

# Implementing a clinical-educator curriculum to enrich internal medicine residents' teaching capacity

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## Research article

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# Abstract

Background Physicians-in-training (residents) are typically the primary educators for medical students (MS) during clinical clerkships. However, residents are not formally trained to teach or to assess their teaching. The aim of this study was to assess the implementation of a clinical educator rotation aimed at developing residents' competencies related to clinical teaching and professional growth. Methods A mixed-methods approach was used to develop and assess the clinical educator rotation at a teaching community hospital. Internal medicine residents who participated in the rotation and consented to the research were assigned to the clinical educator trainee group (CET), the remaining residents were assigned to the control group. Osteopathic MS rotating in the medicine service line were invited to participate. Five key assessment tools were developed and used to measure four constructs: Communication, Professional-Based Learning, Professional Engagement and System-based learning. The study used descriptive and qualitative analyses to measure primary and secondary outcomes. Results The primary outcome measure showed a positive change in resident knowledge, skills and behaviors in communication, reflection, feedback, precepting, and facilitation. MS perceptions of resident teaching skills confirmed the observed changes in CETs. Some CETs continued to practice and build their capacity for teaching after completing the rotation. Qualitatively, we categorized the described codes under four pre-identified themes; communication, professional engagement, professional-based learning, and systemic-based practice. Conclusion Resident teaching and professional capacity is enriched after completing the clinical educator rotation. Other benefits included: enhanced patient communication and education, increased resident confidence, personal satisfaction with training, work life-balance and enhanced career satisfaction. Future research should focus on curricular content, faculty development and delivery assessment. Also, research efforts should identify appropriate emerging technologies to include in the curriculum for enhancing teaching capacity.

## Introduction

Responding to projected physician shortages in the United States,<sup>[1]</sup> there has been a rapid expansion of graduate medical education (GME) programs. In 2017-2018, 620 new GME programs were launched.<sup>[2]</sup> With this rapid expansion in GME programs, are extensive changes in technology, healthcare, and education delivery methods.

Physicians-in-training (residents) are typically the frontline primary educators for medical students (MS) during clinical clerkships. Even after residency, many residents continue on as educators becoming clinical faculty in medical schools and teaching hospitals. Residents are estimated to contribute an approximated two-thirds of MS education during the clinical MS3 and MS4 years.<sup>[3]</sup> After graduating from medical school, there is an implicit expectation that MS assume the role of educators as they transition into residency. However, most medical academic curricula are crowded and do not allow for the time to include developing residents' teaching competencies.<sup>[4–6]</sup> As a result, residents are left with the challenging task of teaching without having the training or skills to be effective educators. As GME continues to expand, programs will need to invest in developing or acquiring faculty with new skills to

promote positive resident educational experiences leading to successful future clinical careers.[7–10] One method to do so is to institute a clinical-educator track geared towards a resident audience. [11–13]

In fulfilling this approach, we developed and initiated a “clinical-educator” rotation for post-graduate-year two (PGY-2) and three (PGY-3) residents in Internal Medicine (IM) to take on a leading teaching role towards junior residents and MS. The rotation introduces learning theory mixed with pragmatic skill development aided by the use of digital technologies to leverage residents’ teaching capacity within our institution [14]. The primary objective of this study was to assess the impact of the clinical-educator rotation on residents’ competencies related to clinical teaching. Secondary objectives were to determine MS perceptions in reference to observed changes in residents’ teaching as measured by communication, practice-based learning (PBL), professional engagement, and systems-based learning (SBL).

## Material And Methods

A prospective, exploratory descriptive study was conducted with a concurrent triangulation design to collect both qualitative and quantitative data from three stakeholder groups: MS, residents and clinical faculty. This study was approved by the Edward Via College of Osteopathic Medicine, Institutional Review Board.

### *Study Population*

A purposeful sampling technique was employed to recruit residents at a community teaching hospital in Orange Park, Florida. All PGY 1/2/3 IM residents (n=30) were invited to participate in the study after an introductory presentation. Because the rotation was an elective rotation limited to PGY 2/3 residents, we selectively assigned all the PGY I residents (n=10) to the control group. Residents (PGY 2.3) who selected to rotate in the clinical educator rotation were assigned to the test group, clinical-educator trainees (CET). All PGY 2/3 residents who chose not to participate as a CET, along with PGY-1 residents, were assigned to the control group. Using a similar purposive sampling approach, all third year osteopathic medical students (n=20) rotating with IM residents were invited to participate in the study. All participants in the study were consented.

