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INSTRUCTIONAL DESIGN AND ASSESSMENT

A Study of Layered Learning in Oncology

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Objective. To explore use of pharmacy learners as a means to expand pharmacy services in a layered learning practice model (LLPM), to examine whether an LLPM environment precludes achievement of knowledge-based learning objectives, and to explore learner perception of the experience.

Design. An acute care oncology pharmacy practice experience was redesigned to support the LLPM. Specifically, the redesign focused on micro discussion, standardized feedback (eg, rubrics), and cooperative learning to enhance educational gain through performing clinical activities.

Assessment. Posttest scores evaluating knowledge-based learning objectives increased in mean percentage compared to pretest values. Learners viewed the newly designed practice experience positively with respect to perceived knowledge attainment, improved clinical time management skills, contributions to patient care, and development of clinical and self-management skills. A fifth theme among students, comfort with learning, was also noted.

Conclusion. Layered learning in an oncology practice experience was well-received by pharmacy learners. Data suggest a practice experience in the LLPM environment does not preclude achieving knowledge-based learning objectives and supports further studies of the LLPM.

Keywords: Layered learning practice model (LLPM), active learning, experiential education, oncology

INTRODUCTION

The landscape of health care in the United States has been changing since the Affordable Care Act was signed into law in 2010. Demand for health care services is rising as the population ages. Reimbursement for services is declining, and there is an increase in demand for continuous quality improvement initiatives as well as reporting on quality measurements. As such, innovative services offered to patients remain at the forefront of practice keeping the following gestalt in mind “Use less, spend less, waste less.”^{1,2}

Institutions are beginning to explore use of pharmacy learners as a means to expand pharmacy services in a layered learning practice model (LLPM). Reports from health care institutions within the United States highlight use of pharmacy learners engaged in a variety of clinical activities as a means to grow pharmacy practice models and achieve clinical outcomes.^{3,4} Use of pharmacy

learners to enhance care of patients is a forecasted priority.¹ With a growing interest in pharmacy learners as a means to drive clinical outcomes, delivery of education through patient care activities is critical. This may be particularly important to consider when multiple learners at different levels in training are assigned to a single preceptor. Furthermore, it is important to consider the delivery of educational aspects of performing clinical activities and to provide adequate support for learners as they engage, especially when learners are beginning to independently provide patient care activities or when learners are integrated into delivery of novel pharmacy services to expand pharmacy practice models.⁴

Limited publications are available in the pharmacy literature that evaluate a layered learning approach to experiential pharmacy education.^{3,5-7} Studies evaluating the impact of implementing a LLPM at US institutions focus on the effect that learners have on clinical outcomes.³ However, academically-focused questions with respect to embracing this notion remain unanswered: whether layered learning enhances or detracts from quality experiential education; how one can provide education in a layered learning environment; whether learners will reject this practice; and how one can ensure that

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knowledgebase is growing at the same rate as clinical skill. While these questions linger, this model of education and immersing learners in apprenticeship roles has been a long time practice in medicine.⁸⁻¹²

Clinical teaching is founded on traditional apprenticeship models of “see one, do one, teach one.” As this paradigm continues to be pervasive in experiential medicine, concerns about numerous shortcomings have arisen.¹³ Lave and Wenger thought traditional apprenticeship models were too limited. As a result, they expanded the traditional clinical teaching model to community of practice (COP) theory, which emphasizes tacit, cognitive, and social aspects of learning that occur when the learner is immersed in a community of practice through legitimate peripheral participation.¹⁴ Growth in knowledge occurs through the process of changing identity in and through membership in a community of practice. As such, mastery is an organizational and relational aspect of communities of practice. In COP theory, developing an identity as a member of a community and becoming knowledgeably skillful are parts of the same process. Enhanced education through performing clinical activities, a key element of the LLPM environment, can be explained by COP theory.

