ABSTRACT

ROBERTS, LAURA ELIZABETH. Opening Academia: An Activity Theory Analysis of How Academics Learn and Do Openness (Under the direction of Dr. Jean Goodwin).

This study examines how practices of open science, a movement for making scholarship more open, shareable, and reusable, are learned and performed by individual scholars across different fields, in both the sciences and humanities. New open practices are being developed in response to technologies that allow for researchers to easily share their scholarship and collaborate with others. Without established procedures for implementing open scholarship, many academics are faced with building their own communities for openness, while also learning how to assimilate openness into their current workflows for teaching and research. Based on the challenges this presents, this dissertation is guided by the question: how do academics learn and do openness?

To answer this question, I engaged in participant observation at a local training event, the Open Incubator, which was a five-week workshop for developing open projects hosted by a university library. Following the workshop, I conducted qualitative surveys and document-based interviews with attendees and facilitators of the workshop. In these interviews, I asked participants about their experiences learning and practicing openness within their own disciplines. Using activity theory as a framework for analysis, I found that the Open Incubator, as a non-discipline specific learning initiative, functions well because it enables participants to question their current activity systems through exposure to other disciplines and norms. For this to work, this type of training requires facilitators who can act as boundary spanners between faculty members, university initiatives, and the open science movement.

Additionally, I found that individuals pursuing openness face contradictions with traditional systems of teaching and research or neighboring systems that have not yet adapted to
openness. These contradictions are barriers to open practice because participants felt vulnerable or discouraged from pursuing openness in some instances. However, contradictions also allowed participants to envision alternative ways of acting and new systems where openness can work in conjunction with academic practices. Agendas and policies that are specific to individuals’ disciplines may help to bring about more open systems for academics.

Finally, I found that individuals learn by internalizing and externalizing information from diverse sources, including courses, mentors, peers, and conceptual models from other disciplines and media. Individuals adapted these sources through remixing, repurposing, and adapting to create new, open work within their disciplinary communities. With this, learning is a process where individuals learn while also contributing to and shaping their communities of practice.

These results mean that learning and doing openness occur through exposure to systems, norms, and concepts from both inside and outside of the discipline. Further, through my research I find that openness operates differently for different individuals. Therefore, there is no one way to learn openness, rather there are different ways to foster openness. These include encountering different people, disciplines, technologies, and media associated with openness; engaging with boundary spanners who can facilitate open interventions; and creating documentation to support open work, such as policies, agendas, and infrastructure that acknowledge the importance of openness and also protect those who pursue it.
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June 2020
Opening Academia: An Activity Theory Analysis of How Academics Learn and Do Openness

by

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A dissertation submitted to the Graduate Faculty of
North Carolina State University
in partial fulfillment of the
requirements for the degree of
Doctor of Philosophy

Communication, Rhetoric, and Digital Media

Raleigh, North Carolina
2020

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BIOGRAPHY

Laura Roberts was born in Mobile, Alabama and grew up in Rome, Georgia. She received her BA in English from Louisiana State University in 2010 and her MA in Professional Writing from UW-Milwaukee in 2016. Currently, she is a PhD candidate in the Communication, Rhetoric, and Digital Media program and a graduate researcher in the Public Science Cluster at NC State. Laura researches how technologies influence scientific writing and communication between technical and lay audiences. Her interests include professional writing, rhetoric of science, scientific writing, genre studies, and digital rhetoric. In the fall of 2020, she will be joining University of Wisconsin-Platteville as an Assistant Professor of English and Professional Writing.
ACKNOWLEDGMENTS

This dissertation is ultimately a story about how communities can make change happen, and that has been true in my experience as well. I have been so fortunate in this program to have people support my work and see value in it when I could not see that value myself.

My advisor and chair Dr. Jean Goodwin has been not only a mentor in this process but a friend. We started at NC State the same year, her as a professor and me as a PhD student, and connected over our shared interest in public science. I feel so fortunate to have met Jean and have her as a guide throughout my time in CRDM. I am so appreciative of the time and care that she has invested in me. I don’t know that I would ever be able to repay it, but I will try to pay it forward.

Thank you to my committee members, Drs. Huiling Ding, Stacey Pigg, and Grant Bollmer. While I sometimes felt my research and writing were outside of everyone’s wheelhouse (as is often the case with interdisciplinarity), they reeled me back in and grounded my work within professional writing and communication. Additionally, I have also grown so much through the coursework and interactions with faculty at NC State. I would like to especially thank Drs. Jason Swarts, Victoria Gallagher, Emily Winderman, Nicholas Taylor, and Stephen Wiley for classes that challenged me and broadened my worldview.

Thank you to the participants in my study who were so generous with their time and trusted me to tell their stories. I have learned so much from you all.

Thank you to Dr. S. Scott Graham for his generosity and mentorship. UW-Milwaukee was where I saw my writing transform from student to scholar, and I credit that to Scott’s guidance. Thank you to Dr. Jenell Johnson, whose course in rhetoric of science at LSU
introduced me to a field I never knew existed. Her scholarship and teachings have been very influential to my trajectory, and for that I am grateful.

I would also like to thank the people in CRDM, students and alumni, who have been friends, allies, and sources of advice. Thank you to my cohort-mates who have learned, struggled, and grown alongside me. A special thanks goes to Mai Xiong Gum who has been a constant friend and reader throughout the dissertation.

Finally, I would like to thank my family and friends for their love and support. Thank you to my parents, Carolyn and Jerry, and to my brothers, David, Andy, Jesse, and Stephen. To my friends, I can’t wait for us to celebrate together! To Clay, thank you for always being there for me and encouraging me to be my best. Thank you for all of the little things and the big things. I could not have done this without you!
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CHAPTER 1: When Old Traditions Meet New Technologies

During the session, Micah pulls up Maria’s project outline on the projector. He discusses how she needs to identify a repository for her open educational resources. “We rely on systems all the time. It’s possible that YouTube could shut down. Any platform could shut down. Google sites, how long is that going to keep alive?” Chris, a research professor, suggests GitHub as a repository for Maria’s multimedia files, but Maria is frustrated by the current GitHub trainings that the library offers. “The workshops on GitHub are worthless,” she says. “They need to start with what is it, not just assume that you already know. The learning has to change, and I don’t have time to become an expert.” Will, the second facilitator, interjects, “GitHub is like another language—you have to keep doing it.”

The example above illustrates the complexities researchers and teachers face when trying to incorporate openness into their everyday practices. Maria has attended the trainings that take place at the library, but because they assume background knowledge of the technology, she cannot incorporate them into her everyday life. In contrast, Chris considers GitHub his “go to” technology for organizing his research, one that he trains his department’s graduate students and post-doctoral researchers in every year. The difference between Maria’s experiences and Chris’ is how the technology is incorporated socially into their respective discipline and how scholars localize technologies and technology training to their specific discipline. As this study reveals, there are systems of technologies, practices, and platforms that scholars encounter to communicate with others, but at the same time, these systems must be learned, socialized, and incorporated into day-to-day practice—like a “language.”
This study examines how practices of openness, a movement for making scholarship more open, shareable, and reusable, are fostered and encultured by scholars, both teachers and researchers, novices and experts. Openness is a new movement for many disciplines, and as such, there are not established procedures and practices for openness for many academics. This dissertation takes on this issue to uncover how individuals learn and develop new open practices. Further, I explore the tensions that emerge between their open goals and the technologies, policies, and communities they operate within.

In this introduction, I begin by providing background of openness using open science as my starting point. I discuss current conversations surrounding open science within the humanities and social sciences. I point to two gaps in the research concerning discipline-specific training in open practices. These gaps set up the framework for my study, which I discuss in the second chapter. Subsequent to this background information, I describe my research design. This section includes information about my guiding research question, site, methods, and data analysis. Following my research design, I provide a statement of significance and my chapter outline.

**Openness and Open Science: Old Traditions and New Technologies**

Throughout this study, I use the term “openness” to be inclusive of open practices within the science, humanities, and social sciences. “Openness” is a rhetorically flexible word. It can mean open like open access, open for commercialization, or open to lay understandings. There is no one definition of “openness,” and each of the participants in my study operates on a different, personalized definition of open that guides their work. However, open, as a concept, has a history, specifically in relationship to open science. In this section, I aim to uncover how open has emerged as a topic for academia and why it is a pressing issue for research. I turn to open
science instead of openness for two reasons. One, open science is more traceable through the literature than openness as it has been tied to the history and philosophy of science, whereas openness is less specific to any one discipline. Two, many of the tenets of open science can be applied to openness more generally. Openness is a continuation and broadening of open science to encompass various disciplines outside of the sciences. Therefore, while openness lacks the historicity of open science, the implications of examining openness and open science are similar.

In this section, I explore open science as a historical activity that has developed in relationship to scientific norms and technological advancement.

Open science is a movement that has gained considerable traction within the last two decades with its goal of making research and scholarship more accessible, collaborative, reproducible, and reusable. Definitions of open science vary from focus on it as an idea (Nielson, 2011), an ideology (Martiny et al., 2016), and a practice (FOSTER, n.d). With a general lack of consensus over what open science is, scholars have sought to define it through assessing the field as a whole and reviewing open science literature. Fecher and Friesike’s (2014) review of open science considers it as an umbrella concept with five schools of thought spanning infrastructure, publics, metrics, democracy, and collaboration. Similarly, open science taxonomies categorize practices of open science to include open access, open data, open methodology, open source, open peer review, and open educational resources (Kasberger, 2013).

At its core, open science is sustained through its reliance on old cultural values and new information communication technologies. The 2002 Budapest Open Access Initiative (BOAI) begins with the memorable line: “An old tradition and a new technology have converged to make possible an unprecedented public good” (Chan et al., 2002). Although referring particularly to open access, this statement applies more generally to open science. The traditions of open
science are considered long-standing cultural norms endemic to the scientific community. An oft-cited antecedent to open science is Merton’s (1942) institutional norms for the ethos of modern science. These consist of communism (scientific knowledge is commonly owned), universalism (scientific knowledge does not rely on the identity of the person making the claim), disinterestedness (scientists must disengage their interests from their actions and judgments), and organized skepticism (scientists should disbelieve new ideas until they become established). Open science is frequently brought up in relationship to the norm of communism, where participating in open science allows for the scientific community, at large, to broaden knowledge.

Although Merton is discussing “modern science,” Guédon (2017), an advocate of open science, equates these norms to a much older ethos arising with the Scientific Revolution (p. 2). In some sense this is true, with studies of the Philosophical Transactions pointing to the early dialogic norms of the gentleman researchers, where proto-scientists contributed letters, rather than reports, with the goal of sharing scientific knowledge (Atkinson, 1996). However, as David’s (2008) economic history of open science unveils, the openness and collaborative ethos of science during the Scientific Revolution can also be attributed to the patronage system and “informational asymmetries” between patron and client. Because patrons could not judge the expertise of the mathematicians and scientists they hired, mathematicians and scientists engaged in public acts, such as boasts, contests, and challenges, to garner credibility. These public acts included the vigorous exchange of letters and the pronouncement of discoveries. A closed system of science meant that patrons had no way of assessing the validity of their hired scientists. What could be taken for openness, then, arises from attempts at publicity by scientists to secure funding. Therefore, although proponents may draw on long-standing cultural values, as David...
(2008) contends, “the institutions of open science, rather than having emerged and survived as robust epiphenomena of a new organum of intellectual inquiry, are thus seen to be independent and in some measure fortuitous social and political constructs” (p. 88). In other words, the norms of open science cannot be considered consistent and sustained from the Scientific Revolution to the present day and, instead, reflect discrete responses to social and political situations. As such, the open science movement reifies itself through historical connections to an older ethos of science, an ethos which may in part be an imaginary to evoke communal norms.

In tandem with the invocation of old communal norms, the BOAI also indicates new technologies as a driver towards openness. The coupling of technology and scientific concepts is not new for media studies of science, with many scholars associating media technologies with the rise in certain scientific movements and ideas. For example, the printing press has been associated with the Scientific Revolution (Eisenstein, 1980), photography with objectivity (Daston & Galison, 2007), and diagrams with correlation (Bender & Marrinan, 2010). For open science, media scholars (Martiny et al., 2016; Veletsianos & Kimmons, 2012) and open science advocates (Guédon, 2017; Weller, 2011) alike attribute the burgeoning movement to the availability and adoption of information communication technologies (ICTs). These ICTs allow researchers to share and distribute their work in new ways, using digital platforms to communicate and collaborate on scientific knowledge. For example, data that was once only easily accessible to the research team can be scanned and uploaded to a digital repository for others to use. Furthermore, scholars can archive their already published works in open institutional repositories, following the green model of open access.

ICTs, then, are perhaps the greatest driver of moving towards open models of scientific practices. These new practices are not just aimed at opening science, but fundamentally changing
how science is done. Open science proponents call on researchers to explore how digitization can transform scholarship, beyond merely circulating that content more widely. Media theorist Gary Hall (2008) argues that there has been little serious attention to how digital is able to "remediate older media forms, and thus deliver a preexisting and more-or-less unchanged content, albeit in a new way, but to transform fundamentally that content, and with it our relationship to knowledge" (p. 10). Similarly, Martiny et al. (2017) call for open media as an extension of open science “to emphasize the ambition of opening up the media through which scientific knowledge is processed, validated and circulated" (p. 5). Others, such as Fitzpatrick (2011) and Borgman (2007), consider scholarship as at a crossroads, where the adoption of openness may be fundamental to preserving its future.

The new and open practices of science are in many ways uncharted. While scholars may appeal to a long-standing ethos of openness, on closer examination, these communal norms are not as long-standing and affirmed as they appear to be. Further, research into the scholarly transformation that can be accomplished through new technologies is at a crossroads. Many advocates proclaim that change toward openness is possible and should happen, but what this change will be remains uncertain. There is no roadmap for how to change scholarly practices towards openness, nor are there any set frameworks for what this openness should be. As scholars of writing and communication, we are well-positioned to map the changes that technology brings to communication and communal norms of scholars and consider interventions to foster open science practices. In this next subsection, I discuss how current work studying open science has sought to accomplish these goals.
Democratic and Disciplinary Futures

With the two foci, on cultural-historical norms and new technologies, studies of open science can roughly be divided into inquiring into the democratic future of open science or applying open science technologies to other disciplines. The former of this category follows a long trajectory since at least the 1980s of science and technology studies examining issues in and affordances to the public participation in science (Collins & Evans, 2002; Funtowicz & Ravetz, 1993; Trench, 2008; Wynne, 1989). In this vein, the edited collection Science and the Politics of Openness (2018) considers open science in relation to the unforeseen consequences of making science more open to the public with each section positioning a different “monster” that arises with openness. Within the collection, Curry (2018) considers open access a means of increasing scientific transparency, public engagement, and trust, although one that is still an uncontrolled “beast.” The association of openness and trust echoes previous claims that open science is a “trust technology” that could strengthen relationships between scientists and the public (Grand et al., 2012). This line of studies debates how open science and research should be to facilitate public deliberation and policy actions.

Yet, other studies of open science and open access find fault with their transparency and access, particularly in how openness is defined. Candidly, Suber (2012) admits that open access (OA) excludes many meanings of openness. One of which is public access: “OA isn’t primarily about bringing access to lay readers. If anything, the OA movement focuses on bringing access to professional researchers whose careers depend on access” (p. 25). For those interested in public communication of science, open access would have to include accessibility to lay audiences, rather than strictly academic audiences. Kelly and Autry (2013) argue that open access should expand to include accessibility and rhetorical accommodation to lay audiences.
While Kelly and Autry consider ways to improve open access and open science, others reject open science altogether. Mirowski’s (2018) critique of open science departs strongly from the common boosterism of openness in an extreme denunciation of it:

The taken-for-granted premise that modern science is in crying need of top-to-bottom restructuring and reform turns out to be one of the more telling aspects of this unseemly scrum, a melee to be in the vanguard of prying science ‘open’. But the language is deceptive: In what sense was science actually ever ‘closed’, and who precisely is so intent upon cracking it open now? Where did all the funding come from to turn this vague and ill-specified opinion into a movement? (p. 172)

Mirowski points to corporate entities as the primary funders of the movement and rejects the idea that open science will improve public distrust in science. Instead, he views open science as a precursor to continued commercialization of science. “Open” to him means open to be used for corporate monopolization, rather than public good. These studies, which focus on issues of publicness, continue a tradition within science and technology studies of questioning scientific initiatives and their involvement of the public. They seek to theorize what open ought to be if it becomes a part of science and scholarship.

Within technical communication specifically, the focus shifts to the technological affordances of the movement. This can be seen in the proliferation of attention to open source software and the implications of openness, typically in order to apply to writing and communication programs. For example, Zoetewey (2013) studies technical communicators’ perceptions of free in relation to open source software development to consider how programs may adopt open source software. Similarly, Still (2010) calls for OpenTechComm, which he envisages as an “open community of teachers, students, and practitioners, some more active than
others, some more experienced than others, but all collaborating together to offer and use pedagogical technical communication information” (p. 222). These studies support the ideas of openness and its accompanying technologies for adoption outside of the sciences.

Essentially, questioning the affordances of openness and its technologies seem to be the primary focus of research into open science thus far. As this literature demonstrates, inquiries of open science and openness have often focused on the democratic nature of technology and what this affords for openness. In other words, these studies consider the potential futures available for scholarship through technology that allows of instantaneous sharing, collaboration, and access. Generally, these studies attempt to define what openness is (David, 2018; Levin et al., 2016) or what openness should be (Mirowski, 2018). Further, many attempt a large-scale overview of open policies (Curry, 2018), journals (Kelly & Autry, 2013), or open science as a whole (Mirowski, 2018). Within this literature, small-scale, bottom-up approaches to openness are mostly absent.

This gap in the literature should be redressed because small-scale initiatives are promising for understanding and even changing how openness is adopted and learned by the average, everyday scientist. After tracing the roots of open science, David (2008) concludes that the future of open science “rests not in the hands of some distant, unknown and hopefully wise designers of public policy, but upon scientists’ acceptance of responsibility for day-to-day individual and collective actions” (88-89). Following individual actions as they relate to openness may enable nuanced understandings of barriers scholars face for adopting openness and may reveal concrete interventions. In Swarts’ (2019) study of open source science software forums, he addresses how the localized nature of the software is both an affordance and an obstacle:
The uniqueness of such local circumstances were what made adaptable and customizable OSSs so valuable in the first place, yet the idiosyncrasies of those local circumstances were what created the issues that were too specific to be addressed in documentation, even in task-based documentation. (p. 82)

The localized nature of the software results in issues highly specific to the use-case, where generalized documentation is ineffective for helping users navigate these obstacles. Extending this line of inquiry, we need to consider the localized issues of openness, in addition to global, overarching, and systemic problems related to openness. In other words, because openness is deployed differently by different disciplines and scholars, scholars will face unique problems when adopting openness, and these problems will need targeted and specific solutions that consider the communities within which scholars act.

A localized understanding of openness also requires considering how scholars learn to be open. Essentially, we must understand the activities that encourage and sustain open practices. While there has been continued focus on open policies (Levin et al., 2016; Stodden, 2010), much less attention has been devoted to how open science is encultured at the individual level. Training in open practices appears largely generalized and global in scale with prominent training appearing through widely available websites. This can be seen in open science training initiatives, such as FOSTER, an e-learning platform for those that need to “need to develop strategies and skills for implementing Open Science practices in their daily workflows” (“About FOSTER”, n.d.). These online resources are backed by abstract principles of open science. For example, the website opensciencetraining.com has the Panton Principles, a set of principles about data reuse, as one of the primary choices on its menu bar. The relationship between
training and principles is strongly connected in open science and represents a top-down approach of adopting open science.

To further our knowledge of how individuals are enculturated into open science, more studies are needed that determine how generalized trainings are effective for enculturing open practices. How does a training that is not tailored to a scholar’s discipline but rather guided by abstract principles help scholars adopt open practices?