### **Clinical Educator Rotation**

The curriculum was drawn from the contemporary clinical-educator and faculty development literature based on participating faculty’s experience and training in faculty development.[11, 15] In addition to including traditional clinical faculty development topics such as precepting, feedback, learning theories, lecturing, and small group facilitation, delivered in weeks 1 & 2. We added contemporary topics selected from Gonzalo et al’s, report on changing clinical faculty development needs to include: change management, patient-centered medical care, electronic health records (EHR), complexity, learning healthcare systems, and digital technologies. [16] The contemporary topics were designed to be delivered as elective modules, in weeks 3 & 4, based on learners’ interest and needs identified with faculty collaboration. [16] In brief, the hybrid model was built on a two to four-week rotation with an emphasis on

communication and PBL delivered in the first two weeks in eight mandatory modules. For the remaining weeks 3 & 4, residents may select up to two additional modules per week. These latter modules exposed the residents to the domains of professional engagement, and SBL (Table 1). One faculty member (SB) delivered the eight modules in the first two weeks face-to-face and included a variety of exercises that promote dialogue, reflection, problem-solving and hands-on experience to anchor and promote the transition from theory to practice. Whereas week 3 & 4 elective modules were designed to be delivered face-to-face or remotely (based on available faculty expertise) using video and supervised locally by (SB).

The CET and control groups were involved in the usual daily teaching activities of the residency program by leading daily morning huddles, morning topic discussions, precepting, evaluating clinical notes, providing feedback, and facilitation during various topic presentations. In addition, the CETs also participated in weekly bedside teaching sessions with the MS. Residents from the control group did not participate in bedside teaching, because of potential unfairness to residents who may be put on the spot in the presence of patients and students without proper training. Instead, for the bedside teaching experience, we elected to identify differences at the beginning and end of rotation for each CET. Prior to bedside teaching, each CET was oriented to the objectives and format of the bedside teaching session with emphasis on pre-session student orientation to clarify objectives and respond to students' questions. After the bedside session, the group met to debrief their reflections-on-learning.

### ***Data Collection***

A total of five key assessments, designed in-house, were utilized to answer the research questions listed in Table 2. Four of the key assessments, communication, SBL, professional engagement, and PBL, aligned with the basic constructs that framed the study. Both the control and the CET groups completed these assessments. The fifth assessment was a summative pre/post assessment, open-ended questionnaire, to help identify if the program met the objectives. All MS and residents completed the pre-assessment; whereas the post-assessment was completed by the CET group only. Towards the end of the study, we conducted a focus group discussion for the MS, residents, and faculty. Table 3 demonstrates the matrix of the assessment methods. The key constructs and assessments are described below:

**Communication:** This construct targets verbal, written, and digital communication standards with the purpose of facilitating effective communication behaviors/patterns between all stakeholders. The stakeholders included students, residents, faculty, staff, patients/families. Communication was assessed using the morning huddle survey, an eight questions likert scale ranging from strongly disagree to strongly agree, during the morning huddle where trainees briefly review their scheduled patients. In addition, we used different strategies to assess resident communication during the rotation using observation, video, reflection and review of electronic health record notes.

**Practice Based Learning (PBL)-** The purpose of engaging residents in reflective practice was to develop residents' capacity for life-long learning. The second assessment was therefore, reflective journaling. Each resident practiced daily journaling using Mezirows' reflective levels [17] for transformative learning to frame their reflective discussions followed by one-on-one sessions with a faculty member to anchor

their skills in reflection. In addition, weekly journal narratives were assessed via a rubric by three faculty members. The reflection rubric consisted of 4-point likert scale ranging from below expectations to outstanding to assess two components, content and personal growth.

**Professional Engagement-** This construct targets the domain of professionalism practiced by the resident during interactions with stakeholders in the context of cultural diversity and transnational competence during presentations. The CET participants were given two choices of presentations: prepare a 15-20 minute presentation around Evidence-Based Physical Examination and deliver the presentation in a small group meeting or facilitate a small group teaching session, (60-75 minute), on an inpatient clinical case. The third assessment was presentation skills that measured if the CET demonstrated mastery of professional competencies such as the practice of empathy, cultural humility in a culturally diverse context, mastery of knowledge content, role modeling, and appropriately (voice, tone, body language, etc.) responding to learner or patient difficult interactions. Presentation rubric, 4-point likert scale, was used to assess trainees presentations from below expectations to outstanding.

**Systems Based Learning (SBL)-** This construct targets documentation processes in the EHR as a surrogate for SBL, using QNOTE,<sup>[18]</sup> a validated electronic evaluation tool used to assess clinical notes for quality by generating a quantitative score for clinical notes quality. Both resident groups completed multiple QNOTE evaluations for the same peers and provided peer-to-peer feedback regarding gaps in documentation and opportunities for improvement. Also, QNOTE enabled the CET group to identify the progression of residents and categorize them using the RIME (reporter, interpreter, manager, educator) model, Table 4 further explains the RIME model.

**Program evaluation:** A 7-item pre-and an 8-item post semi-structured questionnaire was designed in-house to determine if the program met its objectives. In addition to collecting data from the control and CET groups, this study aimed to triangulate its findings by capturing MS perceptions of the clinical educator rotation as measured by communication, PBL, professional engagement, and SBL. Towards the end of the study period we conducted three focus groups for the MS, the CETs, and faculty to assess program outcomes.

