

Identifying Teaching Methods Used by Clinical Instructors in Nuclear Medicine

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Purpose To qualitatively address the teaching methods, effective pedagogy, feedback delivery, and perceived value of orientation workshops of nuclear medicine preceptors, also known as *clinical instructors*.

Methods Open-ended interviews were conducted face-to-face and by email correspondence to collect data from 11 nuclear medicine clinical instructors in the southwestern United States. A case study method was used to obtain salient themes from the participants.

Results Findings demonstrated that the most commonly used teaching styles were hands-on and observation. Participants described their self-perceived teaching skills as high quality, even though they had little or no formal teaching experience. Participants were not aware that students completed teaching evaluations, or they did not find value in the students' reviews. The participants perceived orientation workshops as a valuable option, identifying the following relevant topics: types of learners, communication skills, ethical situations, sensitivity training, and cultural competence.

Discussion This study identified useful teaching methods, including feedback, to fill the existing gap in literature related to clinical instruction in nuclear medicine. Findings of this study indicate a need to better educate clinical instructors. One method for this is conducting orientation workshops that improve teaching method effectiveness, expand the educational experience of students, and strengthen the students' clinical skills.

Conclusion A process that encourages awareness and change is needed to develop instructors' teaching skills in a clinical setting. The absence of review or responses to student feedback through teacher evaluation scores should be at the forefront of change, regardless of the teaching method employed.

Keywords | *clinical instructor teaching methods, education, feedback, nuclear medicine, preceptors, workshops*

Clinical education is an essential component of a student's coursework in nuclear medicine. During clinical rotations, students take the conceptual theories they learned during their didactic sections and apply them in a hands-on patient care environment.¹ The clinical instructor's ability to assist a student's transition from a traditional classroom to a clinical setting is a vital part of the educational process.² The teaching-learning interaction is complex, and its effectiveness relies on the teaching and learning styles of the preceptor, also known as a *clinical instructor*, and student, respectively.³ Competent clinical instructors who teach responsibility, accountability, and independence are essential in preparing students for their career in nuclear medicine.⁴

Teaching methods, learning styles, and approaches for delivering feedback to students all are important for optimal clinical training. Professional development and a system that encourages change in teaching methods when required are critical when preparing clinical instructors to be effective. Students are dependent on the clinical instructor during clinical rotations, therefore, the use of effective teaching methods is important when providing guidance to students during experiential learning.⁵ The styles of teaching and assessment in clinical preceptorship are important when improving professional development. Providing clinical instructors with support that increases the quality of the student experience will produce competent practitioners. Determining what methods of teaching are being used

in the clinical setting would assist in establishing where change is needed. This study was intended to increase knowledge in the nuclear medicine profession regarding preceptorship approaches by investigating current teaching methods and how they compare to effective pedagogy, the mechanisms of feedback delivery, student satisfaction with clinical instructors' teaching approaches, and the value instructors place on teaching orientation workshops.

Literature Review

Helping students apply their didactic knowledge in a clinical setting can be a challenging task for instructors. According to Steves, 3 important educational skills that nuclear medicine clinical instructors need are planning and applying instruction, objectively examining student performance, and facilitating student learning.¹ Clinical instructors, however, seldom have formal training in teaching methodology, learning styles, or evaluating clinical performance before receiving students. This is true for nuclear medicine as well as other health professions.¹ For example, clinical instructors in the physical therapy profession are not required to complete uniform prerequisites, although they are required to have 1 year of licensed practice before accepting the position.⁶ Teaching methods of an unskilled instructor can have a negative effect on students' learning outcomes.²

Clinical Instructor Requirements

The Joint Review Committee on Educational Programs in Nuclear Medicine Technology has accredited 74 nuclear medicine programs in the United States and has developed requirements that a nuclear medicine technologist must fulfill to become an affiliated educational supervisor.^{7,8} According to committee requirements, an individual must be certified and registered in nuclear medicine technology with a national certification board or hold suitable equivalent qualifications relevant to the particular clinical area and must have at least 2 years of postcertification clinical experience.⁷ There is no requirement for formal teaching experience, which might limit how prepared these affiliated educational supervisors are for their new role.¹ Expert clinicians with years of experience

will not necessarily transition intuitively into expert clinical instructors.²

Benefits and Challenges of a Clinical Environment

Learning in a clinical setting provides benefits to a students' education. During clinical rotation and under clinical instructor supervision, students participate in activities directly related to their profession, which provides them with many learning opportunities.⁹ Despite the benefits provided by hands-on clinical education, weaknesses can arise quickly owing to common challenges clinical instructors face in a clinical environment such as⁹:

