

# EXPERIENTIAL LEARNING IN THE VETERINARY SETTING:

## DIFFRACTING WHAT MATTERS

by

KATHERINE HEATHER LINDELL

(Under the Direction of Aliko Nicolaides)

### ABSTRACT

Experiential learning is an adult learning approach used in pharmacy schools for educating professional students. In this new materialist research informed by agential realism, I apply a diffractive methodology to garner insights, to stimulate further inquiries, and to illuminate where effects of differences appear during experiential learning rotations of pharmacy students in veterinary settings. I introduce the background of my area of study including the concern (problem), the intent (purpose), mattering (significance), and common notions employed when engaging an agential realist approach (e.g., intra-action). I trouble foundational adult learning theories, methodologies, and methods by examining experiential learning genealogy and exploring emerging approaches (e.g., generative knowing, diffraction). To generate data for engaging a diffractive methodology and associated diffractive analysis, I conduct semi-structured interviews, host focus groups; and collect documents, artifacts, and collages. I find employing post-anthropocentric learning (humans-animals-environments in-relationship; One Health concept) in pharmacy curriculum contributes a different approach to adult learning models of experiential learning and produces insights (e.g., contingencies and implications). From illuminations, I generate future analytical inquiries to examine entanglements making a

difference benefiting human and nonhuman health within and of the world (health of environments). Importantly I find, by employing agential realism (ethico-onto-epistemological framework) we can apply post-anthropocentric learning methods and examine differences mattering, how practices matter, and for whom they matter.

INDEX WORDS:     Adult learning, Experiential learning, Transdisciplinarity, Diffractive methodology, Agential realism, Intra-active entanglement, Becoming, Post-anthropocentric learning, One Health

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DEDICATION

To God the Father, God the Son, God the Holy Spirit...

the original entanglement.

## ACKNOWLEDGEMENTS

Thanks be to God and the divine intervention provided to carry me through this doctoral journey. I am thankful for the humans and nonhumans entangling with me on the path to becoming PhD. When teaching professional students, I would ask my class coordinator, Trina von Waldner, many questions about adult learning. One day, after a string of questioning, she told me I needed to go get my PhD in adult learning. I took her advice and applied to the Learning, Leadership, and Organization Development (LLOD) program. Karen Watkins and Juanita Johnson-Bailey, world renowned scholars, interviewed me and graciously accepted me into the program. I am thankful for their positive response. I am grateful for the departmental coordinators, my faculty, cohort, collaborations, peer reviews, and writing groups.

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When I took my first qualitative research class with Kathy Roulston, I wondered why I had never learned different qualitative approaches before. Coming from a medical professional

learning background and experience with numerous drug studies, a mixed methods approach entailed quantitative numbers and qualitative descriptive statistics. However, I learned so much more about qualitative research with Dr. Roulston. Dr. Roulston inspired me to obtain a qualitative research certificate as I progressed in the PhD program, and she introduced me to new materialism. The new materialist learning resonated with me, leading me to pursue more qualitative research learning and to adopt a new materialist underpinning in my research.

In this research I conducted interviews with past pharmacy students and preceptors. I am thankful to the Society of Veterinary Hospital Pharmacists (SVHP) for allowing me to recruit participants from their organization. Thank you to all research participants who entangled with me sharing knowledge and materials. I humbly submit this manuscript to readers for a virtual knowledge sharing experience. I am thankful for you.

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## CHAPTER 1

### INTRODUCTION

It is vitally important that we understand how matter matters. (Barad, 2003, p. 803)

Pharmacy schools around the world offer experiential learning rotations to their professional pharmacy students; however, not all pharmacy schools offer veterinary pharmacy experiential learning rotations. Experiential learning, in the form of Advanced Pharmacy Practice Experience (APPE)<sup>1</sup> rotations, is situated in adult learning. Adult learning diffracted through a new materialist philosophy informed by agential realism (Barad, 2007) and the One Health concept (CDC, 2021; WHO, 2017) is examined in this research. The context<sup>2</sup> for the study is APPE experiential learning of pharmacy students in veterinary settings. I engaged preceptors who facilitated learning of APPE students in veterinary settings and pharmacy students who completed an APPE rotation in a veterinary setting.

This chapter serves as an introductory review of theories and approaches used in the research study. It contains the background of the inquiry and troubles anthropocentric (human-centered) learning. The intent of the agential realist research is presented followed by an overview of the significance of the research. The chapter starts with what is known about adult learning and experiential learning, then moves into a review of agential realist notions engaged throughout the research.

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<sup>1</sup> An Advanced Pharmacy Practice Experience (APPE) is experiential learning. Professional pharmacy students in their last year of pharmacy school rotate through different practice sites under the supervision of a preceptor. They use foundational knowledge they gained while in school to apply their pharmacy learning in real-life practices.

<sup>2</sup> I use 'context' throughout not to signify a container with fixed boundaries and separability of agents but through an agential realist 'context' of intra-active entanglements and inseparability.

### **Inquiry Concern**

Pharmacy students engage experiential learning during APPE rotations the last year of their professional Doctor of Pharmacy (PharmD) degree program. Experiential learning, facilitated by preceptors (learning facilitators) at different APPE rotation sites, supports students' continued pharmacy learning: "APPEs integrate, apply, reinforce, and advance the knowledge, skills, attitudes, abilities, and behaviors developed in the Pre-APPE curriculum, co-curriculum, and extracurricular activities" (ACPE, 2024, p. 10). Students must complete four core APPEs and can rotate through a limited number of electives. Being a preceptor for pharmacy students in the veterinary setting for over two decades, I learned from students not many of them have foundational learning about animal medicine before coming to their veterinary pharmacy APPE rotation.

Considering how many pharmacy students are exposed to mostly anthropocentric pharmacy learning, there is an epistemological exclusion concerning veterinary pharmacy knowledge, an ontological exclusion of students becoming veterinary pharmacists, and an ethical exclusion in the medical care of animals. For many students I precept in a veterinary setting, the experiential learning rotation is the only exposure to veterinary pharmacy learning they will receive while in school. Therefore, I engaged a new materialist philosophy informed by Barad's (2007) agential realism theory and diffractive methodology to examine interview data from pharmacy students who completed an APPE rotation in a veterinary setting; to examine data from a focus group comprised of preceptors from veterinary settings who precepted pharmacy students; and to examine gathered documents, artifacts, and collages from students and preceptors. Engaging this research approach stimulated and overarching inquiry: *What happens*

*to the way we want to grow and develop our future veterinary pharmacists when we approach adult learning through a post-anthropocentric new materialist philosophy?*

### **Study Entanglement**

The intent of employing an agential realist<sup>3</sup> research approach encompassed garnering insights and further inquiries into adult learning by engaging a diffractive methodology for illuminating where effects of differences appeared when exploring performative intra-active entanglements during experiential learning rotations of pharmacy students in veterinary settings.

Research questions included:

Q1 What aspects of experiential learning in the veterinary setting illuminate the learner's way of valuing (ethics), being (ontology), and knowing (epistemology)?

Q2 In what ways are *matters*<sup>4</sup> significant in the student's veterinary pharmacy experiential learning in the veterinary setting?

Q3 Where do effects of difference appear in the context of experiential learning in veterinary settings?

### **Mattering**

Agential realism is an ethico-onto-epistemological<sup>5</sup> framework with a holistic approach to matter (e.g., dynamic intra-activity of humans, animals, environments, technologies, pharmaceuticals). An agential realist approach relationally enfolds both material and discursive (material-discursive) considerations producing phenomenon. Importantly, intra-activity informs matter; meaning, "*matter is substance in its intra-active becoming—not a thing, but a doing, a*

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<sup>3</sup> Agential realism is an ethico-onto-epistemological framework proffered by Karen Barad (2007).

<sup>4</sup> Materialization of phenomenon (Barad, 2003).

<sup>5</sup> Barad (2007) proposed agential realism as an ethico-onto-epistemology framework bringing binaries such as human and nonhuman into an entanglement with one another. Valuing (ethics), be(ing)coming (ontology), and knowing (epistemology) are not separate in the entanglement but are in-relation.

*congealing of agency. Matter is a stabilizing and destabilizing process of iterative intra-activity*” (Barad, 2003, p. 822). “Matter matters” (Barad, 2007, p. 210) and how students intra-actively entangle with other matter (material-discursive practices producing phenomena) yields insight “that distinct agencies do not precede, but rather emerge through, their intra-action” (p. 33).

Agential realism theory informed by new materialist philosophy can be used to explore becoming professional and intra-active entanglements engaged during the process of *becoming* (Hancock, 2020). New materialist philosophy (post-anthropocentric understandings) can also be used to facilitate learning related to professional ethics and entanglements of animals within the space of learning (Sayers et al., 2021). Pushing past anthropocentrism in pharmacy curriculum has potential to contribute new adult learning insights for the benefit of human and nonhuman health within the world by recognizing intra-active entanglements mattering.

In this agential realist diffractive research, engaging a diffractive methodology by reading through theories and concepts is used as a tool (diffractive analysis) for mapping where effects of difference appear. In the words of Barad (2007), “mattering is differentiating, and which differences come to matter, matter in the iterative production of different differences” (p. 137). Mattering in the heading of this section points to the significance of the study; however, in an agential realist account, mattering is performative. Mattering entails open-ended (iterative) dynamically relational material-discursive practices producing phenomena through specific causal intra-activity. Adult learning and experiential learning are troubled in this chapter to examine what is known and why an inquiry employing notions of agential realism is important for the differential mattering of the world (e.g., post-anthropocentric perspective of adult learning; post-anthropocentric approaches to experiential learning). Therefore, the words in the

title of the research “diffracting what matters” can be understood as an exploration of relational material-discursive practices and causal intra-activities.

### What is Known?

Although philosophers (e.g., Aristotle, Confucius, Plato, Socrates) mulled over learning and knowledge, it was not until later in the nineteenth century when scholars began to systematically research learning and knowledge (Merriam & Bierema, 2013). From these scholars came foundational learning theories including behaviorism, pragmatism, humanism, cognitivism, and constructivism (see Table 1.1). These theories underpin adult learning practices depending on the approach of the practitioner.

**Table 1.1**

*Foundational Learning Theories*

| <b>Theory</b>                  | <b>Key Scholar(s)</b>                                                           | <b>Attribute</b>                                                                                                                                                                                    |
|--------------------------------|---------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Behaviorism                    | John B. Watson, Burrhus F. Skinner, Edward L. Thorndike                         | Facilitating and rewarding behavioral change and learning performance towards set standards (e.g., competency-based learning; evidence-based practice; learning objectives and measurable outcomes) |
| Pragmatism                     | John Dewey                                                                      | Learning focused on practical applications (utility), interests, experience (hands-on doing), holistic integrative approach to learning, and what is known today can change (facts can change)      |
| Humanism                       | Abraham Maslow, Carl Rogers, James F.T. Bugental, Malcolm Knowles, Jack Mezirow | Whole person learning towards self-learning and realization                                                                                                                                         |
| Cognitivism/Social cognitivism | Jean Piaget, David Ausubel, Robert Gagne, Benjamin S. Bloom/Albert Bandura      | Learning through mental processes (information processing)/learning is cognitive and a social construct (cognitive processes + observing others)                                                    |
| Constructivism                 | Lev Vygotsky                                                                    | Learning is cognitive, contextual, self-directed, via experience, and processed through social constructs                                                                                           |

*Note:* Adapted from Merriam and Bierema (2013).

Merriam and Baumgartner (2020) credit Malcom Knowles as introducing the term *andragogy* in North America via a 1968 article, focused on the adult learner. Knowles' andragogy theory of adult learning pushed towards self-directed learning and intrinsic motivation; however, it lacked social factors, context, reflectivity, and extrinsic motivation. Even though it provided a base to build upon, it alone did not go deep enough to address the full context and complexity of professional pharmacy education. Adult learning theory underwent enhancement by Mezirow (1981), who built on the foundation of Jurgen Habermas' three domains of cognitive learning, bringing forth transformative learning and reflective practices. Kolb (1984) built on foundational theories of Jean Piaget, John Dewey, and Kurt Lewin to develop an experiential learning theory (model). Kolb's (1984) model has been applied to experiential learning of APPE rotations (Briceland & Hamilton, 2010; Gurney et al., 2019; Margolis et al., 2020; Romani & Lima, 2022; Romani et al., 2022).

Constructivism produced the foundational adult learning theory of Kolb's (1984) experiential learning model. Experiential learning builds upon knowledge and experience for the student to make meaning. Humanism can also be appreciated since the focus is on whole person learning of the student. Typically, pharmacy students apply knowledge gained from classroom or laboratory learning while in pharmacy school to real-world situations during their last year while on APPE rotations. Based on the experiential learning model of Kolb (1984), Kolb and Kolb (2005) posited,

experiential learning is a process of constructing knowledge that involves a creative tension among the four learning modes that is responsive to contextual demands. This process is portrayed as an idealized learning cycle or spiral where the learner “touches all the bases”— experiencing, reflecting, thinking, and acting—in a recursive process that is

responsive to the learning situation and what is being learned. Immediate or concrete experiences are the basis for observations and reflections. These reflections are assimilated and distilled into abstract concepts from which new implications for action can be drawn. These implications can be actively tested and serve as guides in creating new experiences. (p. 194)

As gleaned from Kolb and Kolb's (2005) description of experiential learning theory, preceptors can harvest other theories of learning for enhancing experiential learning. Other theories may include cognitive theory (Palmer & Williams, 2013; Schumacher et al., 2013; Williams et al., 2016), reflective practices (Mezirow, 1981; Schön, D. A., 1987), and transformative learning theory (Mezirow, 1981, 2000) to employ a holistic approach for meeting the learner where they are within their context. The holistic approach may lean towards a Gestalt praxis within "socially responsible objectives" (du Coudray, 2020, p. 168). In the context of APPE, socially responsible objectives can be found in Accreditation Council for Pharmacy Education (ACPE, 2024) Standard 3.2.a: "APPEs expose students to diverse populations that include age; gender; neurodivergent, race/ethnicity, socioeconomic factors; and disease states" (p. 11).

The ACPE is the United States' national agency recognized by the U.S. Department of Education responsible for developing standards and accrediting pharmacy professional degree programs. Standard 3 encompasses experiential learning in the form of Introductory Pharmacy Practice Experience (IPPE) and APPE rotations. At least 300 clock hours of IPPEs are completed along with other Pre-APPE curriculum prior to pharmacy students engaging APPE rotations (ACPE, 2024, pp. 10-11).

Pharmacy students engage experiential learning at APPE rotation sites during the last year of their PharmD degree program where they put their theoretical classroom knowledge, laboratory skills, and IPPE experience to practical use. Experiential learning is facilitated by preceptors at different APPE rotation sites. The ACPE Curriculum for APPEs is found in ACPE Standard 3.2 and expectations collectively stress a “continuity of care and incorporate acute, chronic, and wellness-promoting patient-care services in outpatient (community/ambulatory care) and inpatient (hospital/health system) settings” (ACPE, 2024, p. 11).

Students are required to engage experiential learning (APPEs) in four different practice settings: “(1) community pharmacy; (2) ambulatory care; (3) hospital/health system pharmacy; and (4) inpatient adult patient care” (ACPE, 2024, p. 11). Elective APPEs, staying within ACPE standards, allow pharmacy students to “(1) mature professionally, (2) secure the breadth and depth of experiences needed to achieve the educational outcomes and activities articulated in Standard 2.1.a-m, and (3) explore various sectors of practice” (p. 11). Limits are placed by ACPE on the number of elective APPEs without a patient care focus a pharmacy student may engage; however, there have been calls for removing limitations (Kanmaz et al., 2022).

Veterinary pharmacy APPE rotations are considered electives. Veterinary pharmacy experiential learning sites are located in pharmacies of veterinary teaching hospitals across the United States, at private veterinary clinics, and at traditional pharmacies specializing in veterinary prescriptions and compounding. Preceptors, typically registered pharmacists, facilitate veterinary pharmacy experiential learning of pharmacy students in these settings. As a preceptor, I found it curious on APPE paperwork I received in the past, veterinary pharmacy in a veterinary setting was not considered a patient based rotation. Therefore, employing an agential realist

approach I explored this curiosity by examining relational material-discursive practices of preceptors and pharmacy students in-relation with nonhuman patients in veterinary settings.

### **Why is Inquiry Important?**

When searching literature for veterinary pharmacy learning, I noticed a lack of empirical research of veterinary pharmacy learning in the veterinary context, including a lack of experiential learning with underpinning adult learning theories, models, or concepts mentioned. I noticed elements of experiential learning in four empirical research articles. Surprisingly, I found “experiential education opportunities in veterinary pharmacy (60%) are more common than didactic offerings in veterinary pharmacy (27%)” (Elaimy et al., 2022, p. 328). If there are more experiential sites than didactic offerings, this exposes a foundational veterinary pharmacy knowledge exclusion when pharmacy students show up to veterinary settings to start their experiential learning rotation.

As a preceptor in a veterinary clinic, I noticed the majority of pharmacy students I precepted had little to no veterinary pharmacy learning prior to their APPE rotation with me. Therefore, I adjusted the rotation to start pharmacy students with foundational veterinary pharmacy learning before they engaged with veterinarians, animals, or clients in the veterinary clinic. Adrian et al. (2014) noted student errors regarding medical terminology in their study, and this reporting led me to wonder if error rates would decrease in this category if foundational veterinary pharmacy learning commenced as soon as students arrived at the veterinary pharmacy APPE site. The first day students come in the clinic at my veterinary practice site, they get a lesson on terminology, nomenclature, abbreviations, and other common veterinary language nuances.

Of the four articles reviewed, no author mentioned any key experiential learning or interprofessional theory; however, I noticed drivers of scholarship in veterinary pharmacy experiential learning are pharmacy school accreditation standards (e.g., ACPE) and board examinations for licensure (Adrian et al., 2014; Ceresia et al., 2009; Elaimy et al., 2022). Considering veterinary pharmacy experiential learning research articles lacked a stated adult learning theory with key scholars, models, or methods, I regarded the theoretical deficit as a welcomed invitation to grow scholarship in this area for the benefit of educators, students, patients (human and nonhuman), and the health of the world (humans, animals, environments).

In four veterinary pharmacy empirical studies reviewed, authors mentioned the lack of veterinary pharmacy educational opportunities (Adrian et al., 2014; Ceresia et al., 2009; Elaimy et al., 2022; Lust, 2006): “A dearth of opportunities incorporates veterinary medicine into pharmacy, and only a couple of colleges have didactic courses on veterinary compounding and electives with animal-centered learning activities” (Adrian et al., 2014, p. 513). There is room for expansion of educational opportunities in veterinary pharmacy: 1) veterinary pharmacy research is needed; 2) adult learning theory applications should be made apparent; and 3) veterinary pharmacy specialists can help fill the void for the benefit of patients (human and nonhuman), animals’ caregivers, and students. There is a “growing need for pharmacists to be able to [competently] provide pharmaceutical care to animal patients” (Lust, 2006, p. 6).

All four articles situated in veterinary pharmacy mentioned the role of the veterinary pharmacist (Adrian et al., 2014; Ceresia et al., 2009; Elaimy et al., 2022; Lust, 2006). Ceresia’s et al. (2009) research contributed to delineating roles for veterinary pharmacists into two main categories: (a) traditional veterinary pharmacists who mainly dispense animal products, compound for animals, and provide drug information; and (b) veterinary pharmacy specialist

who do the same as traditional veterinary pharmacist plus consult, educate, and research. Since “more than half of practicing pharmacists in the US work in community pharmacy” and pharmacists in these practice sites may be faced with filling a veterinary prescription, gaining competence in the role as a veterinary pharmacist is vital for the health of animals served.

Experiential learning is key to exposing pharmacy students to learning about veterinary pharmacy as there are more experiential sites than pharmacy colleges offering veterinary pharmacy learning in the classroom (Adrian et al., 2014; Ceresia et al., 2009; Elaimy et al., 2022; Lust, 2006). Animal-centered learning was mentioned in two articles (Adrian et al., 2014; Lust, 2006); however, entanglements of learning sometimes left out animal contributions as noted when Ceresia et al. (2009) stated, “the authors view the veterinary pharmacist as an integral member of a triad relationship which exists between the veterinarian, the pet owner, and the pharmacist” (p. 6). *What about the animal?* The relationship of the veterinarian, the pet owner, and the pharmacist would not exist without the animal. Expanding the theoretical perspective of veterinary pharmacy learning by researching intra-active entanglements may be able to trouble the triad for the benefit of human and nonhuman patients.

Although animal-centered learning was mentioned in two articles (Adrian et al., 2014; Lust, 2006), theoretical underpinnings were not used to develop this concept. Across the two articles, the role of the animal predominately presented as facilitating recognition of animals as patients and how animals can have similar disease states as humans. As noted in the studies, interactions with animals changed behaviors and attitudes of students; however, without hands-on experience with animals, changes noticed may not have occurred.

Across the studies changed behaviors, actions, skills, and perceptions of pharmacy students are noted after students engaged veterinary pharmacy learning. Other similarities

included a focus on specific roles for pharmacy students. When focused on roles on an interdisciplinary team, boundaries are set; however, there are opportunities to span boundaries for transdisciplinary engagement. Boundary formations signify a performative material-discursive practice (Barad, 2007), drawing me to examine how these practices matter.

Bierema (2019) described the T-shaped professional as “a person who is well-rounded with deep disciplinary and system expertise combined with high levels of boundary spanning capacity. They are valued collaborators and may even develop capacity to mentor or teach others how to become more T-shaped” (p. 75). The T-shaped professional may be modeled in the pharmacy context by a pharmacist working as a regulatory expert in collaboration with regulatory authorities including local authorities, state agencies, and federal agencies. Within the pharmacy context and regulatory expertise, the pharmacist may have hazardous waste training and can collaborate on a regulatory team with environmental questions and concerns. This T-shaped pharmacy professional may also be a preceptor modeling T-shaped actions, modeling professional behavior, and including students in meetings for enhanced learning opportunities.

Although the T-shaped professional offers a visual for understanding, the complexities of boundary spanning blur lines of a conforming shape. Our volatile, uncertain, complex, and ambiguous (VUCA) world (U.S. Army Heritage and Education Center, 2019) of today calls for intra- and transdisciplinary approaches to complex problems such as global health concerns and zoonoses. Anthropocentric learning is not only a problem for animals; it can also be a problem for environments. When I address environments, I not only include the earth, sky, and cosmos, I also include work environments, home environments, play environments, and other such micro-environments (e.g., ecosystems). For example, through One Health learning students can work “together with a common vision to protect humans, animals, and the work environment from

contamination and exposure to hazardous substances that can cause immediate or delayed deleterious effects” (Lindell, 2022, p. 168).

### **One Health Concept**

The One Health approach allows inter- and transdisciplinary engagement to tackle complex local and global health concerns (Kustritz et al., 2013; Sidikou et al., 2021). The emergence of the One Health concept is found “as far back as social medicine founder Rudolf Virchow and 18th century veterinarian Félix Vicq-d'Azyr connected human and animal health within varying degrees of social and ecological contextualization” (Wallace et al., 2015, p. 68). The One Health approach entangles the health of humans, animals, and environments (CDC, 2021; WHO, 2017).

The One Health approach is used as a learning facilitation concept and provides multi-, inter-, and transdisciplinary opportunities for learning (Frankson et al., 2016; Nieuwland & Meijboom, 2020; Rabinowitz et al., 2017). Although the One Health concept does entangle the health of humans, animals, and environments, critique of the approach considered One Health anthropocentric (Hanrahan, 2014); however, awareness of the anthropocentrism concern is troubled via engaging One Health ethics (Lederman et al., 2021; Nieuwland & Meijboom, 2020). Reading the One Health concept through a new materialist philosophy (agential realism) may help push past anthropocentrism, via post-anthropocentric thought, and expose ethical considerations in adult learning specifically by considering the health of nonhumans within pharmacy learning. Interestingly, “post-anthropocentric study of the world comprises unprecedented degrees of ‘trans-disciplinarity’, which are symptomatic of the variety and complexity of the issues at stake” (Susen, 2022, p. 67).

Russell (2019) posited, “the ability to learn from and with other animals comes from our very capacity to experience our differences and similarities, whether in brief or sustained pedagogical relations with them” (p. 134). Searching through literature revealed a dearth of proposed activities and experiences with animals for preceptors to engage for stimulating pharmacy students’ generativity while on APPE rotations in veterinary settings. Animals as knowers challenges traditional epistemologies producing a “better account for the ontology of knowing” (Barad, 2007, p. 378). Learning with animals considers the ethics of co-constitution, reconfigurations, entangled materializations, and mattering. There is a lack of preceptor development (entanglement) opportunities going beyond humanistic, anthropocentric perspectives and a lack of guidance for preceptors to facilitate experiential learning for APPE students on a veterinary pharmacy rotation.

Lack of formal training and resources can lead to prescription errors (McDaniel et al., 2021). Not all drug dosing can be translated from humans to animals; therefore, learning animal physiological differences per species is key for medication use safety. For example, if a human patient comes in with a headache and buys over-the-counter acetaminophen (APAP) to help relieve their head pain, the drug selection is okay if the human is not allergic to APAP or has any other contraindication. However, if the same human came into the pharmacy and wanted to buy APAP to give their cat, the drug selection is likely going to cause a fatality. Cats are unable to metabolize APAP the same way a human metabolizes the drug, and toxic metabolites build up in the cat’s body leading to death (Court, 2013).

Pharmacy students and practicing pharmacists are expected to fill a veterinary prescription when presented with an animal’s prescription in their pharmacy practice setting. Learning about veterinary pharmacy in school and how to fill a veterinary prescription is not

addressed in ACPE accreditation standards of pharmacy schools in the United States. Focusing solely on human medicine in pharmacy schools leaves out other species pharmacists serve (Karriker & Wiebe, 2006; O'Driscoll et al., 2015; Young et al., 2018). Experiential learning of pharmacy students in the veterinary setting using new materialist philosophy (agential realism) and post-anthropocentric notions is an approach to adult learning offering a method to address ethico-onto-epistemological exclusions of pharmacy students concerning animal medicine.

### **Agential Realist Notions**

Examining adult learning via experiential learning through a new materialist philosophy (agential realism) supports (re)thinking<sup>6</sup> about matter via an ontological turn of being, supports (re)orienting relations (e.g., environments, one another, animals), and supports (re)configuring mattering of matter (Coole & Frost, 2010). Agential realism (Barad, 2007) is a performative ethico-onto-epistemological framework proposed for recognizing valuing, being, and knowing while diffractively reading theories and concepts through one another. Specifically, Barad's agential realism theory offers a diffractive methodology to research the adult learning model of experiential learning in the context of pharmacy students' APPE rotations in veterinary settings. Notions commonly used when engaging agential realism are translated in Table 1.2 to enhance accessibility of understanding.

**Table 1.2**

*Notions of Agential Realism Applied to Experiential Learning*

| <b>Notion</b> | <b>Application</b>                                                                                                                                                                                                             |
|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Agential cut  | A 'mark' on the body of the learner formed by causal intra-actions making a difference. Agential cuts occur within the phenomenon of experiential learning (EL) via specific intra-actions. Apparatuses specify agential cuts. |

<sup>6</sup> The use of parentheses () within a word signifies an iterative and recursive state. For example: (re)thinking is read as thinking and rethinking.

| Notion                  | Application                                                                                                                                                                                                                                                                                           |
|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Apparatus               | A tool to create a difference and/or moves the learner towards becoming competent within the boundary of the profession (e.g., experiential learning in a certain context). Provides determinate boundary conditions.                                                                                 |
| Becoming                | The engaging of a learner as part of the world's iterative, (re)configuring, and intra-active becoming. In the case of EL of professional students in veterinary settings, preceptors facilitate learning and intra-actions toward becoming professional.                                             |
| Diffraction analysis    | Examining effects of differences caused by a diffraction grating of an apparatus (performative material-discursive practices; phenomena) and reading insights of examination through one another, including examining how exclusions matter.                                                          |
| Diffraction grating     | Configuration of the apparatus producing patterns marking differences. Within EL the researcher can learn more about the nature of the learner being passed through the diffraction grating or the diffraction grating applied (e.g., the theory, concept, and/or notions used to read through data). |
| Diffraction methodology | Ethico-onto-epistemological framework of agential realism; accounting for differences mattering, how practices matter, and for whom they matter.                                                                                                                                                      |
| Entanglement            | Within the intra-action emerging iterative (re)configuration.                                                                                                                                                                                                                                         |
| Intra-action            | Within an entanglement of matters (inseparability). Where an inter-action is between matters, an intra-action encompasses both within. When the entanglement 'ends', the effect(s)/difference(s) of the entanglement are still there (marks on bodies).                                               |
| Matter                  | "A dynamic intra-active becoming that is implicated and enfolded in its iterative becoming. Matter(ing) is a dynamic articulation/configuration of the world" (p. 151). Matter is phenomena, matter is doing.                                                                                         |

*Note:* Adapted from Barad (2007).

In this research, veterinary settings (iterative boundary productions) provide veterinary pharmacy learning environments (diffractive apparatuses producing phenomena) for veterinary pharmacy experiential learning (performative material-discursive practices). Veterinary settings offer opportunities for post-anthropocentric learning (productive and part of phenomena) where pharmacy students entangle (intra-act) with humans and nonhumans (becoming dynamic intra-

active matter) in a particular intra-activity (apparatus reconfiguring phenomena creating difference). Using a diffractive methodology and associated diffractive analysis entails reading different theories and concepts through (diffraction grating) data and examining insights (performative accounts) produced by particular intra-active entanglements (contingent ontologies). Diffractive analysis is a tool of diffractive methodology to examine and respond to insights produced and effects differences made (diffraction grating marking difference). For example, interviewing a pharmacy student after they completed a veterinary pharmacy APPE rotation (passed through an apparatus intra-actively entangled) to examine experiences (certain agential cuts within the apparatus producing reconfigurations of phenomena) and effects differences made (diffraction grating producing particular diffraction patterns).

The health of animals is at stake when post-anthropocentric learning is excluded from healthcare curriculum. In the excerpt from a past pharmacy student who completed an APPE rotation in a veterinary setting, we can read the excerpt (see Figure 1.1) through the ethico-onto-epistemological framework of agential realism theory and the One Health concept to illuminate effects of difference—differences mattering, how they matter, and for whom (Barad, 2007).