### ***Data analysis***

Data from questionnaires, surveys, audio, and video were collected, summarized, and aggregated per group, CET vs. control, using descriptive statistics and qualitative content analysis. Two investigators transcribed and coded data and ensured appropriate assignment of codes. These codes were reviewed independently by two other faculty members experienced in qualitative analysis to ensure intercoder agreement. We identified recurrent and/or emerging themes from responses in an attempt to further our understanding of how the curriculum was meeting its objectives. MAXQDA 2018.2 was used for the qualitative analysis of the data. Inferential statistics were not appropriate in this study because of the limited sample size and the descriptive nature of the study. Assessments completed by faculty members were quantified in order to establish inter-rater reliability and validity. Moreover, quantitative data were analyzed descriptively in order to establish patterns in responses. We used various strategies to

strengthen the rigor of the study by assessing the credibility, dependability, confirmability, and transferability of the outcomes [19].

## Results

There was an overall improvement in CET's knowledge, skills, attitude, and behavior in relation to the domains of communication, PBL, professional engagement, and SBL. Of the 10 CETs who enrolled in the CET group, 8 completed the rotation. Data saturation was observed by the sixth trainee after which no new themes were emerging and there was triangulation of data from the different stakeholders (students, residents, and faculty). Persistence of changes, post CET rotation, were less pronounced for PGY-2 CETs. We observed consistent use of new behaviors and skills in 4/8 CETs. The primary outcome demonstrated a behavioral change towards embracing and repetitively demonstrating use of the theoretical frameworks in support of a learner-centered approach to teaching. MS perception confirmed the observed behavioral and skill changes described in the CET group.

The most frequent three codes prior to the initiation of the CET rotation were "practice of teaching" (11.8%), "critical thinking" (9.7%), "reflective practice" (8.1%) in the CET group; "practice of teaching" (14.9%), "reflective practice" (10.2%), "challenges to teaching" (8.4%) in the control group. In contrast, the MS groups' top three codes were "reflective practice" (22.1%), "practice of teaching" (7.2%) and "education" (7.1%). Refer to Table 5, for examples of codes and correlating quotes. To identify relationships between the codes, a network map, based on the pre/post-survey and focus group interviews, showed a robust increase in post-rotation interconnectivity and proximity of codes to the practice of reflection. In both pre and post assessments, mentoring showed similar connectivity and proximity to reflective practice, see Figure 1.

Eight (27%) IM residents enrolled as CETs and the remaining, 22 (73%) residents participated as controls. The CET group included 2 PGY-2 and 6 PGY-3 residents. A total of 17/20 (85%) of the MS enrolled in the study. The eight CETs (100%) completed at least two weeks clinical-educator rotation with three residents completing three weeks. Among the residents who elected to rotate for three weeks, one resident completed the population health module and another the patient-centered medical home (PCMH) module. The deliverables for these modules included a Grand Rounds presented by the resident on the topic, the second resident delivered a detailed document describing implementation requirements for a PCMH practice in the resident outpatient clinic.

### *Qualitative*

#### *Communication*

The most common identified codes were 'clear and concise communication' followed by 'feedback', and 'coaching', see Table 4.

Faculty comments: From the focus group discussion, faculty stated that the CETs developed new understanding in relation to professionalism, patient care, teaching process and planning. Communication between CET and stakeholders, including patients, MS, staff, and faculty, was noted to be clear and organized when compared to the control group. CETs made use of verbal and non-verbal cues. Residents learned how to communicate effectively with all stakeholders to plan educational sessions.

*"During the [morning discussion] article there was more discussion compared to before."*

*"So he is now involving the residents to be part of the conversation rather than him just talking so he will ask more questions and listen to them."*

Evaluation tools: Using the morning huddle survey, the mean values for all questions combined were similar in both the CET and control groups with a mean of 4 correlating to 'agree' on the 5-point likert scale indicating a similar improvement in both groups.

Residents: From post-survey and focus group discussion, the residents reported that CETs showed consistency in ensuring knowledge transfer to learners.

*"Facilitating the morning group and feeling/sensing that I was listening and being listened to. I felt effective and that the whole group participated."*

The CET group also used their communication skills to provide constructive feedback, coach learners, and ask questions at different levels of the Bloom taxonomy [20]. At the beginning of the clinical-educator rotation, CETs anticipated communication skills as a major challenge which was not the case after the rotation.

*"Communication skills were challenging, now I know how to effectively communicate our thought process."*

*"I feel empowered as an educator and feel I am able to conduct more thought-provoking questions."*

*"...I think I am better at giving feedback now that I have practiced multiple times and have received feedback on my feedback. I feel more comfortable with it."*

Students: From focus group discussion, the MS also indicated an agreement with the CETs' improvement of communication between stakeholders. In comparison, the controls were much less likely to communicate with learners through pre-planning or clarifying learning objectives when leading an educational activity.

*"...it is interesting when he first started teaching us he was kind of timid and disorganized when we first started. I gained a lot from the cases working with him but he made a lot of improvement just from the second time he was with us as a CET. Toward the end he was very proficient very organized in teaching us."*

## ***Practice-based learning***

The most common identified codes were 'reflective practice', 'objective oriented', and 'efficiency'. See table 5.