However, even within disciplines, studying openness is a challenge for researchers. A significant barrier to studying the enculturation of openness is its relative newness. Practices of openness have not penetrated many fields, with the humanities as perhaps the slowest to adopt openness (Eve, 2014; Suber, 2005). Scholars who are attempting to cultivate openness within their discipline are often treading in new terrain without mentors to guide them. While studies show that scholars are pursuing openness and creating open agendas within their disciplines, few studies focus on how academics are constructing these open practices and communities, particularly in disciplines new to these practices.

To conclude this section: openness has been historicized by its advocates as a long-standing cultural norm, but studies of open science have unveiled it as a recent cultural practice emerging in relationship to new ICTs. These ICTs have been considered as potentials for improved public trust of science and tools for helping for other disciplines achieve Mertonian communal norms. However, previous studies have mainly focused on large scale issues of open science, and few have looked at individuals as they encounter open science. Research into how individual academics learn and do openness is where writing and communication scholars may intervene to study how scientists actually incorporate openness into their daily lives. This
research should attend to how scholars create open communities, especially for disciplines where open practices relatively new.

**Learning and Doing Openness Through Activity**

This dissertation adds to an understanding of openness not through providing definitions of “open,” but rather by following the activities of scholars. This sets up the guiding question of this dissertation: how do academics learn and do openness? This guiding question allows us to explore how openness can be incorporated into the everyday practices of individuals. If we want to introduce openness effectively into universities, we must first find out what openness is for specific disciplines. What is the goal of pursuing open work for individual scholars? What challenges prevent them from additional open practices? Does openness look the same across all research practices or does it vary from the humanities to the sciences? Once we know about how individual scholars are practicing openness, then we can focus on how they can best reach this object through learning. What does a workshop offer to scholars who want to learn about openness? How does mentorship change someone’s teaching practices?

This dissertation addresses these questions through activity theory. Activity theory is a framework that encompasses both learning and doing from its beginnings in Russian educational psychology to its contemporary uses for mapping practices within organizations and institutions. Chapter 2 provides a literature review of activity theory to arrive at the specific research questions derived from this framework.

**Research Design**

To uncover how individual scholars learn and practice openness, I began my research by observing a newly piloted training in open scholarship for researchers at NC State. The Open
Incubator is a North Carolina State University Library initiative to promote open scholarship and projects on campus. I chose to study the Open Incubator for three primary reasons.

First, the training provided a generalized, rather than discipline-specific approach to openness. While my study aims to uncover localized enculturation of openness, I wanted to engage with scholars in different research communities who were working toward openness. The generalized training of the workshop meant different disciplines and approaches to openness were present within the workshop. This provided me with participants from different disciplines and at different levels in their academic careers. With this opportunity, I could see how people learned from non-discipline specific approaches to teaching openness.

Second, the workshop provides a small-scale approach to open training. Because my research question concerns individual training, I wanted to observe enculturation that took place with a small group of participants. The training was only available to faculty and students associated with NC State, rather than a wider population of open scholars. This small-scale approach meant that I could observe and participate in smaller, group discussions of what openness meant to individual participants and how it applied to their fields. Also, I could study smaller initiatives that could potentially be replicated at other universities and organizations.

Finally, the workshop met face-to-face. While mediated ethnography is a recognized methodology for uncovering information about virtual communities (Hine, 2015), I wanted to study the face-to-face interactions and discussions between participants to understand how social relationships are fostered through training. The workshop allowed me to take notes on synchronous discussion of openness. I could then follow up with my participants through face-to-face interviews. This differs from many open science training initiatives which take place purely online with little interaction between participants and facilitators.
As the first iteration of the Open Incubator at NC State, facilitators were new to hosting this format for researchers and teachers for this campus community. As such, the research based on this Open Incubator is nascent and limited. While I make claims about the state of openness based on my experiences within the incubator and my interactions with incubatees and facilitators, these views are partial and framed by my own experiences. This perspective offers a small-scale look at an early-stage program to foster an emerging social and academic movement. Movements toward openness are emerging as they incorporate new technologies, infrastructures, and practices. As one of the facilitators remarked at one point on openness, “every five to ten years we have to relearn for the new scholarship” [Session 2]. Therefore, studies of a similar incubator at a different point in time may yield different grappling with systems, technologies, and infrastructures than the ones presented in this dissertation.

Methods

My methods for this dissertation were participant observation, surveys, documents, and interviews. In this subsection, I provide a description of how I employed each method.

Participant Observation

While observation and ethnography are valid methods for examining activity, I choose to act as a participant observer in this study in order to learn alongside my participants and experience the Open Incubator for my own research. Jorgensen (2015) defines participant observation as a method where the “researcher more or less actively participates with people in commonplace situations and everyday life settings while observing and otherwise collecting information” (p. 1). With its goal of participation, the researcher can experience the same learning activities as the participants from an insider’s perspective.
For each meeting, I contributed thoughts to discussion on my own use of open scholarship and took notes on others’ contributions to the discussion. After each meeting, I made a memo of my notes, where I reflected on important and recurring themes that were brought up for that week. This allowed me to reflect on openness in my own field and share my experiences with the group, while also observing how others perceived openness in their disciplines.

As an active participant, I position myself as a cautious proponent of openness. I believe open scholarship has potential for improving knowledge and that its technologies and ideals can benefit disciplines outside of the sciences. However, my study also examines the tensions that emerge from practicing openness. With these tensions, I am cognizant of the commercial aspects of openness. Chapters 3 and 4 in particular are somewhat critical of entrepreneurship and commercialization within open practices. It is important to recognize that entrepreneurship and commercialization can be positive goals for openness, but they have the potential to overpower other open goals such as freedom of use and open access.

**Surveys**

I distributed surveys one month after the completion of the workshop in order to follow up with participants about their experiences during the workshop. These surveys asked open-ended questions about participants’ views of the open incubator and openness more generally.\(^1\)

**Documents**

Next, I collected documents created during the Open Incubator. With the consent of my fellow participants and the facilitators, I collected initial application materials, project outlines, proof of concepts, and results from survey distributed by the facilitators. Documents served a key

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\(^1\) See Appendix A for a list of survey questions.
role in understanding how participants perceived the systems of openness that they interacted
with and how they have incorporated or planned to incorporate open practices into their work.

**Interviews and Artifact Analysis**

To follow up on the ideas expressed in the incubator, I conducted interviews with the
attendees and facilitators of the Open Incubator\(^2\). Interviews are crucial for understanding how
subjects participate in and perceive openness and its associated systems. As Sun (2006) describes
in her examination of user localization, users “know what works in their own contexts, and they
know how to make use of a technology in their life spheres if they are able to find a good fit” (p.
458). In other words, if a researcher wants to know about a participants’ specific situation and
technologies, the best way is to ask them their opinions and perspectives. I deploy interviews as a
means to understand how my participants individually encounter and operate in regard to
openness. These semi-structured interviews allow me to understand the activity involved as
someone practices and learns open science.

To examine how participants learn to practice openness, I also undertake an artifact
analysis during the interview. With this part of the interview, I asked my participants to share
with me a document, artifact, or piece of media they created relating to openness. Then, I asked
them specific questions about the success and challenges of the artifact. In particular, I use this
section of the interview to understand their practices of openness in relation to the artifact and
how they learned these practices.

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\(^2\) See Appendix B for the interview protocol.
Chapter Outline

Chapter 2 - Activity Theory as a Framework for Observing Open Practices

Activity theory is a methodology born out of Marxist Russian psychology that has been adapted to study complex activities. In Chapter 2, I provide an overview of activity theory as the framework for my dissertation and a stimulus for my research questions. Within this chapter, I delineate the three generations of activity theory as formulated by Engeström (2001). I also speculate about fourth generation activity theory (4GAT) and how it may be useful for considering complex activities. I then connect activity theory to writing studies, specifically genre studies. The entanglement of these two concepts, activity and genre, allow me to productively realize the connections between open practice and documentation. Following this, I provide three themes of activity theory research and research questions derived from these themes. These three themes are learning, cultural-historical activity theory (CHAT), and contradictions. Through these themes, I discuss my refined research questions. These are the following: how do people learn to practice openness, what is the object of openness for individuals, and what are the challenges to openness and how can we intervene to overcome these challenges?

Chapter 3 - Openness through Boundary Spanning: The Open Incubator, Its Origins, and Objects

In Chapter 3, I introduce the Open Incubator, a five-week workshop for learning about openness and developing open projects. As my main site of study, the Open Incubator is the starting point for exploring openness, academia, and learning. Here, I present my eight participants, each at various stages in their academic career and each pursuing openness in some manner. Within this chapter, I deploy CHAT to understand the object of the Open Incubator—is
it based in learning, entrepreneurship, or something else? CHAT allows me to trace the cultural relevance of incubators and library studies to understand the purpose of the Open Incubator for enculturing open practices. Through this analysis, I am able to understand the object of the Open Incubator, as one which developed through the activities of both business and libraries. Essentially, this object is one that is constructed in relationship to the genres and language of business but motivated by the academic libraries’ imperatives of advancing information literacy and involving libraries in the research workflows of their patrons. For learning, this contrast between library values and entrepreneurship opens up a third space for incubator participants to discuss issues in an informal, interdisciplinary space. The third space requires a mediator who can navigate between different organizations and institutions, and the librarians facilitating the Open Incubator fulfill this role. They are boundary spanners. As boundary spanners, they can mediate the workflows, networks, and systems that researchers and teachers interact with. I argue that the boundary spanner position recasts the role of libraries within the academy to mediate between institutions.

Chapter 4 - Contradictions as a Productive Source of Change within Academic Activity

Systems

While Chapter 3 focuses on the object of the Open Incubator, Chapter 4 examines the activity and practices of individual participants within the Open Incubator. Examining the activity of these participants leads me to explore certain contradictions that arise for participants. In particular, participants express tensions between the expectations of traditional academic activity and practices of openness. Using Engeström’s (1987) four levels of contradictions, I explore how these contradictions may be productive, rather than restrictive, for pursuing openness and finding open interventions. I theorize how open tools can bring transformation to
activity systems. This requires that I must first understand the objects for my participants activities. Through this analysis, I find that tools are a means through which individuals encounter and adopt open practices. These tools of course are associated with a larger body of tool-producing activity. Thus, the norms of these open tools are brought with them into participants’ activity systems. These norms may sometimes clash with existing norms of academia. Here is where culture changes are needed if openness is to be embraced within academia. For disciplines where openness is already encouraged and supported, the contradictions they face are not conflicts between them and their departments or institutions. Rather, they must negotiate openness with issues of data quality and data security when working with government agencies. The chapter ultimately finds that small-scale and discipline-specific changes are needed to support openness within academic activity systems.

Chapter 5 – Learning to be Open

Once academics have encountered open tools and principles, they must incorporate these into their disciplines in order to be effective. In other words, they must learn how to practice openness, specific to their own research and teaching. For this, my fifth chapter examines discipline-specific learning of open practice using Vygotsky’s internalization and externalization as it has been adapted for cognitive and social apprenticeship models. This chapter seeks to understand how discipline-specific training prepares or fails to prepare academics for open practices. I find that participants encultured open identities through school-based instruction but learned to practice openness through mentorship opportunities where they encountered conceptual models for their open work. Because open scholarship is relatively new, old-timers within some fields may be limited, so peer mentors were invaluable for my participants, as well
as conceptual models found through social media. Participants externalized their open
scholarship and provided mentorship and modelling to others.

Chapter 5: Conclusion

The conclusion of this dissertation veers into the territory of the current literature of
openness, namely projections of what openness can become. In this final chapter, I speculate
about the future for openness, not generally, but how it may affect different stakeholders.
Specifically, I consider the open futures available for professional writers and technical
communicators, librarians, and academics. I conclude with possible future research into openness
that stems from this dissertation.
CHAPTER 2: Activity Theory as a Framework for Observing Open Practices

Systems, infrastructure, and networks are commonly deployed metaphors for interacting with complex information and entanglements of humans and nonhumans. While theories involving infrastructure and networks may lend important perspectives for analyzing scientific communication issues, they do not privilege human agents. Instead, following Latourian actor-network theory (2005), they are typically object-oriented or informed by a flat ontology, wherein humans and nonhumans are treated equally (Kelly & Maddalena, 2016; Kessler & Graham, 2018; Potts, 2009; Swarts, 2010). Activity theory is instead focused on objects as purposes of the system, making humans the principal agents. While work in scientific communication and writing has tended toward the posthuman and nonhuman (Mara & Hawk, 2010; Moore & Richards, 2018), for this study, I privilege the human agents involved in learning and doing open science.

Activity theory, through activity systems, does not locate abstract concepts, like power, knowledge, or openness, within any one person or thing. Rather, it maps how these concepts are formed and sustained through interrelations between subjects, mediators, objects, and their communities. The activity system “forms around an object that the activity attempts to cyclically transform or pulse” (Spinuzzi, 2015, p. 8), and this cyclical pulse allows for growth and change to the activity. It allows for closed practices to become open; print publishing to become digitized; and restricted access to become open access.

This section provides a basis in activity theory and outlines its utility for studying enculturation into openness. Activity theory is an object-oriented approach that relies on navigating the mediations between subjects, their communities, and environments in pursuit of an activity. Engeström (2001) divides activity theory into three “generations” with each building
on the next. Moving from mediation under Vygotsky (1978) to objects through Leontiev’s contributions (1981) and concluding with Engeström’s (1987) systems approach to activity, I will briefly review each of the three generations, as they each contribute valuable concepts for understanding activity theory and its development. Specifically, for learning to practice openness, these concepts help us consider how learning is an activity that can be mapped and exists outside of the learner’s mind. I will also summarize how scholars have predicted a fourth generation of activity theory and the implications for this development. While fourth generation activity theory is an approach that could be taken for studying openness, I find that the third generation of activity theory enables me to map individual open practices. Next, I examine how scholars within writing studies have approached activity theory. These scholars frame my own approach to activity theory, and so, I follow this section with a list of concepts I will explore throughout my chapters in relation to activity theory.

**First-Generation Activity Theory (1GAT): Originations of the Theory by Vygotsky**

Russian psychologist Lev Vygotsky is largely credited with initiating activity theory with his writing in the 1920s and 1930s. His approach to activity theory is considered first generation activity theory, or 1GAT. Influenced by Marxian dialectics, Vygotsky (1978) studied developmental change, specifically what differentiates human intelligence from other forms of intelligence. From Vygotsky’s writings, there are three main concepts that remain influential to our current understanding of activity theory. These are activity, cognition, and mediation.

For Vygotsky, activity is a central part of learning. His analysis of learning occurs through analyzing how children encounter difficult tasks and use language to achieve their goals. For example, a task might include retrieving a book on a shelf just outside of the child’s reach. Vygotsky (1978) finds that in such a scenario the child,
engages in a number of preliminary acts, using what we speak of as instrumental, or mediated (indirect), methods. In the process of solving a task the child is able to include stimuli that do not lie within the immediate visual field. (p. 26)

One of these stimuli is language. In other words, the child will use language, alongside other tools, to complete a difficult task. The combination of activity and language are what Vygotsky considers unique to intellectual development and cognition (p. 24). Language, specifically, “enables children to provide for auxiliary tools in the solution of difficult tasks, to overcome impulsive action, to plan a solution to a problem prior to its execution, and to master their own behavior” (p. 28). Of course, it is activity that invokes the use of language for the child and makes that language meaningful.

![Figure 2.1: The image on the left shows a direct stimulus-response interaction. The image on the right is mediation according to Vygotsky (1978) by an artifact.](image)

Important to this thesis is the role of mediation. Mediation, through language and tools, effectively bridges individuals with their environment and as such, imbricates the environment into the development of humanity. As Engeström (2001) writes of Vygotsky,

> The insertion of cultural artifacts into human actions was revolutionary in that the basic unit of analysis now overcame the split between the Cartesian individual and the untouchable societal structure. The individual could no longer be understood without his or her cultural means; and the society could no longer be understood without the agency of individuals who use and produce artifacts… Objects became cultural entities and the object-orientedness of action became the key to understanding human psyche. (p. 134)
Vygotsky deploys a triangle to illustrate the mediational relationship between a stimulus and response. While basic forms of behavior are characterized by a direct line between stimulus and response (Figure 2.1), higher forms of functioning involve the sign as an intermediary between the two (Figure 2.1). This mediational process of the sign “operates on the individual, not the environment” (p. 39). In other words, human’s sign use leads to greater intellectual development and internalization of the sign’s meaning to society. This development is a social process as external actions are internalized through social interaction (pp. 56-57). This is the basis for cognition. The example Vygotsky provides for this is a child’s pointing. Pointing begins as an attempt to grasp an object, but through a response by the child’s mother, the child internalizes the sign as a means of communication with others. Notably, Vygotsky differentiates signs from tools in the acquisition of learning and development. While tools work on an object externally (the hammer hits the nail), signs (like language) work internally on the actor and lead to internalization and higher order thinking (p. 55). Both tools and signs are used to perform a mediated action on an object, which is theorized more specifically in second-generation activity theory.

**Second-Generation Activity Theory (2GAT): Leontiev**

Leontiev, a student of Vygotsky, is largely credited with expanding activity theory into its second generation. Leontiev transformed activity theory through his focus on collective and object-oriented activity. The idea of both the collective and the object are derived from Marxian concepts of labor. While Vygotsky’s theories of mediation focused on the individual, Leontiev considers how individual action contributes to a greater collective activity. This collective activity, he argues, distinguishes humans from animals. While for animals, each animal would follow actions that imminently led to their object (and S→R reaction), humans take up actions as
part of a collective. Their actions may indirectly contribute to their object. His example of the hunt illustrates how the object of the collective activity differs from the actions of individual hunters. Here, Leontiev (1981) describes the relationship of the beater to the overall hunt:

A beater, for example, taking part in a primaeval collective hunt, was stimulated by a need for food or, perhaps, a need for clothing, which the skin of the dead animal would meet for him. At what, however, was his activity directly aimed? It may have been directed, for example, at frightening a herd of animals and sending them toward other hunters, hiding in ambush. That, properly speaking, is what should be the result of the activity of this man. And the activity of this individual member of the hunt ends with that. The rest is completed by the other members. This result, i.e. the frightening of the game, etc. understandably does not in itself, and may not, lead to satisfaction of the beater's need for food, or the skin of the animal. What the processes of his activity were directed to did not, consequently, coincide with that stimulated them, i.e. did not coincide with the motive of his activity; the two were divided from one another in this instance. Processes, the object and motive of which do not coincide with one another, we shall call 'actions'.

We can say, for example, that the beater's activity is the hunt, and the frightening of game his action. (p. 210)

In this extended quotation, Leontiev effectively distinguishes between action and activity. The prior task-oriented experiments with children represent actions, i.e. reaching a book from a shelf. Meanwhile, activities are an organized and collective aggregation of individual actions that lead toward a common motive. This can be to satisfy motives such as the need for food, clothing, or shelter to name a few.
Central to the distinction between actions and activity is an understanding of object, motive, and their relation to activities. Leontiev (1978) describes the relation between objects and motives as follows:

The main thing that distinguishes one activity from another, however, is the difference of their objects. It is exactly the object of an activity that gives it a determined direction. According to the terminology I have proposed, the object of an activity is its true motive. It is understood that the motive may be either material or ideal, either present in perception or existing only in the imagination or in thought. The main thing is that behind activity there should always be a need, that it should always answer one need or another.

(p. 62)

Here, Leontiev provide us with the concept of activity as directed toward an object, and each object is also a motive. The concept that activities can be distinguished by their objects becomes important methodologically for future studies of activity systems, as the object becomes a way of framing the unit of analysis.