Frances (pseudonym) mentioned how after her veterinary pharmacy learning (post-anthropocentric learning) in a veterinary setting she sought out more opportunities in her professional pharmacy career to entangle with animal prescriptions. On one occasion in her pharmacy work environment, she overheard a prescription being called in for an animal. Knowing the other pharmacist did not have previous veterinary pharmacy learning, Frances checked the prescription with the other pharmacist. Thankfully, the weight of the animal was included with the information for the medication allowing a thorough dose check (inclusions and exclusions matter). Frances noticed the dose of the drug for the toy poodle about to be filled

using 10mg tablets was written as one and one-half tablets (15mg) instead of one-half tablet (5mg). Improper dosing (difference mattering) for the animal could have led to health consequences such as serotonin syndrome. Serotonin syndrome may present as central nervous system (CNS) depression or stimulation, cardiovascular insults (e.g., hypertension, tachycardia), and gastrointestinal signs (Crowell-Davis & Poggiagliolmi, 2008; Thomas et al., 2012).

The concept of One Health produced a diffractive pattern of humans (pharmacists), animals (toy poodle, animals with past fluoxetine toxicities), and environments (pharmacy and veterinary work environments, past veterinary pharmacy learning environment) as inextricably entangled. Examining further with an ethico-onto-epistemological framework, the experiential veterinary pharmacy learning experience co-produced a reconfigured phenomenon within the work environment where being and becoming veterinary pharmacist, knowledge sharing with colleagues, and valuing of animal patients co-constituted entangled healthcare productive of a lifesaving intervention.

### Figure 1.1

#### *Mattering: Entangled Healthcare*

**Frances:** I've noticed that I seek out more veterinary medicine than I did in the past. So, whenever we have someone calling in a prescription and another one of my pharmacists takes the prescription, I find myself going to look at the prescription and making sure that it's okay. Like for instance, we had a provider call in a prescription the pharmacist misheard the actual dosage and it was for a toy poodle, but for fluoxetine. It was a very, very small dog. I think the dog only weighed about 6 pounds. They needed 10 milligrams one half tablet a day. And either the pharmacists or the calling in technician from the veterinarian's, veterinary office called in one and a half tablets. And for that, tiny tiny toy poodle, that would send them into serotonin syndrome. That would have been way, way too much for them. I mean that would have been triple the normal dose. So being able to do that I see myself doing more often than not because not everyone has that background in veterinary medicine or veterinary pharmacy to know that, hey, one and a half tablets of a 10 milligram fluoxetine really shouldn't be used in a 6 pound dog. And that's where I see myself going towards more in my career. It's because I have that knowledge, I seek it out and I try to prevent those errors from happening now. I'm only human. I can't see every prescription that comes in, but at least try to. Cause I caught that one and I was like, oh my gosh, poor puppy.

## Summary

In the last year of their professional training, pharmacy students engage experiential learning during APPE rotations. Veterinary pharmacy APPEs are considered elective rotations; however, as I discovered over my years of facilitating learning, the majority of pharmacy students come to my veterinary site without foundational veterinary pharmacy learning. In this chapter I exposed the problem of anthropocentric learning in pharmacy schools and how it renders ethical, ontological, and epistemological exclusions in pharmacy students' veterinary pharmacy learning.

The intent of the research is to engage an agential realist perspective to examine performative intra-activity and effects differences make. The research is significant in that agential realism offers a methodology (diffraction) to trouble adult learning, specifically, experiential learning in veterinary settings. Experiential learning in a veterinary setting provides post-anthropocentric learning; however, examining related literature through diffractive readings exposed exclusion of foundational learning in pharmacy schools related to veterinary pharmacy, revealed theoretical underpinnings are not apparent in veterinary pharmacy research, and exposed exclusion of research exploring where effects of difference appear post-experiential learning in veterinary settings. The diffractive research is meant to benefit humans and nonhumans by exposing and addressing effects of difference, to benefit preceptors by offering a theoretical underpinning for learning facilitation in veterinary settings, and to benefit scholars as an example of a diffractive methodology with associated diffractive analysis.

In this chapter I introduced APPE standards while presenting the problem of anthropocentric (human-centered) learning in pharmacy schools and exclusions illuminated from purely anthropocentric learning. Secondly, I followed with the intent of the study and research



The cloud formation of the collage of this chapter and all summary collages within the manuscript convey entangled performative accounts of corresponding chapters and iterative reconfiguration of phenomena. Collages are not meant to represent stagnations but dynamic intra-actions with contingent ontologies co-constituted dependent on particular material-discursive practices.

The bland white tablets in the background cloud formation of the collage in Figure 1.2 signify traditional anthropocentric learning permeating throughout professional pharmacy learning. ACPE communicates a driver of how pharmacy schools across the United States develop curriculum and what is included and excluded. Traditional classroom (foundational; didactic) learning is conveyed through images of students in classrooms and textbooks. Noticeably, the textbooks are experiential learning (moving outside of the classroom) and adult learning topics informing professional pharmacy learning. Human patients are the type of patients ACPE expects pharmacy students to engage with during experiential learning. Medication marks bodies of students and patients. Tablets on a counting tray and the pharmacist pulling medication from a shelf are biased stereotypical ideas about what a pharmacist does; however, a pharmacist may do more than count capsules for human patients. This is where diffraction is helpful to produce further insights and inquiries about pharmacy learning practices.

The physical phenomenon of diffraction is introduced as a way to examine traditional pharmacy learning practices. The laser pointer conveys an apparatus (material-discursive practices; iterative reconfiguring phenomena of experiential learning). The blue coherent light emanating from the laser is data generated from examining phenomena (objective referent). Coherent light passes through a diffraction grating (reading through data with theories, concepts, notions) to form a diffraction pattern (insights and further inquiries produced by examining

inclusions and exclusions). With the diffraction pattern we can explore effects of difference. Importantly, we examine differences mattering, how practices matter, and for whom they matter. In this particular collage we notice exclusion of animals in pharmacy learning (outside of the pharmacy learning phenomenon).

In the cloud formation we see a human mother and baby. What about the puppy outside of the cloud? Puppies also need medical care and in some instances a pharmacist may fill a prescription for a puppy with a healthcare need. What may happen to the puppy if the pharmacists filled a prescription for the puppy with an ingredient fine for a human patient to ingest but toxic to the puppy? The flower with the honeybee conveys environments and how medications may affect environments, the life of animals (e.g., bees), and food sources for humans and nonhumans. The veterinarian examining the cat clearly conveys animals as patients. If animals are patients, why are they not recognized as such in pharmacy standards (only recognized as laboratory animals in standards)? The calf is another conveyance of environmental impacts as well as food safety. How do medications in our food supply affect human, nonhuman, and environmental health? In what ways can post-anthropocentric learning support the differential becoming of the world (entanglements of humans, nonhumans, environments)?

## CHAPTER 2

### THEORETICAL EXPLORATION

As a veterinary pharmacy preceptor for Advanced Pharmacy Practice Experience (APPE) pharmacy students in a veterinary setting, patterns I have noticed about APPE students' pharmacy learning when they come to the clinic include:

- Pharmacy students learn in anthropocentric environments and purely anthropocentric learning exposes exclusions of valuing, being, and knowledge regarding nonhuman patients.
- Most students who learn with me at my veterinary site have not had any veterinary pharmacy foundational learning.

It is important to study these problems because we live in a volatile-uncertain-complex-and ambiguous world calling for inter-and transdisciplinary approaches to complex challenges. Pharmacists are expected to fill human and nonhuman prescriptions and lack of veterinary pharmacy learning may lead to prescription errors. Prescription errors can potentially lead to harm including fatalities of nonhuman patients.

The adult learning model of experiential learning, in the form of APPEs, is ubiquitous in pharmacy schools; however, most APPE rotations involve human patients. The role of veterinary pharmacy experiential learning is two-fold: (a) to push past anthropocentric learning, and (b) to recognize animals as patients. In this chapter, I presented a genealogy of the state of pharmacy experiential education including a search and review of literature. I then moved from traditional

understandings of experiential learning to showing the theoretical framework I engaged for troubling adult learning in the context of APPEs in veterinary settings.

The intent of employing an agential realist<sup>8</sup> research approach encompassed garnering insights and further inquiries into adult learning by engaging a diffractive methodology for illuminating where effects of differences appeared when exploring performative intra-active entanglements during experiential learning rotations of pharmacy students in veterinary settings.

Research questions included:

Q1 What aspects of experiential learning in the veterinary setting illuminate the learner's way of valuing (ethics), being (ontology), and knowing (epistemology)?

Q2 In what ways are *matters*<sup>9</sup> significant in the student's veterinary pharmacy experiential learning in the veterinary setting?

Q3 Where do effects of difference appear in the context of experiential learning in veterinary settings?

### **State of Pharmacy Experiential Education**

Crass and Romanelli (2018) credit Abraham Flexner with propelling changes of medical and pharmacy education curriculum. Flexner toured the United States and Canada to visit medical schools for assessing medical learning approaches and conditions. Flexner's (1910) critical review of medical education across the United States and Canada found excellent to deplorable conditions: "Nothing more disgraceful calling itself a medical school can be found anywhere" (p. 205). More critical of didactic focused education, Flexner leaned towards preceptorship and scientific laboratory learning. The preceptorship aspect of learning by

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<sup>8</sup> See Footnote 3.

<sup>9</sup> Barad (2003) describes matter as "not a fixed essence; rather, matter is substance in its intra-active becoming—not a thing but a doing, a congealing of agency" (p. 828). Meaning, an entangled intra-action with other matter situates one within the matter for becoming together.

experience Flexner mentioned is understood in pharmacy education as precepted experiential learning of pharmacy students.

Flexner considered learning with animals an important aspect of learning about disease states: “Only a very small minority of our medical schools use animals at all; as a matter of fact, ordinary medical teaching suffers seriously from the failure to employ them” (Flexner, 1910, p. 62). Although Flexner focused more on animal experimentation in laboratory settings (e.g., watching progression of a disease from start to end in an animal), the lives of animals sacrificed for the sake of medical education in the past can be honored by using information learned in the past to inform treatments for humans and nonhumans where appropriate. Interactive computer modeling and artificial intelligence (AI) programs have potential to address ethical and (non)human welfare expectations (Ezanno et al., 2021). Even though Flexner did not have access to interactive computer models and AI programs to critique, Flexner did critique the use of manikins and considered them of limited use without practical guided experience of real cases.

Flexner (1910) argued for practical experience to be addressed not only in the last years of medical learning but throughout the years of the students’ medical education:

An active apperceptive relation must be established and maintained between laboratory and clinical experience. Such a relation cannot be one-sided; it will not spontaneously set itself up in the last two years if it is deliberately suppressed in the first two. (p. 59)

Flexner’s call for early adoption of professional learning by precepted experience is appreciated in the Accreditation Council for Pharmacy Education (ACPE) Doctor of Pharmacy (PharmD) program accreditation standards related to experiential learning. Introductory Pharmacy Practice Experiences (IPPE) are typically engaged within the first two years of PharmD programs. Pharmacy students are required to complete a minimum of 300 hours with at least 75 hours of

patient care in both hospital and community settings. The remaining hours exposing students to patient care may occur in hospital, community, or other pharmacy practice settings. Simulated practice experiences are not counted in the IPPE hour total (e.g., interactive virtual reality; live actors; manikins). The IPPEs prepare pharmacy students for their last year of pharmacy school when pharmacy students begin their Advanced Pharmacy Practice Experience (APPE) curriculum (ACPE, 2024).

In the United States there are 140 accredited Colleges of Pharmacy (ACPE, n.d.). Pharmacy schools are accredited by the ACPE and must meet seven standards to be accredited for administering the PharmD degree program. The standards include: (1) organization and governance; (2) curriculum; (3) experiential learning; (4) students and student services; (5) faculty and staff; (6) resources; (7) assessment. Although information about preceptors and APPEs are dispersed throughout the Standards, Standard 3.2. encompasses APPE curriculum and 3.3. is for preceptors specifically (ACPE, 2024).

Noticeably, assessment and educational outcomes frame PharmD program standards with educational outcomes (EO) showing predominance. More focused interest on EOs entered the scene of pharmacy education in the 1980s. Addressing the EO turn, the American Association of Colleges of Pharmacy (AACP) established the Center for the Advancement of Pharmaceutical Education (CAPE) in 1992, and in 1994 CAPE published 12 performance-based outcomes (7 general ability outcomes; 5 professional outcomes) to guide curricular planning.

Revisions addressing changes in pharmacy practice and education were published in 1998 and 2004. The 2013 CAPE EO iteration included affective outcomes addressing attitudes and behaviors. The 2022 educational outcomes publication enfolded the 2013 CAPE EO and the 2016 AACP Entrustable Professional Activities (EPA) to form the Curricular Outcomes and

Entrustable Professional Activities (COEPA) document. The COEPA document is intended to assist curricular development and associated activities, “EOs represent the knowledge, skills, and attitudes (KSAs) of pharmacists that all students should demonstrate upon graduation” and “EPAs describe the work of pharmacists as workplace tasks and responsibilities that all students are entrusted to do in the experiential setting with direct or distant supervision” (AACP, n.d.).

### **Experiential Learning**

Flexner’s (1910) publication laid the groundwork for medical experiential learning. Flexner was influenced by the 1909 address of John Dewey to the American Association for the Advancement of Science in Boston, Massachusetts. In Dewey’s address, published in 1910, he called for active participation in the making of knowledge. John Dewey, a twentieth century progressive educational theorist, influenced experiential learning. Dewey’s model of experiential learning drew from pragmatism. Dewey’s (1938) model of experiential learning linked personal development, education, and work. Dewey’s model portrayed learning as a dialectic process encompassing concepts, observation, experience, and action. From Kolb’s (1984) description of Dewey’s experiential learning model:

The impulse of experience gives ideas their moving force, and ideas give direction to impulse. Postponement of immediate action is essential for observation and judgement to intervene, and action is essential for achievement of purpose. It is through the integration of these opposing but symbiotically related processes that sophisticated, mature purpose develops from blind impulse. (p. 22)

Experiential learning of pharmacy students builds upon classroom learning, laboratory activities, and IPPE curriculum. During students’ APPE rotations they apply previous pharmacy learning via hands-on experiences in real-life settings.

Although the supporting adult learning theories of Kolb's (1984) experiential learning model are constructivism and humanism, not all experiential learning models draw from the same foundational adult learning theories. For example, Tara Fenwick (2001) detailed five different perspectives for viewing experiential learning and for possibly conjoining the different perspectives: constructivism, enactivism, situative, psychoanalytic, and critical. Recognizing the various approaches to experiential learning, Fenwick (2003) goes on to present experiential learning through complexity science, recognizing relationality of nonhumans and humans as co-emergent.

Another important contributor to understanding the importance of experience in adult learning is Mary Parker Follett. Although Follett is mostly known for contributions to management theory (Graham, 2003), Follett's writings about experience sparked further insight into adult learning by other scholars (Nicolaidis, 2023):

What we have to do is learn how to use the findings of the expert: it is not by a blind acceptance; neither by balancing them against our own 'innate' ideas; it is by learning how to unite experience with experience. (Follett, 1924, p. 30)

Nicolaidis (2023) researched uncovering of generative knowing underlying the experience of experience via presenting generative knowing through a nomadic theory of adult learning. Reaching into phenomenology and agential realism, Nicolaidis engaged diffractive readings of theories and concepts through one another for tapping into generative knowing underneath the experience of experience.

### **Searching and Reviewing Experiential Learning**

To further understand the state of pharmacy APPE experiential education, I searched and reviewed relevant literature. I excluded IPPE experiential education in this search since the

research context is APPE; meaning, I am interested in the final year of pharmacy students' experiential learning. The search and review revealed how APPE experiential learning of pharmacy students is presented in empirical literature. After analysis of the selected empirical studies, I proposed exploring experiential learning of pharmacy students from a new materialist approach (agential realism) for examining what happens to the way we grow and develop our future veterinary pharmacists.

### *Search Strategy*

I searched English language literature to examine the state of pharmacy APPE experiential learning in the United States from years 2012 to 2023. Using inclusion criteria, I limited the search to empirical research published in peer-reviewed academic journals. Articles excluded lacked empirical or theoretical research (e.g., review articles, commentary, abstracts, posters, commentary, books). For identifying relevant resources, I entered search terms 'United States', 'ACPE', 'APPE' and 'theory' into Google Scholar and the University of Georgia Libraries' database to begin. The first search populated 231 results. I added keywords 'Kolb' to discern experiential learning supported by adult learning theory, 'preceptor' to enfold the learning facilitator of experiential learning, and 'CAPE' to address educational outcomes. As I progressed by employing inclusion and exclusion criteria, the results dwindled from 231 to 5 empirical articles as shown in Table 2.1.

**Table 2.1**

*Search and Review: State of APPE Experiential Learning in the United States*

| <b>AUTHOR[S]/YEAR</b>     | <b>TITLE</b>                                                                                               | <b>PURPOSE</b>                                                                                                                                                                                                                                                                      | <b>SAMPLE</b>                                                                                                                                   | <b>METHODOLOGY</b>                                                                                                                                                                                                                                                                                                                                  | <b>FINDINGS</b>                                                                                                                                                                                                                                                  | <b>INSIGHTS</b>                                                                                                                                                                                                                                                                                                                                      |
|---------------------------|------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Danielson et al.,<br>2015 | A qualitative analysis of common concerns about challenges facing pharmacy experiential education programs | What are the most pressing issues experiential education directors in the United States face in their experiential education programs? The specific question in the survey stated, "What are the 2 or 3 most pressing issues your professional experience program is facing today?" | Experiential education directors at 81 of 118 accredited pharmacy schools responded with 78 specifically responding to the inquiry of interest. | Mixed Methods; presented as qualitative, however, the study contained statistical language and elements; 35-item web-based questionnaire - Catalyst Web Tools; Microsoft Excel for analysis; IRB exempt; thematic analysis; grounded theory; Cohen kappa coefficient used to check coding results; reported quantitative data; generalized findings | Experiential education directors face experiential learning (EL) site capacity, preceptor development, and pharmacy student onboarding issues. Authors posited quality assurance of EL, financial support, and workloads continue to challenge pharmacy schools. | <b>H:</b> further investigation of Joint Commission standards for onboarding pharmacy students for health systems (hospital) APPE sites. The survey went out prior to the release of the 2013 CAPE educational outcomes and 2016 ACPE accreditation standards. However, the research gives a historical view of experiential learning development at |

| AUTHOR[S]/YEAR      | TITLE                                                                                            | PURPOSE                                                                                                                                                                                 | SAMPLE                                         | METHODOLOGY                                                                                                                                                                                                                                                                            | FINDINGS                                                                                                                                                                                                                               | INSIGHTS                                                                                                                                                                                                                                                                                                                                   |
|---------------------|--------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Gurney et al., 2019 | Evaluation of a journal club preparatory session on student confidence for a graded journal club | The purpose "was to describe and assess the impact of a journal club preparatory session on advanced pharmacy practice experience (APPE) student confidence pre-and post-graded journal | 26 of 32 APPE students on rotations responded. | Quantitative; pre- and post-surveys sent through Qualtrics (Qualtrics Labs); analyzed via IBM SPSS software version 24.0; non-parametric and descriptive statistics; Wilcoxon signed-rank test; Mann Whitney U Test; McNemar's chi-square test; a priori p-value 0.05 for significance | Students reported increased confidence in their ability to review a journal article for a grade after a preparatory session walking them through the process. Authors posited there are many ways to approach journal club activities; | pharmacy schools in the United States and entanglement of standards, guidance, finances, pharmacy schools, preceptors, students, and place (APPE sites). Development of the journal club activity was based on Knowles' andragogy and Kolb's experiential learning cycle. <b>H:</b> Role-modeling critical thinking is considered helpful. |

| AUTHOR[S]/YEAR        | TITLE                                                                                                                        | PURPOSE                                                                                                                                                                                               | SAMPLE                                                                              | METHODOLOGY                                                                                                                                                                                                                                                            | FINDINGS                                                                                                                                                                                                                                   | INSIGHTS                                                                                       |
|-----------------------|------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|
|                       |                                                                                                                              | club" (p. 1221).                                                                                                                                                                                      |                                                                                     |                                                                                                                                                                                                                                                                        | however, the important point is for preceptors to role-model the approach for a review by externalizing (e.g., verbally communicating; using American Sign Language) preceptor thought processes.                                          |                                                                                                |
| Williams et al., 2018 | Preceptor confidence and engagement in providing leadership activities to students in advanced pharmacy practice experiences | The purpose was to inquire about preceptors' confidence in their leadership ability, leadership activities for APPE students, and supports needed for preceptors to administer leadership activities. | Questionnaire sent to 141 ACPE accredited schools with 86 programs responding (61%) | Mixed Methods; Questionnaire; 171 of 610 APPE preceptors responded; quantitative data analysis with IBM SPSSv22, descriptive statistics, Cronbach alpha set at >0.8, t-test, Mann-Whitney U test, p-value <0.05 significance; qualitative data analysis using constant | Majority of respondents had a leadership role, had leadership training, and felt-confident in their abilities to provide leadership activities to APPE students; preceptors answering questions about leadership activities responded with | This study reviewed preceptor perceptions of outcomes and did not include student perceptions. |

| AUTHOR[S]/YEAR     | TITLE                                                                | PURPOSE                                                                                                                                                                                                                                                        | SAMPLE                                                                                                                                                                           | METHODOLOGY                                                                                                                                                                                                                                                                                                                                         | FINDINGS                                                                                                                                                                                                                                                                | INSIGHTS                                                                                                         |
|--------------------|----------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|
|                    |                                                                      |                                                                                                                                                                                                                                                                |                                                                                                                                                                                  | comparative method and coding                                                                                                                                                                                                                                                                                                                       | a variety of answers; over half of preceptors responding to the preceptor support question desired more leadership training opportunities                                                                                                                               |                                                                                                                  |
| Young et al., 2014 | Factors associated with students' perception of preceptor excellence | The purpose of this study was to "identify factors associated with preceptor excellence as rated by student pharmacists and to assess the correlation of excellent ratings with years as pharmacist, specialty certification, and faculty appointment status." | Retrospective analysis of preceptor evaluations from 2,639 pharmacy students who completed an APPE rotation from 2009-2012; researchers collected 549 preceptor demographic data | Quantitative; 6-point Likert scale evaluation of preceptors; preceptors with $\geq 80\%$ excellent ratings had characteristics examined via descriptive statistics, Somer D test, and Pearson's correlation coefficients (r) for interval data; multivariate logistic regression; chi-square test; 2-tailed and p value = $<0.05$ for significance; | APPE students valued preceptors who role-modeled practice behavior and actions, related to students as individuals, and showed interest in precepting. Other significant factors for excellence included spending time with students, encouraging discussion, providing | This study reviewed student evaluations of preceptors and did not include preceptor evaluations of same students |

| AUTHOR[S]/YEAR   | TITLE                                                                                      | PURPOSE                                                                                                                                                                                                                     | SAMPLE                                                  | METHODOLOGY                                                                                                                                                                    | FINDINGS                                                                                                                                               | INSIGHTS                                                                                                         |
|------------------|--------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|
|                  |                                                                                            |                                                                                                                                                                                                                             |                                                         | analysis via IBM SPSSv19                                                                                                                                                       | problem-solving activities, providing directions and feedback, being available to the students, and having a well-organized APPE.                      |                                                                                                                  |
| Zhou et al, 2017 | Establishing the validity and reliability evidence of preceptor assessment of student tool | The purpose of this study was to "evaluate the validity and reliability evidence of the preceptor assessment of student tool (PAST) which was designed to assess doctor of pharmacy (PharmD) student rotation performance." | Data from 435 preceptor completions using the PAST tool | Quantitative; Reliability and validity of the PAST tool; Rasch analysis via WINSTEPSv3.92.0 software; Infit and Outfit MNSQ; Cronbach alpha reliability coefficient $\geq 0.9$ | Authors found "PAST provides valid and reliable information in evaluating PharmD student rotations as well as capturing the essence of CAPE outcomes." | Researchers built the PAST tool from the 2013 CAPE Educational Outcomes and is intended to measure competencies. |

### ***Content Appraisal***

For organizing analysis of the five articles, I (re)constructed a guiding research framework and categorized the articles. I detailed each article's content into the following categories: (a) author(s)/year; (b) title; (c) purpose; (d) sample; (e) methodology; (f) findings; and (g) insights (see Table 2.1 for categories).

### ***Data Synthesis***

Employing an integrative literature review method is suitable for long held topics continuing to expand and diversify, when (re)consideration and (re)conceptualization of topics are warranted, or when a newly emerging topic needs document integration (Torraco, 2016). I used an integrative literature review research method to determine current perspectives and approaches taken for facilitating pharmacy APPE experiential learning in the United States. I comprehensively reviewed, evaluated, and synthesized empirical research literature related to APPEs. I then synthesized how experiential learning is expressed through a different approach by noting similarities, differences, and exclusions.

### ***Noted Similarities Across Studies***

Similarities across studies included attention by the authors to specific accreditation standards (e.g., ACPE PharmD program standards) and guidance documents (e.g., CAPE). From analyzing the studies, it appears staying within prescriptive ACPE accreditation standards is an important driving factor for APPE rotations and research interests related to pharmacy experiential learning in the United States. I noticed entanglements of standards, guidance, finances, pharmacy schools, preceptors, students, and place (APPE sites) when Danielson et al. (2015) provided a historical account of experiential learning development at Pharmacy schools in the United States.

All studies had an element of measurement described as: (a) surveys; (b) questionnaires; (c) evaluations; or (d) assessment. The importance of following ACPE accreditation standards and using CAPE educational outcomes was apparent in Zhou et al.'s. (2017) research where they validated the reliability of an assessment tool (apparatus) created by their institution to measure competencies. At their College of Pharmacy, the authors developed the preceptor assessment of student tool (PAST) based on the competencies of the 2013 CAPE document.

### ***Noted Differences Across Studies***

Interestingly, only one study mentioned adult learning theory. Gurney et al. (2019) developed a journal club activity for APPE students based on Malcolm Knowles' andragogy adult learning theory and David Kolb's experiential learning cycle. Further explication by the authors using adult learning theory may help demystify activity development for other preceptors who may want to also develop activities for their APPE students. A further genealogy of ACPE standards and CAPE educational outcomes is warranted.

All of the studies were human-centered except for one. Zhou et al. (2017) focused on evaluating the reliability and validation of a nonhuman assessment tool (apparatus). However, the quantitative evaluation of the assessment tool benefited preceptors, putting the research back towards human-centered. All studies had quantitative elements, although, one purported to be a qualitative analysis in the title (Danielson et al., 2015).

### ***Examining Exclusions***

Noticeably, research studies were driven by ACPE accreditation standards and AACP CAPE educational outcomes benefiting humans. Animals are not mentioned in the CAPE educational outcomes; however, they are mentioned in ACPE accreditation standards albeit in the capacity as laboratory animals (see previous discussion of Flexner, 1910) and not as patients.

The void of not recognizing animals as patients illuminated an ethico-onto-epistemological<sup>10</sup> deficiency of pharmacy students and preceptors. To be clear about the deficiency, the ethical void points to accrediting standards not valuing nonhuman patients although the Center for Veterinary Medicine branch of the FDA is dedicated to protecting human and nonhuman health (FDA-CVM, n.d.); the ontological void shows deficiency of pharmacy students becoming and being veterinary pharmacist; the epistemological void exposes deficiency in pharmacy students' knowledge of veterinary pharmacy to provide ethical treatments for animals.

Introducing the One Health concept into pharmacy learning may help fill the ethico-onto-epistemological void by highlighting the health of humans, animals, and environments as inextricably entangled (CDC, 2021; WHO, 2017). Every living birthed human breathes oxygen from the air. The air we breathe affects our health (Jankowski-Kieltyka et al., 2021) and the animals in our world can affect human health (Gee et al., 2021). Likewise, our actions can impact environments and animals. The call for recognizing humans and nonhumans in relation is a call for an awakening, a call for *awaring* (Nicolaidis, 2023), a call for an inseparability of ethics-being-knowing (ethico-onto-epistemology), and a call for researching intra-active entanglements (dynamic intra-active becomings).

Pushing past anthropocentric learning in pharmacy education requires evolving “past our current small view to a more encompassing and long-range perspective” (Pierce, 2017, p. 299). Widening our understanding of dynamic intra-active relations enfolds human and nonhuman patients, environments, and the world in which we live. As noted by Barad (2007), “meaning making is not a human-based practice, but rather a result of specific material reconfigurings of

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<sup>10</sup> See Footnote 5.

the world” (p. 465). In this research I examined intra-active entanglements pushing past anthropocentric learning in pharmacy schools.

### **Theoretical Framework**

Attention to intra-active entanglements is a key approach for exploration in agential realist research. For showing entanglement of relations and to help focus the attention of the reader, I shared Figure 2.1 as a theoretical framework for troubling adult learning in the context of pharmacy students’ experiential learning in veterinary settings. Of note, Figure 2.1 and other figures within the chapters are visuals for recognition and are not meant to stagnate dynamic productions continuously (re)configuring.

The left of Figure 2.1 shows experiential learning (e.g., Kolb, 1984) as an aspect of adult learning. Pharmacy students’ APPE rotations are considered experiential learning; therefore, APPEs are directly situated in adult learning. Humanist and constructivist philosophies foundationally underpin the adult learning theory of experiential learning. On the left of Figure 2.1 there is part of an open cloud visible. The cloud formation throughout Figure 2.1 suggests an apparatus. The apparatus of adult learning and experiential learning theory is entering an apparatus of experiential learning in the veterinary setting. The apparatus is being examined using a performative ethico-onto-epistemological framework (agential realism); therefore, the apparatus is set at a certain diffraction grating for producing and enfolding phenomena (Barad, 2007).

According to Barad (2007),

apparatuses are material (re)configurings or discursive practices that produce material phenomena in their differential becoming. Phenomena are produced through specific causal intra-actions involving multiple apparatuses of bodily production. Intra-actions are

causal (but nondeterministic) enactments through which matter-in-the-process-of-becoming is sedimented out and enfolded in further materializations. (p. 170)

In the theoretical framework model, adult learning and experiential learning are being enfolded into a (re)configuring<sup>11</sup> of experiential learning (apparatus); specifically, experiential learning of pharmacy students in veterinary settings. Generative knowing (Nicolaides, 2023) is noticed supporting (underneath) material discursive practices of the apparatus. The apparatus is matter and “matter is produced and productive, generated and generative” (Barad, 2007, p. 137).