- fewer patients for students
- increasing number of students
- limited rewards and recognition for clinical instructors
- program often is under resourced
- time pressures and competing demands for an instructors' time

These challenges can lead to less-effective clinical teaching. Gatewood and De Gagne also discussed challenges in the clinical environment that affect clinical instructors' teaching such as lack of training or preparation, time burden, productivity demands, and lack of support from school programs.¹⁰ In addition, clinical sites often are chosen based on proximity to the school. Hospital or clinic administration might accept students without considering the instructional expertise of the staff or the quality of the learning opportunities.²

Effects of Unprepared Clinical Instructors

A clinical instructor can have a negative or positive effect on students' clinical performance. Girija categorized important characteristics of a clinical instructor into 3 groups: professional competence with teaching ability, interpersonal relationship with students, and personal attributes of the instructor.³ Many clinical instructors, however, lack the training or the desire to teach effectively. Common challenges in clinical instruction include a lack of clear goals and objectives, passive observation by students vs active participation, and inadequate processes for feedback.⁹ Gemuhay et al evaluated multiple factors affecting clinical practice by surveying 96 nursing students.⁴ The top 3 reasons

identified for poor clinical instruction were lack of communication between staff and students (49%), improper clinical supervision (26%), and unprepared clinical instructors (18%).⁴

Communication is an essential part of effective clinical instruction.¹¹ When clinical instructors are not prepared or adequately trained, ineffective communication can occur and negatively affect students' learning outcomes. Four critical stressors radiography students encountered during clinical rotations were intimidation by staff and instructors, hurtful criticism, negative responses to questions, and too much supervision.¹¹ These factors could affect student attrition in radiography programs. Methods to alleviate stressors should be evaluated by the program director to prevent further negative outcomes.¹¹

A common theme appearing in studies that demonstrates a lack of teaching preparation is that clinical instructors are not correlating their instruction with the evidence-based teaching methods being used in the classroom.^{3,4,9,12} To provide the student with a quality learning experience, the clinical instructor needs to relate knowledge learned in the classroom to challenging tasks in the clinical environment.¹² Without knowing how a subject was didactically taught, gauging whether the current hands-on process is the most effective is difficult.

Poor Teaching Methods

Poor teaching derives from unproductive behavioral characteristics of an instructor's teaching method.¹³ Busler et al ranked the top 5 characteristics of an inferior instructor as¹³:

- being disrespectful
- not being knowledgeable
- having poor communication skills
- having unrealistically high expectations
- offering unfair student learning assessments

The clinical instructors' awareness of these characteristics is an important element in correcting their teaching behavior and approach. Strategies used by clinical instructors should be evaluated to determine if the current approach is the most effective. They might need to adjust their teaching delivery to avoid negatively affecting students' learning experience. To improve

teaching performance, clinical instructors can use methods such as reviewing student feedback, enrolling in teaching preparation courses, and spending time in teaching communities.¹⁴

Kelly found that despite studies providing characteristics of effective clinical instruction, it is unknown which teaching methods are being implemented by instructors.¹⁵ Understanding current teaching methods and structures can guide future techniques to enhance engagement and establish a strong clinical learning foundation.² Research on current teaching methods being used by clinical instructors is limited, especially in the nuclear medicine profession.

Feedback

Feedback has an integral role in learning. Clinical instructors usually provide feedback to students verbally or through written evaluation.¹⁶ Communication is an important component in the quality and effectiveness of feedback. Clinical instructors can use feedback to bridge the gap between a student's current performance and their achieving competence.¹⁷ A lack of continuity in forming and delivering feedback from clinical instructors is a detriment to the development of students' clinical knowledge and reasoning.¹⁸ Through effective feedback, students gain knowledge on how they are progressing during a vulnerable time in their clinical education and begin to form their professional identity.