**Third-Generation Activity Theory (3GAT)**

During the 1980s and 1990s, third-generation activity theory emerges through the works of theorists who reinvigorated activity theory by applying it to fields beyond developmental psychology. While some theorists continued to articulate the theory in relation to cultural psychology (Cole, 1988; Wertsch, 1991), activity theory also gained ground as a methodology with implications for organizational change (Engeström, 1987), literacy studies (Scribner & Cole, 1981), writing studies (Russell, 1997a), and human-computer interactions (Nardi, 1996; Kuutti, 1996).
While former studies within 1GAT and 2GAT relied on individual problem-solving activities (Cole & Engeström, 1993), within 3GAT, we see activity theory associated with organizations, and as Spinuzzi (2020) describes it, becomes a sort of “organizational sociology” (p. 4). Rather than applying simply to the individual seeking to perform a task, the focus shifts to how communities accomplish activities through systems of subjects, mediating artifacts, and objects. As such, Engström’s activity system framework (discussed below), allows 3GAT theorists to not only study the activity of one system, but also study interactions between and among systems, allowing for a more thoroughly exploration of multiple perspectives and activity networks (Engeström, 2001).

Activity systems theory derives from Engeström’s (1987) widely influential *Learning by Expanding* in which he provides a more comprehensive framework for theorizing activity. Building on Vygotsky’s mediational triangle (Figure 1), Engeström enhances the triangle by adding *community* as a component within the activity system. For animals, this community vertex of the triangle is labeled population and is used to consider both social life and collective survival (Engeström, 1987, p. 60). Unmediated, then, the triangle would be a relationship between subject (individual members of the species), object (the environment), and community (or population), which Engeström characterizes as the “animal form of activity” (p. 60, Figure 2.2).

*Figure 2.2: Animal forms of activity from Engeström (1987, p. 60).*
Considering Vygotsky’s 1GAT, each vertex on the triangle is mediated for human activity, and so Engeström adds rules, which mediate between a subject and their community, and division of labor, which mediates between community and the object, in addition to instruments that mediate between individuals and their environment (Figure 2.3). To expand on this, rules are norms, traditions, and guidelines that frame how individuals interact within their community. For example, the rules of the activity of learning in schools involves the relationship of individual learners to the community of interested parties, such as other students, parents, teachers, and administrators. In this activity, the student’s conduct, dress, and behavior in the classroom are just some of the rules developed over time that guide the relationship between the student and her community within the classroom. Division of labor is how tasks are delegated within the population to achieve objects. Returning to the school example, parents may be delegated the task of supervising their children’s homework, while teachers are tasked with providing learning situations, materials, and assessment to students. This division of labor has formed over time to achieve the goal of learning for the student.

![Figure 2.3: Engeström’s model for activity as it transitions from animals to humans (Engeström, 1987, p. 61-62)](image)

Framing this within Marxist theory, Engeström divides this expanded triangle into four sub-triangles to consider how surplus goods are divided within human activity through consumption (Figure 2.4). Of this, he writes, “What used to be adaptive activity is transformed
into consumption and subordinated to the three dominant aspects of human activity – production, distribution, and exchange (or communication)” (p. 62). Each represents a different relationship between components of the system. For example, exchange, or communication, is the relationship between the subject, her community, and rules, while production is the relationship between the subject, instrument, and object. While each of the sub-triangles can be analyzed individually, Engeström argues that it is, “the systemic whole, not just separate connections” (p. 62) that are critical for analyzing any activity. Returning to the example of school learning activity, examining distribution of learning actions through the exchanges between the object of learning, the community of interested stakeholders, and the division of labor would be meaningless without considering other components of the system, such as the production of learning, its exchange, and consumption. Here, consumption means how learning is dispensed within the community.

![Activity systems theory from Engeström (1987, p. 63).](image)

Figure 2.4: Activity systems theory from Engeström (1987, p. 63).

Activity systems provides a framework for interventionist methodology, because while it is descriptive in its approach, it seeks to understand how changes to the activity system can solve issues within the system. This has been implemented in both Engeström’s Change Laboratory
(Engeström et al., 1996) and Developmental Work Research (Engeström, 2005) approaches. In his review of activity theory, Spinuzzi (2020) describes this interventionist research approach as one, “in which researchers and participants deliberate about current, unsatisfactory conditions, then collaborate to develop intentional solutions that address those conditions by transforming the activity” (p. 5). As such, activity systems theory has been employed to consider interventions in schools (Penuel, 2014), businesses (Holt, 2008), and hospitals (Engeström, 2000; Kajamaa, 2012).

**Fourth-Generation Activity Theory (4GAT)**

More recently, activity theorists have proposed a fourth-generation activity theory (4GAT), which attends to the complexity of structures and organizations that have proliferated through digital media. Engeström (2009) suggests the need for 4GAT to handle “mycorrhizae activities.” These include structures that are, “difficult, if not impossible, to bound and close, yet are not indefinite or elusive” (Engeström, 2006). Examples of mycorrhizae activity include the spread of religious extremism or the transmission of a virus—both create patterns of subjects, objects, and artifacts that resist the neat organization of 3GAT’s mediational triangles.

Studies employing 4GAT have been limited, largely with the difficulty of analyzing these rhizomatic structures. Instead, scholars of activity theory have advocated for the development of 4GAT to address peer and social production as well as understand networked organization (Spinuzzi & Guile, 2019). An attempt at using 4GAT can be seen within Spinuzzi’s (2014) study of nonemployer firms, ones which rely on contingent labor. Here, Spinuzzi deploys 4GAT to the study of interorganizational interactions by focusing on coordinating objects. Within his analysis, “4GAT focuses less on the workings of individual activity systems (often represented by triangles) and more on the interactions across activity systems functioning in networks” (p. 92).
Despite calls for 4GAT to study such scenarios and complexity, scholars continue to find value in 3GAT, as well as 1GAT and 2GAT, largely due to their simplicity for mapping activity in a system.

**Activity Theory for Writing Studies**

While I use activity theory to frame my dissertation, my application of this theory is framed not only by the different generations of activity theory, but also by how the theory has developed in relation to professional writing, technical communication, and more broadly, writing studies. The relationship between activity theory and writing studies hinges largely on rhetorical genre studies and the cultural and social analyses that both activity theory and rhetorical genre studies accomplish.

Scribner and Cole’s work in literacy (1981) set the precedent for writing studies to incorporate cultural and social histories of activity theory into the study of writing. This coincided with a greater movement toward analyzing social and cultural influences on writing, specifically in the study of written genres. Rhetorical genre studies, driven largely by Miller’s (1984) “Genre as Social Action,” regarded genres not only through formalistic typifications, but also through the ways in which those typifications coalesced and stabilized, or “stabilized-for-now” (Schryer, 1993), through repeated social use. Bazerman (1988) in his genre study of the experimental research article grounds his analysis in activity and, accordingly, emphasizes the, “social and intellectual activity which the text was part of” (p. 4). This issued a long-standing relationship between rhetorical genre studies and activity theory, which continued through the 1990s with works using sociocognitive approaches to disciplinary (Bazerman & Paradis, 1991; Berkenkotter & Huckin, 1993, 1995; Blakeslee, 1997) and learning genres (Cope & Kalantzis, 1993; Freedman, 1993, 1994).
While the sociocognitive aspects of activity theory were popular within writing studies, Engeström’s 3GAT framework of activity systems did not gain ground with writing scholars until it was adopted by Russell for rhetorical genre analysis. Russell’s work introduced writing studies to activity theorists (1997b) and set a precedent for activity systems theory as a methodology for writing studies (1997a). In both of these works, Russell’s observed genre as the uniting force between activity theory and writing studies, what he terms writing and genre research (WAGR). In Russell’s (1997a) study of the genres of cell biology research, he deploys activity systems theory to consider the networks of activity that influence how genres form and change. As he recounts in a later piece of work (2009):

What the synthesis of AT and phenomenological genre theory helped me to do is analyze typifications of participants operating in multiple contexts, realized and analyzable in specific and concrete ways, in relation to reading and writing, the genre systems or enduring types, and how those typifications both enable and hinder participants from mastering the situation, from learning. (p. 354)

Just as activity systems theory provided a common vocabulary for HCI research (Nardi, 1996), so too did it allow for genre theorists to use activity systems as a unit of analysis for studying the creation and use of genres. Consequently, activity systems have been applied to understand how students learn disciplinary genres (Ding, 2008) and to analyze cultural differences in organizations (Artemeva & Freedman, 2001).

Perhaps the most prolific use of activity systems within writing studies has been the work of Russell’s student Spinuzzi. Following Russell, Spinuzzi applies activity systems largely to the study of genres and documentation but, uniquely, maintains Engeström’s sociological perspective, and as such, contributes to the field of technical and professional writing. For
example, Spinuzzi (2001) uses activity systems theory to understand how a database of traffic information helped Iowa government workers coordinate their work. He has also explored the co-object of activity networks in entrepreneurship training (Spinuzzi, 2017), the emerging activity of co-working (Spinuzzi, 2012), and the circulation of genres in activity networks (Spinuzzi, 2008). Additionally, he has proposed ways of developing activity theory, such as through a typology of activities (Spinuzzi, 2015) and through limiting the object to avoid “runaway objects” (Engeström, 2008) that lose methodological focus (Spinuzzi, 2011).

In sum, activity theory has been influential to the social, cultural, and systems focus of writing studies over the past thirty years. It has provided an adaptable framework for studying organizations and disciplines, their genres and documentation, and how these are encultured through distributed activity towards a specific object.

**Research Questions: Practicing Activity Theory and Activity Systems Theory**

From this review of activity theory, I will identify how such a theory guides my study of open practices. As introduced in Chapter 1, the guiding question for this research is as follows: how do academics learn and do openness? Activity theory provides several different facets through which I can explore and refine this question. Below, I describe the three main areas I will explore within this dissertation and questions that arise from these areas. I connect each of these areas with a different generation of activity theory. Although there is a general alignment between the generations of activity theory, the chapters, and my research questions, some themes will be cross-cutting. While there are other reasons for deploying activity theory, such as its focus on tools and mediation, these three areas represent points of scholarship that are unique to activity theory and my study.
**IGAT and Learning: How do people learn to practice openness?**

Activity theory, since IGAT, has focused on intellectual development. Here, learning is not a direct transmission of information and knowledge between subjects and environments. Rather, activity theory overcomes Cartesian dualism (the separation of the mind from the environment) within the study of cognition and views learning as occurring through interaction and activity systems. Consequently, activity theory emphasizes the sociality of learning, which always involves learning with others in a community. This socialized process of learning has been theorized within and adjacent to activity theory through concepts including zones of proximal development (Vygotsky, 1978), legitimate peripheral participation (Lave & Wenger, 1991), third spaces (Gutiérrez et al, 1999), and expansive cycles of development (Engeström, 1987). I invoke these different perspectives of learning through activity theory throughout my dissertation to ask the following research question:

**RQ 1: How do people learn to practice openness?**

This falls under the guiding question introduced in Chapter 1, and it is explored in more detail in every chapter. For example, in Chapter 3 I consider how generalized, non-discipline specific workshops can be effective for learning. Chapter 4 builds on this through the concept of expansive learning, where I discuss how the questioning process of the workshop, alongside contradictions experienced in everyday practice, can lead to innovative solutions and adoption of openness. In Chapter 5, I shift my focus from interdisciplinarity to discipline-specific learning and expertise. Here, I am concerned with how individuals learn to practice openness within their discipline, whether this is through school-based learning, socialization, or other means. Specifically, I examine how internalization and externalization may enhance the adoption of open science practices for students and faculty for more disciplinary-based training.
2GAT and Cultural-Historical Analysis of Objects: What are the objects of openness?

In my third chapter, I focus specifically on the historical, cultural, and social dimensions of object construction to understand the activity of the Open Incubator. The focus on the object fundamentally arises out of 2GAT, where the object illuminates the motives and actions within the activity. In other words, following the object of an activity shows us how subjects do that object. Activity theory is commonly referred to as cultural-historical activity theory, or CHAT\(^3\) to account for its cultural and historical exploration of activities. As Foot (2014) eloquently explains:

> Cultural points to the premise that humans are enculturated, and everything people do is shaped by and draws upon their cultural values and resources. The term historical is used together with cultural to indicate that since cultures are grounded in histories, and evolve over time, therefore analyses of what people do at any point in time must be viewed in light of the historical trajectories in which their actions take place. (p. 3)

Activities, similar to genres, are formed over time and through cultural use. Consequently, examining the components of an activity system must account for the historical relationship between its components, such as how a technology has been adapted by a community over time. As such, I employ CHAT alongside rhetorical genres studies to understand the following research question:

**RQ 2:** What is the object of openness for individuals?

This question is not about defining openness generally, but rather it aims to understand my participants’ activity systems and in doing so, identify barriers and interventions to pursuing

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\(^3\) Cole (1996) catalogued the works of Vygotsky, Luria, Leontiev, and others under the term CHAT in order to describe their program of psychology that considered cultural influences as fundamental to human cognition. Up until this point, these works were commonly referred to as a socio-historical approach to psychology (Cole, 1986).
openness. While the previous research question was guided by learning, this question is guided by *doing*. Following the objects of an activity allows us to see both what participants define openness and how they seek to accomplish it. In Chapter 3, I trace the object of the Open Incubator to understand what values this training may instill in participants. CHAT allows me to consider how the incubator’s object is constructed historically and culturally through an analysis of the genres used within the incubator and their relationship to the objects of business and libraries. Chapter 4 continues this cultural-historical approach by comparing the traditional object of academia to the more progressive object of openness. Through this comparison, I identify points for change where the objects for individuals can steer towards openness.

**3GAT and Contradictions: What are the challenges to openness and how can we intervene?**

Contradictions are an undertheorized facet of 3GAT that can illuminate transformation within systems. Engeström (1987) theorizes contradictions as brought about because of the dual nature of capitalism, where every object has a use value (cultural worth) and exchange value (monetary worth). Moving beyond the Marxist implications of contradictions, they become points for intervention and change. Contradictions track the movement and growth of a system. This is because they occur where there are tensions between new and old practices. They are turning points for practices and places where researchers can facilitate the development of a new system. As such, I use contradictions in order to ask the following research question:

**RQ 3:** What are the challenges to openness and how can we intervene to overcome these challenges?

Knowing the challenges of openness for individuals allows us to understand the barriers that prevent academics from adopting open practices. Through the theoretical lens of contradictions,
these barriers can be a turning point, where academics take up different practices and transform their activity systems.

In Chapter 4, I map contradictions between new practices of openness and older cultural values of the academy in order to understand the points for intervention and change. I use the four levels of Engeström’s contradictions as a means of understanding how struggle and tensions both prevent and empower academics to pursue openness. While Chapter 4 is the only chapter to explicitly use this aspect of activity theory, contradictions and dualities are found throughout this dissertation. Chapter 1 introduces the study through the duality of principles and practices of openness. Chapter 3 explores the contradictions between entrepreneurship and liberal arts values within the Open Incubator. Finally, Chapter 5 considers the contrasting process of internalization and externalization and how both are necessary for cultivating open communities. Ultimately, contradictions enable me to consider the nature of the contradictions for those pursuing openness—does it put the individual in a double bind? —and if so, how can we act in the face of this contradiction? In my final chapter, I offer some suggestions for ways to move forward in consideration of the challenges that openness presents.

Conclusion

To conclude, activity theory is a theory that, while flexible, adheres to a common vocabulary of activity. It allows one to study activities through their objects; to understand how instruments, such as tools and language, mediate human’s experience with their natural (and artificial) surroundings; and to intervene when systems break. One the one hand, activity theory is descriptive and can be used to simply map a system, to understand an organization, to trace learning. But on the other, activity theory is an intervention. It allows one to point out contradictions, disruptions, and places where the system has failed. And in doing so, the
researcher can envision and help build new systems, through inserting or imagining new instruments, objects, or rules. Within this dissertation, I plan to do both. I aim to understand where the system of learning for openness works, and where it doesn’t. As such, I use activity theory to devise new ways of promoting openness and open practices.
CHAPTER 3: Openness through Boundary Spanning: The Open Incubator, Its Origins and Objects

Workshops, one-shot instruction, and non-discipline-specific trainings are often viewed as ineffective for enculturing learners into new discursive practices. For writing in particular, these generalized trainings are seen as perpetrating a “myth of transience” (Rose, 1985) that skills can be separated from their rhetorical situations and taught in a context-free workshop setting. Building on this, Starke-Meyyering (2011) finds that, “Even when offered, such generic workshops on writing tend to lack a research base, often advancing what are believed to be universal “principles of effective writing,” denying the rhetorical and culturally situated nature of discourse” (p. 83). This speaks to concerns of the “pseudotransactionality” (Spinuzzi, 1996) of the writing classroom, where writing tasks are divorced from the experiences and exigences of workplace writing.

Despite these concerns, workshops and short-term trainings are employed throughout universities to guide students and faculty into new practices, technologies, and skills. The open movement, in particular, hosts many workshops, online training sessions, and tutorials that do not adhere to any one discipline. These trainings aim to encourage academics to adopt open practices. For example, FOSTER provides a series of online tutorials in a variety of open topics such as open licensing, open peer review, and open science and innovation (FOSTER, 2020). Additionally, the Center for Open Science (COS) offers two-day in-person workshops to facilitate groups using its Open Science Framework (OSF), a platform for hosting open projects (Center for Open Science, 2020). Among the corporate and organizational clients for these trainings are universities. COS has conducted its training workshops at Harvard, Boston University, and UC San Diego, among others. Alongside soliciting organizations like COS to
conduct workshops, libraries have also facilitated their own trainings, specifically in open technologies like GitHub, Gephi, and R. As institutions promote and organize these trainings, research is needed to determine what participants get from them. Can a workshop in openness really change open practices for academics? Moreover, what do participants actually learn from participating in these workshops?

This chapter examines whether non-discipline specific training is effective for instilling open practices. Rather than looking at a technology training session or a one-day workshop, I examine a five-week workshop for developing open projects called the Open Incubator. As I will explore in this chapter, the Open Incubator diverges from the traditional incubator model, which emphasizes developing a marketable product within a shared space. Instead, the Open Incubator uses the language of business to deliver the values of digital scholarship. Essentially, its facilitators want participants in the incubator, or incubatees, to embrace open interventions within their work. Using the language of business, the incubator meets the entrepreneurial demands of the modern university but uses them as a conduit for openness.

In this chapter, I introduce my site of study, the Open Incubator. As my site of study, the Open Incubator provides a case study into how individuals are trained and enculturated into open science principles and practices through a generalized, non-discipline specific training. To understand ways of instituting cultural practices of openness, I study how the Open Incubator deploys open learning objectives. I then turn to what sociohistorical discourses, activities, and genres the incubator draws from in order to accomplish these objectives. Cultural historical activity theory (CHAT) and genre theory enable me to uncover the social actions and historical background of the Open Incubator. CHAT, studied through activity systems, considers how subjects reach their goals through complex interactions among mediators (tools, technologies,
and genres), communities, division of labor, and rules. A crucial part of CHAT is understanding the sociohistorical context of an activity. As Foot and Groleau (2011) describe:

CHAT emphasizes the sociomaterial, tool–mediated nature of communication within and between activity systems, highlighting the various kinds of tools entailed in communicative actions such as particular forms of talk and texts, along with culturally–historically shaped notions about and artifacts of interpretation and knowledge. (p. 3)

This chapter focuses on the culturally and historically shaped activities of the Open Incubator. And as such, it provides the contextual underpinnings for understanding the Open Incubator, its exigence, objectives, and genres.

**Chapter Synopsis**

The purpose this chapter is to provide a cultural and historical foundation for the Open Incubator, and in doing so, uncover whether it promotes enculturation into open practices. As such, this chapter seeks to answer two of my research questions regarding generalized, non-discipline specific trainings. First, through the cultural historical analysis of the Open Incubator, I reveal the objectives for these generalized trainings. Specifically, what is their purpose? What are the objectives of their facilitators? This information is provided through my observations, interviews, and analysis of the documents of the incubator. Second, I explore how these generalized trainings prepare or fail to prepare researchers, teachers, and scholars for open practices. How do generalized trainings facilitate learning? For this question, I arrive at the concept of the third space, a space that exists between the formal and informal spaces of the university.