The right side of Figure 2.1 conveys a diffraction pattern of matter (entangled intra-actions) after passing through the apparatus (experiential learning rotation; material-discursive practice). Of interest is the diffraction pattern, in a state of becoming, can potentially yield new insights about approaches to adult learning and produce phenomena for readjusting the diffraction grating of the middle apparatus (experiential learning in the veterinary setting) and the left apparatus (foundational adult learning theories). All the apparatuses (experiential learning rotations) “are perpetually open to rearrangements, rearticulations, and other reworkings” (Barad, 2007, p. 170).

Employing agential realism to explore adult learning allows for affirmatively examining binaries; meaning, binaries are both read through and in conversation with each other instead of siloed into one particular view. Noticing effects of difference where binaries intersect may yield (re)configurings producing changes in thought, approaches, and insights. For example, agential realism allows for natural sciences and social sciences; human and nonhuman; and nature and culture to all specifically intra-act<sup>12</sup> in particular phenomena of the apparatus (open-ended

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<sup>11</sup> See Footnote 6.

<sup>12</sup> “In contrast to the usual ‘interaction,’ which assumes that there are separate individual agencies that precede their interaction, the notion of intra-action recognizes that distinct agencies do not precede, but rather emerge through, their intra-action” (Barad, 2007, p. 33).

material-discursive practices). When binaries are affirmatively read (e.g., human and nonhuman), they both have a role to play (re)configuring the apparatus:

Phenomena produced are not the consequences of human will or intentionality or the effects of the operations of Culture, Language, or Power. Humans do not merely assemble different apparatuses for satisfying particular knowledge projects; they themselves are part of the ongoing reconfiguring of the world. (Barad, 2007, p. 171)

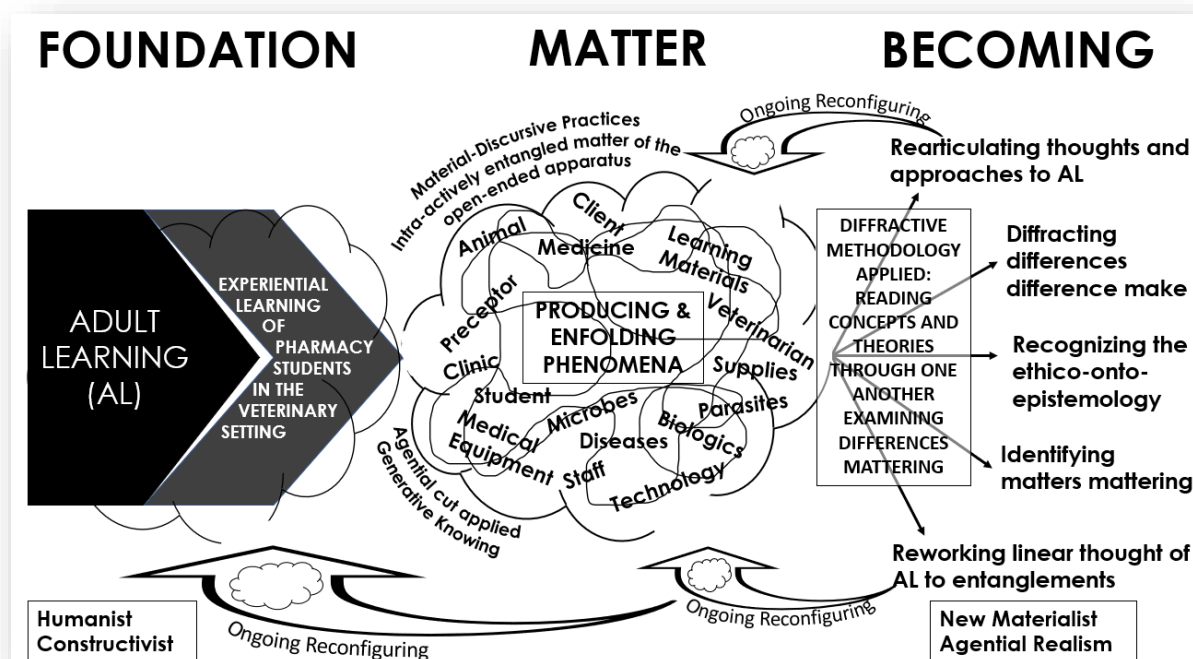
As the researcher, I am a part of the apparatus shown in the middle of the theoretical framework, I am a part of the intra-actively entangled matter, and I receive an agential cut as I intra-actively entangle with the researched. Agential cuts are marks on bodies (e.g., human, nonhuman) of co-constituted intra-acting agencies. The intra-active agencies are the matter passing through the specific apparatus producing phenomena, and “matter’s dynamism is generative not merely in the sense of bringing new things into the world but in the sense of bringing forth new worlds, of engaging in an ongoing reconfiguring of the world” (Barad, 2007, p. 170).

A diffractive methodology is engaged to garner insights and further inquiries into adult learning and to illuminate performative intra-active entanglements producing becoming within the context of experiential learning of pharmacy students in veterinary settings. Experiential learning in the veterinary setting goes beyond a human-centered focus by bringing multispecies learning to the fore (post-anthropocentric), signifying a One Health approach to medicine (CDC, 2021; WHO, 2017) and learning (Frankson et al., 2016; Mor et al., 2018; Nieuwland & Meijboom, 2020; Ruiz de Castañeda, et al., 2018; Rabinowitz, et. al, 2017; Schwind, et al., 2016; Sidikou et. al., 2021) can provide an intra-actively entangled, agential realist approach to consider when studying-, learning-, and becoming-with pharmacy students in veterinary settings.

Reading diffractively through the One Health concept and new materialist philosophy (agential realism) to explore adult learning can illuminate aspects of experiential learning in the veterinary setting surfacing learners' ways of valuing, being, and knowing. Employing a diffractive methodology facilitates noticing where effects of difference appear.

**Figure 2.1**

*Theoretical Framework: Diffracting Adult Learning*



### Agential Realism

Agential realism, as described by Barad (2007), is the new materialist stance selected for entangling with adult learning theory; specifically, the phenomenon of experiential learning in veterinary settings. Reading through data with theories (e.g., agential realism) and concepts (e.g., One Health concept) allows effects of differences to be examined and possible (re)configurings and (re)articulations of learning approaches and activities to be produced. Veterinary pharmacy experiential learning leaves room for decentering the human; therefore, I employed Barad's

(2007) agential realist diffractive methodology for examining experiential learning in veterinary settings as pharmacy students become-veterinary pharmacists.

### **Becoming Veterinary Pharmacist**

Agential realism considers ‘being’ as dynamic and a continual becoming and reconfiguring. Phenomena of being are specific intra-actions producing objects and measuring agencies indeterminately bounded. Where interactions are activities between objects, intra-actions signify being within entangled performativity; separate objects do not preexist their intra-action. Intra-actions may or may not involve humans.

Key assumptions of agential realism to facilitate understanding of ‘being’:

- Being is inseparable from knowing and valuing,
- Being enfolds human and nonhuman becomings,
- Ontology is inseparable from intra-actions,
- An agential realist ontology is a relational, dynamic ontology,
- Being and becoming are produced through entangled intra-activity, and
- “The becoming of the world is a deeply ethical matter” (Barad, 2007, p. 185).

For an example of becoming, I turned to Guyotte (2015) where the author rearticulated and reexamined the author’s own work of *interaction* with Barad’s (2007) notion of *intra-action*. Guyotte (2015) performed an in-process critique and began the narrative inquiry by (re)engaging a dissertation study personally completed years previously. The author recognized three states of being when (re)engaging with the dissertation: “*in the midst, wide-awake, and in-between*” (p. 73). Guyotte then described a methodological shift in thinking about narrative inquiry and explored in-process becoming and becoming in-process through post-structuralist and new materialist approaches. The author ended by presenting narrative inquiry methodology from a

different perspective. The author shifted the stance from constructivist to poststructuralist and new materialist considerations and invited others to critique the work-in-process. The author presented the work for others to consider the framework for application within their own narrative inquiries. The three states of being (becoming) detailed by Guyotte are described in Table 2.2.

**Table 2.2**

*Guyotte's Three States of Being (Becoming)*

| State        | Description                                                                                                              |
|--------------|--------------------------------------------------------------------------------------------------------------------------|
| In the midst | Engaging being with Others; actively entangles with participants being <i>of</i> the midst; intra-active entanglements   |
| Wide-awake   | Relational side of narrative inquiry; awareness of ethical implications; mindful of consciousness and interconnectedness |
| In-between   | Merging of relational and in-process state (ongoing becoming of self and construction of knowledge; continual narrative) |

*Note:* Adapted from Guyotte (2015).

There are different lines of new materialist approaches and many new materialist philosophers entangle becoming. For demonstrating another view of becoming I highlighted the work of Maria Tamboukou. Tamboukou (2021) engaged a narrative analysis of letters written in the early 1900s by a Welsh woman artist living in France, Gwen John. John had a love affair with sculptor Auguste Rodin (*The Thinker*) and wrote him letters. Many of the letters analyzed by Tamboukou are to Rodin. Within the letters John mentioned her cat and these writings about the cat became the focus of Tamboukou's analysis. The author explored the relationship of John with her cat through a new materialist approach and wanted to throw "light at moments when a woman's body makes strong connections with the animal's body blurring the boundaries between humans and nonhumans through a cosmological ethics of care" (p. 131).

Tamboukou (2021) drew upon the works of Rosi Braidotti, Gilles Deleuze, Félix Guattari, Donna Haraway, and Brian Massumi for much of the thematic narrative analysis as the

author explored becoming, ethics, assemblages, and what a woman's body can do. "What is traced in John's letters is her experimentation with what a woman's body can do when released free to be affected by the love of her companion—a non-human animal" (p. 142). Becoming is not being like the animal; it is experiencing with the animal while comprehending intraspecies relations and intertwining an ethical stance.

At one part of the narrative analysis Tamboukou explored narratives of becoming-cat through the experience of John looking for her 'lost' cat. John spent much time looking for her missing cat and Tamboukou recognized this "eagerness to experience the cat's world is an expression of her fear and anxiety about what was happening to her beloved companion, but also a will to be closer to her through entering different spatial and temporal rhythms" (p. 142).

Tamboukou employed a thematic narrative analysis by reading letters of someone in the past and creating a narrative surrounding becoming. By using a new materialist philosophy Tamboukou examined the relationship of John with her cat and how the effects of becoming-cat presented. The freedom of the cat in the wilderness precipitated a shift in identities for John as she explored what her body could do *free*.

'Becoming' through the approach of agential realism's intra-activity is different than traditional experiential learning approaches centered on the development of the human. Through agential realism, becoming veterinary pharmacist is contingent on specific intra-actions; contingent on agential cuts (marks on bodies) materializing different phenomena; contingent on human and nonhuman, nature and culture entanglements; and contingent on iterative ongoing articulations of mattering. Students intra-act with humans (e.g., preceptors, veterinarians, veterinary staff, clients) and nonhumans (e.g., animals, vaccines, medicines, computers, learning materials, environments) within and of the world in its iterative becoming. Becoming is an

“unending iterative process of enfolding” (Barad, 2007, 439) and becomings are “incessant co-constructions that are never complete, as the Self is always in flux” (Guyotte, 2015, p. 73).

Being↔becoming, learning↔knowing, and ethics (valuing) are inextricably entangled within an agential realist stance.

### **Summary**

In this chapter I reviewed the state of pharmacy experiential learning. I started with a historical turn from Flexner’s (1910) critical review of medical education and how it has influenced pharmacy curriculum and experiential learning.

After reviewing past adult learning theories and approaches (experiential learning), I moved towards the present state of pharmacy education. Specifically, I performed a literature search and reviewed research related to experiential learning in the United States to understand driving forces of research, experiential learning approaches, and potential underpinning theory. However, underpinning adult learning theory was not prevalent. Instead, I found pharmacy educational standards and guidelines as driving forces of research and experiential learning approaches.

Next, I showed the theoretical framework I employed to guide my exploration of experiential learning phenomena, and conveyed how I used a diffractive methodology by reading the One Health concept and agential realist theory through data to examine adult learning in the context of experiential learning of pharmacy students in veterinary settings. Finally, I explored notions of agential realism in relation to experiential learning and created a collage and collage explanation of this chapter (see Figure 2.2).

**Figure 2.2**

*Summary Collage: Entangled Learning with Chapter 2*



As in Figure 1.2, the bland white tablets in the background of the collage on the left of Figure 2.2 signify traditional anthropocentric learning permeating throughout professional pharmacy learning. The off-center human on the left side of the cloud formation (reconfiguring phenomena), conveys the literature search and looking back at the genealogy of experiential learning (e.g., Flexner's practical experience in medical education, Kolb's experiential learning, Fenwick's experiential learning through complexity science, Follett's uniting experience with experience, Nicolaides' generative knowing underlying the experience of experience).

Interestingly, after completing the literature search focusing on the state of pharmacy APPE experiential learning in the United States from years 2012 to 2023, similarities revealed authors attended to ACPE standards for APPE rotation in their research and did not rely as

heavily on adult learning theory. ACPE standards underlie pharmacy curriculum from didactic learning to experiential learning. Traditional classroom (foundational; didactic) learning is conveyed through images of students in classrooms and textbooks. Animals are noticed on the left side as well; however, as Flexner mentioned learning with animals in a laboratory setting, ACPE also addressed animals in a laboratory context; “Animal facilities that meet care regulations (if applicable)” (ACPE, 2024, p. 21). The core of ACPE is focused on human patients and human medications as noted under the human figure in the collage on the left looking back in time.

The middle divide of the collage is where college of pharmacies can make changes to coproduce profound effects of differences. Yellow capsules color the middle connection. The yellow color signifies cautions we must take when handling medications (e.g., safe use in humans and nonhumans, safe disposal to protect environments). The dog licking the cage and the horse sticking his nose through the bars of the stall convey constraints of learning. However, the postures of the animals are inviting students to intra-act and to set them free. Some college of pharmacies offer veterinary pharmacy APPE rotation opportunities to their pharmacy students. Agential realism and the One Health concept are an apt theory and concept for veterinary pharmacy preceptors to employ as frameworks for facilitating experiential learning.

The human off-center on the right side of the collage is future facing. Tablets are intertwined with traditional and nontraditional pharmacy learning. Coming out of the center of the collage and underneath the human on the right, we notice the One Health concept (humans, animals, environments inextricable entangled). The bee in the squash blossom touches the environments circle of the One Health figure as a reminder of entanglements. Moving up we see a veterinarian treating a donkey. The donkey is a nonhuman patient. The horse and rider on the

beach conveys the human-animal bond and intra-active entanglement of humans, animals, and environments (agential realism theory; diffractive methodology; One Health concept). The cat, like the horse and rider, reminds us of the blurring of lines as we are co-constituted with our nonhuman companions, not becoming like the animal but experiencing (learning) with the animal in-relation and valuing the ‘other’ within ethico-onto-epistemological phenomena.

## CHAPTER 3

### METHODOLOGY

First and foremost, as Haraway suggests, a diffractive methodology is a critical practice for making a difference in the world. It is a commitment to understanding which differences matter, how they matter, and for whom. (Barad, 2007, p. 90)

In my research, I employed the diffractive methodology of agential realism proffered by Karen Barad (2007) in *Meeting the Universe Halfway: Quantum Physics and the Entanglement of Matter and Meaning*. Diffractive methodology can be understood “as a material-discursive practice and as a critical practice” (p. 94). Simple examples of ‘material’ would be an animal, lab coat, and stethoscope; and ‘discursive’ would be language or power of words used to describe and represent. However, an agential realist view challenges the separation of material from discursive and the power language exerts over materials. From a representationalist view, language (description) mediates between knower and known and views material from the ‘outside’ as an ‘other’ or something to be represented and described. Agential realism understands matter (material) and meaning (discursive) in relation.

In agential realism, the term ‘material-discursive’ is written with a hyphen to show the performative relationship where one does not have power over the other: “a performative account insists on understanding thinking, observing, and theorizing as practices of engagement with, and as part of, the world in which we have our being” (p. 133). A practical example of this performativity can be found in adaptive fashion design: “Materials have a profound impact on the adaptive fashion design process. Fabrics and other materials worn can either constrain or expand a wearer’s movement” (Jun, 2024, p. 114).

In this chapter I described material-discursive practices within the context of performative intra-active entanglements. ‘Performative’ signifies a critical, iterative, dynamic active practice; ‘intra-active’ is being within, not viewing from the outside; and ‘entanglement’ is an inextricable relation.

Barad’s (2007) tool for analysis is diffraction where the researcher examines effects of difference. Used in this way it is a metaphor; however, Barad reminded us it is also a physical phenomenon we should learn more about so we can understand diffraction patterns: “patterns of difference that make a difference” (p. 72). When studying the physical phenomenon of diffraction, I noticed interference patterns. Constructive *interference of overlapping waves* yielded a brighter pattern of difference on the absorbing screen and destructive (deconstructive for metaphorical purposes) interference produced darker patterns of difference; therefore, I used the term ‘illuminate’ when engaging diffractive analysis. To produce ‘interference of overlapping waves’ in my research, I read through data with agential realism theory and the One Health concept (CDC, 2021; WHO, 2017) to produce constructive and deconstructive diffraction patterns; meaning, I examined data where the theory and concept illuminated inclusions and exclusions producing new insights and inquiries.

The intent of employing an agential realist<sup>13</sup> research approach encompassed garnering insights and further inquiries into adult learning by engaging a diffractive methodology for illuminating where effects of differences appeared when exploring performative intra-active entanglements during experiential learning rotations of pharmacy students in veterinary settings.

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<sup>13</sup> See Footnote 3.

Research questions included:

Q1 What aspects of experiential learning in the veterinary setting illuminate the learner's way of valuing (ethics), being (ontology), and knowing (epistemology)?

Q2 In what ways are *matters*<sup>14</sup> significant in the student's veterinary pharmacy experiential learning in the veterinary setting?

Q3 Where do effects of difference appear in the context of experiential learning in veterinary settings?

### Research Design

Karen Barad (2007) proposed using a diffractive methodology in two different ways: (a) as a subject of investigation, and (b) as an apparatus for investigation. In the technical sense “sometimes the goal of a diffraction experiment is to learn about the nature of the substance that is being passed through a diffraction grating, and sometimes it's to learn about the diffraction grating itself” (p. 83). For my purposes, the substance is matter intra-actively entangled, and the diffraction grating is reading through data with a theory (agential realism) and a concept (One Health). I diffractively read participants' insights to explore specific performative intra-active entanglements (material-discursive entanglements) illuminating effects of difference.

The analytic approach of Barad's (2007) diffractive methodology supports examining where effects of difference appear (differences difference make); and exploring becoming-veterinary pharmacist through an ethico-onto-epistemological framework. Using the analysis tool (diffractive analysis), I diffractively read through data with a theory and concept to examine differences revealed, not to highlight the theory or concept over the other, but to affirmatively read through to (re)configure the becoming of the world; to non-deterministically propose

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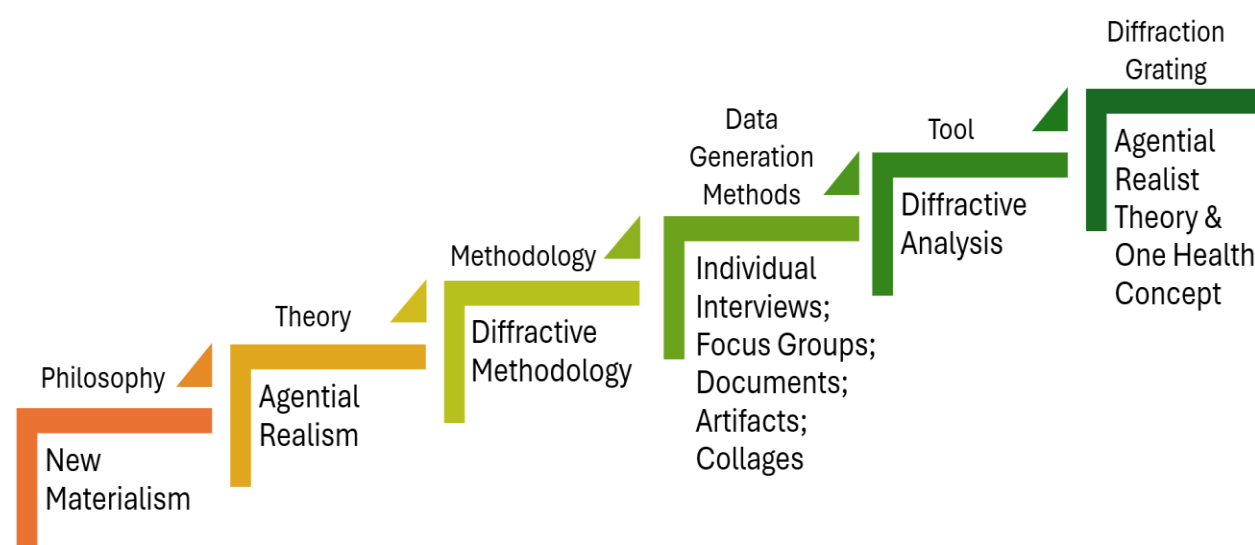
<sup>14</sup> See Footnotes 4 and 9.

contingencies for experiential learning in the veterinary setting; and to illuminate adult learning understandings and implications through human and nonhuman entanglements.

The research design (see Figure 3.1), underpinned by the diffractive methodology of agential realism, is scaffolded by past pharmacy students who completed an Advanced Pharmacy Practice Experience (APPE) rotation in a veterinary setting; focus groups comprised of veterinary pharmacy preceptors; and documents, artifacts, and collage produced by preceptor and student participants. Diffractive analysis ensued after generating transcripts of student interviews and focus groups and after collecting documents, artifacts, and collages. Agential realism is the ethico-onto-epistemological theory and One Health is the concept I employed for reading through data (diffraction grating). Both the agential realist theory and the One Health concept can be used to engage post-anthropocentric learning and are an apt theory and concept for examining data generated within veterinary settings.

**Figure 3.1**

*Research Design*



*Note:* Adapted from Crotty (1998); Roulston (2022a) Activity 5.1

## **Participant Inclusion and Recruitment**

Participant inclusion criteria are described in this section. Participant types included past pharmacy students who completed at least one APPE rotation in a veterinary setting and veterinary pharmacy preceptors who precepted APPE pharmacy students in veterinary settings. Recruitment methods for each participant type are detailed in this chapter. Materials utilized for recruitment are noted within Appendices.

### **Pharmacy Student Inclusion Criteria**

Inclusion criteria for individual pharmacy student interviews entailed recruiting at least ten past pharmacy students in the United States who completed a veterinary pharmacy APPE in a veterinary setting anytime between 2018 to 2024. International past pharmacy students must have completed an APPE or APPE equivalent within the stated timeframe. No international pharmacy students met the inclusion criteria. Eleven past pharmacy students from the United States met the inclusion criteria and participated.

### **Preceptor Inclusion Criteria**

Inclusion criteria for participation in a focus group entailed recruiting three to nine retired or still working veterinary pharmacy preceptors in veterinary settings. Participants must have precepted at least one APPE pharmacy student between 2018 and 2024 in a veterinary setting in the United States, or an APPE equivalent internationally.

Preceptor participants “share[d] a significant experience, identity, history, or goal in common” (Tracy, 2020, p. 191). I recruited a group of peers in a common organization who precepted pharmacy students in veterinary settings. I selected veterinary pharmacy preceptors from the Society of Veterinary Pharmacists (SVHP) with the rationale they have the common goal of facilitating veterinary pharmacy experiential learning of pharmacy students in veterinary

settings. All six veterinary pharmacy APPE preceptors selected were from the United States. I opened recruitment to international veterinary pharmacy preceptors who precepted pharmacy students in veterinary settings from 2018 to 2024. However, none of the preceptors met the inclusion requirement of precepting students from an accredited pharmacy school with Accreditation Council for Pharmacy Education (ACPE) equivalent accreditation and required APPE equivalent rotations.

### **Recruitment of Participants**

Initially, after gaining permission from the SVHP Council, I recruited research participants by posting an email invitation (see Appendix A for participant recruitment letter) on the SVHP listserv to reach members meeting inclusion criteria. However, not all past pharmacy students who met inclusion criteria of completing a veterinary pharmacy APPE in a veterinary setting were members of SVHP. Therefore, I relied on recommendations and contact information from veterinary pharmacy preceptors for additional students. Since I am a preceptor of pharmacy students in a veterinary setting, I also recruited past pharmacy students who completed an APPE rotation at my private veterinary clinic.

All participants recruited were situated in veterinary settings or engaged in experiential learning in veterinary settings. Importantly, the term ‘veterinary setting’ signified a space where the practice of veterinary medicine occurred and where preceptors facilitated veterinary pharmacy experiential learning for pharmacy students with animals in some capacity. Inclusion criteria did not limit veterinary setting sites to a specific veterinary practice site and included private veterinary clinics, academic veterinary teaching hospitals, and governmental veterinary settings.

Once selected, each participant filled out an informed consent (see Appendix B for pharmacy students; see Appendix C for preceptors) and demographic data questionnaire (see Appendix D for pharmacy students; see Appendix E for preceptors). I sent the appropriate informed consent and demographic data questionnaire to each prospective participant individually via email. When recruited participants completed their consents and questionnaires, they submitted their forms to me. Then, we scheduled an agreed upon date and time to meet for an individual interview or 60-to-90-minute focus group via Zoom<sup>®</sup> platform. For the student individual interviews and preceptor focus groups I used interview guides specific to the type of participation (see Appendix F for the individual interview; see Appendix G for the focus group). For a cartography of students and preceptors becoming research participants, see Appendix H.

### **Inclusion and Collection of Materials**

Inclusion criteria for the final method of data generation entailed collecting documents, artifacts, and collages from veterinary pharmacy preceptors and past pharmacy students who completed APPE rotations in veterinary settings. Documents collected included preceptor syllabi, student reflections, student self-assessments, and other materials deemed pertinent (e.g., veterinary pharmacy learning material, activities). Documents varied according to the expected veterinary pharmacy learning activities of the site and requirements of the pharmacy student's pharmacy school while the student engaged in experiential learning at the veterinary pharmacy APPE rotation. Artifacts (e.g., photographs, objects, sketches) varied depending on preceptor activities and permissions granted at the site. A more detailed description of documents, artifacts, and collages received and analyzed is presented in the data analysis chapter. Although I did not restrict the type of materials received, if words were included, I only accepted materials written in English.

### **Data Generation Methods**

Data generation included eleven synchronous online individual semi-structured interviews (Roulston, 2022a; Salmons, 2022) with past pharmacy students who completed APPE rotations in veterinary settings; two synchronous online focus groups (Barbour, 2018; Lobe, 2017; Salmons, 2022) with veterinary pharmacy preceptors of pharmacy students in veterinary settings; document and artifact collection (Merriam & Tisdell, 2015); and collage collection (de Rijke, 2023). “The interview method is not simply a preexisting set of procedures, but rather a constantly evolving sea of possibilities—that each interview intra-action renders possible novel ways of being, thinking, and doing in the interview process” (Marn & Wolgemuth, 2023, p. 113). Although I used interview guides for individual interviews with APPE past pharmacy students and focus group preceptors, I embraced a semi-structured format to allow moments of ambiguity.

Semi-structured individual interviews with past pharmacy students and preceptor focus groups commenced synchronously online (Salmons, 2022). Drawing on the work of Salmons (2022) I addressed considerations for employing online interviews (p. 217) including what technology to use and which interview format (e.g., synchronous). Prior to interviews I used email and scheduling technology to recruit participants and proposed tentative dates and times for interviews. Once scheduled, I employed the Zoom<sup>®</sup> platform to conduct recorded synchronous interviews.

I allowed use of the Zoom<sup>®</sup> ‘chat’ function to enable participants to share written communication as needed (e.g., ideas, links, responses). I enabled the ‘share screen’ function to allow participants to share visual and textual works as needed (e.g., collages, photographs, images of written documents). I used a camera with a microphone so participants could see and hear me within their ability. I enabled closed captions for participants to use as needed. I asked

participants to have their cameras and microphones on so I could see and hear them. I recorded the interviews and transcribed afterwards by starting with Zoom's® generated voice-to-text closed caption transcript, then I (re)listened to each interview many times to edit each transcript for clarity (e.g., words, pauses, sentences).

I used spoken word as the main communication method (video chat); however, I did not discourage sounds, visuals, or written exchanges. “Visual exchanges can serve the purpose of communication medium, to enrich the otherwise word-intensive process of data collection” (p. 239); therefore, engagement with collages prepared by participants stimulated thinking and dialogue with participants (individual interviews) and among participants (focus group). Using interview guides in a semi-structured format for the individual interviews (Appendix F) and the focus group (Appendix G) allowed flexibility for pivoting from specific questions to free-form inquiries based on presentations and responses.

I examined documents, artifacts, and collages in the research study to explore material-discursive phenomena:<sup>15</sup> “Agential realism focuses on the material-discursivity of phenomena, holding that human and non-human (material) agency are both mutually produced in intra-actions” (Marn & Wolgemuth, 2023, p. 109). Drawing from Scott's (1990) general, yet “fuzzy” (p. 13), definition of ‘document’, I took the position of a document as “written text” (p. 12) conveying a primary purpose. Syllabi of preceptors are documents because the documents may

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<sup>15</sup> This section indeterminately binds documents, artifacts, and collage to provide readers insight into the researchers thinking. When reviewing descriptions of documents, artifacts, and collage, the researcher found variability and overlap of categorizations, signifying approaches in-relation. The researcher's descriptions in the methodology section are not meant to separate, categorize, or stagnate approaches but to clarify and recognize dynamic data collection in-relation. A train of thought: “A document is an artefact which has as its central feature an inscribed text” (Scott, 1990, p. 5); “visual documents are to be considered in the same light as handwritten or printed and typeset documents” (p. 185); “photographs fall on the borderline” (p. 13); “Film, video, photography, and web-based media are visual documents” (Merriam & Tisdell, 2015, p. 168); “*Artifacts* are usually three-dimensional physical ‘things’ or objects in the environment that represent some form of communication that is meaningful to participants and/or the setting” (p. 162); “Photographs are three-dimensional objects” (Tinkler, 2013, p. 2).

convey course objectives, schedule, expectations, and other useful information to students. The indeterminate boundary of material documents in this study held documents as textual formations. I used the term ‘textual formations’ to signify physical or digital (e.g., virtual) text. Preceptors provided physical documents (e.g., syllabus text printed on paper) and digital documents (e.g., syllabus text formed as a Microsoft Word file emailed to the researcher).