Faculty comments: From focus group discussion, the faculty stated that the CET group demonstrated effective use of reflective skills and providing feedback to learners. Their questioning styles changed based on Bloom's taxonomy of questions and teaching was more learner-oriented. Although CETs practiced verbal and written reflection, they struggled to align their reflections according to Mezirow's hierarchies for reflective practice.

*"So before he started the rotation he was more of a talker where he would share the knowledge he knows and he will keep going on regarding what he knows but after doing the rotation and during it he learned the skills and abilities of how can he get most out of the learners where he is now adapted the roll of a teacher and not just somebody that gives a lecture."*

Evaluation tools: Based on the Reflective Journaling Rubric, most reflective practices ranged between affective through judgmental reflectivity according to Mezirow's levels. Occasionally, a CET practiced reflection at the conceptual, psychic, or theoretical levels. The content and personal growth based on the Reflective Journaling Rubric were rated as 9% "basic", 50% "proficient", and 41% "outstanding", in the CET group.

Residents: From post-survey, the CETs found reflective practice to be an effective tool to help them understand their role as an educator and enhance their practice-based learning.

*"Reflective practice helped me recognize the caveats and gaps in my practice and interactions and taught me how to find remedies by self-reflection"*

*"One big part of the clinical-educator, there is actually a big mindfulness component to it so there is daily journaling and reflection in that aspect."*

Students: From focus group discussion, MS stated that reflection practice demonstrated by the CETs was consistent with the residents and faculty's findings and noted deeper sense of reflection.

*"...to be a teacher you have to lead by example, and I think it is one of the aspects that I want to improve on,"*

*"Reflection is a sort of personal feedback for me where I can sit back and figure out where I could have been better and next time, I will try to implement that and that is what [the CET] successfully did"*

## ***Professional engagement***

The most common identified codes were 'practice of teaching', 'patient care', and 'precepting'. See Table 5.

Faculty comments: From focus group discussion, the faculty stated that the participants in the CET group had improved their professional interactions with their patients, colleagues, and MS. This was evident through deliberately addressing patients and learners by name, actively organizing and planning teaching activities, and providing feedback in a facilitative and non-judgmental manner.

*"[Another clinical-educator] gave me feedback after I gave a lecture. She video taped it, as an attending you never get this opportunity where you get feedback from peers or from other attendings or from anybody. So that was helpful because by doing this rotation she developed the skills on how to give feedback without hesitation no matter if its a peer, attending, or student."*

Evaluation tools: Using the presentation rubric, the CETs and controls showed similar improvement in presentation skills with a mean value of 3 correlating to 'proficient' in the 4-point Likert scale.

Residents: From post-survey and focus group discussion, the CETs demonstrated their understanding of concepts of adult learning theories, group dynamics, personal values, personal learning inventory and reflection.

*"Explaining my expectations to new students, sometimes we work together only for a couple of weeks, understanding their expectations as many MS are too new to the clinical setting."*

*"It is difficult to evaluate somebody and be able to add to that picture unless you are paying good attention and you are following them along as now I am able to look at the picture and see what I can bring more to the table as my perception changes you are not there to be in the room or be a part of it and say yes to what has been but your job is to make sure that how this process is taking place and where it is going and if we are going together or not."*

Students: From focus group discussion, the MS stated that CETs demonstrated a higher level of professionalism when interacting with learners. There were noticeable changes in behavior that the MS were able to recognize as a different professional behavior when compared to the controls.

*"[Clinical-educators] let me be a reporter and take charge and when I present the patient to the attending, they didn't interrupt me and let me do my job as a reporter"*

*"[Clinical-educators] were very professional, they called me by name, rather than 'medical student,' everyone calls me medical student, but they used my name. They were attentive, listen to us, and keep eye contact."*

### ***Systems-based learning***

The most common identified codes were 'knowledge/education', 'critical thinking', 'technology use in teaching'. See Table 5.

Evaluation tools: CETs were able to demonstrate proficiency in SBL through the use of QNOTE. CETs were more inclined to identify gaps in notes with an average QNOTE score of 80.6, while controls were more

inclined to give a higher score to the same clinical notes with an average score of 91.2, indicating a lack in identifying gaps in EHR note quality.

Residents: From post-survey and focus group discussion, the CETs were able to use their newly acquired skills in different clinical settings including precepting in the outpatient clinic and bedside coaching in the inpatient service. CETs engaged different systems by working as a team leader and facilitating the use of resources available in the hospital to engage the learners.

*“Implementation of a variety of teaching strategies appropriate to learners, engage in critical thinking and create opportunities to do so, using information technology to support the learning process, role model.”*

*“...my opportunity to look at myself from a different point of view. Looking forward to discover what are the challenges that a teacher faces while trying to meet the needs of different people who may be very different from each other in the way they learn, yet have the same objective.”*

CETs were also able to master the use of QNOTE to assist learners in identifying their gaps in clinical notes.