I begin this chapter with a brief overview of incubators. This short synopsis provides information on the history and features of incubators, particularly focusing on university
business incubators. I provide this overview in order to investigate how the Open Incubator builds on, yet diverges from, these previous models. I follow this section with an explanation of the Open Incubator and its origins, as well as a short description of its structure and participants.

Next, I explain the open incubator and its objectives. In this section, I detail the ancestral genres that point toward the incubator’s grounding in both the market-oriented framing of university business incubators and the more collaborative digital scholarship movement. Within this context, the university business incubator format is used as a conduit by facilitators of the Open Incubator to introduce open digital scholarship to the university. I then posit the main facilitator of the open incubator as a “boundary spanner.” As a boundary spanner, the facilitator is a networker who can foster conversations within the “third space” of the incubator.

The Importance of Objects

This chapter uses CHAT to understand the objects of the Open Incubator in order to understand its exigence and relationship to learning. Activity theory centers on the object of an activity system, because objects distinguish one activity system from another (Leontiev, 1978, p. 62). They are considered the “sensemaker” (Kaptelinin, 2005) or “linchpin” (Spinuzzi, 2011) for analysis using activity theory. Accordingly, they establish a purpose for a given activity. As Leontiev (1978) writes:

the object of an activity is its true motive. It is understood that the motive may be either material or ideal, either present in perception or existing only in imagination or in thought. The main thing is that behind activity there should always be a need, that it should always answer one need or another. (p. 62)

While Kaptelinin (2005) questions Leontiev’s use of “true motive,” we can use Leontiev’s famous hunting example (see Chapter 2 for the extended quotation) to consider the object in
relation to the true motive. The object of the hunt is the animal while the motive is the need for food. The object then fulfills the underlying motive to satiate hunger within the activity of the hunt. Understanding the underlying motive of the object then coordinates all components of the system. For the hunt, it defines who is and is not involved in the community and which mediators help to transform the object for the purpose of the activity.

While Leontiev employs quite literal objects, like the animal, objects can be either material or immaterial. Immaterial objects are ones like knowledge, power, or openness. Engeström can be credited with moving activity theory beyond material objects to the object of organizational knowledge, which Spinuzzi defines through the technical communication lens as “knowledge work” (Spinuzzi, 2011), with many of Engeström’s applications of activity theory involving clinical knowledge (Engeström, 2000, 2001, 2018; Engeström & Kerosuo, 2007). Despite the shift from material to immaterial, the framework of activity remains unchanged. One caveat for immaterial objects is that they are subject to becoming runaway objects. These are ones that “have the potential to escalate and expand up to a global scale of influence. They are objects that are poorly under anybody’s control and have far-reaching, unexpected side effects” (Engeström, 2008). Engeström provides the example of chronic illness and drug trafficking as runaway objects. These runaway objects often resist tidy explanations and diagrams. While openness could be classified as a runaway object, I have framed this study within small-scale practices of openness to study it at a microlevel and to avoid this problem.

Importantly, objects are historically and culturally shaped. Every object is durable, in that it has a historical context that exist outside of a one-time “goal-directed action” (Engeström, 2000, p. 964). For example, treating illness is an ongoing activity that is grounded in a specific set of historically and culturally formed practices. Providing a patient with antibiotics to treat an
infection is just one action within the ongoing activity of patient treatment that builds on previous iterations of similar situations and informs subsequent interactions. Activity assumes that the object is in an ongoing process of being changed, processed, or worked upon through mediation by a subject. Therefore, the researcher should first determine the object of an activity in order to understand how the activity is organized. Within this chapter in particular, I am emphasizing the cultural-historical trajectories that led to the Open Incubator in order to understand how it facilitates learning for its participants. Chapter 5 continues this local and cultural-historical approach through understanding how participants within the incubator came to their own situated practices of openness.

The Object of Incubators: Entrepreneurship in University

Naming a workshop an “incubator” carries with it the rhetorical weight of previous business incubators. At the same time pairing “open” with incubator, as in the “Open Incubator,” provides a novel situation that diverges from previous iterations of incubators and the open movement. The Open Incubator can be considered as a proto-activity, one that is developing from existing activities in both openness and incubation. To understand what this proto-activity may eventually become, we must first delve into its antecedent activities. In the introduction, I broadly surveyed open activities. In this section, I will review incubators as a historical and cultural phenomenon and from this review arrive at an interpretation of their objects.

The first purported business incubator is the Batavia Industrial Center, which opened in 1959 in Batavia, NY. The center needed tenants to fill the abandoned warehouse that once housed a farming machinery corporation (Fitzgerald, 2017; Hackett & Dilts, 2004). In the challenge of finding a sole corporation to take over the 80,000 square foot building, the property owners decided to sublet the space to a variety of tenants, including a hatchery. As the story
goes, when giving a tour to a local reporter, the owner passed the chicken hatchery and commented, “These guys are incubating chickens. I guess we’re incubating businesses” (Fitzgerald, 2017).

While business incubators continued to arise in the 1960s and 70s, incubators proliferated in the 1980s and 1990s. Researchers of business incubation (Hackett & Dlts, 2004; Grimaldi & Grandi, 2005) attribute this to several factors, including the passage of the Bayh-Dole Act allowing universities to retain patent and licensing rights for federally-funded research, the growth of internet start-ups in the 1990s, and the commercialization of biomedical research. Although there are many different formats and goals for incubators, Bergek and Norrman (2008) define incubators through four common features:

1. shared office space, which is rented under more or less favourable conditions to incubatees,
2. a pool of shared support services to reduce overhead costs,
3. professional business support or advice (“coaching”) and
4. network provision, internal and/or external. (p. 21)

While early incubator models focused on the first two features of incubation, emphasizing incubators as shared real estate, more recent models of incubation aimed at providing support and networking have emphasized the advisory and “bridging” role of incubators. Incubator managers can serve as network mediators, who negotiate between incubatees and potential investors or resources, or institutional mediators, who introduce incubatees to various institutional laws, norms, rules, and regulations (Bergek & Norrman, 2008). Further, incubators often focus on providing support for early-stage projects, “start-up and fledgling companies” (Peters et al, 2004, p. 83), that are “weak but promising” (Hackett & Dilts, 2004). This
differentiates incubators from research or science parks, which typically serve later-stage business projects. According to Good et al (2019), incubators exist as just one part of the technology transfer ecosystem within academia. As such, many studies of incubation have focused on selection, or the process of choosing potential incubatees that will thrive from incubation (Bergek & Norrman, 2008).

University business incubators are a particular subset of incubators that exist between the nonprofit and for-profit continuum. In their assessment of incubator models, Grimaldi and Grandi (2005) define university business incubators in comparison to business innovation centers (BICs) as:

institutions that provide support and services to new knowledge-based ventures; they are similar to traditional BICs but they place more emphasis on the transfer of scientific and technological knowledge from universities to companies. Interest in university business incubators stems from the significant potential of the concept, which holds out the possibility of linking technology, capital, and know-how to leverage entrepreneurial talent and speed the commercialization of technology by nurturing new knowledge-based ventures. (p. 112)

University business incubators can add value to incubatees’ projects by providing access to laboratories, equipment, and expert personnel. They are also frequently associated with technology transfer offices that foster their development and implementation. These technology transfer offices “administer the commercialization process of a university’s intellectual property (IP), defined as patents, copyrights, trademarks, various know-hows, and related assets” (Markman et al, 2005). Technology transfer offices may be housed within the structure of the university or exist as a separate non-profit or for-profit entity.
With the resources allocated to technology transfer and incubators specifically, researchers have questioned the value that incubators add to the university. Tracing patents from 1969 to 2012, Kolympiris and Klein (2017) find that when incubators are added to a university, patent quality decreased as defined in the number of patent citations and additionally licensing revenue reduced. They conclude that the resources devoted to incubation detract from other innovation supporting services on university campuses (p. 5). Others argue that incubators and research parks prioritize applied research within the university at the risk of moving away from basic research (Markman et al, 2005). Despite uncertainty about the success of university business incubators, incubators and accelerators continue to proliferate on many university campuses to drive applied research and foster connections to local firms and industries.

![Figure 3.1: A mediational triangle of incubation.](image)

From this brief overview of incubators, some themes emerge for their objects and role. The literature frames incubators as mediators between a potential incubatee and an incubated firm (Hackett & Dilts, 2004; Bergek & Norrman, 2008), and diagrams of incubation reinforce this view (Campbell, Kendrick, and Samuelson, 1985; Hackett & Dilts, 2004; Smilor, 1987). Essentially, an incubated firm is one that has undergone the incubation process and is now ready to receive capital and investment. A basic activity systems’ reading of business incubators would
position potential incubatees, or those entrepreneurs with new business proposals, as the subjects of incubating activity; the incubator would be the mediator; and the incubated firm would be the object. A basic diagram of this activity using a subject-instrument-object figuration and taking strictly the top half of Engeström’s model for activity is seen in Figure 3.1. The object in this activity is motivated by the need to generate income, whether this be through venture capital or technology transfer. Ultimately, the object of incubating activity is related to the accumulation of capital.

**The Open Incubator at NC State Libraries**

Against business incubators, libraries stand with their own histories of activities and practices, which gives rise to an Open Incubator within this system. A longstanding object of university libraries was the storage and retrieval of academic texts. This object has shifted for many libraries within the 21st century due to digital media. The modern equivalents to storage and retrieval are digital preservation (Borgman, 2010) and information literacy (Favaro & Hoadley, 2014). Libraries are now tasked with building online repositories to preserve digital academic documents alongside teaching academics and students how to navigate these repositories and search engines to gain information literacy.

Coupled with this changing role, librarians are often asked to dispense this literacy to students in the form of “one-shot” instruction (Walker & Pearce, 2014) in which an undergraduate course spends the day in the library to learn about finding and citing sources. To move beyond this type of instruction, libraries have aimed towards collaborative research projects with academics. Engeström et al. (2012) discuss this in their study of two libraries at the University of Helsinki, where librarians work with academics toward a shared goal. For one library, this involved creating a data management plan over multiple meetings between
researchers and librarians using Engeström’s Change Laboratory, where “the collaboration was built on the shared object and the practitioners involved varied” (p. 401). In such circumstances, a shared object can forge links between researchers and librarians, while also meeting library goals. The Open Incubator was built on similar principles of collaboration between librarians and researchers but occurred with a diverse group of participants over a shorter period of time.

The Open Incubator was planned in the fall of 2018 by NC State Libraries for the summer of 2019. The NC State Libraries services a community of over 2,000 faculty members; 25,000 undergraduates; and 9,000 graduate students and is a hub for various activities on campus. One of these activities has been a move towards open and public science. As stated in the libraries 2018-2019 Annual Report, the library leadership has emphasized “many active partnerships and an organizational culture of openness, creativity, and well-being that is welcoming to all.” The Open Incubator represents part of this movement of the campus toward openness and open practices.

The Open Incubator was the first iteration of the program at NC State, and the stated purpose of the incubator was to foster the development of open projects. Indeed, “open” within the Open Incubator is an acronym for “Open Project Engagement Network.” Micah and Will⁴, two librarians, hosted the five-week incubator session that took place during the summer of 2019. Micah recently began working at NC State as an Open Knowledge Librarian and brought the format of the incubator format with him from a previous academic library position. Will is librarian and lawyer who primarily consults faculty and students on copyright and fair use issues. Both work within the Copyright & Digital Scholarship Center, where Will is the director. The goal Copyright & Digital Scholarship Center is to provide advice for NC State’s community

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⁴ For a table of participants, see Appendix C.
about “scholarly communication, copyright, open knowledge, and digital scholarship” (Copyright & Digital Scholarship Center).

Each meeting was approximately two hours and was held in various meeting rooms at each of NC State’s two main libraries. Building on the model of the university business incubator, the Open Incubator emphasized local resources, particularly related to the library, that incubatees could use in relation to their project. After the first week of the incubator, each session showcased librarians who had expertise in topics, such as data infrastructure, copyright, and communication⁵. Essentially, librarians were trying to incubate projects through acting as a bridge between attendees and various resources. This relates to how the incubator was originally conceived by its facilitators. Micah described the concept of the incubator as a way to answer recurring questions the Copyright & Digital Scholarship Center received:

The idea was that we get a lot of questions about the same things all the time. I think the first presentation I gave about the incubator was subtitled something like, ‘efficiency and effective use of our time’ basically. That if we’re going to answer the same question for fifteen people over a year, let’s just answer that one question with all those fifteen people at the same time in a cohort-based model. (Micah, personal interview)

The cohort-based model consisted of faculty and advanced graduate students who were involved or interested in campus initiatives for openness and had a project that could benefit from openness in some way. In addition to the group meetings, the facilitators had at least one meeting individually with each incubatee to discuss specific issues related to their projects and suggest areas for change or open interventions. Notably, the discussions within each session were not

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⁵ For a breakdown of each week of the incubator, see Appendix D.
devoted to teaching us particular skills or literacies; rather, materials were used to uncover points where openness could be added within our existing projects.

**Duality within the Object and Genres of the Open Incubator**

As the previous section suggests, “open” and “incubator” are not often used together within the context of university business incubators or open trainings. Unlike previous university business incubators, the Open Incubator is not seeding a marketable product to provide potential income. Instead, the incubator focused on ideas for how to research and teach openly. For example, rather than connecting incubatees with investors, the facilitators connected incubatees with library resources, such as on-campus communication experts. Incubatees were expected to envision prototypes for their work. Within this context, tensions emerge particularly within the documents of the incubator and their expected purposes. These documents are neither wholly business-oriented nor borrowed completely from digital libraries scholarship. Consequently, the object of the incubator reflects these dual purposes of incubation and openness. The object of the incubator can be found through analyzing the documents deployed within the incubator as well as the language used by facilitators and participants.

Practices from business were incorporated through assigned document tasks and also in discursive exchanges within the incubator. As an example, after introducing ourselves with our names, positions, and departments, Micah asked us to introduce our projects through project pitches, where we each gave five-minute descriptions of our project. Spinuzzi et al. (2015) describe the pitch as a market-oriented genre intended to establish a business relationship with the audience:

> Entrepreneurs must understand the market and the stakeholders operating in it (investors, business partners, distributors, and others who are positioned to help them and work with
them through business arrangements). They must develop arguments that are persuasive to these stakeholders, arguments that culminate in the pitch: an oral presentation of a market opportunity to prospective business partners. (Spinuzzi et al., 2015)

Incorporating the pitch early into the open incubator reflects the business-related origins of incubators. It also framed our projects as ones that could appeal to various stakeholders and, if adopting a marketing mindset, could be primed for investment by external funders.

After we provided our project pitches, Micah introduced four documents that he wanted us to produce by the end of the incubator. Like the project pitch, these documents seemed oriented toward business incubator models of project development, but on closer examination, drew from digital libraries scholarship. I will give a brief description of each of these documents, their origins, and how they were deployed in the incubator. These were:

**R&D structure/Project outline**: The R&D (research and development) structure was introduced in the first session of the incubator and also included in the online description of the program. This document was only briefly described during the incubator but Tirpak et al. (2006) define R&D structures by its:

- Organization structure, i.e., “org. Chart.”
- Coordination mechanisms, e.g., resource allocation, project planning.
- Culture for innovation, i.e., behavior norms for value creation/capture.
- Strategic mission for R&D activities, i.e., reason for R&D. (p. 20)

The R&D structure is built to foster innovation through structures that support different company goals and the R&D strategy of the organization. Within the open incubator, the R&D structure was later referred to as the project outline. The project outline was a crucial genre within the incubator as it provided a series of questions about our project, including sections on use and
impact, data and infrastructure, collaborators, funding, and sustainability. Our answers to these questions were used to guide how the facilitators worked with us on our projects. Further, according to my survey of participants, incubatees found this to be one of the most helpful aspects of the incubator as it allowed them to consider the full scope and reach of their projects.

**Proof of concept**: The proof of concept was introduced to us as a visionary document to show what our project was working toward. Proof of concepts are used in a variety of fields, including medicine, but are most often associated with business innovation. Like the pitch, the proof of concept is used to attract investors. Technology transfer offices and investors use the proof of concept “to verify that its concept/principle has the potential for real-world application, it will do so by producing a prototype that is designed to determine feasibility, but does not represent deliverables” (Alunni, 2019, p. 24). Essentially, a proof of concept is more valuable for stakeholders external to the project, as it demonstrates that a product will make it to the market stage. Within the incubator, the proof of concept seemed to have more of a self-reflective quality, so that we could envision what we wanted our project to become. Essentially, instead of selling a product to an investor, we were selling the project to ourselves. For the proof of concept, Micah asked us to create something that represented our final project, such as a website or a proposal.

**Resource map**: The resource map was intended to show what resources were relevant to our project and where they were located. The resource map seemed to draw the most from the business incubator model, where incubators “provide its incubatees...with a strategic, value-adding intervention system (i.e. business incubation) of monitoring and business assistance” (Hackett & Dilts, 2004, p. 57). Within the incubator, the resource map became an exercise of mapping our scholarly workflow. This occurred in session three, when we paired up in an exercise to discuss our processes for work.
**Documentation narrative:** The documentation narrative was perhaps the most original genre within the incubator. Unlike the previous three documents, which were more rooted in investment and project development, the documentation narrative seemed to receive its exigence from library values, particularly the goal of libraries to preserve and document. From a business perspective, the documentation narrative functions like a business’s articles of incorporation that register where a firm exists and who is involved with it. In the third session, Micah expands on his meaning of the documentation narrative:

[Session 3]

**Micah:** Where can I find your project? Is there a URL? Is there a DOI? Something that is not necessarily a URL? The value for me in the project narrative is the thing you’re working on. The thing is the tool or dissertation or course material. If that thing fails to exist, we will get to the documentation and the data. We’ll have the story about how these pieces built this thing.

The documentation narrative was designed as a document to consider the lifespan of the project beyond the creator. This document manifested in a Google form where we filled in our project’s name, persistent identifier, launch date, capture date, contributors and roles, copyright statement, tools/infrastructure, and communication strategy.

These documents are important to contextualize the incubator. They reveal what cultural-historical contexts the incubator draws from and how that context may shape the learning goals within the incubator. While I am drawing from CHAT’s emphasis on the context of activity, this analysis of the document also derives from genre theory. Rhetorical genre studies define genres as a recurring, typified text that performs a social action (Miller, 1984). As recurring texts, genres borrow from previous genres to meet the exigencies of a new situation. These borrowed
genres are ancestral genres, and as Miller and Shepherd argue in their excavation of the blog, they are part of the “rhetorical situation to which the rhetor responds, constraining the perception and definition of the situation and its decorum for both the rhetor and the audience” (p. 11). In other words, ancestral genres are adapted for the rhetor’s purpose because of their success in similar situations. Further, uncovering the ancestral genres indicates the social actions of a genre or emerging genre and in turn, can signal the object of an activity.

At first glance, the ancestral genres of the Open Incubator signal that the incubator will draw heavily from business and will focus on prototyping to create marketable open projects. This would be in line with the object of many business incubators that focus on means of incubating a project to develop income. Both the proof of concept and pitch are familiar genres within entrepreneurship for attracting investment from funders. But on further analysis, the documents of the incubator are more closely related to genres within digital scholarship originating from libraries. This is apparent within the R&D/project outline. While an R&D structure would be a genre firmly within the business world, the R&D structure of the open incubator is business-oriented in name only. Instead of drawing on R&D structures, Micah borrowed the project outline directly from the Digital Library Federation, an organization devoted to digital library technologies. According to Micah, the Digital Library Federation “developed a framework for supporting digital scholarship projects, and those questions that we used in the incubator were almost directly copied and pasted with several words changed from the digital project creation questionnaire” (personal interview). Similarly, the emphasis that Micah places on documentation with the documentation narrative derives from digital scholarship’s focus on sustainability through metadata and documentation. As Micah explained in an interview,
there was a flood of work around what we in libraries call digital scholarship around 2015-2016, and a lot of that work was this foundational, what processes and documentation can we share in libraries to help make better products on the other end. (Micah, personal interview)

Sustainability, through documentation, and project development can then be seen as social actions embedded within the documents of the incubator. These point toward the objects of libraries—in particular, the goal of digital preservation discussed earlier. As such, the object of the incubator seems to align with the object of the greater activity of the library system.