Scott (1990) detailed document authorship in two categories, personal and official; with access described as closed, restricted, open-archival, and open-published (p. 14). A preceptor’s syllabus would be an official document; however, access could be any of the previous. I asked participating preceptors for a copy of their syllabus document and searched open-access (open-published) websites for accessibly occurring veterinary pharmacy syllabi on the internet. A student’s self-reflection is an example of a personal, closed document I collected from participating students. I did not collect open-published, personal documents (e.g., open-access commentaries written by students about rotations in veterinary settings).

Although some consider photographs as documents (Polkinghorne, 2005; Merriam & Tisdell, 2015; Scott, 1990; Wildemuth, 2009), I indeterminately bound photographs as visual artifacts. I considered a photograph a document in cases where the photograph was textual in nature; meaning, a photographic image captured words to convey a primary purpose (e.g., photographic image of a written book chapter scanned into a database). However, if the photograph is of humans (e.g., students) and nonhumans (e.g., animals, objects), I considered the photograph an artifact occurring in relation with a particular grating.<sup>16</sup>

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<sup>16</sup> The notion of grating stems from Barad’s (2007) description of agential realism. A particular apparatus (instrument) can be set to a certain grating (setting) for producing patterns marking effects of difference. The apparatus in this case is experiential learning in a veterinary setting. The grating could be a particular entanglement producing an artifact (e.g., object, photograph) signifying possible effects of difference.

Artifacts can be tangible objects (Merriam & Tisdell, 2015) or physical traces of behaviors (Wildemuth, 2009). Physical traces can include erosion (e.g., wear on a book) or accretion (e.g., highlights in a book). Although I attuned to material object artifacts, I did not tune out physical traces. However, I did not engage in-person observations; therefore, I did not collect data in physical trace form. Polkinghorne (2005) posited “methods designed to study physical objects are not a good fit for the study of experience” (p. 138). Nevertheless, since my research actions included exploring performative intra-active entanglements, nonhumans (e.g., artifact objects) are indeed entangled in experiences of humans and are valued in agential realist research.

Collage is a different method of data generation than document and artifact collection. With document and artifact collection participants provided materials without guidance from the researcher regarding content or presentation. Whereas, with collage, I provided guidance to participants about the topic of the collage; the purpose of the collage, and collage explanation; the aim of creating a collage; guiding prompts; and tips (see Appendix I). Merriam and Tisdell (2015) termed this approach to collage a “researcher-generated artifact” since the collage was created “for the researcher by participants after the study has begun” (p. 174). However, some students may have created a collage during their APPE rotation and these collages would be artifacts occurring prior to the research study without input from the researcher (Merriam & Tisdell, 2015).

Collage is a different method of data generation than photograph (photo) and graphic elicitation yet collage does have similarities with the two methods. Bravington (2023) described differences between photo and graphic elicitation as “photography seduces us into recording our lives by freezing a moment of ‘reality,’ drawing and diagramming allow us to access other

dimensions of our experience, and to explore how they make us feel” (p. 189). Graphic elicitation entails diagramming and examining experiential relations: “what distinguishes graphic elicitation from photo-elicitation is its emphasis on the active, performative process of image construction” (p. 170)

More than freezing a moment in time, photo elicitation (photo interviewing) is used to decenter the researcher and shifts power to the image and interviewee for meaning making (Jaumot-Pascual et al., 2023; Tinkler, 2013). Researchers use photo elicitation to foster dialogue with participants and to generate data (Tinkler, 2013). Researchers may ask participants to produce and submit photos with captions in response to particular contextual prompts. In some cases, participants may produce photo collages “to bring together complex meanings difficult to express in one single image” (Jaumot-Pascual et al., 2023; p. 224).

The collage method I used enfolded photo and graphic elicitation by recognizing aspects of visual (image, form), textual (written word), verbal (spoken word), and materiality (presentation of collage) in-relation. I employed collage for data generation by stimulating thinking and dialogue with research participants about experiential learning in veterinary settings. Collage “embraces the inseparability of ethics, ontology, and knowledge” and “reveals that there is more than what is known” (de Rijke, 2023, p. 7). Stimulating each participant’s thinking about the topic of experiential learning in veterinary settings through collage allowed engagement with Nicolaidis’ (2023) notion of generative knowing to explore “beneath the experience of experience” (p. 77) to reveal more than what is known:

Thinking does not reproduce the same thing; it becomes something else, reviving it. In this way, generative knowing is not a problem of science, which seeks reference points and conditions of certainty. Generative knowing is practiced through deep inquiry. (p. 77)

I employed collage to tap into generative knowing (Nicolaidis, 2023) of students and preceptors to surface “ways of being and becoming that activate potential creatively” (p. 2). For the collage activity, I asked preceptors and APPE students to create a collage and corresponding collage explanation to stimulate their thinking about veterinary pharmacy learning in a veterinary setting (see Appendix I). The collage activity supported a material practice and the collage explanation showed the discursive (words; meaning) in relation to the material (collage; matter).

### **Online Semi-structured Interviews and Focus Group Participation**

To generate data from various veterinary settings (research site), I employed the Zoom<sup>®</sup> platform for individual semi-structured interviews and focus groups. Using email for communications and meeting synchronously online for individual interviews and focus groups accommodated transference of data with more efficiency than travelling to each location (each veterinary setting) across the United States. Although nonverbal cues may be lost when meeting online, I did not rely on nuances of nonverbal cues in this study (Salmons, 2022). With focus groups “a particular challenge of the online format is that it reduces the ability of the moderator to guide the discussion and request elaborations” (Barbour, 2018, p. 53). However, I did not experience this particular challenge with the two focus group sessions.

### ***Student Interviews***

A semi-structured interview, described by Roulston (2022), informed the interview structure. To semi-structure the process, I created an interview guide (see Appendix F) based on works of Carspecken, 1996; Jacob and Furgerson, 2012; Roulston et al., 2007, and Roulston, 2022a. I referred to the interview guide throughout student interview sessions. Individual interviews with pharmacy students encompassed a timeframe of 60 minutes with an extension to 90 minutes as needed for collection of data addressing research questions and engaging further

inquiries. I facilitated synchronous semi-structured interviews online (Roulston, 2022a; Salmons, 2022) averaging approximately 61 minutes with eleven student participants using the Zoom® platform.

### ***Preceptor Focus Groups***

Preparing for focus groups, I adopted Kitzinger and Barbour's (1999) definition of focus groups: "Any group discussion may be called a focus group as long as the researcher is actively encouraging of, and attentive to, the group interaction" (p. 20). Preplanned logistics within a focus group interview guide (Barbour, 2018; Roulston, 2022a) assisted me with actively encouraging, being attentive to, and facilitating the focus groups' dialogue (see Appendix G for focus group interview guide). Participants were my peers; therefore, we shared a common identity as veterinary pharmacy preceptors within veterinary settings. Hence, facilitation of two focus groups elicited descriptions from preceptors' perspectives. Similarly to how diffraction patterns can change based on the position of the observer, the position of preceptors produced new insights and inquiries. The focus group interview timeframe encompassed 60 minutes with an extension to 90 minutes depending on dialogue vigor, collection of data addressing research questions, and engagement of further inquiries. I hosted both focus group interviews online (Roulston, 2022a; Salmons, 2022) using the Zoom® platform. Two focus group sessions, with three preceptors in each group, averaged approximately 69 minutes.

I facilitated an opening activity (collage sharing) to begin the focus group (Barbour, 2018; Roulston, 2022a) while understanding my role within the group: to ask clarifying questions, to encourage dialogue, to keep the group focused on the topic, and to ensure all participate. At the end of each session, I summarized statements and asked if anyone wanted to mention anything not discussed or wanted to add clarifying statements.

## **Documents, Artifacts, and Collage**

For data generation, I collected documents, artifacts, and collages to examine. Although some scholars categorize visual documentaries and documentation (e.g., images, photographs) in the ‘document’ category (Polkinghorne, 2005; Merriam & Tisdell, 2015; Wildemuth, 2009), I considered documents as text-based materials occurring in the study setting without researcher input or guidance prior to collection. Documents collected from preceptors and past pharmacy students included syllabi, self-reflections, and self-assessments. If a photograph or figure was in a text-based document (e.g., self-reflection), I considered the visual an artifact in relation to the written document.

Artifacts as visual-based materials occurred in the study setting without researcher input or guidance prior to collection. Artifacts included photographs and images of objects provided by participants. Participants offered materials important to them in a different format; meaning, instead of providing an object (e.g., stethoscope), participants provided a visual of the object (e.g., photograph, graphic art).

Only one collage occurred in the study setting without researcher input or guidance prior to collection. Therefore, I offered guidance (see Appendix I) related to collage formation and associated collage explanation. I grouped collages occurring without researcher guidance with visual-based artifacts.

### ***Document & Artifact Collection***

Once I identified participants and they turned in their informed consents, I proceeded to collect documents and artifacts from veterinary pharmacy APPE rotation site preceptors and past pharmacy students who completed an APPE rotation in a veterinary setting. I collected copies of preceptor syllabi, student reflections, student self-assessments, and other documents

(e.g., mission/vision/values statements; veterinary pharmacy learning material) provided by preceptors and students from different veterinary pharmacy experiential learning sites.

I considered artifacts as objects having specific meaning to preceptors or students. I asked participants to visually capture (e.g., photograph) artifact objects to share with me and tell me more about the artifact during the interview or during a follow-up communication. However, participants shared their artifacts (photographs) in their individual collages. Therefore, we discussed these artifacts during the individual semi-structured interviews and during the opening sequence of each focus group. Once I collected documents and artifacts (artifacts embedded in collages), I engaged a diffractive analysis for exploring patterns of difference. I received diverse documents and artifacts from various veterinary pharmacy APPE rotation sites (see Appendix J for an inventory count).

### ***Collage Collection***

In the collage guidance, I allowed artistic freedom to use either a traditional collage method of paper, cutting, and gluing; or to use a modern digital approach. An example of a digital collage would be layering images, shapes, colors, words on one PowerPoint® slide. From a (post)qualitative grating, collage with a collage explanation is material in relation with discursive, a performative intra-action. I did not share specific collages collected due to the entangled nature of collages submitted; meaning, space, place, humans, animals, objects, images, signs, symbols, and words revealed identities of research participants and their veterinary pharmacy APPE rotation site. However, I did show a compilation of images evoking generative entanglements produced from pharmacy students' quotes (see Figure 5.8). I used my own images to mask participants' identities.

**Student Collage.** Collage stimulated a different way for APPE students to sense their veterinary pharmacy learning: “art is not simply an alternative way of representing knowledge, but allows the release of different forms of understanding” (Roberts & Woods, 2018, p. 627). For students to critically think about what they put in their collages, I asked them to create a collage explanation with the material collage. After submitting collages and collage explanations, we engaged an open dialogue (Bierema, 2018) where I inquired deeper into their knowledge, becoming, and valuing as they verbalized their thoughts (e.g., ideas, suggestions, critique, experiences).

For research participants without a collage activity at their veterinary pharmacy APPE rotation site, I asked them to prepare a collage before the interview (see Appendix I) of what was important and mattered to them during their APPE rotation in a veterinary setting. I asked participants to digitally send me their collages and corresponding collage explanations prior to their individual interview. During the interview, about mid-way, we engaged dialogue about the collage. In this non-structured segment, I inquired deeper with open-ended inquiries to explore aspects illuminating learners’ ways of being, valuing, and knowing; *matters* significant in their learning; and effects of difference.

**Preceptor Collage.** Once I selected participants for each focus group, I reached out to them individually and provided basic instructions for creating a collage (see Appendix I) and guiding inquiries for them to think-with: *What comes to mind when you think about precepting APPE pharmacy students in a veterinary setting?* In each focus group I employed participant collage presentations as the opening activity (Barbour, 2018; Roulston, 2022a), to facilitate thinking about experiential learning in veterinary settings, and to stimulate dialogue among participants.

## **Troubling Data**

Once I completed data generation with participants, I began the process of analysis. To examine generated data in relation to the three research questions, I approached each inquiry with the diffractive analysis tool (reading through data with agential realism theory and One Health concept) of Barad's (2007) diffractive methodology.

### **Approach to Q1**

When reading diffractively with agential realism and One Health tenets in mind, I inquired: How is being, valuing, and knowing showing up? What deconstructive (excluded, missing) and constructive (reoccurring, prominent, valued) areas/topics/needs are exposed in pharmacy learning when the APPE apparatus is examined using a diffraction grating of agential realism and One Health? I explored details of material-discursive elements (e.g., written, verbal, collage, affects, entanglements).

### **Approach to Q2**

Who or what is/are benefiting from intra-active entanglements during veterinary pharmacy APPE rotations? I noted illuminations of entanglements and coproductions (reconfigurations, valuing). I inquired: Why did students select veterinary pharmacy rotations? When students were present at APPE rotations, what did they value, how did they feel in the moment (being/becoming), what did they know or not know?

### **Approach to Q3**

I explored evidence of effects of difference after veterinary pharmacy APPE rotations. I inquired: How were students' values, ontology, and ways of knowing different before the rotation and after? What/who did differences effect?

## **Data Analysis**

I transcribed individual interviews and focus group recordings, then engaged a diffractive analysis of transcriptions, documents, artifact descriptions, and collages with collage explanations. With a diffractive reading, I examined where effects of difference appeared (differences *difference* made). A diffractive analysis entailed reading through data using a theory and concept to garner new insights and inquiries. For my research, I employed the One Health concept and agential realist theory to read through data. Although they are differing lines of thought, agential realism and the One Health concept were co-productively used for illuminating new insights and inquiries by examining patterns of difference and where effects of differences appeared.

### **Diffractive Analysis**

After the focus group interview and individual past pharmacy student interviews, I prepared transcripts from recordings. I analyzed transcripts, documents, artifacts, and collages. I examined data via diffractive analysis as described by Barad (2007) who mentioned diffraction as a way of “attending to and responding to the details and specificities of relations of difference and how they matter” (p. 71). Barad gave credit to the work of Donna Haraway and distilled Haraway’s musings about diffraction: “diffraction can serve as a useful counterpoint to reflection: both are optical phenomena, but whereas the metaphor of reflection reflects the themes of mirroring and sameness, diffraction is marked by patterns of difference” (p. 71). For me, being a scientist and using a new materialist philosophy informed by agential realism, diffraction provided an intriguing physical phenomenon as well as a tool for analysis to explore relationality and entanglements. “Diffraction is a mapping of interference, not of replication,

reflection, or reproduction. A diffraction pattern does not map where differences appear, but rather maps where the effects of difference appear” (Haraway, 1992, p. 300).

### **Reflexivity Entangled with Diffraction**

Tracy (2010) described self-reflexivity as a way to be honest and vulnerable when introspectively assessing motivations and biases, yet this is a self-contained exploration and “holds the world at a distance” (Barad, 2007, p. 87). Using binary thinking of reflexivity, I critically evaluated my position in relation to students and pondered how my role as a preceptor and professional affected outcomes and influenced power gradients. This researcher-centric approach seemed singular, and I began to consider entanglements and boundaries created by the preceptor-student relationship. Reflexivity led me to consider “material-discursive phenomena” (p. 153) and how the student and I are more than a student and preceptor, we affect each other through our entanglement. Roulston and Shelton (2015) posited “Barad’s discussions of the importance of critiquing sameness and examining difference in reflexivity and her diffractive strategies may be a plausible method for encouraging novice qualitative researchers to examine the multidimensionality of theories’ relationships to methods” (p. 7).

Drawing from works of Donna Haraway (1992; 1997) and Karen Barad (2007), I switched from reflexivity to diffraction to explore ethics of research, ethics that are inseparable from the onto-epistemology:

for all of the recent emphasis on reflexivity as a critical method of self-positioning it remains caught up in geometries of sameness; by contrast, diffractions are attuned to differences—differences that our knowledge-making practices make and the effects they have on the world. (Barad, 2007, p. 72)

A diffractive methodology allowed my intra-active performativity to explain entangled states, agential cuts, and transdisciplinary participation mattering in my becoming professional and my ethico-onto-epistemological approach with students. “According to agential realism, knowing, thinking, measuring, theorizing, and observing are material practices of intra-acting within and as part of the world” (p. 90). Therefore, I acknowledge I am part of the world students engaged and the performative “*practices of knowing are specific material engagements that participate in (re)configuring the world*” (p. 91). I am not an outsider of the students’ or preceptors’ world as an observer, I am in their world (re)configuring. Intra-actions mattered in the differential becoming of the world (p. 352).

### **Ethics**

Research commenced after submission reviewed by the University of Georgia Institutional Review Board for research in human subjects, and the review board granted approval of materials (e.g., recruitment letter, informed consent) and IRB clearance (IRB PROJECT 00007957). Participants retained the ability to opt-out at any time once enrolled in their interview or focus group session (see informed consents in Appendix B and Appendix C).

As a preceptor to pharmacy students in a veterinary setting, ethical explorations included wellbeing of beings (human and nonhuman); effects of differences on human and nonhuman health (e.g., human, animal, environment); effects of differences on experiential learning within veterinary pharmacy global communities; and examining intra-relational dynamics (e.g., peer with peer). Through an agential realist diffraction, explorations bring into being the ethics of mattering; meaning, ethical concerns are a part of science, not separate from science viewing it from the outside. I am a part of the research, ethically considered, and my “*values are integral to the nature of knowing and being*” (Barad, 2007, p. 37).

Specifically, the ethical research approach I employed enfolded human and nonhuman experiences and examined how dynamic intra-actions (part of and within the entanglement) reconfigured being and knowing of the world. The ethic-onto-epistemological framework of agential realism informed an ethicality where ethics, ontology, and epistemology are not separate fields of study but are inseparable in occurrence and performativity bringing attention to what is known and future possibilities. Employing an agential realist account of ethics, I examined valuing (Barad, 2007)

### **Entangled Rigor**

Through the notion of entangled intra-actions, Barad's (2007) underlying theory, agential realism, is an ethico-onto-epistemological framework for rethinking foundational understandings (e.g., matter, agency, objectivity, entanglement, ethicality, material-discursive practices). When engaging the notion of entangled intra-actions, we understand agencies do not preexist distinctly outside of entanglement; however, within phenomena (entangled intra-actions; ontological inseparability) is where dynamic contingent ontologies emerge (distinct relational agencies). Particular causal intra-actions (measurements) within phenomena enact agential cuts separating observer and observed (contingent agential separability within phenomena). Importantly, "objectivity is not defined in reference to a human observer: it is not merely about what humans can do to facilitate unambiguous communication about laboratory results. Rather, objectivity is a matter of accountability to marks on bodies" (p. 340).

Roulston (2022b) "illustrated how researchers have attended to the more-than-human through using familiar and experimental methods" (p. 80). I employed different methods for data generation ranging from traditional qualitative methods (semi-structured interviews, focus

groups, document and artifact collection) and experimental methods (e.g., collage) to examine human-nonhuman entanglements.

Barad (2007) proffered a diffractive methodology in-relation to agential realism. The analysis tool associated with Barad's diffractive methodology is diffraction. When employing a diffractive analysis, attention to detail is needed for a rigorous analysis. Keeping in mind, intra-active entanglements (ontological inseparability; contingent agential separability within phenomena) as a key element of agential realism, we understand objective referents to be phenomena (not independent objects). However, in this analysis research questions called for examining learners; therefore, enactment of an agential cut (boundary) within phenomena delineated the learner from the researcher. As the researcher, I explored entangled intra-actions of students within apparatuses of experiential learning producing contingent ontologies and effects of difference.

Maintaining a rigorous diffractive analysis (see Chapter 4) required me (the researcher) to keep the notion of intra-active entanglements at the fore and to make an account of how practices matter. I employed a diffractive reading of data with the theory of agential realism and the One Health concept (diffraction grating). Traditional binary thinking, human versus nonhuman, instead became an examination of humans and nonhumans dynamically in-relation, then an elaboration of associated contingencies and implications (see Chapter 5). Different material-discursive practices (boundary making practices) coproduced different materializations (contingent ontologies) producing different insights. Different insights enabled critical rethinking of pharmacy learning practices and implications.

## Summary

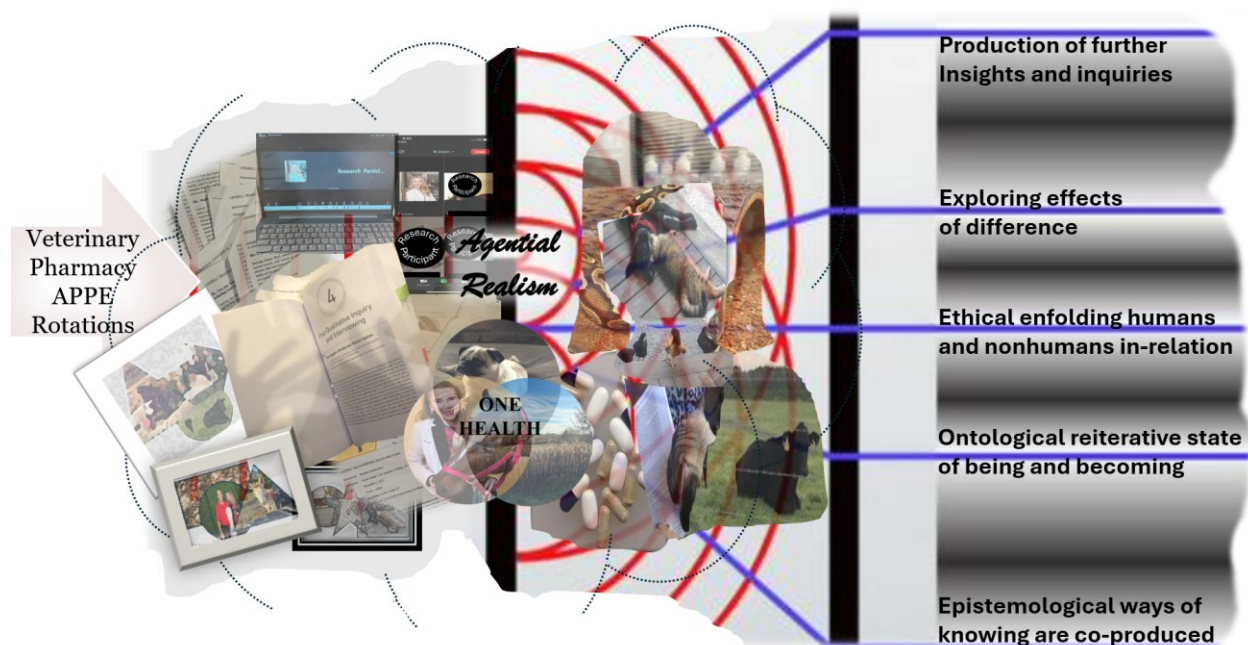
In this chapter I presented a study design for garnering insights and further inquiries into adult learning by engaging a diffractive methodology to illuminate where effects of differences appeared when exploring performative intra-active entanglements in the context of pharmacy students' experiential learning rotations in veterinary settings. I based the study design within new materialist philosophy informed by agential realism. Specifically, I employed Karen Barad's (2007) diffractive methodology and diffractive analysis tool for reading through data with agential realist theory and the One Health concept when engaging interview transcripts, focus group transcripts, documents, artifacts, and collages. Within the study design I detailed inclusion criteria for humans (pharmacy students, veterinary pharmacy preceptors) and nonhumans (documents, artifacts, collage); research site (veterinary settings); methodology (diffractive methodology), data generation (one-on-one individual semi-structured interviews, focus group interview, text-based documents, visual-based artifacts, collage); data analysis (diffractive analysis), and supporting materials (e.g., participant recruitment letter, informed consent). Next, I showed how my reflexivity is entangled with diffraction and followed with ethic and rigor explorations. Finally, I summarized the chapter with an overview of the study approach and produced a summary collage with explanation (see Figure 3.1).

The design of the research allowed exploration of veterinary pharmacy learning facilitation pushing past anthropocentric perspectives when precepting pharmacy students during APPE rotations in veterinary settings. To garner insights and further inquiries into adult learning, I engaged a new materialist philosophy informed by agential realism. Agential realism is an ethico-onto-epistemological theoretical framework underpinning the research exploring human

and nonhuman roles and material-discursive performative intra-actions in the context of APPE rotations in veterinary settings.

### Figure 3.2

*Summary Collage: Entangled Learning with Chapter 3*



The collage conveys the design and flow of the new materialist study informed by agential realist theory where I employed the diffractive methodology proffered by Barad (2007) and an associated diffractive analysis. Veterinary pharmacy AAPE rotations provided dynamic entangled phenomena as the objective referent. In the collage, generated data from collages; semi-structured online individual interviews and interview transcripts; online focus groups and focus group transcripts; documents; and artifacts are passing through a diffraction grating (two slits; agential realism theory, One Health concept). I read through data with a theory and concept to examine entanglements producing a diffraction pattern (insights and inquiry topics).

A diffractive methodology is a transdisciplinary approach (Barad, 2007) supporting a diffractive analysis to think with theories (Jackson & Mazzei, 2023) and concepts while reading

through data. After IRB approval, I recruited participants from my own veterinary pharmacy practice and from SVHP. Willing participants completed a consent form and a demographic questionnaire and returned to me. Data generation commenced: (a) by employing one-on-one individual semi-structured interviews (Roulston, 2022a) with pharmacy students who completed a veterinary pharmacy APPE rotation, (b) by hosting a focus group (Barbour, 2018; Roulston, 2022a) of preceptors who facilitated experiential learning (APPEs) in veterinary settings, and (c) by collecting documents, artifacts, and collages from pharmacy students and veterinary pharmacy preceptors.

In sum, diffractive analysis is an apt approach to use when entangled with a diffractive methodology. I am a researcher positioned within and of the research examining valuing, ways of being, ways of knowing, and effects difference made in the context of experiential learning of pharmacy students in veterinary settings. I continue to be curious to understand “which differences matter, how they matter, and for whom” (Barad, 2007, p. 90).

## CHAPTER 4

### DIFFRACTIVE ANALYSIS: ILLUMINATIONS

The mutually informative methodology of diffractively reading texts (theories) through one another is a particularly apt form of analysis for agential realists. (Barad, 2007, p. 444)

The new materialist philosophy of agential realism developed from Barad's extensive studies in quantum physics is detailed in Barad's (2007) seminal production *Meeting the Universe Halfway: Quantum Physics and the Entanglement of Matter and Meaning* (hereafter noted as *Meeting the Universe Halfway*). Barad offered concepts and methods for research by drawing from the works of physicist Niels Bohr, feminist scholar Donna Haraway, feminist theory, quantum physics, philosophy of physics, science studies, critical theories, and post-ism theories. Barad's diffractive methodology produced a diffractive analysis tool.

Based upon a scientific diffraction apparatus and diffraction grating showing particular bending of waves and particles, and Haraway's (1992; 1997) metaphor of diffraction as an alternative to reflection, Barad (2007) presented diffraction as a methodology for examining differences difference make and differences mattering. Unlike Haraway's semiotic use of diffraction, Barad developed the use of diffraction through quantum aspects, entanglements, and reconsiderations of spacetimemattering for redefining discursive analysis. Specifically, in quantum experiments, light and matter can act like particles or waves in certain conditions and activity can depend on how the diffraction grating is set on the apparatus. Of note, Barad (2007) entangled both microscopic and macroscopic components when Barad considered the apparatus as a material discursive practice: "apparatuses are *material-discursive practices—causal intra-*

*actions through which matter is iteratively and differentially articulated, reconfiguring the material-discursive field of possibilities and impossibilities in the ongoing dynamics of intra-activity that is agency” (p. 170).*

The intent of employing an agential realist<sup>17</sup> research approach encompassed garnering insights and further inquiries into adult learning by engaging a diffractive methodology for illuminating where effects of differences appeared when exploring performative intra-active entanglements during experiential learning rotations of pharmacy students in veterinary settings.

Research questions included:

Q1 What aspects of experiential learning in the veterinary setting illuminate the learner’s way of valuing (ethics), being (ontology), and knowing (epistemology)?

Q2 In what ways are *matters*<sup>18</sup> significant in the student’s veterinary pharmacy experiential learning in the veterinary setting?

Q3 Where do effects of difference appear in the context of experiential learning in veterinary settings?

### **Diffractive Analysis Genealogy**

The key scholar I referenced throughout my research and who proposed agential realism as a theory and diffraction as a methodology for analysis (not just a metaphor) is Karen Barad, a physicist with a PhD in theoretical particle physics and quantum field theory. In the book *Meeting the Universe Halfway*, Barad (2007) detailed the physical phenomenon of diffraction and proposed diffraction as an analysis tool. Barad showed how a diffraction apparatus measures effects of difference, illuminates entanglements, and addresses ontological and epistemological matters.

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<sup>17</sup> See Footnote 3.

<sup>18</sup> See Footnotes 4 and 9.

Barad (2007) mentioned drawing from the work of Donna Haraway. In Haraway's (1992) essay, "The Promises of Monsters: A Regenerative Politics for Inappropriate/d Others", Haraway troubled the metaphor of optical devices for use in analysis and moved away from reflection (mirror; sameness) to diffraction (diffracting apparatus; difference). Haraway (1992) posited, "Diffraction is a mapping of interference, not of replication, reflection, or reproduction. A diffraction pattern does not map where differences appear, but rather maps where the *effects* of difference appear" (p. 300). Haraway (1992) mapped small consequential differences and considered processing of differences a semiotic action.

Haraway (1997) continued writing about how diffractive interference patterns "make a difference in how meanings are made and lived" (p. 14). In an interview with Thyra Nichols Goodeve, Haraway explained she was "interested in the way diffraction patterns record the history of interaction, interference, reinforcement, difference. In this sense, 'diffraction' is a narrative, graphic, psychological, spiritual, and political technology for making consequential meanings" (Haraway, 2000, p. 102).