In 2011, the University of North Carolina (UNC) Medical Center (UNCMC) and the Eshelman School of Pharmacy evaluated the possibility of engaging learners at different experience levels as a means to elevate teaching/learning and practice opportunities. This translated to learners at a different points in training (eg, advanced pharmacy practice experience (APPE) students, postgraduate year (PGY) 1 residents, PGY2 residents) being assigned to practice experiences and was called the LLPM. A challenging aspect of the LLPM is the dichotomy of responsibilities for the preceptor. For example, in addition to leading a team of pharmacy learners who, in partnership with the preceptor, provides care for patients, preceptors must also maintain a robust educational experience at an appropriate academic level for all learners.

The acute care oncology pharmacy practice experience is based in a large 804-bed academic medical center. The practice experience is a 4-week experience for APPE students, PGY1, and PGY2 oncology residents. On average, 20 patients are admitted to this service on any given day. The oncology service is routinely staffed by a multidisciplinary team that includes an attending physician, oncology medical fellow, second-year medical resident, two first-year medical residents, an attending pharmacist (AP), and a registered pharmacy technician who functions as a transitions-of-care specialist.¹⁵

Incorporation of pharmacy learners into the patient care process, part of the LLPM goals, presented

challenges to continuing pedagogical approaches (ie, topic discussions) commonly used. Time constraints made it difficult to attend to complex clinical responsibilities and present therapeutics in lecture format to each learner on rotation. Consequently, our team designed an approach to educate learners within an experiential setting that included multiple layers of learners (eg, APPE students, PGY1 and PGY2 residents). The redesign was intended to support a larger volume of learners at different places in their training. The approach focused on micro discussion, standardized feedback (eg, rubrics), and cooperative learning to enhance educational gain through performing clinical activities. Developing this strategy required changes to the practice experience including preceptor orientation and trainee approaches to learning. The change in orientation necessitated experiential syllabus redesign, alteration in teaching methods, and learning activities. Thus, the purpose of this study was to (1) describe delivery of education in an oncology pharmacy LLPM environment; (2) evaluate achievement of knowledge-based learning objectives in a group of learners engaged in the LLPM; and (3) explore learner perception of the LLPM experience.

DESIGN

Considering the demand for expansion of pharmacist care services (eg, medication reconciliation and discharge counseling) as well as a growing volume of learners, the LLPM represented an opportunity to possibly accommodate both needs. Practicing pharmacy in the LLPM environment causes a shift in orientation of care to occur. It moves the preceptor from being the major driver of pharmacist care services to being responsible for managing a team that works toward these goals. In this context, it was unknown whether adding new pharmacist care services would enhance learning or pose a barrier to it. Because of time constraints, new pharmacist care services ultimately replaced previous pedagogical approaches. Furthermore, learner perception of the experience was unknown. Our team evaluated practice experience design, made changes to support the LLPM, and conducted this evaluation. This study was reviewed and approved by the UNC institutional review board. Overall, the new design of the acute care oncology pharmacy practice experience was developed to: (1) provide robust education to all trainees in a LLPM; (2) reduce time to learner immersion in clinical activities; (3) support residents as copreceptors; and (4) enhance education through performing clinical activities.

Preparation was necessary to implement the new approach to education in the LLPM environment. Two preceptors and one first year resident were principally

involved in the creation of educational tools, learning activities, and structuring of educational activities included as part of the LLPM. Preceptor colleagues assisted with peer review of newly designed educational tools. From concept to reality, preparing for the new approach to education in the LLPM environment took approximately six months. In addition, a team-teaching approach to review oncology-specific content was coordinated by oncology preceptors for each learning level. As part of this arrangement, all preceptors rotated to facilitate the learning activities. Weekly sessions with predefined content, designed by board-certified oncology preceptors, were created as part of a longitudinal curriculum. These sessions, called "Hematology/Oncology Power Hours (HOPS)" were designed to focus on learning at the level of the PGY2 oncology resident. The HOPS content featured advanced level programming that offered continuing education credit for each activity. The content aligned with oncology residency requirements and material tested to achieve board certification in oncology pharmacy. In addition, weekly sessions were coordinated that focused on foundational oncology content such as anticoagulation in cancer, pain management, benign hematology, among other topics. This activity was intended to target learning at the level of APPE students and was designed to be appropriate for a PGY1 learner as well.