![Diagram](image)

*Figure 3.2: Mediation triangle of the Open Incubator.*

This raises the question of why the incubator is tailored and geared toward the entrepreneurial language of business, and more specifically, why the Open Incubator uses the incubator model rather than a workshop or colloquium. When I asked Micah the purpose of using incubator and business-oriented language, he responded:

we borrowed a lot of that language and models because it was helpful. It also, and this is like the icky part, we developed it at the same time that universities were all getting into the language of innovation and entrepreneurship so it was helpful to say “oh we have an incubator too” because the university is interested in entrepreneurship, so let’s do an
incubator. So yeah there was a little bit of just being smart about the ways we call things to make sense to the university administration. (Micah, personal interview)

Therefore, the duality between business and open scholarship in the documents and in the name itself, “Open Incubator,” exist because of the rhetorical savvy of its facilitators. The Open Incubator responds the exigencies of the entrepreneurial university that seeks profitable investment and technology transfer opportunities. Yet, in its content and delivery the incubator can fulfill the primary object of its facilitators: to provide open interventions into people’s research and teaching processes. From this perspective, the Open Incubator borrows the working framework of incubation and adapts it toward open projects. Considering the diagram in Figure 3.1, this would lead toward an open project instead of an incubated firm (Figure 3.2). These projects are motivated by the overall activity of the libraries, which is oriented toward providing information literacy and digital preservation.

**Incubator as a Third Space and the Necessity of the Boundary Spanner**

The facilitators extend their rhetorical savvy not only to the document and format of the incubator, but also to interactions within the incubator. The incubator is a multidisciplinary space, where researchers and teachers at different stages in their careers could discuss openness. Returning to this space then, we can see it as a hybrid space that allows for different activity systems to interact. These interactions enable contradictions to be realized and emerge through informal discussions of participants’ principles and practices. Russell (1997), drawing from science studies, posits this space as a “contact zone” with the interaction of different systems who are negotiating boundaries:

As an activity system interacts with other activity systems in a complex dialectic of boundary work, contradictions arise that drive changes in an activity system and its
participants, individually and collectively, as well as in the genres that mediate dynamic activity. (p. 19)

In CHAT studies of the classroom, this contact zone between activity systems has been described as a “third space” (Gutiérrez et al, 1999; Gutiérrez, 2008). The third space exists between the mechanized, formal systems of learning and unstructured, informal spaces of learning. It is a place where, “alternative and competing discourses and positionings transform conflict and difference into rich zones of collaboration and learning” (Gutiérrez et al, 1999, pp. 286-287).

Thirdness refers to “the generation of novel mediating models, concepts and patterns of activity that go beyond and transcend the available opposing forces or options, pushing the system into a new phase of development” (Engeström & Sannino, 2011, p. 371). Essentially, this thirdness is the questioning of current activity systems that occurs through interactions with other activity systems.

The Open Incubator acts as a third space in that it exists outside of participants normal, everyday practices and fosters opportunities for discussion across disciplines and fields. These discussions become points for questioning principles and practices of openness. However, to be effective this third space needs an agent to negotiate between these systems. My point here is that it is not merely enough to bring diverse viewpoints into a shared location, but facilitators are needed to move between these different systems and foster productive dialogues. Engeström (1987) describes this as the role of the activity systems researcher who can act as the “midwife for bringing about the double bind” (p. 256). For Engeström the double bind is a point of contradiction, in which participants question their current systems. However, in my research this role can also be accomplished by those creating the learning activity, because these participants act as a boundary spanner. Boundary spanner is a term within organizational research that refers
to a person or entity that negotiates between organizations and institutions often as a response to wicked problems, particularly associated with public policy (Williams, 2002). Boundary spanners have more recently been associated with innovation within business (Holmes & Smart, 2009; Ryan & O’Malley, 2016). Ryan and O’Malley (2016) characterize boundary spanners as network builders, entrepreneurs, and mediators, who are able to open relationships between organizations but also close these when necessary. They can “both build bridges across organisational and inter-organisational dimensions, while at the same time be capable of creating a (temporary) wall between organisations if required” (p. 8). The ability to build walls, as well as bridges, means that boundary spanners can be confidants for various groups and achieve goals by controlling what information does and does not get shared between different groups.

For Gutiérrez et al (1999), the boundary spanner is the teacher. Although her role is not acknowledged as such, she is the one who sanctions and creates the third space of learning. In one of Gutiérrez’s examples, Jorge, a playful student, who often interjects during class, comments during a story about fetal development to share that he is nicknamed “bony” by his uncles: “His recognition of his own boniness and this link to the nickname his uncles have bestowed on him, "huesudo/bony," helps him relate to the official text of the class, the book on the development of the fetus” (p. 299). This reincorporation of Jorge’s realization is facilitated by the teacher who questions Jorge about his nickname and its importance in relation to the story. As such, “rather than being marginalized or silenced, Jorge... not only becomes a central part of the community but also reemerges as expert in the official space as he answers the question that the teacher had been so intent on asking” (p. 300). The boundary spanner can traverse between the official and unofficial spaces of the classroom to create a third space of
negotiation. The boundary spanner recognizes and encourages polycontextual encounters that enrich the third space.

Within the incubator, the facilitators act as boundary spanner in two forms: the instigator and the bridge. As instigators, the facilitators asked questions to provoke incubatees to realize contradictions within and between their activity systems, to essentially provoke the changes in practice. For Engeström (2001), contradictions lead to expansive learning, where subject enter into a new, expanded activity to bypass or overcome the contradictions their current activity system faces. Under expansive learning, this is the questioning phase which is meant for “finding and defining problems and contradictions behind them” (Engeström, 2001, p. 152). To encourage us to examine the division of labor within our own activity systems and how this labor was acknowledged, Micah posed questions about current academic practices. This was the main focus of the second session where Micah asked us to think about how we could account for the work that people did on projects. During this discussion, Sarah, an assistant professor in the humanities, responded to Micah’s questions about team collaboration. Sarah had relayed earlier in the incubator that she looked for group collaborations in her research, and this was one of her main goals for the incubator. Through the discussion, Micah challenges Sarah to think differently about how to “talk about” collaboration:

[Session 2]

Micah: How do you talk about the work that two people do together? How do you write it down?

Sarah: Authorship is how you acknowledge collaboration. A grant is different. The collaborator may need to write a letter about what support he or she can provide. It depends.
Micah: For a journal article, you don’t know who did what. You know the names at the top of the journal article.

Sarah: IRB details who contributes what to the project.

Micah: But this is just internal? It’s useful to understand what it means when there’s a bunch of names. It allows us to talk about who did what when.

The conversation continues through a discussion of how we would document labor.

[Session 2]

Micah: In what ways could you document labor for the thing you’re here to do with us?

Sarah: How would we specify a collaborator? For me, a CO-PI, one collaborator.

Micah: For a grant proposal, it would be who is on the form. There are different levels of people who can be named.

Sarah: Probably only one co-PI for this project.

Chris: On a grant, you have co-PIs. There are people who can be PIs. Students can't be PIs. If you push, the university will allow postdocs as PIs.

Chris is a research scholar who works with an interdisciplinary research group for developing modelling and data visualizations. Both Sarah and Chris are research-driven scholars, who have experience working in teams and creating research genres. Several research genres are brought up in the process of discussing collaboration: grants, journal articles, and Institutional Review Board (IRB) protocols, each with varying levels of recognition and openness. Micah’s questions lead incubates to consider the different forms of recognition that each genre entails. Grants recognize certain form of labor. Collaborators write letters of support that detail what they offer to the project. At the same time, they exclude contributors who are not in relatively privileged positions. Students are not included as principal investigators, and postdoctoral researchers are
only allowed to be included “if you push.” For the journal article, it is relatively closed in terms of contributorship. Authorship orders, according to Micah, are “a bunch of names” that do not recognize “who did what when.” IRB protocols are identified as a document with a full list of contributor roles. But unlike the other two documents, these are “internal,” as Micah points out, and generally not seen by the public. This section of questioning roles and contributorship prepared us for an activity of using research taxonomies to acknowledge different types of labor involved in our projects. Ultimately, in the instigating role, Micah could interrogate why we did things in a certain way, and then provide a “thirdness” or alternative way of acting that would negotiate between open principles and academic practices.

As a boundary spanner, Micah also acts as a bridge between the open principles and proprietary or closed practices. Although Micah wants to encourage questioning current practices and adopting more openness, he also realizes the constraints in which academics operate. For example, when we are discussing our scholarly workflows, Carlos brings up the point that he is using proprietary tools for his open work. Carlos is an assistant teaching professor in the science who is interested in open pedagogy and introducing his class to more open practices. He wants to use open source tools, but sometimes he cannot find open source tools that are equivalent to commercially available ones.

[Session 3]

**Carlos:** I’m using a commercial system but making it open access. It’s peer reviewed where you can add peer review with commenting. Does that fit somewhere in here?

**Micah:** Some of the best innovations are people that take an open source tool, then build a layer of tools on top of it. There are ways to do open still using commercial tools. Like
working at the university and using Google Platform, but your products can be on
GitHub. The products can be out in the open.

Here, Micah sanctions Carlos’ working practices, although they do not exist within a purely open
continuum. Carlos’ adaption of commercial tools for open work is an additional example of
thirdness, where Carlos has adapted the tools of his activity systems to align with his open
principles.

Another example of the bridging role of the boundary spanner occurs during the final
session of the incubator when we discuss the difficulty of negotiating open teaching and tenure
requirements. Micah speaks candidly to incubatees about the university after the communications
experts have left:

**Micah:** The state of higher education, this is a business. They're thinking about money,
not just this university. It’s part of the entrepreneurial university. Through things like the
incubator, they start to see here are all of the innovations in teaching that are actually
really valuable to the people of this state.

Micah invites experts into the open incubator who side more with the entrepreneurial vision of
the university, but after these experts leave, he’s able to build a wall between those experts and
the incubatees—this wall allows him to speak to both interests, interests towards open
scholarship and teaching for the sake of knowledge and also openness for innovation. In this
statement, even those Micah is separating himself from the market-driven parts of the university,
“There’s thinking about money,” he still speak in *their* language: “they start to see here are all of
the *innovations* in teaching.” As a boundary spanner, he can speak to both sides to negotiate a
form of openness that is palatable to both, an openness that drives innovative (i.e. marketable)
products for the university, and an openness that is responsive to the values of incubatees.
Conclusion

With an analysis of the cultural and historical background of the open incubator, this chapter reveals the rhetorical situation in which the incubator operates and, further, the ways in which its facilitators navigate this rhetorical situation. Through adapting the models and genres of business incubation and entrepreneurship, the incubator appeals to university initiatives to increase technology transfer on campus. However, rather than catering to the market-driven format of the university business incubator, the open incubator employs the language of entrepreneurship to deliver the libraries’ process-oriented and intervention-seeking initiatives.

The two driving foundations for the incubator, business and digital scholarship, provide tensions that illuminate a third space for participants.

This third space is what allows a generalized training to be effective. Despite the absence of discipline-specific literacies and technologies, the interaction between incubatees enable them to question their current practices and envision alternate ways of acting. The third space does not provide discipline-specific learning, in that participants will not leave the incubator with a new set of formed and established practices to immediately incorporate into their activity systems. For this type of learning, the incubator is ineffective. Rather, the third space allows for questioning. Why are we doing it this way? Why can’t things be open? Questions are the first step toward adapting new practices, and as I will discuss in the next chapter, questions can bring to light contradictions within an activity. Contradictions reveal points of tension, and at a certain point, they push an activity system towards change.

Returning then to the third space, the boundary spanner has a pivotal role in learning for participants. Boundary spanners have the opportunity to encourage change, questions, and debate in their role as both instigator and bridge. As an instigator, they can provoke double binds by
having academics engage in questioning their current practices. They can ask why participants are afraid of openness and allow them to envision what open practices would look like. As a bridge, they can network between contradicting external systems and mediate issues. They can even wall out certain conversations. For example, boundary spanners can choose whether to invite commercial entities to the table and provide a space for academics to discuss their concerns about these commercial entities. Although large-scale cultural change of an ongoing activity system seems impassable, creating opportunities for the third space is not. Instead, these can be small-scale and local initiatives for bringing academics together and discussing issues with implementing open science principles. This bottom-up approach can motivate academics to adopt new principles and perceive interventions into their current practices.

However, in order to be successful this boundary spanning work must move beyond the confines of the incubator and workshop format. As we will see in the next chapter, boundary spanning work is needed at the cultural level within disciplinary learning to change activity systems so that they reward open work through a reconfiguration of research and teaching activity systems. This reconfiguration would entail that the outcomes of the system are no longer publications for tenure promotion. Instead, process-oriented outcomes should be emphasized, such as contributing to knowledge-making and knowledge-sharing activities. These could include activities such as openly sharing data, contributing null findings, and creating citizen science projects.

The findings of this chapter have several implications for openness and writing studies. I have discussed how the boundary spanner role may be implemented by librarians and others who want to facilitate generalized trainings in openness. Regarding writing studies, this chapter has considered the complexity of rhetorical genre studies. Specifically, my analysis of documents
and genres within the incubator unveils how digital scholarship is the primary driver of the incubator, despite the formats and genres borrowed from business. In this vein, we can see how conventions may be borrowed from other genres to serve rhetorical purposes for the audience. An emerging genre may look like it belongs to business and entrepreneurship, but on closer analysis of its objects and social actions, the genre adheres to principles of digital scholarship. As innovation continues to be the dominant watchword of the entrepreneurial university, we can expect that similar genres will emerge within academia, where values of the humanities and liberal arts will be enveloped within the language of business to be palatable to administrators and funding agencies.
CHAPTER 4: Contradictions as a Productive Source of Change within Academic Activity Systems

[Session 1]

All nine of us are seated at an oval table with bagels, coffee, and orange juice in the center. Behind me are two marker boards. The board closest to the door is divided into “Open Principles” and “Open Practices.”

This is how the incubator begins, with dichotomies. Here, dichotomies between principles and practices. And, as this chapter posits, dichotomies, contradictions, and boundaries are recurring and inherent themes of openness as seen in the Open Incubator and within my participants’ open practices. These dualities are productive in several ways. They allow participants to talk across disciplines and envision possibilities for openness in their own work. Discursive exchanges reveal the current ways that knowledge is treated within the academy and how individuals must balance pursuing openness with the communal norms of their departments, disciplinary communities, and funding agencies. In the previous chapter, I uncovered how the incubator became a third space for academics to interact from different disciplines. In the third space of the incubator, incubatees interact with others who have different practices than their own to realize unique attributes and the contradictions of their own systems. Further, the boundary spanning role of the facilitators allowed for incubatees to question their current systems and envision new open practices. Through questioning, tensions emerge between openness and academia.

In this chapter, I explore how the questioning provoked in Chapter 3 reveals contradictions within and among activity systems for academics. Here, I am concerned with what academics consider to be tensions, conflicts, or barriers to adopting open practices. Further, this allows me to understand the current activities and objects for academics. Contradictions are
typically perceived as barriers to training and adopting openness. In particular, studies and opinion pieces have considered how contradictions between opening science and the commercialization of scientific products disincentivize researchers’ participation in openness (Barham et al., 2017; Caulfield et al, 2012; Edwards, 2016; Levin et al., 2016; Mogull, 2017).

Caulfield et al. (2012) describe this dilemma for genomics researchers as,

> On the one hand, they are told to commercialize their research by patenting, licensing, and forming close partnerships with industry, which has particular skills, financial assets to facilitate the translation of knowledge into products, and objectives…. On the other hand, researchers are encouraged to share data and disseminate knowledge quickly (that is, to adopt an open science model) so as to foster scientific progress, meet humanitarian goals, and (again) maximize the impact of research. (p. 1)

While these contradictions may be viewed as an impediment to open practices, particularly within the sciences, literature of contradictions finds that they are also essential to progressing a current activity system into a new state. Foot (2001) describes contradictions as an “illuminative hinge through which participants in an activity can reflect on their activity system’s developmental trajectory and understand its dynamics” (p. 63). Essentially, through contradictions, we may emerge at a new, more advanced open practice that harmonizes the conflicts between openness and commercialization instead of eliminating one in favor of the other.

I adopt this view of contradictions in order to understand contradictions as points for intervention and change. If we can recognize the contradictions that academics face for adopting open practices, then we can foresee ways to ease areas of tension and also points at which new systems may emerge. As I argue, openness can be difficult for some academics. Despite this,
openness is often presented as minor changes to a researcher or teacher’s everyday workflow. Deposit a journal into an open repository, and you have achieved green open access. Add your lecture to YouTube and allow students from across the globe to learn alongside your class, and you are now practicing open pedagogy. These practices represent openness as something easily attainable for most academics. But, in practice, achieving openness requires fundamental changes to a scholar’s activity system. These cultural changes are hard won and arise by confronting the contradictions within our activity systems. While tools can effectively introduce scholars to open work, principles, and practices, fundamental changes to the communal norms of activity systems must support openness. Fundamental changes to activity systems require first that individuals acknowledge the contradictions within their systems, and then, realize alternative ways of acting either inside or outside of that system.

Chapter Synopsis

In this chapter, I explore the contradictions between academia and openness and how individuals perceive contradictions between their principles and practices of teaching and research. I begin a review of contradictions in the literature of activity systems. I first provide an overview of the literature of contradictions as explicated by Engeström. I delve into the four levels of contradictions, before specifically focusing on literature of academic activity systems. Here, I focus primarily on the complexity of academic activity systems and how they may be transformed and reconceptualized through contradictions and mediations. My literature review enables me to conceive of contradictions as a productive force for change within academic activity.

I then explore how transformations can occur to activity systems through the introduction of open tools. I argue that tool use can orient scholars unfamiliar with openness to communal
norms of open through using the tool and becoming involved with the tools-producing activity system. Importantly, this section differs from Engeström’s definition of tertiary contradictions, because rather than a new object becoming the source of change, the new tool becomes an agent of change within the system. Thus, a new tool can induce a new object within a scholar’s activity system.

However, as my next section demonstrates, changes in objects may lead to profound contradictions with the current activity system of scholars operating within academia. In particular, scholars face pushback from the communal norms of their departments and disciplines, where rules and division of labor does not support open work. While scholars may seek some temporary measures to support this work, a true transformation of their activity system cannot take place until academia acknowledges open work as valid and productive.

Contrasting the traditional academic system are open systems of academia, where open scholarship is seen as productive and necessary for creating immediate technological responses to scientific issues. For this system, although openness is sanctioned, I find that quaternary contradictions emerge between openness and concerns about risk. In particular, I detail two forms of risk: risk of data security and risk of data quality. Each constrain and reformulate how the open scholar must act, and as such, place limitations on open work.

Through this analysis, I conclude two things. First, I find that tools are a productive agent for producing small-scale changes to activity systems for scholars who are unacquainted with openness. Second, I identify cultural change as the biggest impediment to implementing open work. However, through my interactions with incubator attendees and facilitators, I conclude that localized initiatives can help induce openness through creating or changing expected rules and division of labor within academic activity systems.
Using Contradictions to Transform Academic Activity Systems

In this section, I review the literature of contradictions using activity system theory in order to understand contradictions for teachers and researchers who adopt open practices. First, I consider the background of contradictions in relationship to activity system theory. I then look specifically at analyses of contradictions within the activity systems of academics. Through this literature, I consider the transformative effect that contradictions may have on an activity system. With this transformative effect, I employ contradictions as a framework for identifying areas of potentiality and change within an activity system.