Theoretical Framework: Teacher Change

Clinical instructor development is important for adapting and improving teaching styles. The term *teacher change* has been used in various studies to define multiple perspectives.¹⁹ Change is a gradual and challenging process for teachers.²⁰ Change in the clinical setting might be more difficult for clinical instructors because teaching often is secondary to their full-time professional career. Often, clinical instructors have students 1 to 3 times a week on inconsistent days, which can make the process of change difficult.

The teacher change model, created by Guskey, introduced a process to foster more effective teaching practices based on 3 core phases of the professional development model. The phases are developing change in teachers' classroom practices, creating change in

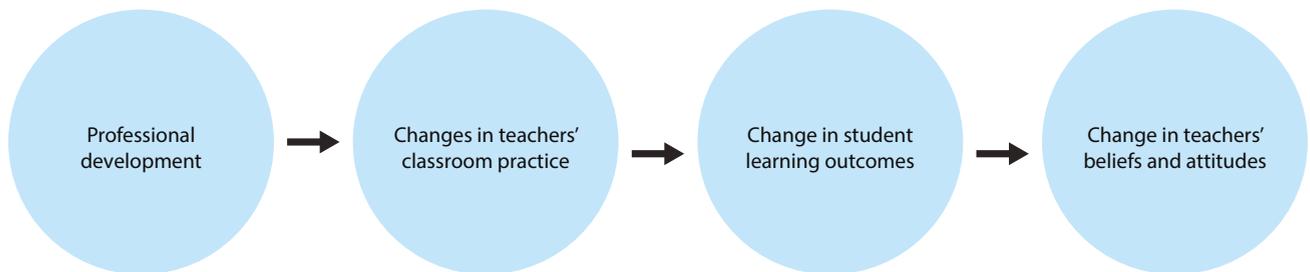


Figure. The model of teacher change developed by Guskey. Reprinted with permission from the Educational Assessment, Evaluation, and Research Commons and the Teacher Education and Professional Development Commons. Guskey TR. Staff development and teacher change. *Educ Leadersh.* 1985;42(7):57-60. uknowledge.uky.edu/edp_facpub/21

students' learning outcomes, and instilling change in teachers' beliefs and attitudes (see **Figure**).²⁰ Clarke and Hollingsworth suggest that professional development can be initiated by a change model and that the interpretation of the word *change* can differ by situation.¹⁹ They provide 6 perspectives on teacher change as examples of how the Guskey model can be applied to clinical instructor development¹⁹:

- change as an adaptation to different conditions
- change as growth or learning through professional activities
- change as local reform for personal growth
- change as personal development in an attempt to improve performance or develop skills
- change in systematic restructuring and enacting change policies
- change as training

Historically, the process of teacher change has been related to strategies that improve professional development.²¹ An instructor's perceived value in a proposed strategy affects whether it will result in changes in their instructional methods.²¹ Strategy implementation requires diligent planning and a deep understanding of the type of change needed and why.^{20,21} To facilitate professional development in clinical instructors, understanding the location of weaknesses and the conditions that enhance teaching effectiveness is necessary.¹⁹

Heijne-Penninga et al used the teacher change model to evaluate a professional development course exclusively for upper-level honors instructors.²¹ The study design implemented the different phases of the change model to formulate guidelines and develop teaching strategies,

while addressing underlying beliefs of the instructors. The honors instructors completed professional course activities related to topics in pedagogy, learning styles, student perspectives, and evidenced-based teaching strategies. These courses demonstrated a positive influence on instructors by facilitating a productive change in pedagogical approaches.²¹

Recker-Hughes et al recognized the need for a continuing education program or course to improve clinical instructors' ability to provide student feedback.²² Their study used a multisession workshop for clinical instructors to develop student assessment skills through student standardized patient examinations. Results included an increase in students' performance, student and clinical instructor feedback, clinical decision making, and clinical instructor gratification for a valuable learning experience.²²

Support from school administrators is an important factor in strengthening the relationship between school administrators and clinical instructors.¹⁵ Administrative support might mean applying changes from instructor feedback or creating a professional development course or workshop. Establishing a systematic follow-up support process for clinical instructors is indispensable for the change process.²¹ With regard to professional development, Guskey and Sparks stated: "A good idea implemented poorly seldom brings positive results."²³

It is crucial that clinical instructors, like students, receive feedback during the learning process and that the teacher change model is continually integrating lines of communication for support.^{21,24} An instructor's teaching methods and knowledge can be measured

in various ways, and it is important to remember that the refinement and adaptation of current methods to achieve effective change might take considerable time. The teacher change model frames an optimistic viewpoint for instructors to advance their teaching and learning styles, ultimately creating an opportunity for students to be exposed to a richer and more effective pedagogy.

