviate learning barriers during clinicals, as clinical educators are very influential on students' learning experiences.

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Abbreviations

The following abbreviations are used in this manuscript:

ASCP	American Society for Clinical Pathology
MLS	Medical Laboratory Science
BOC	Board of Certification
CAP	College of American Pathologists

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