Engeström’s Four Levels of Contradictions

Most of the literature of contradictions within activity systems originates in organizational and management theory stemming from Engeström’s (1987) use of contradictions in *Learning by Expanding* (Bonneau, 2013; Engeström & Sannino, 2011; Foot & Groleau, 2011). For activity systems theorists, a contradiction is not merely a conflict, but an ongoing and “competing opposite forces” (Engeström, 1987, p. 69). This accords with activity systems that occur through repeated and continuing interactions, as discussed in the previous chapter. As activity systems form through recurring situations, the contradictions within them also have history and should not be thought of as momentary or one-time tensions.

Further, contradictions can only be identified from their discursive manifestations (Engeström & Sannino, 2011). The discursive manifestation, or conflict, is not the contradiction itself, rather they are representations of the contradiction through language, typically disagreements. Bonneau (2013) succinctly explains this point: “For instance, if two different priorities or strategies are combined through the practices of actors, they should not be described as contradictions, but rather as manifestations of socio-historical contradictions” (p. 6). In other
words, contradictions are embedded in the historical and social activities of systems, whereas conflicts are momentary discursive eruptions of these tensions. Studying conflicts within language is a means of uncovering deeper competing forces within activity systems and also understanding how systems can change and evolve. These conflicts can then point to contradictions and help researchers understand the competing forces within an activity.

Engeström (1987) divides contradictions into four distinctive levels. The primary contradiction within any activity system endures because of the activity’s existence within the context of capitalism (Engeström, 1987). Contradictions are within each node of a system—in its subject, objects, mediators, etc. Primary contradictions derive from Marxian dialectics, where an inherent contradiction exists between the use value and exchange value of labor. Essentially, labor exists in the world because it has some use. We need mechanics to fix our cars. We need farmers to cultivate our food. This labor is useful to us as a society, so we place value in it. At the same time, all labor has a price that it is exchanged for. This is its exchange value. We pay the mechanic to fix our car, and we pay the farmer for her crops. The contradiction between exchange value and use value persists because putting too much weight on any one value within the system can throw that entire system off-balance.

From primary contradictions, secondary and tertiary contradictions emerge. These are the contradictions that are unveiled through tensions between nodes of an activity system. Ultimately, secondary contradictions reveal the underlying primary contradictions between the nodes of the system. This may be a contradiction between a rule and an object. For example, extending from our previous example of mechanics who fix our cars, we could imagine an oil change business. The business institutes a rule that oil changes must be completed within ten minutes. This rule in the system increases the turnover of cars that the business sees and thus
increases the exchange value for the employees of the business. However, because of the rule, mechanics devote less time to routine maintenance checks in order to speed up the oil change process. Some even cut corners to meet the imposed time requirements. As the activity continues, customers begin to complain that the wrong oil was put in their cars and that the mechanics skipped basic maintenance checks for the car. This secondary contradiction, the new rule versus customer satisfaction, reveals the dual nature of the system’s object: provide routine maintenance for the car (use value) versus receive payment for maintaining the car (exchange value). Secondary contradictions as they exacerbate can lead to tertiary contradictions, when the activity system adopts a new component to manage some aspect of the system.

Tertiary contradictions materialize when a new object is introduced from a more “culturally advanced” activity system (Engeström, 1987, p. 70). The example Engeström gives is when, “the primary school pupil goes to school in order to play with his mates (the dominant motive), but the parents and the teacher try to make him study seriously (the culturally more advanced motive)” (pp. 70-71). Importantly, the tertiary contradiction indicates an area for transformation. In their examination of contradictions, Foot and Groleau (2011) posit that within tertiary contradictions:

an oppositional pull results when a new object forms within the central activity being analyzed. While the new object may be related to the old, there is a collision between the two that is manifested in forms of resistance. Such resistance may lead to a defeat of the new, and thus a contraction of the activity system. Alternatively, it may lead to the gradual or abrupt triumph of the new, and thus an expansion. Or, resistance may lead to a bifurcation of the activity system — the emergence of a potentially separate new cycle.

(p. 15)
Essentially, the activity system must change when this new object is introduced. Either the object is resisted and the activity system reverts to its older object, or the activity system expands to a new, more advanced state through incorporation of the new object. Alternatively, a stalemate between the new object and older system may result in two systems. Tertiary contradictions are important areas for empirical study because identifying these areas to lead to intervention points as a new system is adopted.

Finally, quaternary contradictions occur when the new activity system introduced through tertiary contradictions interacts with external activity systems, or neighboring activity systems. These neighboring activity systems are the node-producing activity systems that enable the activity. Engeström (1987) describes these as contradiction that occur in the “implementation” phase of an activity. As an example, he describes the results of a doctor adopting holistic medicine,

Suppose that a doctor, working on such a new holistic and integrated basis, orders or suggests that the patient accept a new habit or conception and change his way of life in some respect. The patient may react with resistance. This is an instance of the quaternary contradictions. (p. 72)

As such, quaternary contradictions are the ripple effects of change in a system. In Engeström’s example, the object-producing activity system has not yet “caught on” to the changes involved in the new holistic practice.

These four levels of contradictions are cyclical. Once quaternary contradictions have been overcome, the system will start anew with new primary contradictions emerging and pushing the system to change. In this way, activity systems are always experiencing contradictions and always moving toward new norms and practices. For openness, this represents
a point of opportunity as systems may be able to incorporate openness as they respond to contradictions and change their practices. Alternatively, we may also find that systems turn away from openness as they face these same contradictions. The first step to seeing how researchers and open advocates may intervene then is to understand more about what these contradictions are for academics.

**Contradictions of Scholarly Activity**

While few activity theorists have studied open science or openness explicitly, studies have examined the activity systems of academics as they learn to work with instruments in the pursuit of new knowledge. Engeström’s (1987) analysis of activity system theory examines three sites of learning, which include learning in school, learning at work, and learning in the sciences in order to trace the “the inner contradictions of the presently dominant forms of societally organized human learning” (p. 74). Within science, these internal contradictions exist in the tensions between the commodifications of the products of science and the unpredictableness of the objects of science: “The essence of the contradiction is the tension between the fixed, reified, predetermined nature of the exchange-value aspect of scientific objects, on the one hand, and the transitional, expansive, unexpected nature of their use-value aspect, on the other” (p. 95). Engeström diagrams the primary contradiction for each component of the system (Figure 4.1) to indicate how the contradiction permeates the system. As Engeström describes, science has motives of providing solutions in the world, solutions that can be marketed as research products for consumption. Yet, science is also associated with broadening our knowledge of the world and contributing to better models for explaining phenomena.
Russell’s (1997) study of the role of genre in academic activity systems confirms Engeström theories of scientific contradictions. In this article, Russell considers genres as mediators in a complex network of activity systems. Examining the activity system of a cell biologist, Russell finds that within the cell biologists’ immediate activity system, the cell is the object of the system which the research acts on through the instruments of genres to achieve the primary outcome of research articles. Yet this genre, alongside other genres, such as grant proposals and review articles, fulfills needs for interacting activity systems and are used to negotiate the contradictions that academics face with these neighboring activities. Here, Russell highlights contradictions specific to academics working with competing values within complex activity networks, such as teaching vs. research, pure vs. applied research, and use value vs. market value. For example, he discusses the contradiction of motive and object for researchers apply for grant funding:

- to gain funding from some outside source (NIH or a drug company), the research lab might have to change its direction (motive) and take up different problems (object), or at least appropriate some of the discourse of the funding activity systems to write a
successful grant proposal, a proposal that would frame the lab's work in terms of furthering the motive of the funder (Myers, 1985, 1990). Hence there is the contradiction between what are sometimes called pure and applied research. (Russell, 1997, p. 524)

In the example Russell provides, the proposal focuses the object of the lab to highlight its applied research and meet the requirements of the grant. However, other genres, such as the review article, may frame the lab’s work as basic research to meet the needs of researchers who want to learn from the lab’s activities. This work shows how genres, as the result of scientific research, help researchers to mediate the competing forces of their activity networks.

Bonneau (2013) provides an alternative viewpoint of change within an activity system of teaching at the university level. Her case specifically examines contradictions in the implementation of Moodle, an open source learning management system, at a Canadian university. Adapting Engeström’s diagram for teaching activities, Bonneau’s (2013) diagram (Figure 4.2) illustrates the current tensions within teachers’ activity systems. Within this activity, the student is the object of the system, who can be treated either as a learner or a client:

The incarnation of the primary contradiction within the object of the teachers’ activities results in a dilemma for the teacher, which leads him to consider the student as a client or learner. By this very fact, the teacher, in his capacity, is torn between two positions with regard to his role that of a service provider and of a partner in the student’s learning (p. 11).

The result, or outcome, is the measurement of effectiveness to which the teacher is subjected. Within the university setting, the market-driven, or “managerial” logic (Bonneau, 2013, p. 9), that professors are subjected to drives them toward meeting measurable standards for tenure, such as procuring funding and publishing in high-impact journals.
Like Russell’s activity networks, teachers face complex interactions with other activity systems. Through these interactions, the activity system of the teacher changes as well. In her article, Bonneau argues that through adopting open source software the university is able to access alternative ways of working with technology and easing the tensions within some of the contradictions of the teaching activity system. The open source software eases contradictions of instruments by designating a tool that allows for more transparency and flexibility. Teachers, rather than being forced to work within the confines of a commercial learning management system, could adapt the system to meet needs specific to their classes. This illustrates the ability of neighboring activity systems to change or alleviate tensions within seemingly fixed activity systems. By introducing a new, open instrument, current practices may be questioned and may push the overall system into a new state.

As the literature of academic activity systems reveals, academics face complex interactions with other activity systems while also negotiating with contradictions within their individual systems. Contradictions, then, emerge as points for both invention and intervention. While they can be managed through genres or other mediators, they can also reveal alternative ways of operating and provoke change within an activity system. In this chapter, I use

![Activity System Diagram](image-url)
contradictions as an “illuminating hinge” (Foot, 2001) to reveal points of tension within the activity systems of teachers and researchers who attended the Open Incubator. My purpose here is not merely to reveal the challenges they face with their open practices, but also to highlight how these practices may change and reveal points of intervention.

**Tools Use for Driving Change in Academic Activity Systems**

Through the incubator, tools emerged as the leading drivers of change for teachers’ and researchers’ activity systems. Tertiary contradictions are often perceived as changing systems through the introduction of a new object. Within these contradictions, the new object provokes changes to the system and may or may not lead to more contradictions. For my participants, neighboring activity systems acquainted them with open tools. These tools then were an avenue for my participants to learn about openness. In other words, participants were not setting out to adopt openness as an object of their academic activity, rather openness was introduced to them tangentially through the tools of neighboring activity systems.

For James, the introduction to openness came through using open source tools that related to his goal of data visualization. James is a doctoral student in the humanities. His project involves digital humanities, specifically creating interactive visual and web-based transcriptions of medieval texts. When I asked him how he first heard about openness, he responded:

**James:** I think it was first through the software that I needed to use for my research. Certainly, the open workshop that the library did really pushed the ideas of openness. But open access was kind of what brought me into the visualization of the research. So, Gephi, Tableau, stuff that was not restrictive.

The object of James’ activity here was to produce data visualizations. Open source software, like Gephi and Tableau, allowed James to access software for data visualization free of charge and
helped him achieve his object. Notably, he was not seeking out open tools to match principles of openness. Yet, once he adopted the tool, he learned more about the open community and pursued open work. Once open tools are incorporated into an individual’s activity system, we can then see transformations to their current activity systems as they adopt these open tools. Under Engeström’s four level of contradictions the introduction of a more advanced component from a neighboring system leads to a tertiary contradiction between the new component and the old activity system. For my participants, the neighboring activity systems using open tools are not a barrier or negative contradictory force, rather interaction with these systems seems to promote a more advanced understanding of and appreciation for open work. As such, tools encourage new ways that actors can understand open work within their activity system. This was exhibited by both Maria and Carlos.

Maria has worked with creating open materials for a number of years, while Carlos more recently has changed his courses to adopt and produce open educational resources. Maria is a teaching professor in the sciences and incorporates YouTube as a way to create teaching demos with her students in her class. During my interview with her, she explained that she did not set out to be part of the open movement, but it became a part of her teaching due to wanting students to create resources that other students could have access to. Specifically, she was creating the videos in an upper level course for students in a lower level undergraduate course that she taught:

**Maria:** I did not set out to become an expert in open access. I didn't even set out to become an expert in science videos. The only thing that I was trying to do is I was trying to give my students an opportunity to create these videos, to teach other students how to do something. It turns out that the easiest platform for us to work this was in an open model. So a student creates something, they put them on YouTube. And then if we wanna
refine it, we take that file... You can download it, refine it, put it back up. So it just so happens that the open platform worked.

Through YouTube, her materials circulated to students beyond her university, particularly ones who did not have access to these resources at their home institutions:

**Maria:** So by the time I discovered that that was called "open ed" I had already made some open materials and I had them out there, and I knew how helpful it could be to other people, especially people that may not have the same access that we have. I always get emails from people from other countries saying, "Thank you for sharing this. We don't have access to this equipment, but we got to see it because it was online.”

Maria’s transition into openness occurred through the use of open tools, in her case YouTube. By posting her materials online, she could create instructional science videos not only for her undergraduate courses, but for students globally who had access to YouTube. While YouTube is proprietary, it is free for users to watch and share videos and has an international presence. Like James, Maria did not aim to radically change her activity system towards an open object, rather her goals aligned with the neighboring activity system of the open educational movement, and she was able to use open tools to meet her object of creating easy and accessible video tutorials.

Tools, such as software, hardware, and genres, carry with them their own tool-producing activity systems. In the creation of every tool, there are actors who develop the tool and a community of interested people who sanction the tool’s creation. For example, open source software is produced by developers within the open source community who carry with them the rules and division of labor inherent to this open community. When open source software is used as a tool within another activity system, actors are exposed to those norms. This can be embedded in the rules of using the tool. For example, Linux is released under a GNU General
Public License. This license requires that anyone who modifies the Linux source code must release the code under that same GNU General Public License. Therefore, when you use this tool, you must essentially abide by its open principles through the licensing. The license mandates openness for future software use and adoption. Alternatively, this can happen subtly, whereby using the tool, subjects are exposed to the community of tool users and communal norms without abiding by a set of guidelines. Returning to Linux, while there are explicit rules for licensing, there are also Linux User Groups that meet regularly and promote free software (Clark & Moen, 2013). These groups instill norms for using Linux, but these norms are encouraged by the community rather than stringently enforced. Tools often have both explicit and implicit norms, rules, and standards that users are exposed to once they adopt the tool.

For Carlos, this relationship was explicit. His pursuit of open pedagogy began through a library initiative to promote open educational resources (OER) and has continued through support from external funding.

**Carlos:** A couple of years ago, Will [facilitator of the Open Incubator] made us aware of the Open Educational Resource Initiative and alt textbooks. So, several years ago at the bio-technology programs, we changed our research project, or our Capstone project, for our course to be a, "Okay, develop an OER."

Carlos changed the instruments for his course to be more open in response to an ongoing initiative that recruited teachers to produce OER. Rather than using the standard textbook, he has integrated OER and alternative textbooks into his classroom through the neighboring activity system of the libraries. The libraries are essentially both a rule-producing and an instrument-producing activity system for teachers—they promote and sanction various resources, either proprietary or non-proprietary, that will be utilized by teachers and researchers on campus. The
change in instruments for Carlos had secondary effects on his activity system. Rather than simply use OER in the classroom, he has students produce OER materials, similar to Maria’s creation of YouTube videos. For both, this learning activity system shifts the traditional format of students learning through the instruments of the classroom to students creating the instruments of the classroom. This, in turn, changes the student-producing activity system. In other words, learning for the student is created through engagement with materials rather than through didactic instruction. This learning process is explored more within the next chapter.

While Engeström’s tertiary contradictions focus primarily on contradictions through a change of objects, as I posit in this section, tools can have profound effects on the transformation of an object for open scholars. With their tool-producing activity systems, open tools carry with them the norms of openness that scholars must interact with to successfully use the tools. For scholars like James, Maria, and Carlos, these open tools orient them towards the object of openness. As such, introduction to open tools can be an effective way in which to introduce scholars to openness. Of course, these tools must fit with the scholar’s ongoing activity system. As I will discuss in the next chapter, these tools must be socially integrated within an activity system in order to be effective. James would not have used Gephi if it did not enable him to easily create data visualization. Nor, would Maria use YouTube if it were difficult to upload and modify videos. However, when easily navigable tools are incorporated well with a scholar’s activity system, they can connect them to new open norms. Contradictions arise when the norms of the new, open tool conflict with the norms of the ongoing activity system.

Conflicts between New, Open Objects and Old Norms

As the previous section demonstrates, the introduction of open tools from neighboring activity systems may in turn introduce academics to open norms and practices. However, with
this change to their activity system comes new contradictions. In particular, there are contradictions between the values from the newly adapted tool and the values of the current activity system. While these contradictions are productive forces, as seen in the examples in the previous section, they also present challenges to academic who are balancing their newly acquired open principles with the traditional and seemingly fixed practices of the academy. In particular, scholars must navigate how to achieve their open goals in opposition to the communal norms of their current activity system.

For Maria, in particular, she perceives contradictions between her open principles and the practices of her department. Maria operates within a more traditional system of teaching and research, and as such, exhibits many internal contradictions that teaching faculty face when they pursue open work. As a participant, Maria is forthcoming with the issues she faces and reveals the contradictions she encounters both during the Open Incubator and in my interview with her. Maria illustrates the difficulty of pursuing open work when Micah asked how she balances teaching and research within her department.

[Session 4]

Maria: Teaching is my research. My department only cares about funding and publications. They don't care about books, presentations. I do a lot of things because I like it. Where do you put all of that stuff [in your tenure package]? I don't know. Publish an article so you can get credit for it. You should be credited for all of the work that you do.

Maria advances the point that for many teachers is a fundamental conflict: pursue open work or receive recognition in the department. For Maria, she is a teaching professor and is able to actively pursue open teaching as part of her research, but she acknowledges that for others open
pedagogy may be difficult to enact because it does not fit easily with a tenure portfolio. Maria can put her principles into practice through publishing about her open work. Yet, these principles are not valued by the department, because the “work” of openness does not fit with the expected activity systems of the department. As discussed above, all labor exists in a dualistic contradiction between use value and exchange value. While open pedagogy has use value for students and teachers (it enables students learning through access to pedagogical materials), its exchange value is not apparent within the system (it is not seen as productive to her department). Therefore, while open pedagogy is valuable to students and teachers, the lack of immediate exchange value make it seem relatively unimportant to a department that typically measures value through publications, external funding, and teaching evaluations. If we map this through activity systems, it is apparent that open scholarship and teaching as instruments conflict with the existing rules and division of labor within traditional academic activity systems (Figure 4.3).

Figure 4.3: Activity systems for academic teaching. The system on the left represents a traditional model of activity for teaching faculty. The system on the right uses jagged arrows to indicate contradictions when open instruments are introduced into this system.

For those who are operating in a traditional activity system of research, these contradictions are similar to Maria’s open pedagogy case. Within the incubator these contradictions manifested in discussions of research activity, where some researchers seemed hesitant about being fully open. In these cases, openness equates with vulnerability, particularly
vulnerable data. One example of this happened while discussing James’ research. As a digital humanities scholar, James wants to share his work openly with his peer community. Specifically, his work involves digitally scanning and translating texts. In the excerpt below, Maria cautions James about sharing his work and demonstrates a potential contradiction within James’ academic research.

[Session 1]

**James:** I’ve thought about the legalities of scanning work and also about the data I’ve created data through open tools. Could other people use these?