Methods

This qualitative case study took place between September 2019 and April 2020 and was approved by the A.T. Still University Institutional Review Board (IRB# 660-626-2320). Cases were defined as the individual clinical instructors. The target population for the research study was clinical instructors affiliated with a community college nuclear medicine program. Clinical instructors were verified online to have active licenses through the Nuclear Medicine Technology Certification Board and the American Registry of Radiologic Technologists websites. Forty-two clinical instructors in the metropolitan area were sent email invitations. Of the 42 affiliated clinical instructors, a target sample size of 9 to 12 was anticipated to satisfy requirements of data saturation and appropriately establish content validity.²⁵ Purposive sampling was used to select individual clinical instructors for the interviews from those who responded to the recruitment email. Inclusion criteria consisted of being a licensed nuclear medicine technologists, being a current clinical instructor, and completing the consent form. Those who did not meet those requirements were excluded from the study. In the recruitment email, participants were given the options of a face-to-face or email interview. Informed consent was obtained before the interview. The instrument used for this study was an interview guide created by the author using 11 open-ended questions.

Credibility, transferability, dependability, and confirmability were established to promote trustworthiness throughout the research. Member-checking was implemented by allowing participants to review the author's notes and summarize their own responses at the close of the interview. To demonstrate that findings were applicable in other contexts, transferability was supported by incorporating thick description. A detailed account of

the encounter with the participants was documented, as well as the interpretation process of notes and audio recordings. A university research instructor who was not involved in the study was selected to evaluate the accuracy and review the data to determine if the processes, interpretations, findings, and conclusions were sufficiently supported.²⁶ Confirmability was implemented by fostering reflexivity. A reflexive journal was created for the documentation during the research process. Entries contained the author's methodological decisions and supportive reasoning, logistics of the study, and reflections using personal values and interests.²⁶

Data Collection

Participants were interviewed one-on-one or through written email responses in Microsoft Word using questions in the interview guide. Nine participants met face-to-face and 2 selected to correspond through email. Audio recordings were used during the semistructured one-on-one interviews. Recordings were transcribed into Microsoft Word for data analysis. Both written responses and transcription were entered into NVivo 12 (QSR International) for analysis.

Data Analysis

An interpretive thematic analysis was used to identify patterns and themes in the data and categorize information until the point of theoretical saturation was reached at the completion of the 11 interviews. Constant comparison was used to ensure identification of salient themes and establish dependability. Patterns were characterized by the these terms²⁷:

- causation
- correspondence
- difference
- frequency
- sequence
- similarity

Data cleaning was conducted in NVivo by comparing the audio recordings with the transcription to identify misspellings, errors, missing information, and invalid data. Descriptive nodes were created to facilitate coding to sample demographics. Inductive coding was used to categorize chunks of data. Responses related to feedback from the clinical instructors were coded using

the node title Feedback Delivery, along with the child node title Positive Reinforcement.

Results

Of the 42 clinical instructors emailed, 18 responded to the invitation, and 11 met the inclusion criteria. Of the 11 participants interviewed, 3 were women and 8 were men. The participants experience as clinical instructors ranged from 2 to 26 years.

Experience, Preparation, and Selection

When participants discussed their teaching experience, 9 of the 11 had not taught students in a formal setting before becoming a clinical instructor. The 2 individuals with teaching experience stated “I have had minimal teaching experience. I was a student teacher in summer school about 25 years ago” and “I taught Juvenile First Time Offenders years ago.” Neither participant considered themselves as having prior teaching experience. Some participants considered their clinical experience to be equitable to teaching experience, such as participant 1005 who stated, “I have never been a formal teacher in any setting. However, I was a supervisor for 9 years prior to coming to this hospital.” When asked about previous teaching experience, 1 participant answered “I have not [had any]. I kind of went through becoming a clinical instructor from what I received when I was a student by my clinical instructor.” When asked how they were selected to be a clinical instructor, responses were categorized into 2 themes, convenience (3) and selected by workplace (5). **Table 1** categorizes participants’ responses regarding their selection as an instructor by theme.