*“I also had another CET and she went over my notes using QNOTE and I noticed a lot of errors so now I am looking at everything deeper.”*

Students: From focus group discussion, MS stated that CETs' behavior change was evident through the bedside teaching where their actions manifested in a patient and learner-centered approach. Patients were enthusiastic to participate in the teaching session as it provided them with a deeper insight about their case and the MS had a unique opportunity to reciprocate their theoretical knowledge into practice.

*“When going through review of systems and physical exam, systems-based learning allows the student to compartmentalize the teaching and ensuring all aspects of patient care/differential diagnosis are addressed. At the same time, providing a method to draw from to develop a “bigger picture” mentality with patient care.”*

In addition to collecting data on these four constructs, we aimed to assess if the clinical educator rotation met its objectives from the perspective of students, residents, and faculty. Faculty and study participants observed significant behavioral changes in the CET group after the completion of the rotation.

*“In my opinion I think that this was a really good effort. I have seen significant changes, and these changes are lifelong. It's like you developed the muscles and you keep working and those that learn and retain it if they practice it.”*

The most noticeable behavioral changes included the ability to conduct well-structured, concise, and focused feedback to learners. For example, when precepting or leading small groups, CETs used a mix of higher order questions that engaged the learners in analysis and evaluation rather than the predominant

use of low order questions such as knowledge or comprehension based. CETs provided learners with space to work through problem solving and focus on their clinical reasoning skills.

*“One thing about CE he has always been very like inquisitive and always ask good questions he is always thinking deeper and thinking well what would you do in this scenario and always think that he was a person that showed that if he wanted to share something with you then he asks what do you think about this”*

*“... what I want for both of us to critically think and then I try to direct the question in a way where it is learner-centered so if they are struggling to provide me with the answer I stop and reframe my mode of questioning in a way that it may benefit the learner to kind of see where I am trying to lead them, because sometimes what we try to do as a teacher is to give all my knowledge but don't have time to answer everything.”*

Other behavioral changes that were acquired and used by CETs included: facilitating skills, concise and clear communication while coaching, improved patient communication, and the overall novel approach to teaching.

*“With CET they were very clear and able to tell me what they wanted and communicate with me how they wanted me to do something and what the expectations were.”*

In contrast, the control group asked more knowledge-based questions and usually provided the answer to the questions without providing the opportunity for the learner to process the question and respond.

*“...some other [control residents] were a little more all over the place. You wouldn't know what the expectations from day-to-day or what you are going to get or how things are going to go. If they assign you a topic, you don't know if you are going to discuss it that day, five days later, or never. So that was something I knew with CET I knew if they assign me something to read, they will ask me the next day and need to prepare for it so we always had that discussion. I knew what my expectations were...”*

*“In regard to other residents, the experience is not the same it depends on the senior, I had four different seniors, and each was very different some took the role on. I didn't know who is my go-to to teach me. Sometimes the interns teach more, sometime the senior. I Don't know the hierarchy, but I think the seniors have more free time to teach us and go over our notes.”*

Through direct and indirect assessments, the most impactful observed change was the strength of association between concepts related to clinical education, especially reflective practice, feedback, mentoring, precepting, and teaching (Figure 1).

We also assessed the progression of the CET group through focused group discussion with the MS. In comparison to the control group, MS reported that CETs were clear and concise in communicating teaching objectives for teaching activities, and professionally conducted the bedside teaching sessions. All MS concurred that the CET group conducted teaching in a standardized fashion, while some residents

in the control group demonstrated similar organization in their teaching, they were not consistent with significant variability between residents.

*“It has created structure in how to approach bedside teaching and improve my knowledge of various forms of bedside teaching, how to effectively give feedback, and how to reflect with more organization.”*

*“Last week I feel you weren’t as prepared as far what you wanted us to do but this week you had it laid out what you wanted us to do, how you wanted the structure to go, and that was better. This week you came in with a game plan before we saw the patient.”*

*“[A control resident] particularly spent extra time with us to help teach us, I think it kinda came natural to him, without going through this process he is good at teaching....it varies, depends on characters. Some teach spontaneously and others need to develop the skills.”*

## Discussion

Historically, training programs have relied on residents to teach MS without equipping the residents with the knowledge and skills to be an effective educator [21]. In this study, the emphasis on communication and professionalism was purposeful. Although the rotation is limited in time to 4 weeks, by the end of their rotation, CETs had successfully achieved the objectives of the rotation. The assessment tools demonstrated that CETs developed a mindful stance and actively practiced reflection, feedback, process observation, precepting and effective questioning techniques.

*“Implementation of a variety of teaching strategies appropriate to learners, engage in critical thinking and create opportunities to do so, using information technology to support the learning process, role model.”*

Through triangulation of data sources such as the direct and indirect methods to collect data from multiple stakeholders improved the robustness of the study. Furthermore, the CET group demonstrated behavioral changes, that persisted after completion of the rotation, related to communication, professional engagement, practice-based learning, and systems-based learning. Although, our goal is for long-term positive behavioral changes in teaching skills, we are unable to make such a claim beyond the confines of the study period.