**Micah:** It depends on how you’re licensing it.

**Maria:** Open is safer once you’re more established. Once it’s open, it’s open. You have to let it go. You have a set of data and you’re working toward openness, but you should keep it under wraps. There are safety issues. Once you’ve published it, then you can open it to others.

Maria’s concerns about sharing data stem from the proprietary nature of academic publishing. With the competitive secrecy of academic publishing others research groups may “scoop” James’ data and publish results before he has finished his analysis. For James, this scenario is not merely a hypothetical. In my interview with James, I asked how open he was with his research. He responded:

**James:** Because of where I am in my research and where I am as a PhD student, I’m probably at a 70/30 to 80/20 split in terms of open and closed. I want people to see what I'm doing and I want to make my information available, but there's still... I don't want to completely pull the curtain back and reveal the wizard behind it... And that's not because I don't want to share, it's just because I've had this happen before where I've been
working on a research project and I've just been a little slow to develop it and someone else on the other side of the world has done the exact same thing. Yeah, this is why I left my first PhD program because I just was so absolutely gutted that someone at another university pretty much produced my dissertation a year before I was done.

**Laura:** And they saw something that you had done?

**James:** No, no that's the thing. Just randomly happened the same exact manuscript, the same exact perspective, everything and it just kind of sucks. So, there is a bit of hold back just because of that experience that I've had.

James’ experience epitomizes the very real worries of graduate students and early career researchers who debate pursuing open work. The competitive nature of publishing rewards those who publish first. In James’ case, the competitive rather than collaborative division of labor within an academic’s activity system render James’ research useless if another researcher publishes on the same topic first. Here is a contradiction between the newly adopted instruments of open research and the older division of labor within the traditional activity system of academic research (Figure 4.4). While James still uses open tools for his research and produces some open scholarship, he does not embrace total openness. As a graduate student, he is among the most vulnerable to the rules of the academic system and cannot afford to have his research scooped again.
Figure 4.4: Contradictions between open scholarship and the rules and division of labor for graduate students.

Maria elucidates on these concerns within the final session when she describes the research process within her discipline. In the excerpt below, Maria is responding to Micah who asks her how change could come about in her field:

[Session 5]

Maria: I see it but it's a very slow process and different from what you see on your side. Preprint servers are still a direct competition community. How do you publish when someone is going to come and scoop you? If we're making the same molecule and I do it first, then it's done. If we could share, then we could get it done in half the time but the funding is unilateral so it doesn't work that way. You would have to have a different funding model and culture.

Maria describes a contradiction between the division of labor and rules of her system with the values of preprint servers. While hypothetically she could work with others towards her object in a more collaborative and open environment, the rules of the activity system dictate that only one person will receive funding and recognition for this work. Further, the division of labor within the system enforce competition for who will discover a finding first, rather than collaboratively rewarding everyone involved in producing findings about a certain molecule. While the
community has adopted the open access tool of the preprint server, the open principles of that tools have yet to permeate the activity systems of traditional academic research.

Maria’s example demonstrates that funding enforces the rules of the traditional academic activity system. Without funding, changes to the current systems are unsustainable, and despite open tools and open goals, most scholars will revert to following the rules that will recognize the exchange value of their work. Ultimately, new practices of openness may not be galvanized into systemic changes unless they are sustainable. In other words, since these activity systems are tangential to the participant’s immediate activity system, they may not be viable for long-term change unless they are supported within the actor’s current activity system. As this section demonstrates, once a scholar is reoriented toward openness, and ultimately seeking to adapt to the norms of neighboring systems of openness, they must confront the communal norms of their current activity system. These norms are enforced through rules and the division of labor within the activity system. Rewarding competition through funding and recognition limits the ability of scholars to pursue open research and teaching. Pursuing openness despite these barriers can alienate them from their peers, departments, and disciplinary communities. As a productive force, contradictions then between the instruments of openness and traditional rules and division of labor in academia compel changes to the system. With these changes, scholars may adapt to a more open system where rules and division of labor rewards open work.

**Challenges for Scholars in Open Academic Activity Systems**

Against the more traditional activity systems of research, the Open Incubator revealed participants whose activity systems had already adopted open principles into open practices. These researchers represent a new way of operating within an activity system that had embraced open principles and whose norms encouraged open work through rules and division of labor that
rewards collaborative research. For Chris and Umesh, open was a primary way of conducting their research. Umesh is a doctoral student within the interdisciplinary center for modelling and data visualizations that Chris also works for. While Chris focuses more on modelling, Umesh works with AI and deep learning. Both were familiar with using open tools and working collaboratively on projects using GitHub, a platform that allows its users to share and simultaneously work on projects using git. Throughout the incubator, Chris and Umesh exemplified how open principles and practices could work in tandem. Yet, while their activity systems embrace openness, they still experience contradictions between their open activities and traditional neighboring activity systems.

Their experience with openness represents a stark contrast to the experiences of those operating in more traditional systems of academia. After the example above where Maria cautioned James on putting his work out in the open, Chris shared his experiences with openness within his research community:

[Session 1]

**Chris:** Reusability is a benefit. When I was at a conference, someone created software for measuring water quality. Then, a scholar from a different country was able to plug data into the software at the conference and generate water quality measurements for his own area.

Chris provides an alternative to the closed system of academic competition in which openness functions differently in relation to an academic peer community. This is essentially an open system, where open source software can be shared with other researchers and stakeholders with the goal of improving the software in the future and receiving immediate results. While it could be argued that software creation is necessarily commercialized, open source software gets
reincorporated into future iterations of the system as an open instrument that can be further improved. In the case of Chris’ conference, the community of conference attendees supply their own data to plug into the software to achieve measurements of the water quality in their area. Ultimately in this example, the outcome is a flexible system of sharing code to achieve water quality measurements.

We might consider the community in which Chris works as a “culturally more advanced” system than the one of traditional academic research (Engeström, 1987, p. 70). However, this more advanced system of openness is not free from contradictions. Here, rather than scholar’s old activity system conflicting with newer, neighboring activity systems, we see the inverse. Instead, the more advanced activity system of openness that the scholar works within is challenged by neighboring activity systems that are older and more traditional. This is essentially a quaternary contradiction. Again, it is important to affirm that the new contradictions and constraints that emerge are not necessarily a negative force, instead they may arise out of the necessity of these neighboring systems. In the cases of my participants, they provided me with examples where neighboring systems resisted practices of openness because of risk. This risk occurred in two forms surrounding data: the risk of data security and data quality. When adopting an open object, researchers and teachers should be sensitive to potential drawbacks of openness, particularly with open data. Open data, specifically, should not expose others to security and privacy risks, and further, should be validated to ensure its quality.

Concerns about data security occurred when teachers and researchers are working with private data that could have negative effects on neighboring activity systems if made public. For example, Chris unveils contradictions that occur with his own research team and working with national agencies later in the incubator. This occurred during the fifth and final meeting. During
this meeting, communications experts were brought in to discuss how to communicate our work with the public and the resources available on campus. One of these experts brought up the necessity of sharing your data with the public, since tax dollars went into the funding of the research. Chris presented the dilemma he faces, where he is not legally allowed to share the data:

[Session 5]

**Chris**: Our project is funded by a national organization for developing a tool to make more informed management decisions. I was in DC presenting on an invasive species to officials who were making a 30-million-dollar management decision. That was the first time I’ve seen work have an impact beyond citations. For communicating to the public, here's the way we would like the public to help. They would look at SciStarter and indicate the presence of the species. But researchers don't know how to report that data. We’re trying to connect the dots. The data is the national organization’s data. So we have to mask that data, because it can reveal where this invasive species is located. And that could be a privacy issue.

**Communication expert**: You can't anonymize it?

**Chris**: We’re aggregating info at the county level, but we hide the data. Part of the problem is that we partner with a national organization and we have to meet their standards.

These contradictions reveal competing external activity systems that exert pressure on researchers to keep aspects of their data closed in order to protect the privacy of individuals. External government agencies provide and own the data that Chris’ team works with. Further, they fund the project and set the project’s goals. Meanwhile, citizen scientists act as community members who gather the data that is used for analysis. As a researcher who works within
communities that are open, rather than proprietary, Chris is caught between wanting to provide the public with data and adhering to the mandates of his partnering agency.

Similarly, Umesh has been constrained in producing open work when completing an internship with a government agency, where his open principles conflicted with the security protocols enforced by the agency. While Umesh is committed to using open source, he recognizes that when working with issues of national security, open data is a security risk:

**Umesh:** The national lab is very different than both in academics and industry because they have sensitive data. They have sensitive problems to solve. They work closely with intelligence, defense, national security. I worked there and none of my work was even taken out of my set or given to researchers. We can’t use hard drives; we can’t use any third-party tools. You can use open source stuff, but you can’t make it open source… And also, there’s no reason of making that open source, because you can make the code open source, but not the data, especially this data which I’ve captured by remote sensors, like satellites. It can be misused.

While open source can be incorporated within the activity systems of government researchers, rules that enforce security will override open communal norms that are brought into the system by technologies or researchers. For Umesh, the national lab has its own system of operating that prioritizes security over openness. Against this system, Umesh’s work stays within the lab and is not open to others. While he is used to acting within systems that support openness, during his internship he must confirm to the norms of a different system. For Chris, he also must abide by the system of data security enforced by the government agencies he works with. These are quaternary contradictions that occur when open and closed activity systems interact.
An interrelated issue of data is data quality. While studies have shown that open access articles increase citation impact (Gargouri, 2010) and have similar quality to non-open access articles (Pastorino, 2016), concerns remain about the quality of open data, particularly when data has not gone through a formal peer review process. Carlos illustrates these concerns about data quality in regard to sharing student work. Since Carlos’ open pedagogy is supported by his department and through external funding, unlike Maria, he worries less about continuing to pursue open work. Rather, he has concerns about how to share student-generated data. In Carlos’ project, he makes public data that was collected by undergraduate students as part of his course. This data can be used by other researchers who may not question where the data came from or its quality. This potentially opens these scholars up to risk if they publish results based on this data.

In a discussion about metadata during the incubator, Micah asked what metadata means to us. During the conversation, Carlos voiced his concerns:

**Carlos:** Some software allows you to fork a project. Some have a model of publish and then share. But I’m hesitant to publish data that students generated. You have to make sure you clarify that it’s part of a course and it’s student generated data.

During my interview with Carlos, I asked him to clarify on this point.

**Laura:** I remember one thing you said during the incubator was that you had this issue with disclosing it with student work. Did you ever find a way to solve that?

**Carlos:** And that was brought up at this [department] meeting, too. Because some of these sequences, in my case, are student-produced, so they may not be part of a publication. And I still struggle with that, but I... And the others at this meeting agreed, and there’s definitely information that others could build on. So, if it's a Google site we create where we can share these things or a Pressbooks, it's still things that others could
build on. And my goal is to create a community, maybe I'm stuck on this [scientific issue], but create a community that could focus on learning more about it.

Although Carlos has reoriented his students to be active learners and co-researchers, a downside of this activity is that student-generated data may not be accepted within the larger disciplinary community. A new tension emerges between student-generated data and peer-accepted data. While the students’ data may have use value to the students of the class who acquire research experience, this data may be of little use to the research community. Further, it may discredit Carlos if he publishes student data that does not meet the standards of his research community.

As this section demonstrates, when an activity system transforms, former contradictions may be alleviated but new contradictions will emerge. The point is not to eliminate contradictions but rather to recognize these productive tensions and consider ways to intervene to alleviate tensions. When working with a more powerful neighboring activity, scholars may have to relinquish some open practices or find alternative ways of acting. For Chris, he was able to aggregate data to make the information visible without compromising the privacy of individuals who contributed the data. Carlos also proposed an alternative to publishing student data, where he could share student-generated data through Google Sites or Pressbooks. These sites would allow the data to be public available but lessen the risk of other academics publishing based on this data.

**Conclusion**

I began my literature review by discussing the contradictions between commercialization and openness that many researchers perceive when they choose to adopt openness. While these are thoroughly explained within Engeström’s model of primary contradictions, they do not represent the more every day and mundane contradictions that scholars face when pursuing
openness in their research and teaching. For my own participants, their contradictions were more localized to their specific situations, former experiences, and disciplinary communities. These contradictions compelled them to act in certain ways and make certain choices, whether that be following the rules of an external funding agency or putting up YouTube videos despite the department’s lack of recognition for such work. In each case, scholars must choose how to balance their principles of openness with the sanctioned practices of the activity system.

I argue that tools are change agents for current academic systems. They introduce scholars to new ways of doing work and can familiarize scholars with the norms of the open community without requiring immediate buy-in or changes to the scholar’s workflow. However, as shown in my research, these tools contrast with the current activity systems in place within academia, and specifically, must confront the norms of academia as enforced through rules and division of labor. To counteract this, I would argue that those in rule-producing and division of labor-producing activity systems work toward recognizing and rewarding open work. Such work is often culture changing work and as such, remains a challenge. Scholars of open pedagogy have already recognized the need to adopt cultural changes in order to meaningfully deploy open principles as open practices (Cronin, 2017; Wiley & Hilton III, 2018).

Such change moves beyond merely introducing tools. Micah further supports this in my interview with him. When I asked him about what open tools he used, Micah challenged my question:

**Micah:** I kind of resist that, most of that is because I’m not a deeply technical person. Being trained as a humanist, I function in the world of ideas and not that technical or nonhumanist people don’t, but the tools that I rely on the most are ideas.
Micah is part of the library, a tool-producing activity system. As such, he does not have to use the tools himself to promote open science. Rather, he can intervene through the rule setting genres of library agendas and initiatives to encourage different open practices. In my interview with Micah, agenda-setting is a recurring theme, where Micah challenges the “one size fits all” open principles that many try to enforce:

**Micah:** So from my perspective from libraries for a long time we’ve pushed an all-encompassing open agenda and that isn’t going to work so what I’m interested in pushing for the next ten years are discipline-specific open strategies that make sense for how the discipline already works.

As part of a tool- and rule-producing activity system, Micah has influence over what scholars at his institution adopt for their own practices. He recognizes that rather than forcing a generalized vision of openness, the libraries must work within the current activity systems of teachers and researchers. Through this approach, the libraries may support long-term investment in openness that is sustainable for teachers and researchers.

For others who are in the position to support open work, agenda setting items can encourage scholars to adapt open work. This can take place through grant funding, recognition of open work within the tenure portfolio, and acknowledgement of alternative metrics, such as number of downloads or views of an OER video. Others may consider smaller interventions if they wish to see larger changes from their colleagues or students. This can be introducing colleagues to open tools, encouraging students to publicly share their research online, or creating an OER project.

Further, it should be noted that any pursuit of openness comes with risk. Openly sharing data and research can put those with less power in a vulnerable position, particularly graduate
students, postdoctoral researchers, and non-tenure track faculty. Even for those less vulnerable, data can present concerns if it is sourced from private information or if it can pose a security risk to the health and safety of others. As a consideration, open scholars should perform their own cost-benefit analyses to determine whether sharing and openness is appropriate for their situation, position, and activity system. Part of this process is acknowledging whether one operates within a traditional activity system, an open activity system, or somewhere in between. Taking stock of the rules, division of labor, and community that one interacts with can lead to a more productive understanding of how to enact openness effectively and in a way that will be productive for the scholar.
CHAPTER 5: Learning to be Open

The previous chapters in this study have focused on expansive opportunities that are afforded by learning outside of one’s discipline. In Chapter 2, I discussed how the open incubator could be a third space for learning as a mediator between disciplinary learning, commercial interests, and the open movement. For Chapter 3, I took up the activity systems of my participants to explore contradictions they faced in expanding their research and teaching to include open practices. I found that tools were change agents that allowed for these academics to transform their activity systems and incorporate open practices. In this chapter, I turn to studying how openness is cultivated within one’s discipline. Namely, how do academics learn to do open? By “doing” open, I mean how do they learn to reshape their academic practices of teaching and learning to fit with open principles, such as findability, accessibility, interoperability, and reusability.

Practice has a specific history tied to Lave and Wenger’s (1991) work illuminating how communities of practice enact learning through participation. In an academic context, learning to participate in the community of practice is tied to the creation and distribution of genres (Prior, 1998). And as such, studies at the intersection of writing and disciplinarity consider how knowledges are deployed and how professional identity is formed through participation in genres (Berkenkotter, 2001; Berkenkotter & Huckin, 1995; Ding, 2008; Paré et al., 2011; Starke-Meyerring, 2011; Winsor, 1999, 2013). Within these works, newcomers are encultured into their profession through socialization in the localized genres of the profession. By localized, I mean genres specific to an organization or institution. Essentially, this is a process where newcomers learn to write by interacting with others in their new field. As writers become more acquainted
with the localized genres of their profession, they adopt more nuanced writing tasks that reflect their growing expertise (Beaufort, 2000).

Framing the question as “how do academics learn to do open?” through studies of workplace and disciplinary learning provides a unique challenge that differentiates this study from previous works. Previous studies of apprenticeship and professional development relied on an established community of practice that the newcomer integrates into. This community provides mentorship, support, and correction to the newcomer as they graduate to full participation. Open scholarship is relatively new, and consequently, for many disciplines, locating “oldtimers” in their field is impossible because they do not yet exist. For many fields, scholars are still developing their open practices and only just starting to codify these into guidelines and effective practices (Marwick et al., 2017; Munafò et al., 2017; Nosek, 2018; Wicherts et al., 2016). Despite this, writing studies and studies of apprenticeship still prove useful for investigating how people learn under such circumstances. Examining practices of socialization reveals how learners are simultaneously creating communities and learning to act within these new communities. Participating in the community enables learning and, at the same time, this participation builds the community. This social learning of scholarly work takes place through the exchange and creation of texts. As such, this chapter details how newcomers draw from distributed sources of learning to ultimately produce texts that shape their open communities.

**Chapter Synopsis**

This chapter explores how academics come to identify as open scholars and learn to produce open work within their individual disciplines. The main research question that this chapter answer is: how do researchers, teachers, and scholars learn to practice openness? My
literature review grounds this question at the intersection of activity theory, situated learning, and rhetorical genre studies. Specifically, I take Vygotsky’s (1978) internalization and externalization as a framework for analyzing how my participants become a part of open activities. To study internalization, I delineate three themes from my participants for how they learned to practice open. These are school-based learning, mentorship, and conceptual models.

First, I reflect how school-based learning was identified by my participants as part of building their identity as open scholars. I discuss in this section both the opportunities and constraints of school-based learning. For openness, school-based learning can help form scholar’s identities through introduction to concepts, mentors, and technologies. However, surface-level understandings of concepts and technologies must later be incorporated in open practices to be effective. Next, I discuss how mentorship, either with an advisor or peer, is a crucial component for supporting open work. Advising mentors, or those in a teacher-student dyad, can guide newcomers into the field and shape their disciplinary identity to include openness. Likewise, peer mentors can introduce colleagues to open practices and encourage them to see how their work aligns with openness. Mentors may also be helpful because they provide conceptual models—the third theme of open internalization that I explore in this chapter. Conceptual models allow newcomers to understand unfamiliar genres and act as an exemplar for practice within an activity. Conceptual models are constructed through exposure to various artifacts that learners can model their practice one.

I then turn to externalizations of openness. Participants in my study draw from diverse artifacts to put together conceptual models. These models are then repurposed by my participants to create externalizations for their communities. Externalizations serve as models, texts, and mentorship for others within the community. In some cases, participants take part in these
activities to advance their pedagogy and shape their discipline. For others, these activities contribute to ongoing knowledge production within their discipline. In either case, externalizations help construct an open community and serve as internalizations for others. As my study ultimately reveals, the connection between internalization and externalization is ongoing and nonlinear. Participants learn from multiple sources and use these sources to externalize within their own discipline. Additionally, these externalization reach audiences outside their discipline because they are open and publicly available.