A syllabus for this practice experience was created for each layer of learner (eg, APPE students, PGY1 and PGY2 oncology residents). Each syllabus had clear rotational outcomes, goals, and objectives stratified by knowledge, ability, and professionalism for every learning layer.

A key element of the syllabus redesign was that when comparing and contrasting learning level syllabi with respect to knowledge-based learning objectives, the objectives varied in both depth and breadth of subject matter. However, general content was consistent among all learning levels. Knowledge-based content was selected according to the most commonly encountered clinical scenarios on the acute care oncology service.¹⁶ Educational activities were developed to coach the learner through development of the library of oncology pharmacy illness scripts irrespective of patient cases encountered on service and highlighted by the learning objectives.¹⁶

For each learning level, a case-based self-study learning guide was created that aligned with learning objectives for the practice experience. The guide was given to the learner at the start of the experiential month. Within this document, a general timeline was constructed to guide the learner in time management of educational activities. The suggested time frame of completion was generally one to two key practice experience concepts per

week with completion of the entire guide spanning over the course of the experiential month. Therefore, concept ordering in the learning guide was strategic, with content at the beginning of the learning guide being basic and building toward more advanced content. Given that one of the objectives of the LLPM was to improve pharmacy-related national patient safety goals, some content focused on background information and system processes that the learner needed to know to perform clinical activities such as medication reconciliation, medication history taking, patient counseling, creation of adherence care plans, and navigation of specialty pharmacy services. Students were to complete these sections of the learning guide prior to the first day of the practice experience. Structuring the learning guide this way was meant to allow learners to engage in higher orders of critical thinking when encountering patients. For each lesson, background reading citations were offered alongside key learning concepts. This was supplemented with case-based scenarios learners were instructed to work through.

Using the learning guide in this manner parallels the flipped classroom model where the review of content occurs prior to the first learning activity.¹⁷ This was followed by application of this content through performing clinical activities. Evaluation of learner performance of clinical activities took place through observation and real-time feedback using a rubric to ensure consistent evaluations took place. This technique was helpful when engaging the learner team in new and innovative pharmacist care services that could help grow the pharmacy practice model and when they were first engaging in independent performance of clinical activities.

Both APPE students and PGY1 residents were required to maintain a daily log. In the log, they identified concepts learned and expanded on them with a short excerpt describing what was learned using one to two supporting primary literature references. Topics were learner-identified. The daily log was meant to reinforce educational content encountered during the experiential month. Originally maintained in a Microsoft Word document submitted weekly to the preceptor for review, the learning log was recreated as a wiki-based online tool called Pharmacopedia (UNC Eshelman School of Pharmacy, Chapel Hill, NC). The Pharmacopedia program functions like a message board where learners can post their learning log entries online using wiki text programming. These entries are accessible to other current or future learners in the practice experience. Using Pharmacopedia allowed real-time preceptor review of content and thus feedback and coaching for the learner. Preceptor feedback included micro-discussion on entries to reinforce and clarify content. In addition, posted topics could

be shared among learners as an educational resource. Lastly, learner performance evaluation data could be discerned based on selection of topics.

Orientation content was provided to learners prior to the experiential month and included a copy of the syllabus and respective learning guide. In addition, information pertinent to the acute care service and an introduction to aspects and processes that are part of the service (eg, specialty pharmacy services, prescription insurance, and medication assistance programs) were provided to learners. Assessment rubrics for clinical activities such as admission medication histories and patient counseling were also distributed. Information relative to expectations with regard to monitoring parameters for an oncology patient and presentation of an oncology patient case was developed in a written format and also given to learners up front. Literature on precepting practices and experiential education was distributed to residents. Lastly, learners were required to complete a prerotation questionnaire that inquired about short-term and long-term learning goals.