In this section I gave a brief visual overview of the physical phenomenon of diffraction displayed with descriptions to foster connection of diffraction as a physical phenomenon and as a methodology for analysis proposed by Karen Barad. Barad (2007) described the methodology as "a transdisciplinary approach" (p. 25) and "the notion of diffraction as a tool of analysis for attending to and responding to the effects of difference" (p. 75). Staying close to Barad's (2007) words, I heeded the call to impart understanding of diffraction: "If diffraction is to be a useful tool of analysis it is important to have a thorough understanding of its nature and how it works" (p. 75).

Merriam-Webster (n.d.) defined diffraction as “the bending or spreading of a beam of light especially when passing through a narrow opening or by the edge of an object.” I graphed and demonstrated bending of light (diffraction) in Figures 4.1 and 4.2. All images and graphics are my own in Figures 4.1 and 4.2. After conveying basic diffraction behaviors, I mapped how Barad (2007) entangled theoretical quantum physics to produce a diffractive methodology and a diffractive analysis tool by putting social and scientific theories in conversation for enabling “critical rethinking of science and the social in their relationality” and fostering “respectful engagements with different disciplinary practices” (p. 93).

It is important to remember the diffractive methodology (e.g., diffractive analysis) supported by agential realism is not an additive approach, it is examining dynamic relational ontologies while attentively examining differences, exclusions, and boundary productions. However, drawing from the physical phenomenon of diffraction we notice illumination; therefore, when using a diffractive methodology, we can illuminate insight(s). I explained this further in this section when reading the physical phenomenon of diffraction through the diffractive methodology of agential realism.

In Figure 4.1, I showed the difference between a light wave diffracted and a light wave not diffracted. I used the colors red and blue since they have different wavelengths with red being greater. Although there is a range depending on the ‘shade of color’ (radiation, spectral region, wavelength), for my purposes of explanation I used a wavelength of 650 nm (nanometers) for red and 450 nm for blue (Lüders & Pohl, 1930/2018, p. 322). I used ‘’ in the previous sentence around *shade of color* since there are physicists who are not keen on word descriptors and use such terms (e.g., red) by describing where the word came from: “*Colors* are

not physical properties, but rather results of psychology and physiology!” (Lüders & Pohl, 1932/2017, p. 4).

In Figure 4.1, the two different slits where coherent blue and red waves passed through are the same size. By coherent I mean the blue light (electromagnetic radiation) is one particular wavelength traveling in the same direction and the red light (electromagnetic radiation) is a particular wavelength traveling in the same direction. The blue light (450 nm) passed through the slit in a straight line, then amplified onto the screen directly since the wavelength size passed through the slit without interference. In contrast, since the wavelength of red light is greater (650 nm), the wave of light did not pass freely through the slit and became a diffracted wave producing a diffraction pattern on the screen with the center showing the greatest amplification. Of note, in Figures 4.1 and 4.2 the screens are absorbing screens measuring (recording) the diffraction (e.g., pattern, amplification).

**Figure 4.1**

*Light Waves Diffracted and Not Diffracted*

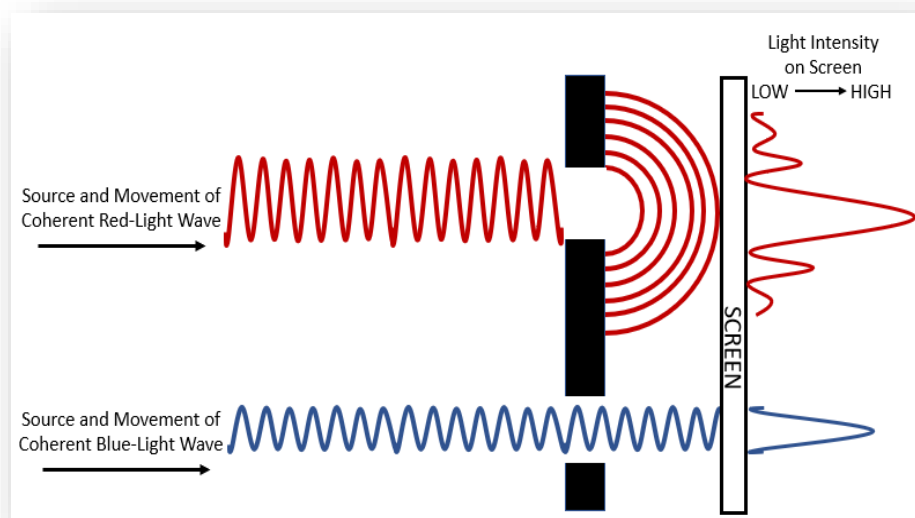
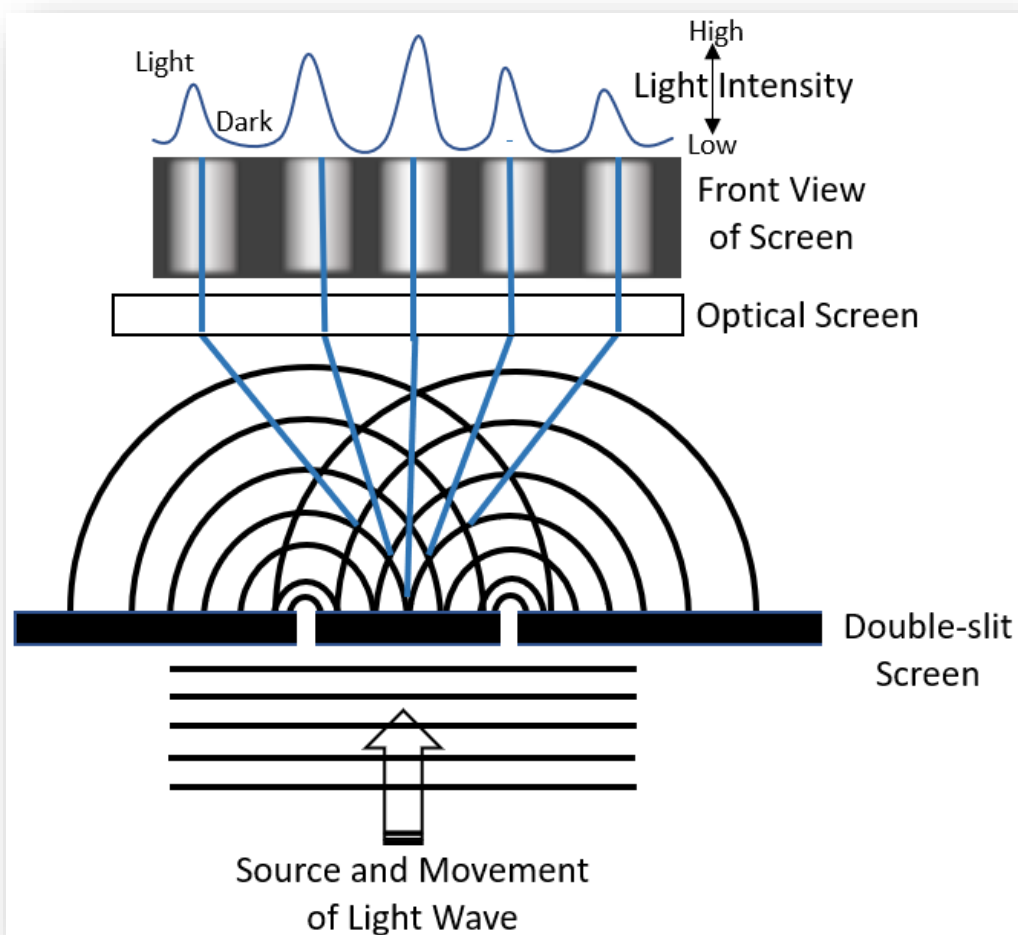


Figure 4.2 is a two slit experiment where a wave passed through two slits and produced two diffracted waves. At the intersection where the two diffracted waves overlapped, we noticed constructive and destructive interference. Placing the blue lines going from the waves to the screen guided our view for noticing the difference between constructive and destructive interference. The blue lines follow the path of constructive interference. When the waves are in sync (maxima in phase), they produce a greater intensity of light. When waves are not in phase, we notice dark regions (low intensity of light).

**Figure 4.2**

*Light Waves Diffracted: Double Slit*



## **Diffracting Diffraction**

By performatively intra-acting with the physical phenomenon of diffraction I read the diffraction patterns through the methodology of diffraction, enacting a diffractive analysis, to produce further insights for (re)examining adult learning. In Figure 4.1, I noticed the size of the slits and the size of the wavelength can produce effects of difference when one passes through the other. Reading through Barad's (2007) terminology, the slits are the diffraction grating of the apparatus. When I looked at the material-discursive practice (apparatus) I entangled the researcher, the material of the apparatus, the light source, the location, and the waves to not only consider what caused a difference (interference), but also the difference the difference made (diffraction pattern) and what was excluded (no interference with blue light).

I garnered more insights when reading the two slit diffraction of Figure 4.2. The constructive and destructive interference patterns drew my attention. I thought (I confused the word interfere with disruption) when the waves overlapped, they would have cancelled each other out, flattening the effect; however, this is not the case with diffraction. When the waves overlapped a constructive interference formed (where effects of difference appear) producing a greater intensity. The more constructive interferences, the greater the intensity when projected on the screen (differences difference made). The darker areas on the screen conveyed low intensity destructive interference producing diminishing intensity (accountability of exclusions).

Reading the diffractive methodology through the physical phenomenon (material entanglement) of diffraction I related insights to my research. The purpose of my research is to recognize performative intra-active entanglements diffracting differences mattering for students' experiential learning and becoming veterinary pharmacist in the veterinary setting. I troubled this purpose as I engaged diffracting diffraction. Diffractive methodology, as described by Barad

(2014), is used “constructively and deconstructively (not destructively) in making new patterns of understanding-becoming” (p. 187); hence, Barad moved diffraction as a methodology to an affirmative engagement for studying difference (diffractive analysis). An affirmative engagement celebrates difference as productive (e.g., produces new insights, produces analytical inquiries).

### **Diffractive Analysis Enactments**

As I searched literature, I found varied approaches for employing a diffractive analysis when engaging a diffractive methodology. In Table 4.1, I highlighted different diffractive analysis applications. Interestingly, although none of the approaches were exactly the same, I found the openness of diffractive analysis, in the context of diffractive methodology, a welcoming invitation for contributing to the field of adult learning; specifically, experiential learning of pharmacy students in veterinary settings.

**Table 4.1**

*Examples of Diffractive Analysis Approaches*

| <b>Author/Year</b>           | <b>Diffractive Analysis Approach</b>                                                                                                                                                                                                         |
|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Chappell et al. (2019)       | Read through a large data set and multiple cases using two underlying concepts: dialogue and transdisciplinary                                                                                                                               |
| Crickmay & Ruck Keene (2022) | Read a thematic analysis and diffractive analysis of same data next to and in dialogue together (intra-active material discursive practice)                                                                                                  |
| Hill (2017)                  | Re-read data through theories of self-regulation and new materialism looking for overlaps and interferences; considered the literature review a diffractive practice                                                                         |
| Murris & Bozalek (2019)      | Affirmatively, diffractively read philosophies through each other in two different forms: writings of two scholars and three books about posthuman; non-representational research yielding propositions for approaching diffractive analysis |
| Ulmer (2016)                 | Read a critical policy analysis through two different theoretical concepts: Jane Bennett’s vibrant (political) ecologies and Gloria Anzaldúa’s B/borderlands for understanding educational policy differently                                |
| Warren (2021)                | Read data from a research study diffractively through concepts of Deleuze and Guattari: rhizoanalysis and cartography of sense analysis for understanding love in teaching                                                                   |

### Entangling Diffractive Analysis

Diffraction can be understood “as a material-discursive practice and as a critical practice” (Barad, 2007, p. 94). I explored performative intra-active entanglements diffracting becoming-with and ongoingness (Haraway, 2016) within experiential learning research data. I read through data with Barad’s (2007) agential realist theory and One Health concept (CDC, 2021; WHO, 2017) to examine generated data. Agential realism supported a transdisciplinary One Health entangled intra-activity of humans, animals, and environments producing illuminations of post-anthropocentric experiential learning of pharmacy students in veterinary settings. To assist illuminations, I employed diagrammatical thinking via diffractive analysis when exploring intra-actions (Q2; Q3).

The point of diagrammatical thinking is to acknowledge human materiality alongside other matter and enter into co-constituting relationships in ways that put into motion new continuums of becoming for humans, nonhumans, institutions, material and conceptual entities, and their infinite and possible intersections. (Freeman, 2017, p. 108)

Data I examined included transcript productions formed from narrative of participants who engaged in either semi-structured interviews (students who completed APPE rotations in veterinary settings), or a focus group (preceptors who facilitated learning of pharmacy students in veterinary settings). When I presented excerpts of transcript productions, I cleaned up the narrative of participants (e.g., removed ‘um’, removed ‘you know’) for readability and did not cut apart or restructure the narrative. I kept in mind Yardley’s (2006) words, “when we share a narrative we are entering, together, a creative, imaginative space that has great power in the ‘real’ world” (para. 34). I had a responsibility to perform ethically and as transparent as possible while protecting the identity of participant(s). I also examined documents (e.g., student

reflections, syllabuses, self-assessments), artifacts (e.g., digital images, objects), and collages. I presented written material data verbatim. When I used the term ‘written’ it signified handwritten, typed, or digital formats.

### **Diffraction Entangled Ethio-Onto-Epistemologies**

In this section, I explored the question (Q1): What aspects of experiential learning in the veterinary setting illuminate the learner’s way of being (ontology), valuing (ethics), and knowing (epistemology)? Barad (2007) presented agential realism and diffraction as ethico-onto-epistemological frameworks for exploring entangled material-discursive practices. Barad proposed ethics, ontology, and epistemology as not separable (p. 90) and when reading transcripts, I noticed the inseparability. Knowing and obtaining knowledge (knowing↔learning) are intertwined with being and becoming (being↔becoming) and ethics (valuing) as shown in past pharmacy students’ semi-structured interview transcript excerpts.

I assigned pseudonyms for all past pharmacy students for privacy. Darren (see Figure 4.3), Gabriel (see Figure 4.4), and Ashley (see Figure 4.5) completed veterinary pharmacy APPE rotations in veterinary settings. One completed an APPE in a University’s Veterinary Teaching Hospital and two completed their APPE’s in a private veterinary clinic. On the surface, each of the past pharmacy students’ transcript excerpts appeared to be situated in either valuing (ethics; Darren), being (ontology; Gabriel), or knowing (epistemology; Ashley). However, with a diffractive reading employing the theoretical framework of agential realism (Barad, 2007) and the One Health concept (CDC, 2021; WHO, 2017), inseparability of ethico-onto-epistemologies became more apparent.

### Figure 4.3

#### *Entangled Ethicality of Care*

**Darren:** As a general statement, working directly with animals taught me a unique outlook on how to deal with humans because an animal can't tell you it hurts here and you're relying so much on all the nonverbal communication. Being able to see a practitioner rely more on the signs and signals versus the actual word conversation with a patient gave me a unique perspective to where when I went to all of my other APPE rotations, I definitely felt like I had a different outlook where I was looking at more than just the simple. If you're talking about diabetes, well, this is my diet. Okay, well, there is more to it than just the simple words being said. You have to explore the nonverbal cues when you have a species who can't talk to you.

Darren expressed valuing nonverbal cues to help human and nonhuman patients. The exclusion (barrier; deconstruction) of understandable verbal communications between human and nonhuman illuminated a material-discursive practice of more than words. An ethicality of care, healthcare benefiting patients, became an entangled doing (performative intra-active entanglement) where valuing, knowing↔learning, and being↔becoming expressed inseparability. Although Darren said, “an animal can’t tell you it hurts,” I argue animals can and do communicate with us; however, it is because of our human condition we cannot fully understand what they are trying to tell us. The practitioner and animal mattered in the (re)configuring of Darren’s onto-epistemology by showing how signs and signals (intra-active doing; congealing of agency) opened new insights to communication. Darren employed his new reconfiguration on other APPE rotations (effects of difference). Darren’s other APPE rotations involved human patients. However, valuing animals in an entangled ethicality of care allowed practicing communication skills with animals and enhanced his learning, knowing, and becoming as he developed from a student to pharmacy practitioner.

#### Figure 4.4

##### *Entangled Compassion*

**Gabriel:** People that work in the animal setting have a different level of compassion, in my opinion, for helping. Patients do have a lot of those communication barriers and it's just something that you have to be actively seeking out to further your education, you can't just work in veterinary medicine because it's a job and not have the compassion, you have to seek out the learning and the experiences to be a good veterinary pharmacist. You have to have that kind of compassion there to want to further your education and experience to be a good veterinary pharmacist. Those are important things to me that I noticed everybody had but nobody necessarily talked about or maybe didn't know they had, but I could see the compassion in all the other people that worked there.

Gabriel noticed a state of being (ontology) of people (others) she learned with during her APPE rotation in a veterinary setting. Gabriel noticed how people working in the veterinary setting had high levels of compassion for animals (others). Barad (2012) addressed compassion:

Living compassionately, sharing in the suffering of the other, does not require anything like complete understanding (and might, in fact, necessitate the disruption of this very yearning). Rather, living compassionately requires recognizing and facing our responsibility to the infinitude of the other, welcoming the stranger whose very existence is the possibility of touching and being touched, who gifts us with both the ability to respond and the longing for justice-to-come. (p. 219)

Employing a diffractive analysis and reading through the transcript excerpt with an agential realist theory (Barad, 2007) and the One Health concept (CDC, 2021; WHO, 2017) where the health of humans, animals, and environments are entangled, I noticed the entanglements of others (e.g., humans, nonhumans). When Gabriel mentioned, “you can’t just work in veterinary medicine because it’s a job and not have the compassion, you have to seek out

the learning and the experiences to be a good veterinary pharmacist” and further stated, “those are important things to me”, Gabriel expressed an inseparable ethico-onto-epistemology. Entangled learning and experiences coproduced an epistemology with other matters while being a student, becoming professional, and attending to an ethicality of care becoming compassionate for others.

Entanglements are relations of obligation—being bound to the other—enfolded traces of othering. Othering, the constitution of an ‘Other’, entails an indebtedness to the ‘Other’, who is irreducibly and materially bound to, threaded through, the ‘self’—a diffraction/dispersion of identity. ‘Otherness’ is an entangled relation of difference (*différance*). Ethicality entails noncoincidence with oneself. (Barad, 2010, p. 265)

#### Figure 4.5

##### *Illuminating Exclusion*

**Ashley:** We had a horse before [in the retail setting where I worked] that was on dexamethasone and the dose was crazy. I feel like since I'm not taught this at the University, I need to have the experience and apply these things that I'm gonna learn on rotation, to be able to make the connections back home. So, I wanted to grasp all of this information and take it back with me so that I can continue to share. My experience is definitely coming from the drive to want to grow personally and professionally, as well as to bridge the gap between my retail experience and something that I'm unfamiliar with.

**Ashley:** It just amazes me that not once, not even in a toxicology lecture, were we introduced to veterinary pharmacy or veterinary medicine and how [the veterinary pharmacy APPE] was my first time learning that a single Tylenol could kill a cat. It's just, it's crazy to me that [...] University does not teach on this topic. And I think it is so, so, so important.

Diffractively reading Ashley's transcript excerpts, I noticed an epistemological illumination of exclusion: “I'm not taught this at the University.” The exclusion coproduced Ashley's desire to intra-actively entangle with other matters (e.g., space, place, humans,

nonhumans). Ashley felt a need to connect human and nonhuman health (One Health) by experiencing veterinary pharmacy learning in an experiential APPE rotation. Nonhuman entanglements (dexamethasone, horse, acetaminophen, cat) illuminated a need for veterinary pharmacy learning, a need for becoming veterinary pharmacist, and an expressed ethicality enfolding others “through oneself and through all being and non/being” (Barad 2012, p. 217).

### **Diffraction Mattering**

In this section, I explored the question (Q2): In what ways are *matters*<sup>19</sup> significant in the student’s veterinary pharmacy experiential learning in the veterinary setting? With diagrammatical thinking “the focus of analysis is on the between-state of entangled entities” (Freeman, 2017, p. 68); therefore, I employed diagrammatical thinking in the line of diffractive analysis as an approach to examine and convey entangled intra-actions. “‘Diffractive analysis’ focuses on the emergence of new phenomena through relationality and difference” (Chappell et al., 2019, p. 302). Drawing from approaches of scholars employing a diffractive analysis (see Table 4.1) and the open, ongoingness of new materialist philosophy, I read interview and focus group transcripts through the One Health concept (CDC, 2021; WHO, 2017), then through an agential realist perspective (Barad, 2007).

The One Health (OH) concept is an approach I employ as a preceptor for introducing students to learning-with animals and within environments. The OH concept considers the health of humans, animals, and environments as inextricably entangled. I have found introducing students to the OH concept useful for helping them engage a nonhuman patient case, and pushing past anthropocentrism into post-anthropocentric learning where we evolve to encompass nonhumans and ecosystems for sustainable health (Pierce, 2017).

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<sup>19</sup> See Footnotes 4 and 9.

I read through data (e.g., transcripts, documents, artifacts, collages) with the OH concept and agential realism theory at the fore and noticed ways matters expressed as significant in veterinary pharmacy learning. I (re)troubled (affirmatively constructed and deconstructed) one section of Kellye's transcript excerpts (see Figure 4.6) as shown in Figure 4.7.

**Figure 4.6**

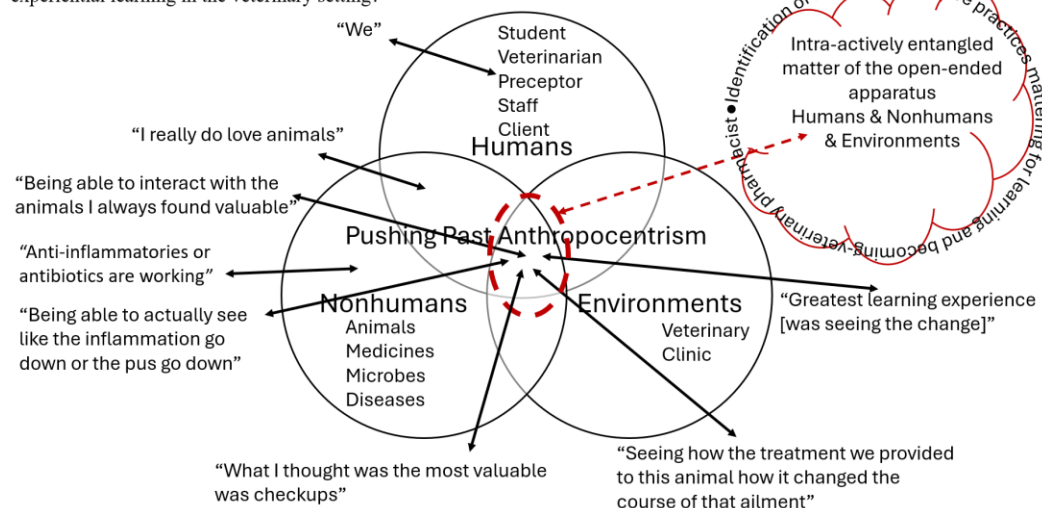
*Experiential Learning Entanglements*

**Kellye:** I loved most engagements with the animals because, like I said, I really do love animals. And so, being able to interact with the animals I always found valuable. What I thought was the most valuable was checkups. So, if we saw a patient for a condition one day, and then we had to do a follow up in a week, seeing how the treatment we provided to this animal, how it changed the course of that ailment in that patient, how it worked, and how the patient responded, things like that. So, I think that was the greatest learning experience, was seeing: oh, they came in looking like this when they arrived, we treated them for one or two weeks, and this is how they look now. I think seeing that play through is very helpful compared to just providing treatment and then not being able to see that follow up. So, that's more like theory: like oh, I know what this is supposed to do for them. But being able to actually see the inflammation go down, or the pus go down so we know that our anti-inflammatories or antibiotics are working, I think was a great learning experience.

**Figure 4.7**

*Diffraction Analysis: Material-Discursive Co-Production*

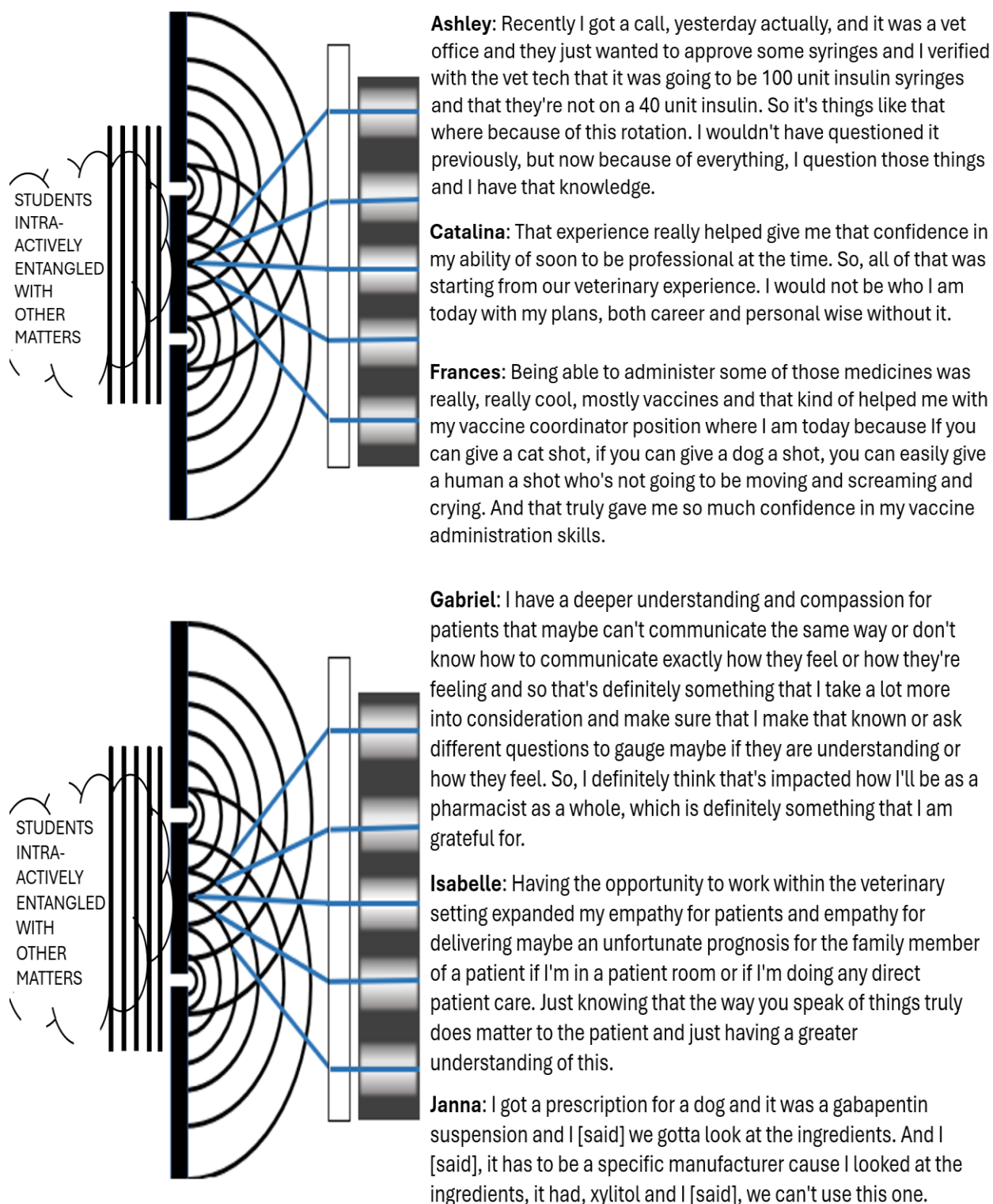
In what ways are *matters* significant in the student's veterinary pharmacy experiential learning in the veterinary setting?



Modifying the OH model of humans, animals, and environments, I transformed the word ‘animals’ into ‘nonhumans’ to capture a wider breath of materiality (e.g., animals, equipment, medications, diseases). I noticed Kellye spoke throughout the section using the term ‘we’ when mentioning exams. Kellye was not one, she was intra-actively entangled matter of the open-ended apparatus (Barad, 2007). Entangled within the apparatus becoming together in the doing (Barad, 2003), I noticed humans (e.g., student, veterinarian, preceptor, support staff, client), environment (e.g., veterinary clinic), nonhumans (e.g., animals, treatments, medications, vaccines, ailments), and the experiential learning experience (e.g., checkups, exams, procedures, counseling). Intra-active entanglements not only mattered to Kellye’s learning but also benefited animals (e.g., preventative care).

### **Diffraction Differences**

For question three (Q3) I explored: Where do effects of difference appear in the context of experiential learning in veterinary settings? I was nearly overwhelmed with illuminations from effects of difference illuminations. Therefore, I selected effects of difference (see Figure 4.8) reported by six past pharmacy students who completed an APPE rotation in a veterinary setting while understanding effects of differences would not have occurred without intra-active entanglements. Effects of difference were co-produced with other matters (e.g., humans, nonhumans, environments). Reporting from students signified insights of agential cuts (marks on bodies; in this case, reconfiguration of the student). The effects of differences conveyed in Figure 4.8 are excerpts. I did not show all effects of differences illuminated. I did not include others (e.g., preceptors, veterinarians, animals, space, place); although, traces of entanglement with others linger within the reconfiguration of past pharmacy students (inseparability).

**Figure 4.8***Diffracting Effects of Difference Through an Experiential Learning Apparatus*

### Agential Cuts

Agential cuts are enacted within phenomena “‘they’ and ‘we’ are co-constituted and entangled through the very cuts ‘we’ help to enact. Intra-actions cut ‘things’ together and apart. Cuts are not enacted from the outside, nor are they ever enacted once and for all” (Barad, 2007, p. 179). For researchers employing a *diffraction methodology*,<sup>20</sup> securing objectivity of an agential realist research approach is through agential separability within phenomena and accounting for marks on bodies (intra-actions reconfiguring differential mattering). Importantly, non-separability of intra-actions allows researchers to objectively examine phenomena (objective referents) without disentangling phenomena because particular intra-actions (non-separability) and particular agential cuts (contingent agential separability within phenomena) are coproductive of particular marks on bodies (differences mattering; contingent ontologies; Barad, 2007).