Becoming an effective clinical educator is a challenging process that requires time and deliberate effort [22]. Hence, a transformative approach to medical education is needed to innovate an integrated pedagogical strategy. Gonzalo et. al. (2018), outlined some of the gaps in the competencies and curricular domains needed to reform medical education. Their viewpoint is a paradigm shift in how faculty and academic centers should approach healthcare education compared to current practices [16]. In addition, Gonzalo et al, provided a roadmap to transform medical education emphasizing informatics, teamwork, leadership, population health, socio-ecological health from a systems science perspective [23]. Given the rapid changes in healthcare systems, it is imperative for graduate medical education to adapt to the dynamically complex healthcare system and restructure the curriculum to help learners develop the

skills needed to become effective educators and leaders [24]. These studies are in line with our research initiative to develop clinical educators and help residents become resilient in this dynamically complex healthcare system.

Several studies have demonstrated the benefits of developing a clinical educator program [11, 13, 25, 26]. Reported outcomes from these studies were positive for improvement in the level of skills [11], impact on career choices [11,12], development as a clinical educator [12], increasing opportunities to teach [25] and improved feedback skills [26]. Our study identifies similar benefits and further expands on the outcomes of clinical educator programs to include improvement in communication, practice-based learning, engagement and systems-based learning.

Interestingly, the benefits gained from the CET rotation were not confined to the CETs; we observed active transfer of skills from the CETs to other learners, such as morning huddle presentation skill and leading small group activities. Benefits were also noted in the assessments of presentations and huddle by learners, where both the CET and control group showed improvement. We believe this is secondary to reactivity of measurement where participant controls benefit from CETs by being in proximity and observing them during their training [27]. This is a favorable outcome where further dissemination of knowledge and skills occurs among all participants.

## **Limitations and challenges**

The overarching challenges in this study were primarily related to faculty time and the broad faculty expertise required to manage all the modules coupled with a short rotation schedule. Although residents self-selection into the test group may have biased the results of the study; however, similar to other 'elective' clinical rotations, residents are given the freedom to select what they want to learn in line with their interests. Another challenge was occasional patient reluctance to participate in bedside teaching sessions. We also noticed some discrepancy in individualized learning challenges stemming from workload and family balance issues. This led to a variability in ability to complete the required reading during the rotation. Another limitation is potential bias by the main faculty member who facilitated the modules in the first two weeks covering communication and practice-based learning. However, we sought input from all faculty regarding observed changes in resident behaviors and progress which confirmed our findings. There may be limitations to the generalizability and transferability of the results of this study because the study was conducted at one clinical setting. Participant comments at the end of the study expressed their desire to see the rotation expanded to include all residents. Anchoring traditional clinical-educator learning using practical exercises that draw from implemented available technologies such as the electronic medical record can be challenging.

## **Conclusion**

This mixed methods approach used in the study provides evidence that residents can benefit from attending a time-limited rotation that builds on the foundations of teaching and professional growth. This study suggests that to build residents' teaching ability and proficiency as a clinical educator, exposing

them to the theory and practice of topics on practical contemporary education theory, facilitation, and communication skills is an effective strategy. Other benefits besides improving delivery of medical student education may include enhanced patient communication and education, increased resident confidence, personal satisfaction with training, work life-balance and enhanced career satisfaction. Challenges that may limit such experiences are primarily resource driven especially time and availability of experienced faculty. Future research should focus on curricular content, faculty development and delivery assessment. Also, research efforts should identify appropriate emerging technologies to include in the curriculum for enhancing teaching capacity.

## **Abbreviations**

CET: Clinical educator trainee

EHR: Electronic health records

GME: Graduate medical education

IM: Internal medicine

MS: Medical students

PBL: Professional based learning

PCMH: patient centered medical home

PGY: Post graduate year

SBL: System based learning

## **Declarations**

Ethics approval and consent to participate: The research study was approved by the Institutional Review Board of the Edward Via College of Osteopathic Medicine, IRB number 1208135-2

Consent for publication: Consent for publication was granted by PubClear of Orange Park Medical Center, a facility of HCA. This research was supported by HCA and/or an HCA affiliated entity. The views expressed in this publication represent those of the author(s) and do not necessarily represent the official views of HCA or any of its affiliated entities.

Availability of data and material: The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests: The authors declare that they have no competing interests

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Authors' contributions: YH collected, analyzed, and interpreted the data, he also wrote the first draft of the manuscript. AS helped in interpreting the data and was a major contributor to writing the manuscript. CT helped in developing the protocol and assisted in writing the manuscript. SB is the principal investigator who was instrumental in developing the curriculum and methodology of the research project and its protocol, he was also a major contributor to the writing of the manuscript. All authors read and approved the final manuscript.