Teaching Methods

When asked about teaching methods, responses commonly reflected an observatory approach where students perform clinical tasks while the instructor observes and assumes the role of a guide. One participant explained his teaching method as:

My way of teaching isn't to hound the student or continue to watch over their shoulder. I like to use a challenging technique that allows the student to think through the process, whether it is a procedure, equipment, or physiological process. For example, I

will ask the student how does the camera work and what produces our pictures... Many students, even though they go through the program, are stumped by this question... I tell them I do not do this to embarrass you or make you feel inadequate, I do this because it is an important part of what we are doing.

Most (8) of the teaching methods were described as giving students an opportunity to learn by performing the same tasks as a licensed technologist.

Reported pedagogical approaches were predominately focused on the students observing and then performing hands-on tasks. One participant described their method of teaching as a “no pressure environment where a student will learn by both observation and hands-on when they are ready.” Another participant responded that students “learn best hands-on, maybe [watching] until [their] comfort level is there and encourage [them] to participate shortly after,” and a third described his hands-on approach in which students “[follow] [him] around... and see how [he demonstrates] work, and they would just learn through the demonstrations.” Another participant expressed her teaching style as being dependent on the educational level of the student:

Of course, if it's like first year students then obviously [observational], but I haven't had first years yet. I've only had third year students, so they know everything. I assume that once I have first year students that will change a lot because I'll be more of a teacher than an observer. Letting them do stuff on their own and figuring out what works for them and what doesn't because everybody, no matter where you go, is going to do stuff a little different. So just getting what they feel comfortable with.

Feedback

According to a consensus (9) of the responses, feedback was delivered in the form of positive reinforcement. Each participant conveyed the value of feedback as being important to student progression. For 5 participants, the timing of feedback delivery was a heavily expressed topic. Clinical instructors responded as providing feedback in a one-on-one setting and in a

Table 1

Thematic Analysis of Open-ended Responses to Selection as Clinical Instructors^a

Theme	Participants' Responses
Convenience	<i>I became a clinical instructor by default. The lead tech at my hospital had resigned his full-time position, and I filled the vacancy. I became a clinical instructor because the affiliated program needed more places to put students, so they picked my location. The previous clinical instructor left so I was already working during the week so I thought I'd try it.</i>
Selected by workplace	<i>I was contacted by Nuclear Medicine Director. She told me that they need a clinical instructor for our site and asked me.</i> <i>The clinical instructor had left and so I filled position because my supervisor felt like I was the best fit for it. She asked me if I wanted to do it and I agreed to do it.</i> <i>My current nuclear medicine department had lost their clinical instructor. The opportunity was offered to me and I felt it was a good opportunity to give back to the nuclear medicine community.</i> <i>When I became a full-time technologist, the supervisor of nuclear medicine was the clinical instructor. The director and my supervisor asked me to share in the clinical instructor duties and I was happy for the added responsibility.</i> <i>I became a clinical instructor incidentally. The hospital where I was working asked if I would be interested in doing it, and I replied yes. I was interested because I had, at that point, been in nuclear medicine for 10 years and felt confident with my knowledge about the field.</i>

^a Three participants gave answers that did not align with a cohesive theme and were not included in the table.

respectful manner. One participant expressed how he used feedback while instructing:

I try to give feedback as honestly as I can. If there is something I find they are struggling with, I tell them they need to work on that thing. I also like to show them multiple ways of doing things that way they can find what works best for them.

While another echoed a similar approach:

When I have one-on-one time with them, particularly at the end of the day, each time they are here I try to let them know some good things and some bad things that they did that day or something that I would have done different or a different approach to use for that situation when it occurs next time

Instructor Evaluation Scores

Three subthemes were extracted from responses regarding the participants' use of their scores from instructor evaluations completed by the students:

- The scores were used for teaching improvement or positive reinforcement.

- Instructors were unaware that the scores existed.
- Clinical instructors were aware but ignored the scores indicating they did not view it as helpful.

Clinical instructors (3) who evaluated their instructor evaluation scores had a positive perspective and found value in the data because it was used to find areas of improvement. The remaining participants (8) did not use the scores because they did not find value in them (ie, ignored score) or were unaware that performance scores were generated by the students. One instructor who was aware of the scores but chose not to use the scoring felt that when they were with the students they were aware of how the students felt and that honest critique and positive feedback were given in both directions (instructor-student; student-instructor) to promote learning and improvement. **Table 2** contains a list of the participants' responses related to instructor evaluation scores categorized by theme.