Looking at effects of differences of past veterinary pharmacy APPE students in Figure 4.8, we can read through data with an agential realist theory and the One Health concept (diffraction grating<sup>21</sup>) and examine contingent ontologies (reconfigurations of students materialized through different material-discursive practices). Exploring Ashley’s transcript excerpt, the past pharmacy student attributed questioning the size of the insulin to the knowledge she gained from the veterinary pharmacy APPE rotation. However, examining through the diffraction grating (agential realism theory, One Health concept), an ethico-onto-epistemological framework comes to the fore. From Ashley’s past intra-active entanglement (contingent ontology) at the veterinary pharmacy APPE rotation, a reconfigured phenomenon emerged

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<sup>20</sup> Italicized words of my own (excluding quotes from others) signify contingencies produced from the diffractive analysis and reviewed in Chapter 5.

<sup>21</sup> The two slits in Figure 4.8 signify agential realism and One Health where matters are being passes through. Students and other matters are inseparable within phenomena. However, with a contingent agential cut, agential separability is enacted productive of objectivity and examining students within phenomena (within intra-active entanglements).

enfolding another veterinary office. *Generative entanglements* of intra-active matter co-produced ethical care of a nonhuman. Matters significant within the generative entanglement included humans (e.g., preceptor, veterinarians, veterinary staff), nonhumans (e.g., animals, references, resources, insulins, syringes, veterinary pharmacy learning environment, pharmacy work environment). Ashley, being a healthcare provider in a reconfigured phenomenon expressed becoming intertwined with learning and knowing as she questioned the type of insulin for supplying the correct syringe to the client for the animal (differences matter; 100U or 40U syringe). These differences matter as they have profound effects of difference on the life of the animal the caregiver is treating. The wrong syringe for a particular insulin could result in an over- or underdose producing ethico-onto-epistemological consequences.

Similarly, Janna questioned a gabapentin prescription fill almost dispensed to a canine patient. Although the gabapentin and the dose were appropriate, Janna looked for inclusions and exclusions (what sweetening agent was mixed with the gabapentin). Using a diffractive methodology, inclusions and exclusions are important for examining material-discursive practices and differences mattering. Differences mattering in this case illuminated inclusion or exclusion of xylitol. Importantly, xylitol (at certain concentrations) should be excluded from formulations for canine patients due to toxic side effects (e.g., gastrointestinal effects, liver failure, death). Janna said the product needed to be switched to a gabapentin product without xylitol. Examining inclusions and exclusions of generative entanglements matter. Exclusion of veterinary pharmacy learning about xylitol could potentially lead to a fatal error when xylitol is included in gabapentin products being dispensed to canines. However, Janna changed the gabapentin product to exclude the xylitol, producing a favorable ethico-onto-epistemological

consequence. Effects of differences are contingent upon entanglement of matter (e.g., human, canine, allergic response, metabolism).

*Entangled learning* produced confidence in Catalina and Frances. Catalina said, “I would not be who I am today with my plans, both career and personal wise without it.” Entangled learning from the veterinary pharmacy APPE rotation reconfigured Catalina onto a different path where she is committed to a future serving animal patients and their caregivers. Marked by confidence, at the time of the interview, Catalina expressed her plans to build her own veterinary pharmacy practice.

Frances’ veterinary pharmacy learning produced confidence in her vaccine administration skills. Entangled learning mattering enfolded animals, medicines, preceptor, veterinarians, veterinary staff, veterinary learning environments, and vaccines. Material-discursive practices within entanglements produced effects of difference. The contingent ontology at the time of the interview of the past veterinary pharmacy APPE student illuminated her vaccine coordinator position. Frances said veterinary pharmacy learning helped her with her vaccine coordinator role, “if you can give a cat a shot, if you can give a dog a shot, you can easily give a human a shot.”

Preceptors are an important inclusion of entangled learning of veterinary pharmacy APPE students. How preceptors are *leading learning*—what preceptors do, what they include, and what they exclude (material-discursive practices)—makes a mark on those they intra-actively entangle with. Gabriel observed how her preceptor compassionately communicated with animal patients. Intra-actively entangling with the preceptor, animals, veterinary staff, and veterinary learning environment coproduced a reconfiguration of Gabriel where nonverbal compassionate care could be reapproached and reimagined for both human and nonhuman patients. Isabelle’s intra-active entanglements produced empathy for human and nonhuman patients and family members as she

observed how the preceptor delivered grim diagnoses to animal caregivers. Isabelle expressed a reconfiguration towards ethical care: “Just knowing that the way you speak of things truly does matter to the patient and just having a greater understanding of this.”

### Summary

In this chapter I traced the genealogy of diffractive analysis in the context of the diffractive methodology proposed by Barad (2007) by detailing Barad’s background and examining the physical phenomenon of diffraction. Next, I created a table of how researchers have differently enacted diffractive analysis. Then, I engaged a diffractive analysis by re-turning research data and shared insights produced. I used re-turning data as demonstrated by Barad’s (2014) nonhuman example:

We might imagine re-turning as a multiplicity of processes, such as the kinds earthworms revel in while helping to make compost or otherwise being busy at work and at play: turning the soil over and over – ingesting and excreting it, tunnelling through it, burrowing, all means of aerating the soil, allowing oxygen in, opening it up and breathing new life into it. (p. 168)

Diffractive analysis allowed troubling an ethico-onto-epistemological framework for noticing differences, entanglements, and relationalities (Warren, 2021). Through different material-discursive practices (contingent ontologies) varied patterns of difference materialized. With a diffractive analysis I examined effects of difference. Effects of difference are contingent upon intra-active entanglements within phenomena. Contingent ontologies read through the diffraction grating of agential realism theory and the One Health concept illuminated entangled learning, leading learning, generative entanglements, and how a diffractive methodology



stairway is a sign of opportunity going from one intra-active reconfiguration to another (dynamic phenomena). The rail of the staircase is support and intra-activity in relation. It looks like the stairway ends at a wall (barrier) but what we cannot see is the platform leading us to another level (revealing the unknown to be known; awaring).

The veterinarian communicating with an animal's caregiver depicts an entangled ethicality of care (see Figure 4.3, Darren, see Figure 4.8, Isabelle) where the animal and caregiver are valued. Although it may seem odd the animal is in a carrier, it is a compassionate approach (see Figure 4.4 & 4.8, Gabriel) for a nervous cat. The cat remains in a familiar space to help decrease anxiety of unfamiliar territory. Another way the veterinarian and caregiver may help calm the patient is by administering compounded gabapentin. Compounded gabapentin is shown through the images of the bottle and powder. However, ingredients used for different animals matter differently (see Figure 4.8, Janna). Occurring without human intervention, entangled learning about compassion, nurturing, care, and valuing can be found in nature shown by the canine with her pups and the mare with her foal,

The horse at the top center of the collage reminds us of not only the variety of animals but also dose differences (see Figure 4.5, Ashley). Purely anthropocentric learning is a disservice for our animal patients. Products and doses can yield profound effects on both human and nonhuman patients. Sometimes effects of difference are favorable (e.g., insulin at correct dose helps control diabetes) and sometimes effects of difference are deleterious (wrong insulin syringe selected for insulin and incorrect dose given causing harm; see Figure 4.8, Ashley).

Post-anthropocentric learning exclusion in pharmacy schools can be harmful to human and nonhuman health (see Figure 4.5, Ashley). I have had several APPE students who I have precepted in the veterinary clinic who love cats. However, when we start learning more about

toxicology, they are surprised acetaminophen could kill their cat. Counseling animal caregivers not only about how to administer medications to their animals but also storage (depicted by chain on cabinet) and what not to give (depicted by ‘poison’ sticker) become important aspects of post-anthropocentric learning.

Post-anthropocentric learning is vital for protecting human and nonhuman lives (including environments). In nature, a cat may be harmful to a grey parrot; however, something as simple as a stargazer lily found in home living environments and landscapes are plants toxic to cats. Grapes and natural grape flavors in drug products can be harmful to dogs. Drugs given to food production animals can cause residues in our food sources if proper discard and withdrawal times are excluded, conveyed in the collage by the dairy cattle, milk, egg, and meat. Post-anthropocentric entangled learning can have an effect of difference illuminating improvement of skills (e.g., vaccine administration; see Figure 4.8, Frances) beneficial for human and nonhuman patients. Entanglements matter.

## CHAPTER 5

### CONTINGENCIES AND IMPLICATIONS

Becoming diffractive involves shifting the gaze from individuals to human and more-than-human entanglements, and attending to the emergence of phenomena and to how differences are produced and made to matter. The goal of the diffractive practitioner is not to determine cause and effect relationships but rather to observe how particular entanglements become agential, co-constituting reality. (Hill, 2017, p. 7)

In this chapter I explore contingencies and implications bursting forth (Roulston, 2022b) from engaging a diffractive analysis. I use the term contingency to acknowledge the physical phenomenon of diffraction as appreciated in quantum mechanics. Importantly, unlike constructs of deterministic geometrical theory of diffraction with formulaic contingencies (Mazar and Felsen, 1989), agential realism supports contingent ontologies where determinate entities are coproduced from their intra-action within a particular phenomenon. For example, if looking through a microscope, what is revealed is contingent upon material-discursive practices (e.g., type of microscope and capabilities; grating set; method; stain; cell). In our case, contingent material-discursive practices are revealed through apparatuses of experiential learning. Apparatuses of experiential learning “are not preexisting or fixed entities; they are themselves constituted through particular practices that are perpetually open to rearrangements, rearticulations, and other reworkings” (Barad, 2007, p. 203).

When applying a diffractive methodology, contingent entangled intra-actions illuminated variable diffraction patterns. Contingencies exposed phenomenon (entangled material-discursive practices) as not fixed but as reiterative, reconfigurative, and generative contingent upon particular (in)determinate boundaries. When I showed the physical phenomenon of diffraction

(objective referent; see Chapter 4, see Figures 4.1 & 4.2), contingencies produced variable diffraction patterns based on certain conditions (e.g., light source, wavelength, diffraction grating). Significantly, students are not the objective referent of this research, the objective referent is the phenomenon (entangled intra-actions of objects and agencies of observation) where contingencies produced particular illuminations. With this in mind, research questions focusing on learners allowed enactment of a cut<sup>22</sup> (boundary) delineating the learner from the agencies of observation (e.g., researcher).

Attuning to ethico-onto-epistemological implications, agential realism theory entangled with the One Health concept supported examining and understanding experiential learning differently (diffraction grating). When discursive practices are recognized as material articulations of the world with mutual implications (material and discursive practices are inseparable), one can examine phenomena from a post-anthropocentric stance (nature and culture in relation).

Implications presented in this chapter enfold humans, nonhumans, and environments in relation. Entangled intra-actions coproduced insights and inquiries for further research. I present implications for educators and policy leaders in general; researchers considering diffractive methodology; and preceptors of experiential learning in various settings are brought forth.

The intent of employing an agential realist<sup>23</sup> research approach encompassed garnering insights and further inquiries into adult learning by engaging a diffractive methodology for illuminating where effects of differences appeared when exploring performative intra-active entanglements during experiential learning rotations of pharmacy students in veterinary settings.

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<sup>22</sup> “What is at issue is the enactment of an agential cut, of a contingent separability within a phenomenon. Agential cuts enact the ontological determinacy within a phenomenon and the extension of entanglements that take place through measurement intra-actions” (Barad, 2007, p. 350).

<sup>23</sup> See Footnote 3.

Research questions included:

Q1 What aspects of experiential learning in the veterinary setting illuminate the learner's way of valuing (ethics), being (ontology), and knowing (epistemology)?

Q2 In what ways are *matters*<sup>24</sup> significant in the student's veterinary pharmacy experiential learning in the veterinary setting?

Q3 Where do effects of difference appear in the context of experiential learning in veterinary settings?

### Contingencies

Before presenting diffracted contingencies, I first overview research questions (Q1, Q2, Q3) as a reminder of previous chapters and to enact a contingent cut. When exploring Q1, the relationship of ethics (valuing), being (ontology), and knowing (epistemology) became apparent as inextricably entangled. An example of the entanglement is shown in Figure 5.1 when Catalina (pseudonym) discussed her collage.

#### Figure 5.1

*Entangled Ethico-onto-epistemology*

**Catalina:** I included [resource book] because that was a lot of what we talked about on [my APPE] rotation, about that it's weight-based dosing, also looking at species-specific indications, and then carrying that to the community setting, and if I was in there [the veterinary clinic during APPE rotation] that was my best friend. That was my lifeline, and I was very, very, very happy that I purchased it because community pharmacies don't really have access to it. It has been important to me and has been a good aid both while I was on rotation, my continuing education, and while I was out practicing in the community.

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<sup>24</sup> See Footnotes 4 and 9.

Catalina had a photo-artifact from her Advanced Pharmacy Practice Experience (APPE) rotation of a particular veterinary pharmacy resource book. Catalina called the book her “best friend.” Not only did Catalina value the book, “important to me”, the entanglement of Catalina and the book supported learning and knowing, “what we talked about on rotation”, and being and becoming, “my continuing education.”

Significance of intra-actions (Q2) during experiential learning is shown in Figure 5.2. While on his APPE rotation Darren (pseudonym) observed a surgery performed on a snake. The entanglement (congealed agency of matters) helped reshape his thoughts to consider the health and wellbeing of other species through differences in doses, differences in mechanisms, and variances in how different species metabolize products. Matters significant in Darren’s veterinary pharmacy experiential learning included humans (e.g., veterinarians, veterinary support staff, pharmacist, preceptor, client), nonhumans (snake, dogs, cats, eggs, drugs, implements, tools) and environments (e.g., veterinary hospital, surgery suite).

## Figure 5.2

### *Congeling of Agencies*

**Darren:** They were doing surgery on a 17-foot python who had, it was egg bound. They ended up, I don’t remember the exact number, I want to say there were 25 eggs from this very large snake during surgery. And they were amazing, and I got to observe the entire thing from start to finish. And we talked a lot about sedation and kind of the different mechanism of how they sedate reptiles because of the difference with their body temperatures and how they metabolize drugs, and pulling up what would probably be like 10 times the dose you would give a dog or a cat, and it absolutely terrified the pharmacist dispensing the drugs because they were giving it out by the bottle as opposed to the syringe. So, that was a big learning opportunity.

To show effects of difference of a past veterinary pharmacy APPE student (Q3), I first showed the entangled learning significant to Holly's (pseudonym) reconfiguration during the veterinary pharmacy APPE rotation in Figure 5.3. While Holly was on rotation she spent time with the veterinary cardiology service. Significant to her learning included humans (veterinarians, veterinary support staff, preceptor, client), nonhumans (dog, tests, equipment), environments (e.g., veterinary hospital, cardiology service). Then, I presented an effect of difference by showing how Holly expressed the veterinary pharmacy learning to help a nonhuman patient in Figure 5.4.

### Figure 5.3

#### *Significant Matters*

**Holly:** I think I mentioned one of the animals that I interacted with during [my APPE rotation], it was a cardiology visit. I think this dog in particular either had a heart murmur or heart failure. He was a small little poodle and so I got to sit and observe while they were doing some examinations on him. I don't remember exactly which tests they were doing, but maybe they were doing an echo for him. I can't remember, but I think just being there and watching the whole process then later learning about the medications helped solidify some of that learning at the time when I was there.

### Figure 5.4

#### *Effects of Difference: The Heart of the Matter*

**Holly:** My dog actually had heart failure. So, [after the veterinary pharmacy APPE rotation] I was able to talk through with the veterinarian about the different choices that she was thinking about using and what I thought was probably going to be the most appropriate. We didn't ever start enalapril on her just because her kidney function was never good enough, and that's something that I was able to express to my parents easily because they were like, 'oh, maybe she should get all the medicines.' And I'm like, she's a Maltese and I think this is going to hurt her kidney more than it's going to help her in the long run because her heart failure medications are often a long-term benefit.

Holly helped not only her dog with heart failure but also helped her parents who were taking care of her dog to understand why more medicine would not necessarily be better than fewer medications. “Believing something is true doesn’t make it true. But phenomena—whether lizards, electrons, or humans—exist only as a result of, and as part of, the world’s ongoing intra-activity, its dynamic and contingent differentiation into specific relationalities” (Barad, 2007, p. 353). Holly’s parents believed giving their dog more medicine would be beneficial. However, with Holly’s entangled learning (humans-nonhumans-environments), she expressed contingent differentiation<sup>25</sup> into specific relationalities by enfolding medicine, organ systems, disease states, the animal, and veterinary pharmacy learning helping the dog live another day.

### **Entangled Learning**

As I engaged the diffractive methodology presented by Karen Barad (2027), the entangled nature of the world became clear to me. Specifically, how students are reconfigured differently through various practices (contingent ontology). When reading through data with agential realism and One Health, entangled learning<sup>26</sup> came to the fore. How can we approach entangled learning?

After a workshop at the 2018 Australian Association for Environmental Education (AAEE) Conference and Research Symposium, researchers employing Barad’s agential realism theory (Barad, 2007) identified four entangled learning practices relevant to environmental education praxis (Brown et al., 2020): fracturing binary thinking, engaging interdisciplinary learning, considering entangled agencies, and inquiring through complexity. In the case of post-anthropocentric pharmacy learning where binary thinking is fractured, instead of only learning

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<sup>25</sup> What medicine and when to use medicine depends (is contingent) on many factors (e.g., health of patient, body function status).

<sup>26</sup> Entangled learning is learning-with (learning in-relation). Entangled learning is being aware learning is not in a vacuum but takes place with others, whether human or nonhuman.

how a drug may act within or on the body of a human patient, an educator would be inclusive of nonhuman elements (e.g., animals, environments). Interdisciplinary learning is ubiquitous in pharmacy learning related to humans (e.g., human pharmacy, human medicine, human nursing); however, it is lacking transdisciplinary learning across species and practices (e.g., veterinary pharmacy, veterinary medicine, environmental practices). Considering entangled agencies could be especially useful for underserved populations, and a question an educator may pose would be: ‘In what ways are humans, animals, environments excluded from significance?’ Inquiring through complexity expands educator capacities to enfold human and nonhuman entanglements not only locally but worldly, and “seemingly insignificant actions can contribute to significant effects. The always already entanglement of agential realism reminds us that all of our actions matter” (p. 232).

### **Leading Learning**

Throughout interview transcripts and reflections students mentioned observing preceptors, veterinarians, and others (e.g., veterinary staff, veterinary students) during their APPE rotation. Various coproductions of contingent ontologies materialized through different entangled intra-actions.

### ***Catalina***

Catalina (pseudonym; see Figure 5.5) had a preceptor who modeled critical thinking skills to work through a patient case. In the excerpt, Catalina’s becoming professional illuminated as she described moving from panic to faith in herself. A coproduced contingent ontology materialized through dynamic intra-actions of the student with the preceptor, space and place of learning, dog, radiograph, lungs, medicine, and references.

## Figure 5.5

### *Preceptor Leading Learning: Catalina Becoming Professional*

**Catalina:** I still remember Dr. [...]. I remember the first patient that I had he put up a dog's x ray and was showing me the lungs and he's like, 'okay, you tell me what medications that you use, you see there's fluid in the lungs, go find the medications and give me a dose.' And I remember being like this is totally out of my league, I'm not gonna be able to do this, I have no idea, like just panic. And coming back with him walking me through the steps and then let's go get the doses, all that kind of stuff, go figure it out, I actually felt for the first time that I had that doctorate education behind me afterwards. And before then I had so much self-doubt in myself. Like I said, I didn't really know what I wanted to do where. I just I didn't feel like I had a place or maybe even deserved to be there. So, the fact that I got to go there and feel like I was an actual practitioner, and be able to contribute, and even if I didn't, even if my first answer was wrong, it was figuring out the steps to thinking towards the right answer. So, it was everything for me. It just really built a way for me to think through problems and actually have faith in myself.

### *Emanuel*

Emanuel (pseudonym; see Figure 5.6) expressed appreciation for his preceptors who modeled learning support by creating a welcoming environment. In this excerpt, Emanuel's becoming educator illuminated as he described how the learning environment, coproduced by educators, inspired him to want to precept students.

## Figure 5.6

### *Preceptor Leading Learning: Emanuel Becoming Educator*

**Emanuel:** In my career going forward, I think teaching is something that I really want to do. And so I know that going forward the way that my preceptors, went above and beyond for me to get me all these opportunities, and how open and welcoming all of these veterinarians and veterinary students were to me, that's something that I want to do for other students going forward hopefully if I have the opportunity to precept. I would want to create that environment for [students] that [my preceptors] did for me. So, I think that's something that I'll continue to take going forward, is that welcoming environment that they created.

## *Isabelle*

Isabelle (pseudonym; see Figure 5.7) had a preceptor who modeled empathetic communications when having difficult conversations with animal caregivers. Euthanasia is the practice of ending a patient's life. In veterinary settings, students may observe euthanasia of an animal. In this excerpt, Isabelle's becoming communicator illuminated as she described how learning in the veterinary setting expanded her empathy and approach to communications.

### **Figure 5.7**

#### *Preceptor Leading Learning: Isabelle Becoming Communicator*

**Isabelle:** I think just having the opportunity to work within the veterinary setting expanded my empathy for patients and empathy for delivering maybe an unfortunate prognosis for the family member of a patient if I'm in a patient room or if I'm doing any direct patient care. Just knowing that the way you speak of things truly does matter to the patient and just having a greater understanding of this.

### **Generative Entanglement**

Generativity brings forth new worlds, ideas, reiterations, and reconfigurings. Generativity is an 'awaring', a coproduction of that which is becoming known that was never foreknowable (Nicolaides et al., 2023). Through the theory of agential realism, entangled intra-actions are dynamically generative and reconfigurative (Barad, 2007). With the One Health concept, generative entanglements of humans, nonhumans, and environments are dynamically generative and reconfigure approaches to complex challenges (e.g., sustainable workplace safety; Lindell et al., 2022). To convey generative entanglement contingencies within the environment of veterinary pharmacy learning, I show a collage created from images and words of past veterinary pharmacy APPE students (see Figure 5.8). Importantly, "images or representations are not snapshots or depictions of what awaits us but rather condensations or traces of multiple practices of engagement" (Barad, 2007, p. 53). Here are excerpts from students' collage explanations:

- “Learning about drug information regarding veterinary practice, that of which I had little exposure to while in pharmacy school, was vital to me. This included both review of canine and feline disease states and pharmacotherapy treatment plans, as well as the resources utilized to determine drug dosing.”
- “While I had rudimentary knowledge of compounding before rotation (depicted by the mortar and pestle), I gained significant knowledge and became proficient at it while on rotation.”
- “While on rotation I was able to participate in many off-site experiences including rounding with exotics doctors at a local zoo.”
- “I also included a quote by Mahatma Gandhi because it reminded me of One Health and reflects how we are responsible for the wellbeing of the animals around us.”
- “I took many photos of my snowy walks to the veterinary campus. Most veterinary campuses have a rural quality, and this campus was no different with its beautiful scenery.”
- “I learned so much during my veterinary medicine rotation at [the Veterinary Hospital] about pharmacy and my love for animals grew deeper for them having had the opportunity to help get them better.”
- “The experiences within the surgical suites from the moment of acquiring vitals on the patient long before it was anesthetized for its procedure all the way to waking up the patient post-operatively, were invaluable.”
- “I was able to work within the lab to perform and analyze the results of various diagnostic tests, including CBC, Chem-17, SDMA, thyroid hormone (T4), electrolyte, heartworm, and fecal testing, as seen under the microscope.”

- “The most exciting experiences from my APPE rotation include assisting with patient exams and procedures.”

Depending on the veterinary pharmacy APPE site, various types of animals may be the focus of learning activities (zoo med: lion; farm animals: cattle, horse, rooster; small animal clinic: dogs, cats) and the space and place of learning yield various affective responses (snowy rural farm scene). Sometimes animals harbor microbes or parasites we cannot see without assistance of a microscope. Microscopes and other diagnostic tools allow what was not seen to be seen, aiding our approach to helping animals.

Gandhi's quote in the collage reminded a student about One Health and our responsibility for their wellbeing. Underlying veterinary pharmacy learning is an ethical valuing of animal lives as conveyed by the heart underneath the center of the collage. Throughout students' collage explanations and interviews, they expressed their love for animals. Generative entanglements of their veterinary pharmacy learning supported their valuing of animals, knowing how to better treat their patients, and their becoming veterinary pharmacists.

### **Diffraction Methodology**

After data generation, I proceeded with a diffractive analysis where I read data through a theory (agential realism) and a concept (One Health). 'Reading through' is the diffraction grating. In a physics experiment a researcher may study the diffraction grating or the object (e.g., light, matter) passing through the diffraction grating (Barad, 2007). For our purposes in this research, we are not particularly studying the diffraction grating itself (two slits, agential realism and One Health), we are researching entangled matter being passed through the two slit diffraction grating. We can use diffraction because in quantum physics we understand light (e.g., wavelengths) can act like a particle or wave contingent upon certain conditions, and matter (e.g., electrons) can act like a wave or particle contingent upon certain conditions (2007). In this

research, matter<sup>27</sup> is a material-discursive practice intra-actively entangled<sup>28</sup> in the open-ended apparatus of veterinary pharmacy experiential learning environments (see Chapter 2, Figure 2.1 *Theoretical Framework: Diffracting Adult Learning*).

### **Implications**

Implications of employing an agential realist research approach call for attending to entangled ethico-onto-epistemological material-discursive practices and reconfigurations of phenomena. Agential realism pushes us to seek implications of nonbinary views, moving from human versus nonhuman to human and nonhuman in relationship. When examining data, I researched entangled phenomena—entanglements of humans, nonhumans, and environments. The apparatus, experiential learning in a veterinary setting, (co)produced phenomena. To address research questions, as a researcher within the phenomenon, I enacted a cut to delineate agencies of observation (apparatus) from the object of observation (student) while keeping in mind the contingent ontology of the student. From observations of the study, I presented implications for policy leaders, preceptors, educators, and researchers.

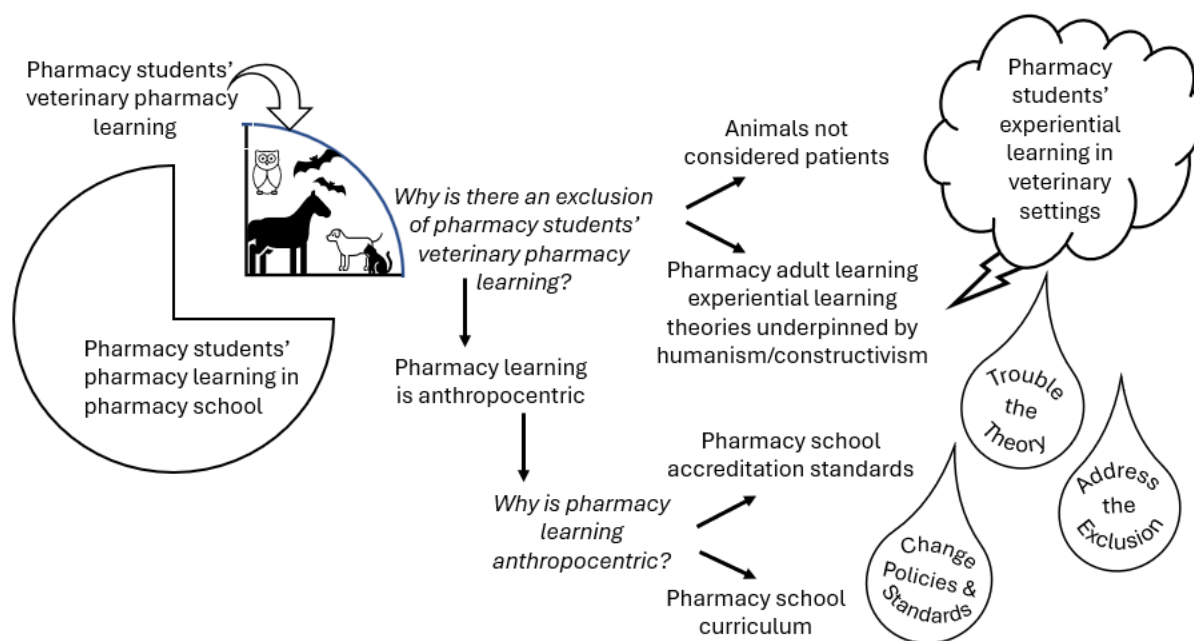
### **For Policy Leaders: Inclusivity for Supporting Positive Health Outcomes**

As a preceptor to pharmacy students in a veterinary setting, I noticed many students did not have formal veterinary pharmacy learning prior to coming to my clinic for their veterinary pharmacy APPE rotation. Unsurprisingly, many student participants in the study did not have formal veterinary pharmacy learning before their veterinary pharmacy APPE, nor had they learned about the One Health concept in pharmacy school (see Figure 5.9).

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<sup>27</sup> See Footnotes 4 and 9.

<sup>28</sup> Material-discursive practices are inseparable and are intra-actively entangled; meaning, actions not between one another but within one another coproducing phenomena.

**Figure 5.9***Approaching Pharmacy Learning Differently*

We can trouble adult learning theory by employing an ethico-onto-epistemological stance (diffractive methodology) where we address exclusions (valuing nonhumans, being↔becoming veterinary pharmacist, learning↔knowing nonhuman pharmacy). To address exclusions, we would enfold pharmacy learning inclusive of humans, animals, and environments. We can start by recognizing animals as patients and updating standards to recognize their value as patients (more than just laboratory animals).

The U.S. Food and Drug Administration (FDA) is an agency within the Department of Health and Human Services (HHS). In pharmacy learning, the primary focus is on humanistic aspects of the HHS and FDA although the FDA also has a Center for Veterinary Medicine (FDA-CVM). The FDA-CVM's focus is to protect human and animal health.

Illuminations, after engaging a diffractive analysis of data, conveyed human and nonhuman health as inextricably entangled. Therefore, implicating both human and nonhuman

(including environments) pharmacy learning should be made available to pharmacy students in a more inclusive manner since the health of one may affect the other in profound ways (e.g., anthroponosis, zoonosis, toxicities).