In the previous model, this content was covered in a lecture-based format as part of the orientation process. In the LLPM experience, the same information was given to learners on an electronic platform with the request to review it prior to the first day of the practice experience. This evolved over time into a website resource in which orientation documents were housed to offer learners more context and convenient access to the information. Learners were encouraged to apply learned concepts by performing clinical activities immediately upon starting the practice experience. Examples of clinical activities included medication reconciliation, resident-led patient counseling, and for APPE students, taking admission medication histories. Thus, this process resembles a flipped model approach in the classroom containing all three elements of a flipped model (preclass content, student centered active learning, assessment of student learning).

The layered practice experience was designed to incorporate cooperative learning techniques into cognitive development of learners through near peer teaching.¹⁸ Learner layers included one resident and one APPE student. Either a PGY1 or PGY2 resident served as copreceptor of the APPE student with the AP preceptor. Further, knowledge-based learning objective content was consistent among the three learning levels and thus created a structure in which a resident teaching an APPE student reinforced resident retention of content according to the learning pyramid.¹⁹ To support this process, the AP preceptor created an answer key to the APPE student learning guide and offered this for the resident to use as a tool to facilitate cooperative learning. The answer key contained answers to case questions, but also included talking points

and considerations of the educational content to guide discussion and learning activities between the resident and APPE student. The resident also reviewed patients the APPE student cared for on a daily basis. The AP preceptor was responsible for the resident's learning activities pertaining to learning guide content and patients the resident cared for. For residents and APPE students, patient volume was gradually increased over time according to learner level and tailored to individual progress.

Providing a written performance evaluation was reviewed with the resident at the start of the experiential month. The resident was encouraged to maintain a log documenting teaching activities pursued with the APPE student and observations throughout the month. The written evaluation for the student was edited by the AP preceptor to produce the final written evaluation for the student. The AP preceptor also provided written evaluation for the resident at the end of the practice experience.

The practice experience was structured to provide each learner with a higher volume of and continual feedback throughout the experience. Feedback was offered in a goal-oriented, objective, performance-based, sensitive style, with the learner and preceptor working together to create a common goal, a process often called feed-forward.²⁰ In addition to feedback offered in real-time as practice experience activities occurred, the AP preceptor scheduled time dedicated to reflecting on the experience with each learner each week for three meetings, followed by a formal end-of-experience evaluation during the last week. These interactions focused on whether or not the practice experience was meeting learner goals or if there were any aspects that required change. Furthermore, the AP preceptor provided constructive feedback that included development of goals for the upcoming week.²¹ Reflective sessions allowed the resident and/or student to identify new goals to incorporate into the experience. The process of giving verbal feedback to the APPE student was facilitated by the AP preceptor and used as a learning experience for the resident. The AP preceptor provided the resident constructive feedback verbally during each reflection meeting.

Two rubrics were created to objectively guide feedback given for APPE student medication histories and resident-led patient counseling sessions. The resident and student were given the medication history and patient counseling rubrics at the start of the practice experience, and the tool was reviewed with them. All skill rubrics created were based on a patient-centered approach to care.^{22,23}

EVALUATION AND ASSESSMENT

Sixteen learners who were assigned to the acute care oncology pharmacy practice experience from August

Table 1. Learner Pre/Posttest Scores for 4-Month Evaluation (N=8, 4 APPE Students and 4 Residents)

Learner Layers Per Month	%			
	APPE Student Pretest	APPE Student Posttest	Resident Pretest*	Resident Posttest*
Month 1: APPE Student #1/Resident #1	30	50	60	80
Month 2: APPE Student #2/Resident #2	40	70	40	50
Month 3: APPE Student #3/Resident #3	90	100	70	80
Month 4: APPE Student #4/Resident #4	80	90	70	80