Value in Clinical Instructor Workshops

The use of clinical instructor workshops was explored during the semistructured interviews, and a consensus of value was demonstrated by the participants' responses (10). Many of the clinical instructors

Table 2

Thematic Analysis of Open-ended Responses to Instructor Evaluation Scores from Students

Theme	Participants' Responses
Positive perspective	<p><i>You know, I try to review them and see what other students say. It's good to get that third-party intervention to see what you're doing good at and what you're not doing good at, and just kind of go from the feedback and look at all feedback is positive and then just go from there.</i></p> <p><i>I use the performance scores from the students as a critique, to learn other ways of teaching students to become a more effective instructor.</i></p> <p><i>The scores help myself get better in teaching just because I'm so new at this too, like I haven't been in the field a long time so I'm still learning stuff myself.</i></p>
Ignore score	<p><i>I honestly do not evaluate or review my performance scores. I know how the students feel when they are with me in the clinical setting. We communicate our thoughts and provide each other with an honest critique and use positive feedback or positive reviews. I always let the students know that I am learning too, from them. I always ask them what I can do better or what do they feel I can improve upon either for them personally or with the next student. Also, I would hope that the program director would let me know immediately if there is something I can improve upon.</i></p> <p><i>I remember viewing scores at a program advisory meeting once, but didn't put too much thought into it.</i></p> <p><i>I know about the performance scores but don't have the time to go through them</i></p>
Unaware of scores	<p><i>I'm not aware of performance scores from students.</i></p> <p><i>I don't think performance reviews are released to CIs.</i></p> <p><i>I didn't know we get performance scores.</i></p> <p><i>I don't get any performance scores from the students.</i></p> <p><i>I do not remember seeing any performance scores.</i></p>

Abbreviation: CI, clinical instructor.

also expressed workshop topics to improve teaching effectiveness. One participant stated:

A clinical workshop is extremely valuable for many reasons. Firstly, the instructors meet others like them and can build professional relationships. The bridges to others allow clinical instructors to ask questions to others when they have challenging issues. Secondly, the workshop should provide guidance on topics such as relating to diverse students, how to [prepare] yourself as a clinical instructor, how to handle challenging students step by step, the grading process, expectations of your students as it relates to their clinical tasks and workflows, empathy training so students can learn to relate in a human way with their patients and their families, and mentorship of the clinical instructor by other experienced and seasoned instructors.

The **Box** displays participants' responses about their perceived value of workshops, as well as suggested workshop topics.

Discussion

A purposive sample of nuclear medicine clinical instructors was used to examine current teaching methods and compare them with effective pedagogy. Previous studies do not identify whether instructional methods and techniques used by nuclear medicine clinical instructors are congruent with best pedagogical practices. Open-ended interview questions provided data on instructors' teaching methods, feedback delivery, use of instructor evaluation scores, and perceived value of training workshops. The characteristics of nuclear medicine clinical instructors are similar to other radiologic and allied health professions.

Therefore, the research results from the studied sample could be transferable to evaluate teaching methods in other health care professions.

Two prominent teaching methods identified in this study were hands-on and observatory. The hands-on method was employed by instructors who preferred to model a technique and then have the student replicate it in the clinical setting. This type of teaching method resembles an experimental learning pedagogy.²⁸ A case study conducted by Ventura-DiPersia et al concluded that the hands-on approach to teaching, especially in medicine, was imperative in a students' progression to successful practitioner.²⁹ Thus, this finding conforms with a best practice for pedagogy.