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## Tables

**Table 1:** Modules for the Clinical-Educator Rotation

<b>Time frame</b>	<b>Category</b>	<b>Modules</b>
Week 1	Communication Science	<ul style="list-style-type: none"> <li>· Principles of Adult Learning &amp; Definitions</li> <li>· Reflective Practice / Journaling</li> <li>· Feedback</li> <li>· Electronic Health Records/Quality Documentation</li> </ul>
Week 2	Practice-Based Learning	<ul style="list-style-type: none"> <li>· Precepting Skills</li> <li>· RIME</li> <li>· Mentoring</li> <li>· Small Group Meetings / Skills</li> </ul>
Week 3	Systems-Based Learning	<ul style="list-style-type: none"> <li>· Relationship-centered communication</li> <li>· Problem learner</li> <li>· Difficult patient</li> <li>· Presentation Skills using digital tools</li> <li>· Managing Change &amp; Complexity</li> <li>· Social Media in Healthcare</li> <li>· Quality Improvement</li> <li>· Social Determinants of Health</li> <li>· Time Management</li> </ul>
Week 4	Professional Engagement	<ul style="list-style-type: none"> <li>· Leadership / Teams</li> <li>· Negotiation / Problem Solving</li> <li>· Patient-Centered Medical Home</li> <li>· Population Health</li> <li>· Precision Medicine</li> <li>· Value Healthcare</li> <li>· Innovation / Data &amp; Measurement</li> <li>· Health Systems</li> </ul>

RIME- Reporter, interpreter, manager, educator.

**Table 2:** Research objectives and questions

<p><b>Primary Objective and Questions</b></p>	<p>Does the Clinical Educator rotation directly improves resident competencies related to clinical teaching and professional growth?</p> <ol style="list-style-type: none"> <li>1. <i>Is there a difference in how CET communicate with stakeholders when compared with the control group?</i></li> <li>2. <i>Is there a difference, as compared to the control group, in how CET improve practice-based learning?</i></li> <li>3. <i>Is there a difference in levels of professional engagement between CET and the control group?</i></li> <li>4. <i>Is there a difference, as compared to the control group, in how CET demonstrate systems-based learning?</i></li> <li>5. <i>To what extent program objectives are met from the perspective of the clinical educator trainees?</i></li> </ol>
<p><b>Secondary Objective and Question</b></p>	<p>Assess medical students' perception of how do clinical educator trainees use and apply communication, practice-based learning, professional engagement, and system-based learning?</p>

CET- clinical educator trainee.

**Table 3:** Matrix of assessment methods

<p><b>Assessment Tools</b></p>	<p><b>Triangulation Methods</b></p>					<p><b>Themes</b></p>
	<p><b>Observation</b></p>	<p><b>Video</b></p>	<p><b>Journaling</b></p>	<p><b>EHR</b></p>	<p><b>Focus Group</b></p>	
<p>Huddle</p>	<p>Faculty</p>	<p>CET/C</p>	<p>-</p>	<p>CET/C</p>	<p>MS/R</p>	<p>Communication</p>
<p>Reflection</p>	<p>Faculty</p>	<p>CET</p>	<p>CET</p>	<p>-</p>	<p>MS/R</p>	<p>PBL</p>
<p>Presentation</p>	<p>Faculty</p>	<p>CET/C</p>	<p>-</p>	<p>-</p>	<p>MS/R</p>	<p>Professional Engagement</p>
<p>QNOTE</p>	<p>Faculty</p>	<p>-</p>	<p>-</p>	<p>CET/C</p>	<p>-</p>	<p>SBL</p>
<p>Pre/Post-Surveys</p>	<p>-</p>	<p>-</p>	<p>CET/C</p>	<p>-</p>	<p>-</p>	<p>All</p>

C- Controls, CET- Clinical-educator trainees, EHR- Electronic health records, MS- Medical students, PBL- Practice-based learning, R- Residents, SBL- Systems-based learning

Table 4. Explanation of the RIME Model

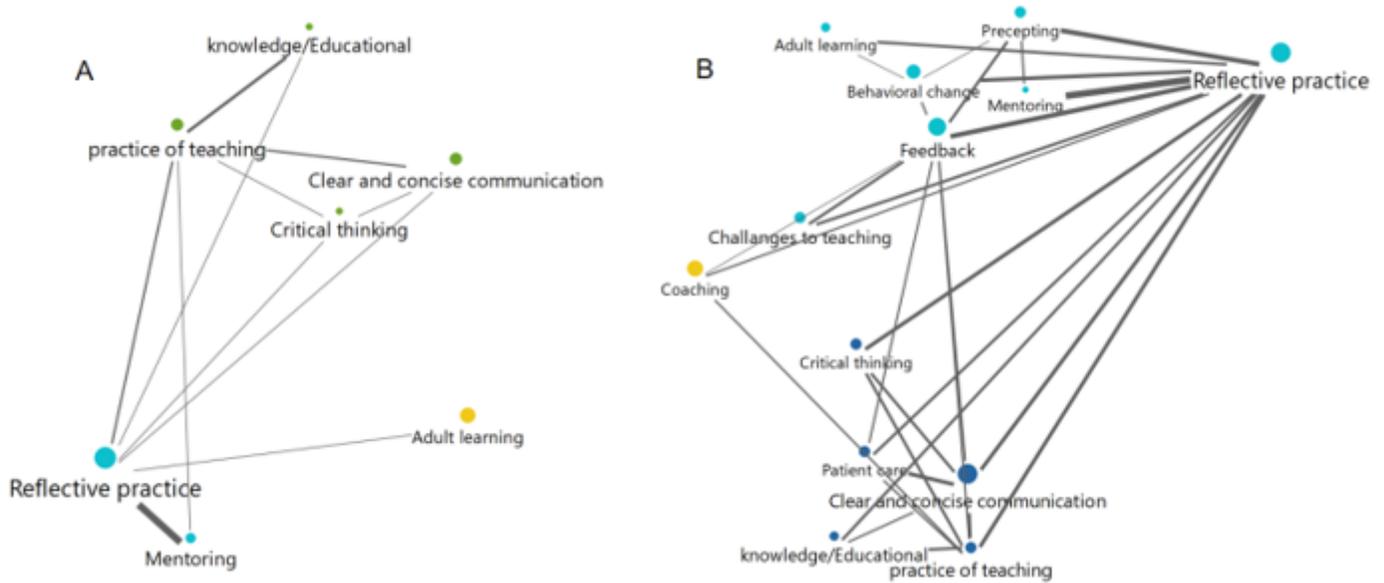
RIME Model	Function
Reporter	Gather and report data
Interpreter	Interprets information, applies medical knowledge, weighs evidence
Manager	Organize and manage information and resources, prioritize differential diagnoses with respect to the evidence, suggest appropriate considerations for plan of care
Educator	Articulate what is known, determine what needs to be known, convey medical knowledge in understandable terms to patients and colleagues