### **For Preceptors: Awareness of Marks Made**

Becoming a diffractive preceptor stimulates one to examine effects of difference (marks made) and attuning to preceptor intra-actions of entangled learning. Preceptors coproduce reconfigurations within becomings of students: “We send messages to our students not only by what we say but also by what we don’t bother saying” (Barad, 1995, p. 66). What is included and excluded produces differences mattering. When examining students’ interview transcripts, effects of difference illuminated marks made (agential cuts). Marks can reveal transformative elements coproduced with a supportive, inclusive preceptor or non-supportive, non-inclusive preceptor; although, effects of difference produced may be different as conveyed in Figures 5.10 and Figures 5.11.

### **Figure 5.10**

#### *Supportive Entangled Precepting*

**Catalina:** After the [veterinary pharmacy APPE] rotation my other rotations went better. One of my next ones was a hospital rotation and it was very clinical driven. And before that, I would have been shaking in my boots. I had to round with doctors, and it was a lot of the skill sets that [preceptor from vet rotation] put me through of ‘here, I’m going to grow you, I’m going to put you in charge, you’re the pharmacist.’ It really helped me too that at our [veterinary pharmacy APPE] rotation was patient based. I had to hold animals, I got to figure out where [and] what their disease states were, what was going on. That really helped, with the hands on, helped later where it was more clinical settings for my other rotations too. Just the fact that it was being able to talk to, talk to [veterinary pharmacy preceptor], who was the veterinarian and [veterinary pharmacy preceptor] also is a pharmacist, that it helps it be easier to bounce ideas off of residents and other doctors too, whenever it came to other settings. And then additionally into my career as a pharmacist.

**Figure 5.11***Precepting Producing Negative Outcomes*

**Janna:** [...] is an amazing preceptor. She is so sweet, so hands on, very patient, right? But she was always so busy. So, we never really got her. But when we did, it was such a treat. But the other [...] veterinary pharmacist, [...] was just very harsh about things. And so that's another reason why I didn't want to be in the small animal hospital was because she was there, and so every time I was there it was just her. She was always so busy as well, but she didn't handle it as well as [...] because every time you would have a question it was like you were burdening her to ask her that question. And so even my math problems, like after 20 minutes, I actually asked, I was like, 'hey, can I have some help? Can you just tell me like how to start it?' And I was like, 'once you tell me how to start it, I can do the rest, I learn fast.' And she would just be like, 'you can figure it out.' And so like, you know, you're so frustrated with yourself and the situation and you're just staring at this page, and you know the animals need the medications because you have the vet student being like, 'hey, where is it?' And you're just like, 'I don't know how to compound this.' You know, so not having that help, I think the preceptor can really make or break your experience. I'm glad I wasn't in the small animal hospital very often, but I know my friend who was also there was just like, 'yeah, she just isn't helpful.'

Implications for preceptors when diffractively reading through the excerpts illuminate the desire of the student to connect with the preceptor and preceptors should make themselves available to support the student if they are going to be a preceptor. There are many resources for preceptors to enhance their educating skills. Typically, schools where students come from offer preceptor development resources, guidance, and tools to support preceptors. As in the airline industry, if there is a time the oxygen mask is needed during a flight and it deploys from the overhead pocket, we would put on our mask first before helping someone else. The implication for the preceptor is the same, prepare yourself first before precepting a student, make yourself available, and learn inclusive ways to support students. When sending the student to learn with another, ensure the other is a willing educator (e.g., supportive entangled educator). Furthermore, ACPE 2025 Standards (ACPE, 2024) call on preceptors to serve as mentors and positive role

models for students. It is especially troubling in Janna's excerpt where she asked for help to learn calculations for compounding and she did not receive the guidance she needed. The North American Pharmacist Licensure Examination® (NAPLEX®) Competency Statements include both performance of calculations (Area 4) and compounding (Area 5) as important skills, knowledge, and judgment competencies an entry-level pharmacist should be able to demonstrate and are topics on the national examination (NABP, 2025). When preceptors do not have time to spend with students and send them to others who are unwilling to engage sustainable knowledge sharing (Lindell et al., 2022), the exclusion is illuminated with a possible effect of difference of lower than average testing on those competencies on the national board examination or worse, harm to a patient (human or nonhuman) because calculations and compounding are not performed correctly.

We are all responsible to and for shaping conditions for multispecies flourishing in the face of terrible histories, and sometimes joyful histories too, but we are not all responsible in the same ways. The differences matter—in ecologies, economies, species, lives. (Haraway, 2016, p. 29)

### **For Educators: Rethinking Teaching**

Educators are pulled in many directions and are bound by requirements of their organization and profession. Educators experience pressures from students, staff, faculty, caregivers (e.g., parents), credentialing bodies (e.g., accreditation standards, standardized testing, funding) and nonhuman elements (e.g., environments, resource availability, technologies). Through an agential realist stance, these structures are indeterminately bound.<sup>29</sup> Rethinking teaching is a catalyst for “*ruptures*” (Nicolaidis, 2023, p. 8) in ways of being and knowing.

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<sup>29</sup> Structures reconfigure through different intra-actions. Boundaries are fleeting and fuzzy. Boundaries can change in an instant (e.g., new policy, new guideline, new standard, new law, new disease).

When rethinking teaching we can “*in-scend* beneath the experience into the territory of the not fore-known” (Nicolaidis, 2023, p. 9). In-scending allows us to follow “the sensations of the experience in order to undergo it” bringing forth inquiries and an *awaring* of potential with ethical undercurrents (p. 9). The adult learning theory of generative knowing proffered by Alik Nicolaidis is a relational ethico-onto-epistemology:

Generative knowing begins with ruptures in knowledge that do not leave being and becoming behind, meaning that experiences, unfolding as relational ontology, lead the way while the epistemology (known-knowing) of experience shifts into the back-ground for a new way of coming to know to emerge. (Perry et al., 2024, p. 19)

Keeping in mind generative knowing, we can employ an ethico-onto-epistemological approach to rethinking teaching. The inseparability of ethics, being↔becoming, and learning↔knowing illuminates an underpinning of teaching through agential realism as learning-with. Learning-with is learning in-relation through entangled intra-actions. Entangled intra-actions are generative material-discursive practices producing phenomena and effects of difference through continual reconfigurations. Learning-with is not binary thinking of human versus world, it is human in-relation with world, learning (reconfiguring) together. An approach I employ to help students move towards post-anthropocentric thinking (learning-with, in-relation) is through introducing the One Health approach to medicine where the health of humans, animals, and environments are inextricably entangled.

At the end of our students’ APPE rotation, students present a veterinary pharmacy topic of their choice. Within drug review presentations, students will add a section about counseling the client about the drug for the caregiver’s animal. One particular student presented a topic and counseling tips were less than a minute (e.g., give with food, give one tablet twice daily).

Intrigued by the short counseling part of the presentation, I asked the student to think back to learning about One Health. The student recalled the entanglement of humans, animals, and environments, then I asked the student to recounsel the client with the One Health relational framework in mind. The student took a resetting breath in and began again, this time entwining the health of humans, nonhumans, and environments. The student began with the nonhuman (e.g., dose, how much to give, how to give, signs to look for in animal before/after dosing, shake drug well before dosing), then the human (e.g., safety precautions, wear gloves, wash hands well after use, keep out of reach of children), and finally environments (e.g., where to store, how to store securely, temperature to maintain, safety of living environment, precautions for environmental exposure). The student became more animated as they talked and after about eight minutes of unscripted counseling, the student stopped. I asked the student to sense and express what just happened. The student could not believe how they were able to freeform counseling when thinking through with a relational framework. The student expressed joy, confidence, and competence and said the experience would help with other rotations and becoming a pharmacist. Rethinking teaching as a relational ethico-onto-epistemology coproduces a contingent ontology.

Nicolaides et al (2023) propositioned arts-informed methods to “help educators construct enabling constraints for encouraging the playful interactions that cultivate generative knowing and response-ability in the complex, constantly transforming reality adult learners always already inhabit” (p. 242). Through this research, I understand collage not only as a critical reflective practice for experiential learning students, but also as a diffractive practice where intra-active entanglements and effects of difference are illuminated. Surprisingly, collage as an ethical practice came to the fore exposing the ethico-onto-epistemological nature of veterinary pharmacy experiential learning. As an educator, we can explore students’ collages to understand

what students value, what is included or excluded, and how teaching environments matter.

Insights produced can help inform future educational approaches and environmental adjustments.

### **For Researchers: Exploring Different Approaches**

This research provided an example of employing a diffractive methodology with an associated diffractive analysis. Reading through collected data with agential realism theory and the One Health concept provided the diffraction grating producing patterns of difference. See Chapter 4, Table 4.1 for additional diffractive approaches. As shown in Chapter 4, diffraction is a physical phenomenon (see Figures 4.1 and 4.2). Importantly, when metaphorically uptaking a diffractive methodology we understand entangled intra-actions as (re)configurations of material-discursive phenomena. Phenomena are objective referents.<sup>30</sup> As researchers within phenomena, we understand subject and object do not preexist but come into being (however fleeting) through intra-actions. An agential cut (agential separability) enacts causal structures (differential boundaries) within phenomena and allows us to examine, through diffraction, effects of difference and how material-discursive practices matter (Barad, 2007).

Through a philosophical agential realist framework, researchers understand they are entangled within phenomena. The ethico-onto-epistemological underpinning of agential realism allows researchers to explore valuing, being↔becoming, and learning↔knowing via diffractive analysis. Two ways I intra-actively engaged with participants in this research to generate data included focus groups with preceptors and semi-structured interviews with past veterinary pharmacy APPE students. With both the focus groups and semi-structured interviews, participants formed collages and collage explanations. When reading collages diffractively, we can examine valuing (e.g., prominence, centering, shapes, color), being↔becoming of

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<sup>30</sup> Material-discursive phenomena are matter and meaning in-relation and are foci of research (objective referents).

participants (e.g., dress, placement, tags) and how participants engaged learning↔knowing (e.g., objects, spaces, humans, nonhumans). Diffractively, collages convey intra-active entanglements (see Figure 5.8) generating new insights and inquiries.

### Summary

In the last year of the professional Doctor of Pharmacy degree program, students practice becoming pharmacist at APPE rotations where they put foundational theoretical classroom knowledge and introductory pharmacy practice experiences (IPPE) to practical use. Accreditation of pharmacy professional degree programs is through ACPE and ACPE sets standards for APPE rotations. Veterinary pharmacy APPE rotations are considered electives.

At each APPE rotation site preceptors facilitate learning. Being a preceptor at an APPE site in a veterinary setting, I observed many pharmacy students who came to learn-with me lacked foundational learning about animal medicine. Through the study of agential realism and the One Health concept, it became apparent to me students had a void in their ethico-onto-epistemological underpinnings; meaning, with anthropocentric learning (only studying about human medicine and effects focused on humans only), students missed learning about the rest of the world and how medicines may affect nonhumans (e.g., animals, environments). Therefore, I researched adult learning entanglements of post-anthropocentric learning and effects of difference produced.

Traditional adult learning theory, specifically experiential learning, has humanist and constructivist underpinnings (Kolb, 1984). Considering the underlying stance of traditional adult learning theory, I pondered: *What contributions to adult learning would there be if I approached experiential learning from a different stance, enfolding binaries into an intra-active entanglement (e.g., from human versus non-human learning to human and nonhuman learning)?*

*How would the development and becoming of students benefit from an adult learning approach encompassing post-anthropocentric learning and how would this benefit others (e.g., humans and nonhumans)?*

Figure 2.1 in Chapter 2 conveys the theoretical framework guiding this research where I explored adult learning in the context of pharmacy students' experiential learning in veterinary settings. The framework included a new materialist philosophy informed by agential realism (Barad, 2007). Agential realism provided a different approach for troubling adult learning by enfolding human and nonhuman intra-activity (post-anthropocentric stance).

The diffractive methodology proffered by Barad (2007) allowed generative data collection through semi-structured interviews with past veterinary pharmacy APPE students, focus groups with veterinary pharmacy preceptors, and document, artifact, and collage collection. To analyze collected data, I employed a diffractive analysis where I read through data with a theory (agential realism) and a concept (One Health). Reading through with agential realism and One Health provided the diffraction grating producing illuminations of material-discursive practices mattering. Diffraction patterns conveyed inclusions and exclusions (difference patterns, effects of difference), producing new insights and further inquiries.

### **Diffracted Insights**

Experiential learning of pharmacy students in veterinary settings is an approach to adult learning where an ethico-onto-epistemological framework can be applied to enfold post-anthropocentric learning (e.g., animal medicine and environmental responsibility and human medicine). The world and learning theories are reconfigured through contingent ontologies. Contingencies diffracted in this research included patterns of entangled learning, leading learning, generative entanglements, and diffractive methodology employment. Implications

enfolded responsibility for policy leaders, preceptors, educators, and researchers to understand our practices matter, what we include and exclude matters, and although we may have agential separability within phenomena, we are not absolutely separated from the world, we are within and part of the world in its differential becomings (Barad, 2007).

### **Diffraction Inquiries**

Future inquiries may explore contingencies and implications further by making agential cuts within phenomena to examine other entangled subjects (e.g., animals, preceptors, environments). Possible future research questions may include:

- How is post-anthropocentric learning befitting the world (e.g., humans, animals, environments)?
- How can we incorporate post-anthropocentric learning into our education practices?
- In what ways does a diffractive methodology help us approach educating differently?
- In what ways does a diffractive analysis help us examine experiential learning differently?
- How would incorporating an ethico-onto-epistemological stance effect professional learning?
- How are preceptors entangled in coproducing differences mattering?
- What is the motivation of the preceptor? What do actions of the preceptors illuminate?
- In what ways does a formal approach to educating preceptors produce effects of difference differently?
- How are pharmacy schools implementing inclusive processes enfolded preceptors into their organizational culture; curriculum oversight; experiential learning development;

enrollment management processes; facility (e.g., library) and educational resource access; and program evaluation assessments?

- In what ways do materials and discursive practices in-relation (e.g., workspace designs, color schemes, pharmacy equipment, interactive technology) shape students' understanding of healthcare?

Attending to Barad's (2007) call for making an account of how practices matter, I end with a photograph (Figure 5.12) of the sun's rays diffracting through the clouds on a cold blustery day at my farm in north Georgia. It is a visual reminder of how diffraction is produced without the help of humans. It is a phenomenon, always already present and entangled. As humans we can learn-with the world (nature-culture in-relation). A post-anthropocentric stance allows us to recognize our responsibility within the world, to examine effects of difference, and to explore intra-active entanglements with an ethico-onto-epistemological framework where we account for differences mattering, how practices matter, and for whom they matter.

**Figure 5.12**

*Diffraction: Always Already*



## Epilogue

*Dear Preceptor Practitioners,<sup>31</sup>*

*What does this research mean for educators precepting students during experiential learning experiences? How can we, as preceptors, address the contingency of leading learning through an ethico-onto-epistemological framework?<sup>32</sup>*

*As part of pharmacy schools' organizational culture expected by ACPE Standards 2025 (ACPE, 2024), preceptors should engage development activities addressing leadership and professionalism by serving "as mentors and positive role models for students" (p. 3). This research contributes to preceptors' intertwined leadership and professionalism development through exploring 'leading learning' (contingency) and 'marks made' (implication) as presented in Chapter 5.*

*To further develop preceptors as mentors and role models, we need to address educator 'mindsets' and provide methods and tools to support preceptors. Preceptors are included as educators in the formal education of pharmacy students. Bierma (2019) posited, "educators have a significant impact on formal learning and their self-awareness, mindset, and well-being directly affect the quality of instruction" (p. 9) and the "educator mindset incorporates resiliency, flexibility, and openness" (p. 10). In addition, "staff at ACPE recognize the importance of mindset on educational needs, experiences, and outcomes of pharmacy educators and learners" (Murry et al., 2024, p. 3).*

*When embracing flexibility and openness, preceptors' mindsets may shift towards an ethico-onto-epistemological framework (Barad, 2007) as a tool for rethinking teaching and a*

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<sup>31</sup> To convey a different style from the body of the research manuscript, this section is in italics. The epilogue is written to educator practitioners to care for the readers' understandings of the illuminations and how educators can practically apply post-anthropocentric entangled learning.

<sup>32</sup> See Footnote 5.

*method for leading learning by modeling valuing others (ethical healthcare enfolded humans and nonhumans), becoming professional (professionalism through constructive relations), and continuous professional development (CPD; continuous learning↔knowing).*

*As a preceptor, especially a veterinary pharmacy preceptor, the One Health concept is a practical tool preceptors can use to apply an ethico-onto-epistemological framework. The One Health concept is an ethical approach to recognizing inextricable entanglements of humans, animals, and environments (Nieuwland & Meijboom, 2020). Preceptors can think with One Health to examine how we value humans, animals, and environments in-relation to the healthcare question at hand; to examine what the human-animal-environment relationship is coproducing (e.g., becoming healthy, becoming toxic); and what we are learning and knowing from the human-animal-environment relationship outcome(s). See Appendix K for a Leadership Development Tip (Bierema, n.d.) worksheet to practice leading learning through an ethico-onto-epistemological framework using the One Health concept. Walk students through the steps showing them your work, then have them practice with cases on their own.*

*For an advanced use of the ethico-onto-epistemological framework, practitioners can use diffractive methodology and the associated diffractive analysis to examine their experiential learning practices. When practitioners apply a diffractive methodology, preceptors move into a growth mindset (Murry et al., 2024) where they are open to insights from a diffractive reading, feedback from learners, and can constructively improve practices (e.g., learning facilitation methods). I invite preceptors to read Chapters 1-5 to rethink teaching, embrace a growth mindset, and lead learning by applying a diffractive methodology to examine teaching practices. With sincere appreciation and care,*

*Heather Lindell*

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## APPENDIX A

### *Participant Recruitment Letter*

April 29, 2023

Hello Dear Colleagues,

I am writing to invite you to participate in a veterinary pharmacy research study. The purpose of the study is to examine experiential learning in veterinary settings. The specific experiential learning is veterinary pharmacy Advanced Pharmacy Practice Experience (APPE) of pharmacy students in veterinary settings in the United States or an APPE equivalent internationally.

I am recruiting two groups of participants. For inclusion in the study participants must have precepted APPE students in a veterinary setting or have been an APPE student in a veterinary setting. In some cases, participants may qualify for each group. Importantly, the term 'veterinary setting' signifies a space where the practice of veterinary medicine occurs and pharmacy students have been exposed to learning with animals in some capacity (e.g., veterinary pharmacy APPE at a private veterinary clinic).

#### Group 1

Inclusion criteria: Advanced Pharmacy Practice Experience (APPE) preceptors (still working or retired) who precepted a pharmacy student in a veterinary setting anytime between 2018 and 2023. International veterinary pharmacy preceptors who precepted pharmacy students in veterinary settings are invited to participate if the precepted students were from an accredited pharmacy school with Accreditation Council for Pharmacy Education (ACPE) equivalent accreditation and required APPE equivalent rotations. Group 1 participants will voluntarily engage in one 60-90 minute focus group facilitated by the researcher (Heather Lindell Tally). The focus group will meet online via Zoom® platform. If clarification is needed after the focus group, the researcher will contact the individual participant via telephone or email within 4 weeks of the focus group.

#### Group 2

Inclusion criteria: Pharmacists or pharmacy students who have completed an APPE rotation in a veterinary setting anytime between 2018 and 2023. Group 2 participants will voluntarily engage in one 60-90 minute one-on-one semi-structured interview with the researcher (Heather Lindell Tally) via Zoom® platform. If clarification is needed after the one-on-one interview, the researcher will contact the individual participant via telephone or email within 4 weeks of the interview.

If you meet the inclusion criteria, participation in either or both Groups is voluntary. You may forward the recruitment letter to potential participants who may fit the inclusion criteria. Participants will receive further instructions and materials prior to participation (e.g., consent form). The focus group and one-on-one interviews will commence via Zoom and be recorded. The researcher will use recordings to create transcripts for examination. The researcher will change names of participants and places to pseudonyms to protect identities. Participants may withdraw at any time without penalty.

Participation in the study is voluntary. If you would like to participate, have a contact who may fit the inclusion criteria I should reach out to, or have further questions about the research, please contact me directly at [hlindell@gmail.com](mailto:hlindell@gmail.com), [htally@uga.edu](mailto:htally@uga.edu), or text 706.540.7254.

With appreciation,  
*Heather Lindell Tally, PharmD*  
 University of Georgia LLOD PhD Candidate

## APPENDIX B

*Informed Consent for Pharmacy Student Interview*

**UNIVERSITY OF GEORGIA  
CONSENT FORM**

**Experiential Learning of Pharmacy Students in the Veterinary Setting: Diffracting What Matters**

**Researcher's Statement**

You are being asked to take part in a research study. The information in this form will help you decide if you want to be in the study. Please ask the researcher below if there is anything that is not clear or if you need more information.

**Principal Investigator:** Aliko Nicolaides, EdD

**Co-investigator:** Heather Lindell Tally, PharmD  
Department of Lifelong Education, Administration, and Policy  
[alikin@uga.edu](mailto:alikin@uga.edu) | 706-583-8098; [htally@uga.edu](mailto:htally@uga.edu) | 706-540-7254

- The purpose of this study is to explore adult learning in the context of pharmacy students' Advanced Pharmacy Practice Experience (APPE) rotations in veterinary settings;
- Your involvement in the study is voluntary, and you may choose not to participate or to stop at any time without penalty or loss of benefits to which you are otherwise entitled;
- The participant is expected to engage in a 60-to-90-minute one-one-one interview with follow up clarification inquiries from the researcher as necessary within 4 weeks after the interview;
- The key procedures to be followed in the research include a one-on-one interview via Zoom<sup>®</sup>, a review of a collage created by participant, and analysis of transcript data;
- There are no foreseeable major risks or discomforts expected to the participant and the participant may withdraw at any time without penalty;
- The primary benefit to the participant and other pharmacy students who completed an APPE rotation in a veterinary setting reasonably expected from the research includes contributing to an understanding of experiential learning in the veterinary setting; and
- Your participation as a pharmacy student who completed an APPE rotation in the veterinary setting is a valued contribution to the deeper understanding of facilitating veterinary pharmacy experiential learning.

If you are interested in participating in the study, please read the additional information on the following page, sign, and ask questions at any point.

### **Study Procedures and Time Commitment**

The participant's time commitment includes time to read, sign, and return the informed consent (5 minutes); read, complete, and return the demographic questionnaire (5 minutes); create one collage showing your experiences learning in a veterinary setting (60 to 120-minutes); one 90-minute one-on-one interview (60 to 90 minutes); and follow up inquiries as needed within the 4 weeks after the one-on-one interview (30 minutes). The one-on-one interview will be held online using Zoom<sup>®</sup> and will be recorded.

### **Risks and discomforts**

There are no anticipated risks from participating in this research. Participants may withdraw from the one-on-one interview at any time.

### **Benefits**

There are no direct benefits for participating in the study as research subjects other than being able to reflect on the topic of experiential learning in the veterinary setting.

### **Confidentiality of records**

The recording of the one-on-one interview, notes, collage, and transcript will be kept by the researcher after identifiers of the participant have been removed. The researcher will share data with those connected to the research (research committee) for data analysis and processing. Pseudonyms will be used in any ensuing publication(s) and during analysis. Data generated may be used for future related studies without additional consent. All electronic materials will be kept on a password protected external hard drive, and hardcopy materials will be kept in a safe. De-identified materials will be deleted or shredded after seven years.

### **Participant rights**

If you have any questions or concerns regarding your rights as a research participant in this study, you may contact the University of Georgia Institutional Review Board (IRB) Chairperson at 706.542.3199 or [irb@uga.edu](mailto:irb@uga.edu).

If you agree to participate in this research study, please sign below:

\_\_\_\_\_  
Name of Researcher

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

\_\_\_\_\_  
Name of Participant

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

**Please keep one copy and return the signed copy to the researcher.**

## APPENDIX C

*Informed Consent for Preceptor Focus Group*

**UNIVERSITY OF GEORGIA  
CONSENT FORM**

**Experiential Learning of Pharmacy Students in the Veterinary Setting: Diffracting What Matters**

**Researcher's Statement**

You are being asked to take part in a research study. The information in this form will help you decide if you want to be in the study. Please ask the researcher below if there is anything that is not clear or if you need more information.

**Principal Investigator:** Aliko Nicolaides, EdD

**Co-investigator:** Heather Lindell Tally, PharmD  
Department of Lifelong Education, Administration, and Policy  
[alikin@uga.edu](mailto:alikin@uga.edu) | 706-583-8098; [htally@uga.edu](mailto:htally@uga.edu) | 706-540-7254

- The purpose of this study is to explore adult learning through performative intra-active entanglements in the context of pharmacy students' Advanced Pharmacy Practice Experience (APPE) rotations in the veterinary setting;
- Your involvement in the study is voluntary, and you may choose not to participate or to stop at any time without penalty or loss of benefits to which you are otherwise entitled;
- The participant is expected to engage in a 60-to-90-minute focus group interview with follow up clarification inquiries from the researcher on a one-on-one basis as necessary within 4 weeks after the focus group;
- The key procedures to be followed in the research include a focus group interview via Zoom<sup>®</sup>, a review of a collage created by participant, and analysis of transcript data;
- There are no foreseeable major risks or discomforts expected to the participant and the participant may withdraw at any time without penalty;
- The primary benefit to the participant and other preceptors of APPE students in a veterinary setting reasonably expected from the research includes contributing to an understanding of experiential learning facilitation in the veterinary setting; and
- Your participation as a preceptor of APPE pharmacy students in the veterinary setting is a valued contribution to the deeper understanding of facilitating veterinary pharmacy learning in this student population.

If you are interested in participating in the study, please read the additional information on the following page, sign, and ask questions at any point.

### **Study Procedures and Time Commitment**

The participant's time commitment includes time to read, sign, and return the informed consent (5 minutes); read, complete, and return the demographic questionnaire (5 minutes); create one collage showing your experiences facilitating learning in a veterinary setting (60 to 120-minutes); one 90-minute focus group (60 to 90 minutes); and one-on-one follow up inquiries as needed within the 4 weeks after the focus group (30 minutes). The focus group will be held online using Zoom® and will be recorded.

### **Risks and discomforts**

There are no anticipated risks from participating in this research. Participants may withdraw from the focus group at any time.

### **Benefits**

There are no direct benefits for participating in the study as research subjects other than being able to reflect on the topic of experiential learning in the veterinary setting.

### **Confidentiality of records**

The recording of the focus group, , notes, collage, and transcript will be kept by the researcher after identifiers of the participant have been removed. The researcher will share data with those connected to the research (research committee) for data analysis and processing. Pseudonyms will be used in any ensuing publication(s) and during analysis. Data generated may be used for future related studies without additional consent. All electronic materials will be kept on a password protected external hard drive, and hardcopy materials will be kept in a safe. De-identified materials will be deleted or shredded after seven years.

### **Participant rights**

If you have any questions or concerns regarding your rights as a research participant in this study, you may contact the University of Georgia Institutional Review Board (IRB) Chairperson at 706.542.3199 or [irb@uga.edu](mailto:irb@uga.edu).

If you agree to participate in this research study, please sign below:

\_\_\_\_\_  
Name of Researcher

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

\_\_\_\_\_  
Name of Participant

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

**Please keep one copy and return the signed copy to the researcher.**

## APPENDIX D

*Pharmacy Student Demographic Questionnaire***Demographic Data Collection****Name:** \_\_\_\_\_

1. Which pharmacy school were you attending when you completed your Advanced Pharmacy Practice Experience (APPE) rotation in the veterinary setting?

(Name of pharmacy school - \_\_\_\_\_)

2. Did you have any veterinary pharmacy learning in pharmacy school prior to your Advanced Pharmacy Practice Experience (APPE) rotation in the veterinary setting?

Yes    or    No

If yes, what type of veterinary pharmacy learning:

- a. Veterinary pharmacy class provided at school where enrolled:

(Name of school - \_\_\_\_\_)

- b. Veterinary pharmacy class provided by another school but recognized by school where enrolled:

(Name of school offering class - \_\_\_\_\_)

- c. Other veterinary pharmacy learning:

(Please describe - \_\_\_\_\_)

\_\_\_\_\_)

3. In what type of veterinary setting did you engage an APPE rotation?

- a. Academic

- b. Private practice

- c. Governmental (e.g., USDA, FDA, NIH)
- d. Other (specify) \_\_\_\_\_
4. Describe the main reasons you wanted to engage a veterinary pharmacy APPE in a veterinary setting?
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
5. Prior to veterinary pharmacy learning on an APPE rotation in a veterinary setting, had you ever filled a veterinary prescription?
- Yes    or    No
- If yes, please describe the animal species, drug dispensed, and if compounded.
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
6. Did you seek additional veterinary pharmacy learning after your APPE rotation in the veterinary setting? (e.g., Veterinary Pharmacy Residency, continuing education)
- If yes, please describe the additional veterinary pharmacy learning and location.
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

7. If you did not know about the One Health concept prior to your veterinary pharmacy

APPE rotation, did you learn about the One Health concept on your veterinary pharmacy

APPE rotation?      Yes      or      No

## APPENDIX E

*Preceptor Demographic Questionnaire***Demographic Data Collection****Name:** \_\_\_\_\_

1. Approximately how many Advanced Pharmacy Practice Experience (APPE) pharmacy students do you precept each year in the veterinary setting? \_\_\_\_\_
2. In what type of veterinary setting do you practice?
  - a. Academic
  - b. Private practice
  - c. Governmental (e.g., USDA, FDA, NIH)
  - d. Other (specify) \_\_\_\_\_
3. Do you engage in preceptor development? Yes      or      No
  - a. If yes, please specify.
    - i. Who administers (e.g., X College of Pharmacy) \_\_\_\_\_
    - ii. Type (e.g., Continuing Education) \_\_\_\_\_
4. Do you have a teaching certificate? Yes      or      No
  - a. If yes, please specify.
    - i. From whom (e.g., X College of Veterinary Medicine) \_\_\_\_\_
    - ii. Type (e.g., Adult Education) \_\_\_\_\_
5. Please write your degree(s), year obtained, and major in the table.

| Degree          | Year | Major    |
|-----------------|------|----------|
| Example: PharmD | 1994 | Pharmacy |

| Degree | Year | Major |
|--------|------|-------|
|        |      |       |
|        |      |       |
|        |      |       |
|        |      |       |

6. Please list additional training (excluding continuing education), certificates, and certifications you have related to veterinary pharmacy and the year completed (e.g., Veterinary Pharmacy Residency – 2021)

- a. \_\_\_\_\_
- b. \_\_\_\_\_
- c. \_\_\_\_\_
- d. \_\_\_\_\_
- e. \_\_\_\_\_
- f. \_\_\_\_\_

7. How many years have you been a preceptor for APPE students in the veterinary setting?

\_\_\_\_\_

8. How many years have you practiced in a veterinary setting? \_\_\_\_\_

## APPENDIX F

### *Pharmacy Student Interview Guide*

#### **Introduction**

Thank you for participating in the interview today. I am Dr. Heather Lindell, a veterinary pharmacist that precepts students in a veterinary setting. I am also a PhD student researching this topic so I may learn more about adult learning in the context of pharmacy students' experiential learning rotations in veterinary settings.