*Small sample size prohibits publication of stratified scores by resident level

2012-November 2013 were included in this evaluation. Stage of learner was not used to schedule learners when assigning them to the practice experience during the study period. For both APPE students and PGY1 or PGY2 residents, there were learner layers in the first half of the experiential or residency year (seven learner layers) and others who were in their second half of the year (one learner layer). Demographics of the learners included APPE students (n=8), PGY1 (n=1) and PGY2-oncology (n=7) residents. Within this time frame, a four-month evaluation was conducted to assess achievement of knowledge-based learning objectives in a subgroup of learners within the 16-learner cohort. This subgroup included three PGY2-oncology residents, one PGY1 resident and four APPE students.

During the four-month evaluation, a 10-item pre/posttest assessment was given (100% response rate). The same set of multiple choice questions were used for both the pretest and the posttest. Questions were constructed for each learner layer to test content supported by the self-study learning guide. Domains of content evaluated for every learner layer included chemotherapy order review and febrile neutropenia as well as antimicrobial prophylaxis. For APPE students, evaluation included content focused on chemotherapy-induced nausea and

vomiting, vancomycin pharmacokinetics, pain management, and hematopoiesis. For APPE students and the PGY1 resident, evaluations included content on anticoagulation in cancer. For both PGY1 and PGY2-oncology residents, the evaluation included content on chemotherapy-related discharge coordination, and chemotherapy toxicity. Lastly, for PGY2-oncology residents, the evaluation included content on selection of chemotherapy regimen.

Descriptive statistics were used to analyze the results. All learners improved their scores based on pre/posttest values (Table 1). Students and residents had varying entry scores on the pretest with an average score of 60% for both learner cohorts. There was an overall positive value change in percentage of difference between pretest and posttest scores with a mean change in score of +15%. When comparing percentage of change, students had the largest change in scores (+18% average change) followed by residents who improved their scores +12.5%. All APPE students and residents passed this practice experience.

To assess learner perceptions of experiential education in the LLPM environment, qualitative research methods were applied to evaluate feedback from the 16 learners assigned to the practice experience. Comments

Table 2. Educational Design Principles for Layered Learning Practice Model in Pharmacy Practice Experiences

Design stratified learning outcomes with supporting goals and objectives for each level of learner; learning objectives should be congruent across all learner layers but differ in depth and breadth (eg, rotation-specific syllabus)
Directly link all learning objectives to rotational activities (eg, a febrile neutropenia learning objective is supported by a section of the self-study guide)
Shift foundational and orientation content to a self-study approach as a means of maximizing learner time engaged in performing clinical activities (eg, create a practice experience website and self-study learning guide)
Facilitate, motivate, and provide framework to learners to empower them to engage in self-directed learning; use micro-discussions to reinforce and clarify content (eg, provide structure in the form of a self-study learning guide and review the content to clarify any misunderstand of material)
More advanced levels of learners should engage in near peer teaching with junior learners to reinforce their own understanding and develop teaching competencies; however, they will require differentiated support by the primary preceptor to do so (eg, create an answer key with discussion points on self-study learning guide content for the more senior learner to use when teaching a more junior learner)
Provide additional learning strategies to enhance learner education through direct patient care activities (eg, evaluation rubrics)

from resident and student evaluations, as well as written feedback from residents and students who experienced the practice experience as part of the LLPM, were analyzed. Qualitative feedback submitted either through the formalized evaluation process or written and submitted to the AP preceptor was reviewed by four independent persons, who categorized and coded the data thematically.²⁴ The coders collectively refined the categories and used descriptive results to generate key themes present in these data.