**Table 5:** Themes and codes. Codes are arranged in descending order according to frequency for all groups.

	<b>Codes</b>	<b>Examples</b>
Communication	Bedside teaching	"they did an excellent job of showing us what we haven't learned before, like how to properly do a joint exam"
	Clear and concise communication	"her communication is super clear, we understand what we are doing and why we are doing it"
	Coaching	"She helps to lead us if we are going to stray from the point"
	Collaborative	"I know if the residents engage with us I like that cause I got to work with the residents that I wouldn't otherwise got the chance to work with"
	Evaluation	"you are not worried as far as they are affecting you evaluation so you are taking the feedback and it is more open and easy going"
	Feedback	"I think I am better at giving feedback now that I have practiced multiple times and have received feedback on my feedback"
	Leadership	"it made me a better leader as well as more compassionate"
	Mentoring	"Mentoring is not easy either you have to focus and be understanding of a lot of things as it is not a one dimensional process"
	Planning	"It has created structure in how to approach bedside teaching"
	Questioning types	"Use questions which help them do analysis, synthesis and to increase their comprehension"
Learning	Efficiency	"he was well acquainted with him and his case, therefore the flow was very smooth"
	Motivation	"The role of a facilitator in the group by being involved and setting an example so that it motivated others as well"
	Objectives oriented	"I liked how the first day we went through our values and objectives, then began to formulate what we found to be important to us and whether we are meeting and exhibiting those values or not"
	Reflective practice	"Being more self-aware of habits and being able to sit back and think about what we are doing and why we are doing it"
	RIME	"The curriculum can help residents at different levels"
	Time management	"They are thorough and deliver information in an appropriate and timely manner"
Personal	Challenges	"To identify or own premised notions or biases"
	Cultural awareness	"Transnational competence: intricate, difficult to put into action effectively unless practiced"

	Independent practice	"You have to develop emotional intelligence, and be cognizance to treat patients as people and not numbers"
	Patient care	"it definitely improved patient care and safety"
	Practice of teaching	"the trainee did a great job keeping us focused on one subject/system/topic at a time and seemed to guide us when needed"
	Precepting	"when went to see patients he actually came with me and assessed how I did my HP. He observed me directly and when we finished the encounter he gave me feedback which was very helpful to have and kind of mentoring one-on-one"
	Professionalism	"Trainees engage in professional engagement by speaking to students properly"
	Responsibility for education	"[She] is also good at assigning patients that are good learning patients if you have seen like 3 MIs in a week, she assigns me a patient with gastritis so it's always something new so you are not constantly seeing the same patients"
3-	Critical thinking	"Residents innately use their own personal strategies to go about decision making"
4-	Evidence-based medicine	"Residents innately use their own personal strategies to go about decision making"
5-	Information retrieval	"We can use resources like images that was helpful and labs which was nice"
6-	Knowledge/ education	"Helps define reading for you that really high-yield"
7-	Organizational	"very organized in teaching us and for sure he was a great teacher in those three sessions"
8-	Technology use	"video readings helped identify areas in which I did not realize that I was appearing a certain way, and gave me concrete evidence of what I need to change"

## Figures



**Figure 1**

CET group: Pre- and post- clinical-educator rotation codes interactivity: A: pre-clinical educator rotation, B: post-clinical educator rotation. Each circle symbolizes a code. Distances between codes represents how similarly the codes have been applied. Colors highlight groupings. Connecting lines between the codes indicate which codes overlap or co-occur and their frequency.

## Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [SupplementReflectionRubric.pdf](#)
- [PostSurvey.pdf](#)