#### **Purpose**

The purpose of this interview is to explore your experiences of learning in the veterinary setting. If you feel uncomfortable at any time in the interview, you are welcome to withdraw your participation with no penalty.

The interview session is scheduled for a minimum of 60 minutes with a 30-minute extension as needed. The interview session is being recorded. Your participation will be represented via a pseudonym or code in any publication of quotes unless you feel strongly about wanting to use your real name, then I will make sure if I use a quote that your preferred name is displayed.

#### **Ground Rules**

There are no right or wrong answers to inquiries. The answers are based off of your experiences in the veterinary setting, reflections about experiential learning, and feedback you have received from others about experiential learning in the veterinary setting.

Please speak one at a time and pause between speakers to allow completion of thought.

I will inquire of you to prompt dialogue about a topic. After the inquiry, you may begin the dialogue and talk as you wish.

I may jump in every now in then to redirect the dialogue or make another inquiry about another topic.

#### **Terminology**

A term I may use that you may or may not be familiar with is;  
Experiential learning: Learning in a setting where one can reflect, think, experience, and act to construct knowledge (Kolb & Kolb, 2005).

**Interview Guide: Learners in the Veterinary Setting**

| <b>Topical Area</b>                                                        | <b>Interview Inquiry</b>                                                                                                                                                                                                                                                                                                                            | <b>What I Want to Know</b>                                                                                                                                                                                                            |
|----------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Background                                                                 | <p>Tell me how you came to be in your current/past role in the veterinary setting.</p> <p><u>Possible probe:</u></p> <ul style="list-style-type: none"> <li>• What experiences did you have that helped you develop as a _____?</li> <li>• What learning informed your role in the veterinary setting?</li> </ul>                                   | <p>Background information/demographic data</p> <p><u>Possible additional probes:</u></p> <ul style="list-style-type: none"> <li>• Do you have a specialty?</li> <li>• How did you become interested in what you are doing?</li> </ul> |
| Knowledge, activities, or values related to veterinary pharmacy or animals | <p>Before you started your APPE rotation in a veterinary setting, what kind of veterinary pharmacy learning did you have?</p> <p><u>Possible probe:</u></p> <ul style="list-style-type: none"> <li>• What was your motivation to seek a veterinary pharmacy APPE rotation?</li> </ul>                                                               | <p>Background ethico-onto-epistemology</p> <p><u>Possible additional probes:</u></p> <ul style="list-style-type: none"> <li>• What experiences did you have with animals prior to the veterinary pharmacy APPE?</li> </ul> <p>RQ1</p> |
| Expectations and knowledge of veterinary pharmacy learning                 | <p>Think back to when you first started your APPE rotation in the veterinary setting, what was your expectation of what you would be doing?</p> <p><u>Possible probe:</u></p> <ul style="list-style-type: none"> <li>• What kind of learning experience did you have?</li> <li>• What learning did you expect in the veterinary setting?</li> </ul> | <p>Participant's expectations of what their veterinary pharmacy learning activities would involve. Tools used to facilitate learning.</p> <p>RQ1</p>                                                                                  |
| Experiences related to learning in the veterinary setting                  | <p>Tell me about your learning in the veterinary setting.</p> <p><u>Possible probe:</u></p> <ul style="list-style-type: none"> <li>• What kind of learning activities did you engage?</li> <li>• In what ways do you think about learning?</li> <li>• How were animals involved in your learning?</li> </ul>                                        | <p>Participant's involvement and experience facilitating learning, activities engaged, and approach (e.g., pedagogy, human-centered, entanglements)</p> <p>RQ1, RQ2, RQ3</p>                                                          |
| Opinions and values of learning                                            | <p>In what ways do you engage in learning?</p> <p><u>Possible probe:</u></p> <ul style="list-style-type: none"> <li>• If you feel like you need to learn more about learning in the veterinary setting, what does that look like?</li> <li>• What topics would be beneficial for you in a veterinary setting?</li> </ul>                            | <p>Engagement of the participant in continuing professional development and acceptance of pedagogies and theoretical frameworks to add to facilitating learning.</p> <p><u>Possible additional probes:</u></p>                        |

|                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                              |
|--------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                          | <ul style="list-style-type: none"> <li>• What engagements with animals do you value when learning?</li> <li>• What do you value learning about that would help others learn in the veterinary setting?</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <ul style="list-style-type: none"> <li>• In what ways could learning be enhanced in the veterinary setting?</li> </ul> <p>RQ1, RQ2</p>                                                                                                                       |
| Knowledge about self-progress towards competence (becoming professional) | <p>What have you observed about your progress towards competence and readiness for experiential learning in the veterinary setting?</p> <p><u>Possible probe:</u></p> <ul style="list-style-type: none"> <li>• What experiences or learning prepared you to learn in the veterinary setting? (e.g., elective class, past experience in a veterinary setting)</li> </ul> <p>What have you observed about your progress towards competence and readiness for becoming a professional after completing a rotation in the veterinary setting?</p> <p><u>Possible probe:</u></p> <ul style="list-style-type: none"> <li>• What learning facilitated becoming a veterinary professional?</li> </ul> | <p>Participant's observations and evaluations of progress towards competence and readiness for experiential learning in the veterinary setting.</p> <p>What the learner gains from experiential learning in the veterinary setting.</p> <p>RQ1, RQ2, RQ3</p> |
| Benefits of experiential learning in the veterinary setting              | <p>What do you see as the benefits of experiential learning in the veterinary setting for professional students?</p> <p>What are your perceptions about your engagement in experiential learning in the veterinary setting?</p> <p>Describe feedback you have received from preceptors/mentors/teachers in the veterinary setting.</p> <p>Describe a time, during or after learning in the veterinary setting, you applied the learning outside of the learning environment.</p>                                                                                                                                                                                                              | <p>Feedback from others, reports of applied learning, what students find most engaging/rewarding, etc.</p> <p>RQ2, RQ3</p>                                                                                                                                   |
| Collage                                                                  | Tell me about your collage.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | RQ1, RQ2, RQ3                                                                                                                                                                                                                                                |
| Additional thoughts                                                      | <p>How do you feel about learning in the veterinary setting?</p> <p>How do you think you will continue to use the veterinary pharmacy learning?</p> <p>Describe differences you noticed in yourself after learning in the veterinary setting? (Who/what benefited from your veterinary pharmacy learning?)</p>                                                                                                                                                                                                                                                                                                                                                                                | <p>Open to any additional points the participant feels need to be addressed.</p> <p><u>Possible additional probes:</u></p> <ul style="list-style-type: none"> <li>• Would you like to know more about learning in the veterinary setting?</li> </ul>         |

|  |                                                                                     |               |
|--|-------------------------------------------------------------------------------------|---------------|
|  | Is there anything else I should know about your learning in the veterinary setting? | RQ1, RQ2, RQ3 |
|--|-------------------------------------------------------------------------------------|---------------|

### **Conclusion**

Thank you for your participation. I appreciate your time, consideration, reflections, and input for this research.

If I have questions about what you said in the interview, I will reach out to you within 4-weeks.

If you have any questions afterwards, you are welcome to contact me.

If you would like to see the final report. Let me know and I will send you a link. I will be working on this over the next few months.

Thank you again for your participation.

## APPENDIX G

### *Focus Group Interview Guide*

#### **Introduction**

Thank you for participating in the focus group today. I am Dr. Heather Lindell Tally, a veterinary pharmacist that precepts students in a veterinary setting. I am also a PhD student researching this topic so I may share insights and propositions having potential for supporting and enhancing preceptor learning facilitation of APPE pharmacy students in the veterinary setting.

#### **Purpose**

The purpose of this focus group is to explore experiences of preceptors facilitating learning of APPE pharmacy students in veterinary settings. If you feel uncomfortable at any time in the focus group, you are welcome to withdraw your participation with no penalty.

The focus group session is scheduled for 60 minutes with a 30-minute extension depending on dialogue of the group and follow up inquiries needed. The focus group session is being recorded. Your participation will be represented via a pseudonym or code in any publication of quotes unless you feel strongly about wanting to use your real name, then I will make sure if I use a quote that your preferred name is displayed.

#### **Ground Rules**

There are no right or wrong answers to inquiries. The answers are based off of your experiences precepting APPE students in the veterinary setting, reflections about precepting, and feedback you have received from your students.

Please speak one at a time and pause between speakers to allow completion of thought.

I will inquire of the group to prompt dialogue of a topic. After the inquiry, anyone may begin the dialogue and you can talk with each other, not just to me. I may jump in every now and then to redirect the dialogue or make another inquiry about another topic.

#### **Terminology**

A term I may use that you may or may not be familiar with is;

Experiential learning: Learning in a setting where one can reflect, think, experience, and act to construct knowledge (Kolb & Kolb, 2005).

### Interview Guide: Preceptor Focus Group

| Topical Area                  | Interview Inquiry                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | What I Want to Know                                                                                                                                                                                                                                                                                                            |
|-------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Opening Sequence              | <p>Prior to this focus group I gave you each instruction for creating a collage on one PowerPoint slide and a guiding question: <i>What are things that come to mind when you think about precepting APPE pharmacy students in the veterinary setting?</i></p> <p>I will ask for a volunteer to start us off by sharing your collage. I will give you access to share your screen. When you are done and questions from the group are answered related to your collage, you can call on the next person.</p> | <p><u>Possible additional probes:</u></p> <ul style="list-style-type: none"> <li>• What is your role facilitating learning of pharmacy students in a veterinary setting?</li> <li>• How do you view precepting pharmacy students in a veterinary setting?</li> </ul> <p>RQ1, RQ2, RQ3</p>                                      |
| Way of knowing (epistemology) | <p>What have you observed about professional students' progress towards competence and readiness for experiential learning in the veterinary setting? What did they know about veterinary pharmacy before coming to your veterinary site?</p> <p><u>Possible probe:</u></p> <ul style="list-style-type: none"> <li>• What experiences or learning prepared them to learn with you in the veterinary setting? (e.g., elective class, past experience in a veterinary setting)</li> </ul>                      | <p>Participant's observations and evaluations of professional students' progress towards competence and readiness for experiential learning in the veterinary setting.</p> <p>What is the knowledge base?</p> <p>What do the students (or nonhumans) gain from experiential learning in the veterinary setting?</p> <p>RQ1</p> |
| Way of being (ontology)       | <p>What have you observed about professional students' progress towards competence and readiness for becoming veterinary pharmacists after they complete a rotation with you in the veterinary setting?</p> <p><u>Possible probe:</u></p> <p>What learning facilitated the students to becoming a veterinary pharmacist (or retail pharmacist that fills veterinary prescriptions)?</p>                                                                                                                      | <p>What experiences did you have that developed you as a veterinary pharmacist?</p> <p>What experiences have you noticed supported your students' growth becoming veterinary pharmacists?</p>                                                                                                                                  |

|                            |                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                            |                                                                                                                                                                                                                                               | RQ1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Valuing (ethics)           | What have you noticed your students value when learning in your veterinary setting?                                                                                                                                                           | RQ1, RQ2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Intra-active entanglements | <p>Tell me about your experiences precepting APPE students in the veterinary setting.</p> <p><u>Possible probe:</u></p> <ul style="list-style-type: none"> <li>What kind of learning activities do you facilitate for the student?</li> </ul> | <p>Participant's involvement and experience facilitating learning, activities engaged, and approach (e.g., pedagogy, human-centered, entanglements, animal roles)</p> <p>RQ2</p>                                                                                                                                                                                                                                                                                                                           |
| Effects of difference      | Describe a time when a student contacted you during or after the APPE in the veterinary setting to let you know how they applied the learning.                                                                                                | <p>Agential cuts:<br/>Feedback from students, reports of students applying learning, what students find most engaging/rewarding, etc.</p> <p><u>Possible additional probes:</u></p> <ul style="list-style-type: none"> <li>What do you see as benefits of experiential learning in the veterinary setting for pharmacy students?</li> <li>What are your perceptions about students' engagement in experiential learning?</li> <li>Describe feedback you have received from students.</li> </ul> <p>RQ3</p> |
| Additional thoughts        | Is there anything else I should know about precepting students in the veterinary setting?                                                                                                                                                     | <p>Open to any additional points focus group participants need addressed.</p> <p><u>Possible additional probes:</u></p>                                                                                                                                                                                                                                                                                                                                                                                    |

|  |  |                                                                                                                                                                                                                                                                                     |
|--|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  |  | <ul style="list-style-type: none"> <li>• How has being a preceptor made a difference for you?</li> <li>• What differences or changes have you noticed in yourself or the students after APPEs?</li> <li>• Who or what seems to benefit after APPEs?</li> </ul> <p>RQ1, RQ2, RQ3</p> |
|--|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

### **Conclusion**

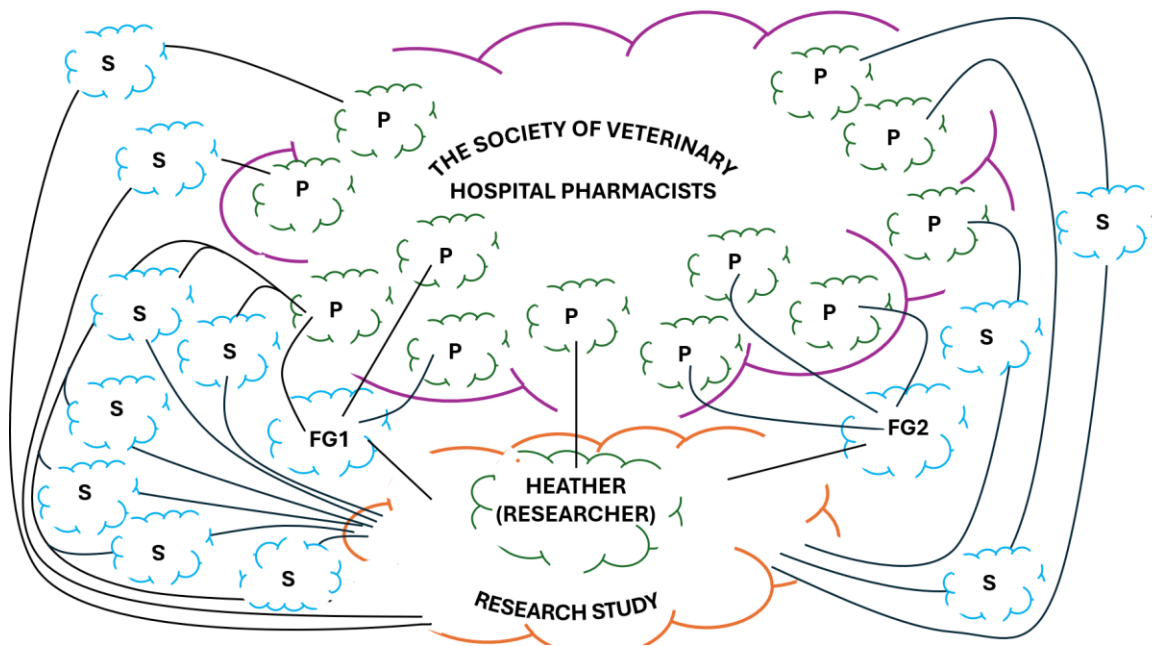
Thank you all for your participation. I appreciate your time, consideration, reflections, and input for this research.

If I have questions about what you said in the focus group, I will reach out to you within four weeks. If you have any questions afterwards, you are welcome to contact me.

If any of you would like to see the final report. Let me know and I will send you a link. I will be working on this over the next few months.

Thank you again for your participation.

## APPENDIX H

*Cartography of Becoming Research Participant*

*Note:* This cartography explores how pharmacy students (S) and preceptors (P) came to be research participants through intra-actions. Students participated in semi-structured individual interviews and veterinary pharmacy preceptors participated in focus groups (FG1; FG2). Importantly, humans are not devalued (Barad, 2007) in the relational cartography (Braidotti, 2019; Nicolaides, 2023) and we recognize others' value. With post-anthropocentric research, we can examine humans in-relation with others (e.g., materials, objects, references, resources, artificial intelligence, plants, animals, environments) co-constituting humans becoming research participants. Open ended clouds signify various entangled reconfigurations. It is not just students or preceptors, it is students, preceptors, and researcher in-relation with others (humans and nonhumans).

## APPENDIX I

*Collage and Collage Explanation Guidance***COLLAGE GUIDANCE****COLLAGE GUIDANCE: APPE STUDENTS AND VETERINARY PHARMACY PRECEPTORS**

For this activity you will produce a collage and collage explanation. The purpose of the activity is to stimulate your thinking about learning in a veterinary setting.

**APPE STUDENTS****Creating a Collage**

The aim of creating a collage is to show what you engaged with during your experience learning in a veterinary setting. The researcher may ask you about your collage during the individual interview.

Guiding prompts to consider visualizing in a collage: What was important to you? How did you learn? What was the most exciting? What did you learn? What did you find most challenging?

**CREATING A COLLAGE IS A REFLECTIVE ACTIVITY. WRITING A COLLAGE EXPLANATION ABOUT THE COLLAGE SHARES THE EXPERIENCE AND UNDERLYING IDEAS BEING CONVEYED.**

**APPE PRECEPTORS****Creating a Collage**

The aim of creating a collage is to show your experience as a preceptor and what was used to facilitate learning in a veterinary setting. Sharing your collage will be a part of the opening inquiry for the focus group interview.

Guiding prompts to consider visualizing in a collage: What was important? What helped you? How did your students react? How did students learn? What activities did students engage? What feedback did you receive? What comes to mind when you think about precepting APPE students in a veterinary setting?

**COLLAGE TIPS:**

Collages can be made many different ways. Collages can be made traditionally with paper, cutting blade, and glue or using a digital format. Here are a few ideas of materials to use for collaging: magazines, posterboard, cutting blade, paint sticks, colored pencils cutout images, cutout words, glue, glitter, colors, shapes, digital collage applications, PowerPoint. The key is layering with colors, shapes, and images having meaning for you related to learning in the veterinary setting. Use the guiding prompts to stimulate thinking about the topic.

**EXPLANATION TIPS:**

A collage explanation is typically written in first person and is a description of the participant's work. The participant describes what the collage means to them and why certain elements (e.g., shapes, colors, images) are used in the collage. Any additional clarifying statements are included as the participant sees fit. The collage explanation should contain approximately 100 to 250 words.

Write a collage explanation and submit it with the collage prior to the interview. If the collage is made on a posterboard or any other non-digital format, take a photograph of the collage and send it to the researcher.

**Steps for Completion:**

1. Read guiding prompts and tips to stimulate thoughts.
2. Create a collage.
3. Write a collage explanation explaining the collage.
4. Send the collage explanation and a digital copy of the collage to the researcher. If made traditionally, take a photograph to send digital copy to researcher.

Researcher: Contact Heather Lindell, PharmD if more guidance needed.

Collage guidance: APPE students and veterinary pharmacy preceptors  
htally@uga.edu or hlindell@gmail.com

## APPENDIX J

*Data Inventory*

| Data type                        | Number |
|----------------------------------|--------|
| Artifacts <sup>a</sup>           | 111    |
| Collages                         | 17     |
| Documents <sup>b</sup>           | 21     |
| Focus group transcripts          | 2      |
| Individual interview transcripts | 11     |

<sup>a</sup> Artifacts included personal image artifacts (e.g., photographs, object graphics) embedded in collages. <sup>b</sup> Documents collected included syllabuses, reflections, and self-assessments.

## APPENDIX K

*Leading Learning: Ethico-onto-epistemological Approach***Leadership Development Tip (LDT)****Leading Learning Through an Ethico-onto-epistemological Framework****Heather Lindell, BSPH, PharmD, DICVP**

|                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                    |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Purpose:</b><br>The purpose of this LDT is to explore leading learning through an ethico-onto-epistemological framework. An additional purpose is to engage a One Health activity template for use when counseling clients.                                                                                             | <b>Materials:</b> <ul style="list-style-type: none"> <li>• Access to computer and printer if hardcopy desired.</li> </ul>                                                                                                          |
| <b>Outcomes:</b><br>At the end of the activity, the learner should be able to: <ul style="list-style-type: none"> <li>• Describe an ethico-onto-epistemological framework.</li> <li>• Demonstrate ability to use a One Health approach through an ethico-onto-epistemological framework for counseling clients.</li> </ul> | <b>Approximate time:</b><br>~15 minutes (+/- 10 min) determined by engagement with LDT.<br>~ 4 minutes (+/- 2 min) of reading Epilogue of Chapter 5 (Lindell, 2025).<br>~ 120 minutes (+/- 30 min) of reading background research. |

**Facilitation Guidelines/Process:**

1. Read 'Epilogue' section of *Experiential learning in the veterinary setting: Diffracting what matters* by Heather Lindell (2025).
2. Engage LDT worksheet and complete overview material.
3. Utilize the LDT worksheet to practice counseling a client about a medication through a One Health approach informed by an ethico-onto-epistemological framework.
4. Optional: Read Chapters 1-5 of background research *Experiential learning in the veterinary setting: Diffracting what matters* by Heather Lindell (2025).
5. Optional: Read *Meeting the universe halfway: Quantum physics and the entanglement of matter and meaning* by Karen Barad (2007) for a deeper understanding of agential realism.

**Guiding Inquiries:**

- What are your thoughts related to leading learning through an ethico-onto-epistemological framework?
- How will you apply an ethico-onto-epistemological framework to experiential learning (e.g., One Health approach)?
- How will you apply the LDT learning about One Health (e.g., counseling)?
- What other context will you apply an ethico-onto-epistemological framework and how?

**Use Considerations:**

- Application of an ethico-onto-epistemology framework to facilitate learning, collaboration, and medication error prevention:
  - o Organizations
  - o Experiential Learning
  - o Client counseling

**Source:**

- Barad, K. (2007). *Meeting the universe halfway: Quantum physics and the entanglement of matter and meaning*. Duke University Press.
- Bierema, L. L. (n.d.). *Leadership development tip—LDT template*. [Class published handout]. Department of Lifelong Education, Administration, and Policy, University of Georgia
- Lindell, K. H. (2025). *Experiential learning in the veterinary setting: Diffracting what matters*. [Doctoral dissertation, University of Georgia]
- Nieuwland, J., & Meijboom, F. L. B. (2020). One health: How interdependence enriches veterinary ethics education. *Animals*, 10(1), 1-13. <https://doi.org/10.3390/ani10010013>

# Leadership Development Tip (LDT)

## Leading Learning Through an Ethico-onto-epistemological Framework Heather Lindell, BSPH, PharmD, DICVP

Karen Barad (2007) proffered an ethico-onto-epistemology framework (agential realism) to provide an understanding of roles (agencies). Instead of siloed agencies in our educational practices such as teacher/student or human/animal/environment, agencies are co-constituted in-relationship—teacher and student; human and animal and environment. Table 1 shows elements of an ethico-onto-epistemological framework.

Precepting students is leading learning. Students observe preceptors' actions, words, approaches to situations, thinking through cases, relationships with others, what they include, and what they exclude. Preceptors can make lasting impressions on students (marks made) producing effects of difference. What effect of difference do we want to make?

**Table 1**

*Ethico-onto-epistemological framework Elements*

| Framework element | Action                               | Leading learning                                                 |
|-------------------|--------------------------------------|------------------------------------------------------------------|
| Ethicology        | Valuing                              | Modeling valuing others                                          |
| Ontology          | Way of being↔becoming <sup>a</sup>   | Modeling becoming-professional                                   |
| Epistemology      | Way of learning↔knowing <sup>b</sup> | Modeling continuous professional development; continued learning |

Note: Adapted from Barad (2007).

<sup>a</sup> Being and becoming are in a continual flux of reconfiguration contingent upon relationships.

<sup>b</sup> Learning and knowing continually reconfigure. Relationships (entanglements with matter and meaning) coproduce new learning and different ways of knowing (continuous professional development).

The One Health approach to medicine produces rethinking teaching through relationships and how these relationships can affect us and others in various ways. We can apply a One Health approach through an ethico-onto-epistemological framework for counseling clients. Figure 1 conveys the idea of One Health where humans, animals, and environments are inextricably entangled. The figure shows a canine patient receiving chemotherapy. The human and animal are in-relationship not only with each other but with the environment. Since this is a hazardous drug being administered, the human is taking precautions to protect other animals and humans from exposure to hazardous drug residues.

**Figure 1**

*One Health: Humans-Animals-Environments In-relationship*



Note: Photograph credit Heather Lindell

# Leadership Development Tip (LDT)

## Leading Learning Through an Ethico-onto-epistemological Framework Heather Lindell, BSPH, PharmD, DICVP

### EXAMPLE OF COUNSELING A CLIENT THROUGH A ONE HEALTH APPROACH INFORMED BY AN ETHICO-ONTO-EPISTEMOLOGICAL FRAMEWORK<sup>1</sup>

Case adapted from FDA-CVM (2022):

**Case scenario:** One of your clients comes to your pharmacy and tells you they recently went to the dermatologist about a spot on their arm. They handed you a prescription for one 40 gram tube of fluorouracil cream, USP 5%. The instructions from the dermatologist said to apply to the affected area twice daily for 6 weeks. The client stated they have a follow-up appointment with the dermatologist after six weeks of treatment.

#### VALUING CLIENTS-ANIMALS-ENVIRONMENTS

##### Client Counseling: Humans

The client asks you how to apply their fluorouracil.

How do you counsel the client? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

##### Client Counseling: Animals

You ask the client if they have any pets. The client smiles, pulls out their phone, shows you an image of their new puppy, and begins to tell you all about the new puppy including how it sleeps in their lap while watching television.

How do you counsel the client? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

##### Client Counseling: Environments

The client tells you the dermatologist told them to apply the fluorouracil with a nonmetal applicator or wear gloves.

How do you counsel the client? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

<sup>1</sup> Ethics of an agential realist approach values humans and nonhumans (e.g., animals, environments, materials). An ethico-onto-epistemological framework recognizes the role of human and nonhuman entities in-relation, coproducing being↔becoming and learning↔knowing. Examples of materials in this case scenario producing effects of difference include prescription, fluorouracil, applicators. When counseling clients, think of (value) materials coproducing effects of difference (changing our way of being and knowing).

# Leadership Development Tip (LDT)

## Leading Learning Through an Ethico-onto-epistemological Framework

Heather Lindell, BSPH, PharmD, DICVP

### POSSIBLE CLIENT COUNSELING:

**Humans:** Check the client's (patient) medical profile for allergies to the product or ingredients. If this is a woman of childbearing capacity, ask if they discussed the risk with the dermatologist. Let the patient know fluorouracil is not typically used on pregnant women and not advised when nursing. If there is a woman of childbearing capacity in the household (not the patient), explain to the patient the woman of childbearing capacity in the household should not be exposed to or handle the fluorouracil. The patient should topically apply an amount of fluorouracil to cover the lesion. They should apply the fluorouracil once in the morning and once later in the day (approximately 12 hours of time between applications). Wash hands well after application, especially if using a bare hand (bare hand use not advised, use a nonmetal applicator). Continue treatment for 6 weeks. If you are running low and the tube of fluorouracil does not look like it will last six weeks, call the pharmacy so the pharmacy can call your doctor for a refill.

Inform the patient the treated area may begin to look unsightly during the six week treatment period and a few weeks after discontinuation (e.g., redness, crusting). Other side effects may include increased white blood cells (leukocytosis), mood changes (e.g., irritability, insomnia), inflammation of the mouth and lips, medicinal taste in mouth, other blood changes (e.g., decreased blood platelets), additional skin changes (e.g., blistering, tenderness), and facial irritations (eyes, nose). Contact your doctor for a blood test if experiencing more fatigue than usual accompanied by fever, night sweats, and unexplained weight loss; or experiencing more bruising than typical, bleeding nose or gums, blood in urine or stool. Avoid exposing the treatment area to ultraviolet rays including the sun and tanning beds. Do not apply on mucous membranes or cover the fluorouracil treated skin with an occlusive (tight/airtight) bandage. Do not use on the eye, do not ingest by mouth, and do not use intravaginally.

**Animals:** Pets, especially dogs, can be severely harmed when exposed to fluorouracil. Clean residue of any fluorouracil from your hands, clothes, flooring, bedding, blankets, furniture, etc. so your new puppy will not be exposed to the fluorouracil. Do not let the puppy lick/bite the application site, residues, or the fluorouracil tube. When holding the puppy, avoid exposing the puppy to the fluorouracil. Exposure can be fatal. If your puppy shows any signs of vomiting, diarrhea, shaking, decreased energy, or difficulty breathing, contact the puppy's veterinarian right away and let the veterinarian know the animal was (if you know/saw the exposure) or may have been (you suspect) exposed to fluorouracil.

**Environments:** When applying the fluorouracil in the home environment with a nonmetal applicator, for example a cotton ball, cotton tipped swab, gauze, any paper-based product, or glove, dispose of the applicator in a waste receptacle your pet cannot get into and where anyone in your household (e.g., woman of childbearing capacity, children) cannot accidentally come into contact with the fluorouracil or fluorouracil residues. Store the fluorouracil at room temperature between 59°F and 86°F. Keep out of reach of children and pets. Store separately, away from other tubes (e.g., toothpaste) and away from other medicines.

### Source:

U.S. Food and Drug Administration-Center for Veterinary Medicine [FDA-CVM]. (2022, September 7). *CVM drug safety communication: Fluorouracil products used on people's skin can cause serious reactions in pets.* <https://www.fda.gov/animal-veterinary/cvm-updates/cvm-drug-safety-communication-fluorouracil-products-used-peoples-skin-can-cause-serious-reactions>  
Encube Ethicals. (2025). *Fluorouracil cream, USP 5%* [Product information]. Encube Ethicals Private Limited.