The hands-off technique, or observatory technique, was another common theme expressed during the interviews. This style of teaching commonly is associated with the phrase guide on the side, but other teaching methods also represent an observatory teaching style. For example, Weston proposed an alternative model of teaching that he refers to as *impresarios with scenarios*, which broadens the scope of guide on the side.³⁰ According to Weston, "the Impresario conception is truer to the practices of many teachers inspired by the "guide on the side" model, while at the same time opening up many appealing and venturesome farther possibilities."³⁰ Although the guide on the side is a recognized pedagogical approach, the specific multicentric model proposed by Weston can be used by clinical instructors who prefer an observatory approach to improve their teaching effectiveness by creating scenarios that extend the structured interaction related to the task at hand.³⁰

This study showed that clinical instructors did not use their evaluation scores, and felt a stronger teaching base could be established through workshops. There is concern from this study's results that understanding the correlation between acknowledging received feedback and the use of effective teaching methods might be lacking from nuclear medicine preceptors. Most participants (8) were either not aware that students were rating their performance or ignored the scores; furthermore, 1 participant who was aware of the scores did not feel the rating provided any added value from a teaching perspective. Clinical instructors aware of the

evaluation scores used that data to critique themselves and become more effective instructors. The clinical instructors in this study had not realized that their unfamiliarity with the student feedback process might have decreased their teaching effectiveness. Larson et al noted learner evaluation of the clinical instructor should be robust and constructive to promote a higher level of teacher development.³¹ Certain students are not as expressive with their feelings in-person and prefer to provide feedback on instructor's performance in a written evaluation. If instructors are not viewing student feedback or dismissing the value, there is no opportunity to address areas of teaching that need improvement, and it is unlikely a change in teaching style will occur.

The limited amount of formal teaching experience was an overarching theme during the analysis of the data. The data supported that teaching preparation was minimal and previous teaching experience was nonexistent for most of the clinical instructors. The clinical instructors' self-perceived teaching abilities were a particularly informative aspect of the study and confirm previous findings by Kennedy, who conducted a study comparing nurse clinical instructors with and without formal clinical instructor education.³² In that study, clinical instructors consistently reported no formal teaching experience but viewed themselves as quality instructors because of the knowledge they possessed from their nursing experience. Brown and Atkins, however, noted that the basis of effective teaching is understanding the topic at hand, knowing students' learning styles, and having knowledge about teaching approaches.³³ Though some of the clinical instructors in this study have a deep understanding of nuclear medicine from extensive experience in the profession, they might not have sufficient knowledge of effective teaching approaches and how different learning styles affect student outcomes. In addition, research by Tang et al suggested that a teacher's attitude toward students, not their clinical experience, is the difference between being an effective or ineffective instructor.³⁴ The lack of formal clinical instructor education for most participants indicates a need to better educate clinical instructors thorough a professional development course or instructor training session.

Box

Participants' Responses Regarding Value of Workshops and Potential Topics**Value of workshops**

A clinical workshop is extremely valuable for many reasons. Firstly, the instructors meet others like them and can build professional relationships. The bridges to others allow clinical instructors to ask questions to others when they have challenging issues. Secondly, the workshop should provide guidance on topics such as relating to diverse students, how to [prepare] yourself as a clinical instructor, how to handle challenging students step by step, the grading process, expectations of your students as it relates to their clinical tasks and workflows, empathy training so students can learn to relate in a human way with their patients and their families, and mentorship of the clinical instructor by other experienced and seasoned instructors.

I feel that teaching is something you have, or you don't; with that being said I believe there are techniques and methodology that can be taught to future [clinical instructors]. I think one of the biggest supporting factors is to have a program director available to ask questions and to give feedback.

I have talked to other clinical instructors who have mentioned they wished they had a better orientation when taking on the position. I felt pretty comfortable from the get-go, but I can see how some might not.

There was a workshop I attended years ago and I found it very helpful.

Oh for sure, I would have liked to have training regarding what competency expectations are for students when they enter my department.

Potential workshop topics

Range of how each student learns, communication skills for clinical instructors, and understanding types of learner.

I think a teaching guide would be useful.

I think best way to support clinical instructors to begin teaching would be giving a little background about the student and where they are academically.

Yes, so it's the ethical questions are the ones that are hard.

Sensitivity training toward students, because a technologist that has been working in the field for years could have lost sight of what a student's life is like.

Covering topics such as: range of how each student learns, communication skills for clinical instructors, and types of learners.

Proper development of clinical instructors requires an understanding of the process through which teachers grow professionally, including the conditions that support and enhance growth.¹⁹ The teacher change model posits that considerable change in teachers' attitudes and beliefs about teaching methods occurs after they gain evidence of improvement in student learning.²⁴ An evaluation of student outcomes achieved through current instructional methods in nuclear medicine programs could be used to support more sophisticated pedagogical methods, thus creating an opportunity for professional development workshops aimed at changing prevailing ineffective methods.