Overall, APPE student and resident feedback on the new practice experience design was positive. Residents discussed four major themes: perceived knowledge attainment, improved clinical time management skills, contributions to patient care and development of clinical and self-management skills. Students also focused on these four themes with an addition of a fifth theme, comfort with learning.

Students and residents both verbalized that they felt like they developed a deeper understanding of oncology pharmacy as a result of completing the practice experience. Perceived attainment of knowledge was described by residents and students. Resident comments highlighted the practice experience structure, which supported self-directed learning: “The LLPM focuses on independent learning, which is one area that I have improved in this month. This is especially important, as this is an essential skill after residency.” Students perceived the learning guide, discussions of content, and Pharmacopedia as valuable tools to support their knowledge construction: “The learning guide, projects and pharmacopedia entries allow students to keep learning oncology knowledge and patient care skills in an efficient way. Through this rotation, I learned more than I expected.”

Learners perceived an increased ability to manage the demands of a clinical service. Learners expressed that the demand and busy nature of the service and practice experience were unlike any experience they had to that point, which forced them to improve their time management. This theme was more prevalent in resident commentary: “I had opportunity to practice autonomously on a very difficult inpatient service and work on my prioritizing and time management skills.”

Learners reported believing they provided responsible care for patients and contributed to patient care as part of the interdisciplinary health care team: “This opportunity [rounding] provided opportunities to provide patient-centered care to my patients. I was able to round on a daily basis, provide effective disease state and drug therapy monitoring, make therapy-related recommendations, as well as help ensure that patients were able to have access to appropriate medications upon discharge. Having the

opportunity to round as part of a multidisciplinary team, and incorporate oneself as a valued team member.”

Residents often described the theme of developing clinical and self-management skills. Residents associated their skill development most commonly with practice in clinical activities, but also with performing the duties of a resident preceptor: “Being the primary preceptor was an excellent learning experience and taught me how to be organized for both me and the student, as well as manage our time to be able to complete patient care activities and topic discussions. Also, I was able to work towards one of my overall goals of giving feedback. In the student mid-point evaluation, I was required to give some constructive feedback in communication. The student understood and immediately worked towards improving communication skills.”

Most APPE students favored the near peer teaching structure of the new practice experience design: “Having a resident as a preceptor I feel is a little less intimidating than having the primary preceptor as the only preceptor, and I think there was a better comfort level there. Also, especially with pharmacy students that plan to do a residency, I feel having the immediate preceptor being a resident can give invaluable feedback and encouragement to prepare for residency, having very recently been through that process.”

Thus, the data suggests that the new approach to education coupled with the introduction of the LLPM environment was well-received by learners and did not appear to preclude achieving knowledge-based learning objectives.

DISCUSSION

Community of practice theory emphasizes learning cognitive and physical skills inside a community of diverse expertise.¹⁴ The LLPM is best represented by the COP theory where the community is the health care team. In communities of practice, students learn through legitimate peripheral participation. Layered learners are legitimate (required to be there), peripheral (experts are central), and participants (perform patient care services). From participation in patient services, learners derive meaning, purpose, and ultimately a professional identity.²⁵ In theme 3, learners described how this model allowed them greater participation in patient care. This facilitated the students’ view of themselves as valued health care team members.

In COP, learners acquire not only domain knowledge (addressed in theme 1, knowledge attainment), but also heuristic strategies (applicable techniques for accomplishing techniques), control strategies (techniques for solving problems), and learning strategies.²⁶ More informal and

tacit learning was described by theme 2, improved clinical time management skills, and theme 4, development of clinical and self-management skills. In clinical clerkships, students must also have safe learning environments with support in cognitive, affective, and practical domains.^{27,28} The APPE students' theme of comfort in learning is evidence for this need for support, which allows learners to transition to a more central, expert position in the community of practice. Making the transition to provide experiential education in a LLPM environment can be a challenging undertaking. Therefore, we present core educational design principles that could be applied to a given practice site in Table 2.

A larger amount of time was spent preparing for learner experiences in the LLPM environment. This included increased time needed to create and continuously review educational tools, as well as time to coordinate monthly activities for learner teams. Consequently, a checklist of practice experience onboarding components was created to improve preceptor efficiency. It was challenging to create new time management habits and execute learning activities as planned until preceptors learned to function in their new role. The experience underscored that educating learners in this style demanded a different method of leadership using different skillsets. Clinical care of patients was thought to be more thorough and offer more breadth of pharmacy activity. Time was easier to manage with a less lecture-based approach to experiential education (ie topic discussions).

The practice experience itself was more consistent from learner team to learner team. This has important potential benefit to the medical center. More consistent academic practices create an environment in which expectation of deliverables from the pharmacy team are evident in practice. Using a flipped model that frontloads the learner with foundational content allows learners to apply learned concepts to more direct participation in patient care activities. This has potential to translate to scenarios in which the learner serves as a pharmacist extender and provides care services that benefit both patients and the institution, such as medication reconciliation. Additionally, time dedicated to orienting the learner is reduced and therefore does not interfere with patient care activities. This allows the pharmacist and the learners to be more visible to the health care team and patients. With increased patient care activities (eg, medication reconciliation, admission medication histories, patient counseling), the quality of patient care is improved, which may translate into better patient outcomes and less financial losses in the Accountable Care era of health care. Indeed, this experiential education design has the potential to advance the

role of the pharmacist. Not only does the model support growth in knowledge, but, it also considers building practical skill sets and attitudes needed to practice in advanced roles.

Learner perceptions of the practice experience were positive and achievement of knowledge-based learning objectives did not appear to be compromised when providing education in a LLPM environment. This has important implications for the institution to further strengthen the relationship between the medical center and the school of pharmacy. Additionally, for our institution, this model aligns well with goals outlined as part of the renaissance curriculum transformation taking place at the school.²⁹

The authors appreciate multiple limitations associated with this report. This was a small sample size, which may preclude generalizability of the results. Layering of learners only included resident to APPE student layers and did not include resident to resident layers, introductory pharmacy practice experience (IPPE) students or layer variations beyond two learners. Additionally, few PGY1 resident to APPE student layers were included in the evaluation. Furthermore, analyzing a dataset of learners assigned to one individual preceptor undoubtedly introduced subjectivity.

Once our institution implemented the LLPM environment, this became the "standard of care" for the oncology pharmacy practice experience and consequently no control cohort was included in the data analyses. As a result, it is difficult to discern whether these results can specifically be attributed to any of the changes made to experiential education provided in the LLPM environment. Further, the acute care medical service was within oncology pharmacy, a specialized area of practice. Much of the practice experience design was included to empower the learner to provide care at a higher level on a specialized service they may have had little to no experience with.

It is probable that institutional differences in hospital type, affiliations with a pharmacy school, pharmacy practice models, block scheduling, and available learner volume will present challenges to incorporating the techniques outlined here. The data are preliminary and intended to be exploratory and education theory-generating as well as an illustration of a potential "best practice" in experiential pharmacy education delivered within a LLPM environment.

Further studies are warranted in a larger sample size to better characterize layered learning in terms of depth of understanding, measures of problem solving, motivation for further learning and retention rates.² Additionally, more robust quality measures that capture the benefits

of the LLPM at the institutional level, development of preceptor skills, and performance evaluation approaches that improve preceptor accuracy would be beneficial to study.

CONCLUSION

This approach to education in a practice experience supports adoption and expansion of the LLPM. Coupled with the introduction of the LLPM environment, this approach was well-received by learners and did not appear to preclude achieving knowledge-based learning objectives. Broadening this model to other experiential practice sites would serve to generate a larger sample size through which more robust evaluation would be possible. Exploration of patient and institutional outcomes in the setting of the LLPM would be interesting to explore.

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