Busler et al identified qualities exhibited in poor teaching practices and discussed the importance of

educating instructors on techniques to avoid while teaching to prevent them from inadvertently adopting poor habits.¹³ In nuclear medicine and other health care professions, there are few educational workshops for clinical instructors to attend.³⁵ One study compared novice and experienced clinical instructors using an online professional development course and found that a professional learning community was beneficial to clinical instructors regardless of their experience.¹⁴ Most participants (10) saw value in conducting educational workshops for clinical instructors, which could be a useful tactic to begin professional development training, and it aligns well with the teacher change model, as the model promotes professional development by adjusting

teaching practices and adapting student learning outcomes. The workshop would encourage professional development by demonstrating to clinical instructors different styles of effective teaching approaches and also provide purpose for the methods being taught and might solidify new learning outcomes and clinical instructor beliefs and attitudes.²⁴ Clinical instructors also shared potential workshop topics to improve teaching methods such as types of learning, communication skills, cultural competence, and sensitivity training.

Another interesting and unexpected finding was the prevalence of clinical instructors being selected based on availability and convenience, rather than teaching qualifications or experience. The selection process of a clinical instructor might be a contributing factor to the lack of teaching experience. Almost every clinical instructor interviewed was initially chosen to be a clinical instructor out of a necessity for the clinical site and nuclear medicine program, rather than choosing a technologist with teaching experience.

Because the selection process of clinical instructors is based on convenience rather than on teaching experience, as revealed during the interviews, there is an opportunity for professional growth in effective pedagogy. This qualitative case study revealed characteristics that can be used in conjunction with professional development. One topic of particular benefit would be clinical instructor awareness and use of student performance ratings. Implementation of professional development workshops also aligns well.

Limitations

In the data collection phase, correspondence with participants was conducted through open-ended semistructured interviews. Two participants (18%) did request free-text emails instead of face-to-face interaction. Handy and Ross noted written accounts can provide a valuable alternative to face-to-face interviews.³⁶ However, without the opportunity for real-time probing questions fluidly interjected by the author, email correspondence with these 2 participants might have limited the amount of content received. Even though saturation was met, initially providing all participants with the option to use email correspondence

or face-to-face interviews might have produced more robust data.

Because of self-reporting from an interview approach, bias could have affected the assessment of content by failing to provide data for additional relevant themes. Because data were collected in only 1 state in the southwest region of the United States, transferability to other programs could be improved through a more expansive geographical approach.

Recommendations for Future Research

Research on clinical instructor preparation would benefit from a study of the effectiveness of clinical instruction workshops. Research on this component of teacher education is limited in studies specific to clinical instructors but is suggested by the teacher change model.²⁴ A qualitative approach could be used to interview participants before and after workshop participation to collect valuable feedback, enabling continued tailoring and improvement.

Research also is needed to assess the effect that instructors' review of teacher evaluation scores has on instructional changes. Student assessment of instructors will be for naught if the clinical instructors are not reviewing feedback that is potentially essential for promoting teaching growth and effectiveness.

Conclusion

In nuclear medicine, studies are limited regarding the evaluation of effective clinical teaching methods. The current in-depth qualitative study was valuable in identifying current preferred teaching methods of clinical instructors and themes for possible use in improving preparedness, feedback, and educational training. Findings showed most clinical instructors were unaware of performance evaluations completed by their students, or they did not find value from the feedback. The most common teaching approaches used were hands-on and observatory. Clinical instructors felt their instructional methods were effective despite not having formal teaching education and not knowing best practice pedagogy. Clinical instructors expressed value in training workshops for on-boarding clinical instructors that covered types of learners, communication skills, ethical situations, sensitivity training, and cultural competence.

Study findings address the void of research related to clinical instructing in nuclear medicine and provided evidence that change and awareness are needed to develop teaching abilities. The absence of review or response to student feedback should be at the forefront of change, regardless of the teaching method employed. Clinical instructor growth, without acknowledgment of feedback from students, will always be challenging. Orientation workshops were found to be an acceptable and perceptually useful tactic to address identified gaps in effective pedagogies. Without action relative to these key findings, ineffective clinical instructor teaching methods will continue, limiting the educational experience for the students and undermining their clinical skill development.

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