**Learning through Internalization and Externalization**

Activity theory, situated learning, and rhetorical genre studies have been theorized together through a unified social theory of learning to account for the opportunities these three theories afford when used in tandem (Artemeva, 2008). A unified theory “allows genre researchers to explore the interplay of the individual and the social in the process of learning genres and thus extend the understanding of this process” (p. 162). In this chapter, I do not focus primarily on genre as the unit of analysis, as Artemeva does (2008), rather I continue the focus I have adopted throughout this dissertation—activity. Activity, of course, involves genres as they mediate between subject and objects. As such, I adopt a unified theory of social learning in order to investigate how my participants identify as open scholars, learn open practice, and externalize these open practices with genres and emerging genres. In this section of the chapter, I explain how I deploy a unified social theory of learning. My focus begins with activities and how those activities are manifested in practice. Specifically, I frame this chapter through Vygotsky’s (1978) internalization and externalization. I take internalization as a social process, where newcomers interact with their communities and begin to participate in practices that lead them to openness.
Externalization is the manifestation of this practice. It is how the newcomer communicates with their community through physical and discursive artifacts that represent their open practices.

Vygotsky (1978) perceives learning a process of internalization and externalization through which the subject, often a child in his research, internalizes the activity that she observes. Vygotsky describes internalization as, “the internal reconstruction of an external operation” (p. 56). As discussed in the overview of activity theory in Chapter 2, a child pointing can be an example of this internalization process. Pointing is an attempt by the child to grasp an object. The child’s parent responds to the pointing by grabbing the object for the child. The child then internalizes pointing as a sign to the parent, rather than an action of grabbing. This internalization process extends beyond childhood learning to more advanced forms of development, like learning a profession or skill. Several scholars have found internalization problematic as it largely adheres to Cartesian dualism, positing an inside and outside version of learning (Lave & Wenger, 1991, p. 47), and decontextualizes the learning process (Minick, Stone, & Forman, 1993). Yet, Engeström (1992) locates internalization as existing within activity systems. Specifically, he describes how expertise is cultivated through social experience and apprenticeship:

Expertise is acquired through internalization of experience, gained gradually by massive amounts of practice in the skills exhibited by the established masters of the given specialty (the famous novice-master continuum). (pp. 5-6)

Essentially, internalization is the change affected on a subject as she joins in an activity. Here, it is necessary to introduce two interrelated concepts associated with learning through practice. These are the zone of proximal development and legitimate peripheral participation. These two
concepts account for how social participation leads to learning and development for novices as they participate in activities.

The zone of proximal development (ZPD) consists of activities that a novice requires assistance with or instruction in order to complete (Vygotsky, 1978). For example, a student may be unable to solve a math problem on her own but can easily solve the problem once guided through it by a teacher in the classroom setting. This applies to activities outside of school as well, such as weightlifting, driving a car, or sewing a dress. ZPDs consider development not only through a person’s ability to individually complete activities but also through their ability to complete activities with others. The essential difference is not a change in the activity but a change in activity system, where the addition of a more experienced person helps one achieve one’s object. Bazerman (2009) describes ZPDs as occurring, “in the collaborative participation of typified activities and discursive forms familiar to the instructor, adult or more skilled peer, but at which the learner is not yet adept” (p. 136). Cognitive development then occurs in ZPDs through active participation within a social group. During these group activities, the novice gains understanding of concepts, problems, and genres through the guidance of a mentor. ZPDs can also be used within instruction to understand what competences learners bring with them and to help guide learning tasks accordingly (Artemeva & Fox, 2010). They help assess how activity systems can advance an individual learner.

Similarly, legitimate peripheral participation (LPP) accounts for how a novice takes on small peripheral tasks as an apprentice and gradually move towards full participation under the guidance of oldtimers in a community of practice (Lave & Wenger, 1991). Communities of practice are located within activity systems and connected through activities. Lave and Wenger (1991) are clear that a community of practice does not “imply necessarily co-presence, a well-
defined, identifiable group, or socially visible boundaries” (p. 98). But it does imply a practice that is systematized and recognized by its participants. Through this community, novices are integrated into the activity gradually and learn how to behave as one of its members.

Both ZPDs and LPP encourage disciplinarity, as well as learning. Disciplinarity is “one domain of the general process by which people jointly constitute social worlds and identities in activity” (Prior, 1998, p. 26) and is organized by way of texts (p. 27). In other words, disciplinarity is the identity-building that occurs when one participates in an activity with others. Through the lens of activity, disciplinarity is cultivated through ongoing participation and identification with an activity system. And within this system, participating in the writing of genre encultures the novice into the discipline or workplace (Artemeva & Fox, 2010; Beaufort, 2000; Dias, Freedman, Medway, & Paré, 1999; Ding, 2008; Tardy, 2009). Novices are assigned writing roles of low importance that can be written even with only a general understanding of the genre (Beaufort, 2000).

Eventually, novices reach a stage at which they are no longer novices. They now qualify as more advanced participants within the activity through their experience. At this point, they shift from internalization to externalization. Externalization is the process whereby the novice moves from internalizing knowledge to shaping knowledge through producing artifacts associated with the activity, such as texts that organize practices for the community. This is also the point at which the novice begins to become, and eventually replace, the oldtimer. In this way, externalization is similar to a Kuhnian paradigm shift. As Engeström (1992) describes it:

Creative externalization occurs first in the form of discrete individual deviations and innovations. As the disruptions and contradictions of the activity become more demanding, internalization takes increasingly the form of critical self-reflection, and
externalization, search for novel solutions, increases. Externalization reaches its peak when a new model for the activity is envisioned, designed and implemented. (p. 22)

In other words, externalization is a gradual shift from the status quo that takes place because the subject encounters new situations that require new practices, texts, and tools (Figure 5.1). In the figure below, adapted from Engeström (1992), internalization and externalization take place concurrently. Internalization wanes as externalization peaks, and through this externalization, a new status quo may be reached for a community of practice. This is where the cycle begins anew, as new learners internalize and externalize within the activity.

Figure 5.1: Model of internalization and externalization adapted from Engeström (1992).

From a writing studies perspective, externalization is when genres are produced within the workplace or discipline (Artemeva, 2008). Writing within a genre, such as a writing a grant proposal, follows the generic model of previous grant proposals. It responds to the same social actions and follows the same formal features. Creative externalizations are where new genres emerge. These borrow elements from previous genres in order to construct responses to novel situations using new formats. Consequently, these new genres form a new status quo for the community and set the precedent for other learners. With my participants, they borrow from
previous externalizations and genres in order to learn how to code, to create videos, and to make assignments. I use the terms genres loosely here, as my participants produce a variety of texts that may or may not someday cohere into genres. Although we could argue the validity of each text’s status as enacting a genre, I employ the term “genre” in the consideration that these texts are social, perform social actions, and abide by or remix certain forms.

**Developing Identity through School-based Instruction**

As discussed in the previous chapter, many of my participants encountered openness through participation in disciplinary communities where they were first introduced to open tools. In some scenarios, this introduction took place in a school setting, where open tools were a part of the curriculum. However, when I asked participants how they learned to produce open scholarship, they brought up other methods of self-teaching, practice, and mentorship. Instead, formal schooling was brought up when I asked participants, “how did you first hear about openness?” Schooling was a throughway for entering disciplinary communities that incorporated open practices. The importance of schooling was not so much learning to be an open scholar, but rather identifying as an open scholar. Consequently, curriculum that included open practices, principles, and tools was important for leading scholars to pursue other opportunities for openness.

This was especially apparent for Micah, the open knowledge librarian and creator of the open incubator. Micah describes his journey into openness through his undergraduate studies. During his undergraduate education, Micah became aware of digital humanities scholarship through practices that were beginning to be more common within this field of study. As he describes it:
Micah: I studied as a humanist and as I was finishing my degree in American Studies when there was this uptick in what we call digital cultural heritage. So, museums putting collections online, historical photos. Library of Congress put a bunch of stuff on Flickr, those sorts of things. At that same time I started to become aware of things like Creative Commons Licensing, which allows materials that we put online to be openly licensed. So I’d say since the beginning of my career when I started to think of myself as something more than a student, openness was always already part of my practice and my understanding.

This last line in this quotation exemplifies the identity-building work of Micah’s undergraduate and then graduate career. Although he was not yet an academic librarian, Micah already adopted open practices and considered it part of his identity as a scholar. Exposure to open practices, such as Creative Commons Licensing, made him aware that such practices existed and allowed him to pursue these more when he entered library school.

James represents a similar trajectory. James framed his experience with openness through using open tools, rather than through his discipline. However, in my interview with James, it becomes clear that open tools are intertwined with his doctoral coursework. As he explains, he began using open tools through a digital humanities course that was a part of obtaining a graduate certificate in digital humanities:

James: I started the digital humanities certificate in, I want to say it was spring of 2018. So, starting to work with that stuff in the Introduction to Digital Humanities class, we kinda looked at a lot of those tools. So I’d say probably around then.

The Introduction to Digital Humanities class that James took was his entry into practicing open work. It also led the way to further opportunities for digital humanities scholarship that
incorporated openness. Through the course, James began to work with mentors who advised him in subsequent independent studies and projects. For both James and Micah, education was an entry point to open practices and tools.

While school-based instruction can lead scholars to identify as open scholars through the introduction of open practices and the use of open tools, curriculum may be insufficient for training newcomers in the norms of openness. As an example, Chris learned R, an open source coding program during his doctoral education. While he learned how to use the open tool on a functional level, he did not learn the open practices associated with it. As he explains it to me:

**Chris:** At least where I did my PhD, the teaching wasn't caught up to the tech. So we learned R, but we didn't learn how to do R in an open way. And part of that is they would teach you, “oh just... It doesn't matter what your variable name is.” If you wanna do open science, I'd strongly disagree with that. Like every variable name should mean something to someone, so rather than “this is X, Y and Z,” it should be, this is number of population, this should be population growth, or whatever, whatever the context that you're looking at is. And your variables should be named, and all your analysis should spell itself out without the need for comments.

If we consider coding a form of composing, as many scholars of digital writing and rhetoric do (Brock & Mehlenbacher, 2018; DeVoss, Cushman, & Grabill, 2005; Eyman & Ball, 2014), then for Chris, he was taught the tools of composing but without the specific features to make them rhetorically successful. Consider this akin to learning the features of a genre such as the scientific poster but without being taught to label your figures clearly; the results are similar. Without specific variable names, his code is difficult for others to interpret and his code becomes more
occluded than open. This is an instance where curriculum failed to teach the practices of openness alongside open tools.

Studies of writing and the workplace have found that school-based instruction can be effective for content knowledge and disciplinary knowledge (Dias et al., 1999). From these examples, school-based instruction is effective for cultivating disciplinarity. Students may be introduced to open tools and practices and begin to see themselves as open scholars. But school-based instruction can be ineffective for learning if it only teaches the tools of openness without the embedded practices that make those tools function within an open disciplinary community. We can think of this as what Dannels (2009) terms relational genre knowledge, or knowledge of “the system of relationships that they [genres] create and in which they interact with the various players involved” (p. 417). In other words, newcomers must be aware of the systems in which their genres operate, and this knowledge can lead to the success or failure of genres. To achieve this, open tools and principles are best taught alongside open practices. Further, open practices work best when cultivated through mentorship, either by educators or peers.

**Discipline-specific Mentorship and Peer Learning**

Deriving from school-based instruction are opportunities for discipline-specific mentorship, particularly through the help of a teacher or advanced peer. Mentorship is used within studies of apprenticeship to describe the process through which novices learn by practicing activities specific to a community (Lave & Wenger, 1991; etc). In this framework, mentors are experts, or oldtimers, who have also been through the apprenticeship process and can guide the novice allowing them limited forms of participation (Lave & Wenger, 1991), providing conceptual models (Collins et al., 1988), and scaffolding activities so that the novice
graduates to full participation. Within graduate education, advisors and PIs assume the role of mentors who guide students in their disciplinary development (Paré et al., 2011).

For open scholarship, the availability of mentors is limited due to the relative newness of the field. Despite this, my study indicated that there are disciplinary mentors for doctoral students who can guide open work depending on the field of study. In James’ case, he describes coming to his university to work with one of his mentors for precisely this reason:

**James**: Brian⁶ is the reason why I came to state in the first place, because he's a medievalist, because he's a digital humanist. Although he really pushes back against being called a digital humanist. He does this work and so I really wanted to kind of learn this through his eyes and through his expertise.

Although James’ mentor does not define himself as a digital humanist, the work that he does aligns with digital humanism and encourages James’ open orientation toward medieval studies. Brian works on projects with James and guides his disciplinary development. James sought out this relationship to “learn this through his [Brian’s] eyes.” We can think of this as a sort of internalization process—James is seeking to internalize the way in which Brian does scholarship.

Brian advised James on an independent study where James transcribed a 13th century handwritten manuscript for display on a website. His transcription is written in XML and includes TEI, a markup language that allows him to show variations in the translation. When James describes the process for transcribing it follows a similar pattern to other studies of doctoral mentoring. James worked on the project individually struggling to both to translate the text and also decide which choices to include and which choices were unnecessary. Too many choices encoded into the transcription, and the manuscript becomes unhelpful for the reader

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⁶ Brian is a pseudonym for James’ professor.
accessing the online version. Too few and the reader loses the rhetorical nuance of the manuscript. As part of this process, Brian helped answer questions and provided feedback to James. James recounts this experience:

James: It was really cool because he taught me both what to look for in the manuscript, where abbreviations were, what I'm missing. I would be at home at 1:00 in the morning and I would take a picture of my screen and text it to him and he wouldn't reflect that he was annoyed but he would answer me, in the morning saying, "text me during daylight hours" and then he would say, "Okay, this is what this is trying to say" and talk me through the abbreviations. And on the other hand, he would say exactly what I should be thinking about with the code, how to reflect some of these choices.

The passage illustrates the mentoring relationship between James and Brian, wherein Brian not only answers James’ questions but also guides James on what he, “should be thinking” about transcribing the manuscript. This illustrates a ZPD reflecting a process of disciplinary development for James. By disciplinary, I mean James’ identification as a digital humanities scholar, which includes his open work. Writing studies scholars have described this as the “rhetorical subject formation” (Paré et al., 2011, p. 232), in which doctoral students learn how to be a scholar in their field. Importantly this is a process that works “ecosocially” (Green, 2005) where subjectivity, or identification with the discipline, is produced through the activity system of doctoral training. James is not yet at the level of expertise where he can make all of the decisions about a transcription without help from a colleague. And so, learning how to make these choices is part of learning to be and identify as a digital humanities scholar.
This learning occurs through discourse and, in James’ case, through grappling with the manuscript and then turning to Brian. When I ask James about the most difficult part of the project, he responds:

James: Learning how to look at a manuscript and then translate it into a different language. That was a big challenge. And also thinking about the, not just the expert, but also just the lay audience who might be interested in this manuscript. How do I... Are there things that I'm overlooking just because I take them for granted and should I be looking at some things over others? And that's where Brian came in and he would say, “Yes, that's a worthy consideration,” or, "Don't waste your time with that."

As an open scholar, James’ considerations extend not only to his disciplinary community, but also to a wider audience of potentially interested stakeholders. Since his work is public, anyone could look at his transcription, and therefore, he must consider if his translation choices are rely too much on his disciplinary, insider knowledge. This differs from the typical concerns of disciplinary development in which the doctoral writer must overcome the “paradox” of writing in their discipline (Starke-Meyerring, 2011). Here, James must also know how to write outside his discipline for a public audience. James’ main challenge for this piece is learning what is relevant to his community, whether that be disciplinary peers or the public.

Importantly, mentorship consisted not only of student-teacher relationships but also extended to peer relationships, where peers who were more encultured in open practice advised colleagues about how to incorporate openness into their work. Peer learning was a source of support for those who were more advanced in their careers. These peer relationships allowed for scholars to learn from others within their discipline who were practicing openness successfully. Maria describes this when I asked her how she first heard about openness:
Maria: I started to hear about it on Twitter, and I started to hear about it from colleagues, and I got interested in it… and I started to talk to people. I remember talking to [a peer], who's super famous, open person, and just picking her brain. Like, "Why should we do it this way?"

Through Twitter, Maria networked with colleagues to learn about openness. Twitter allows Maria to reach colleagues outside of her department, which was less receptive of open practices, and form connections with open educators. As these discussions with her community of practice continued, Maria began to identify as an open educator. She describes this as a process of self-realization that was brought about by her interactions with this peer:

Maria: And it was [this peer] who pointed out to me that I had already generated open materials because, at that point, I already had lab videos that were posted on YouTube. And they were always open.

By discussing open education with her peer community, Maria saw the value of openness for teaching materials and identified herself as an open educator. Maria’s case illustrates the importance of peer interactions for encouraging open practices and identities, especially for academics who are no longer newcomers to their field.

Carlos also provided several examples of peer learning in my discussions with him. When I ask Carlos if he thinks someone can be an open science expert, he names a colleague, rather than listing qualifications of an open science expert:

Carlos: [A peer] from [a major national lab], he's a good friend of mine, and he's a bioinformatics person, and a really great educator and he does a fantastic job just making resources available to other people. And I think he embodies an openness expert because even though some things may not be truly open, he makes them available. And these can
be resources from websites to computer programs. He really pushes for reusability of resources, both for research as well as for classrooms.

When I later asked Carlos how he learned open practices, he again brings up his peer:

Carlos: [This peer] came here, one year ago last spring, and we got him to do a two-day, three-day workshop and I hope we can do that again.

Carlos does not describe a hierarchical relationship with his peer, rather his peer “embodies an openness expert” and as such can provide Carlos with support, motivation, and inspiration to make his materials more open to students and other educators.

For Carlos and Maria, peers were a source of inspiration to pursue open work, but peers can also help solve problems within open work. When Chris ran into issues with his GitHub repository, he sought out peers to provide feedback and answers to the problem:

Chris: If it was specific to the R package, contact the project owner of that project because that's probably the biggest thing we rely on for this, is that particular package in R. If it's R specific, I'd refer to something that [a well-known package developer] did, 'cause he'll probably have put something out about it. I tend to follow him on Twitter and he puts out when things are available, new updates to his book, new updates to manuals, etcetera.

Laura: Are there any forums you would use?

Chris: Stack Overflow is probably the predominant one for this particular use case. There are some R forums, but they're usually not as helpful as Stack Overflow. Probably Stack Overflow would be the number one source I would turn to, or just an email with [this package developer] something.

Laura: He's that accessible that you can just email?
Chris: Sometimes. It's variable, but he's generally responsive.

The mentorship that Chris receives is distributed in both space and sources. The complexity of Chris’ open project requires him to draw from experts in specific packages and codes using email, documentation, Twitter, and forums. It is also important to note that the person he would turn to for a question about R is someone who has created several highly used packages within R. This perhaps reflects the accessibility of openness as a community of practice. Mentors are available for some fields and, because there may be fewer of them, they are highly visible.

Through this section, we see that oldtimers are not necessarily the backbone for developing open practices for newcomers, mainly because there are few oldtimers for a relatively new practice that is brought about through digital media. In place of oldtimers, we have mentors who are visible in places such as graduate programs, forums, Twitter, and ongoing friendships. These mentors may have a hierarchical student-teacher relationship with newcomers to the field, where they shape how a new scholar makes open choices. Here, they help newcomers in a ZPD of disciplinary development as the newcomer gains experience making choices that reflect the disciplinary and open practices. For those who are more advanced in their discipline, mentors can be peers who discuss and train others in open practices. These peers engage in discussion with scholars who are considering openness. They share their materials, answer questions, and fly in to conduct workshops. Whether the mentor is an advisor or a peer, mentors are crucial for developing open identities for other scholars. Beyond identity building, as I have discussed in this section, mentors provide conceptual models for those considering open practices. And these conceptual models enact learning experiences that enable scholars to take on new and challenging tasks.
Conceptual Models for Learning

Mentors are crucial for providing conceptual models for novices to learn from. A conceptual model “serves as an internal model of expert performance, and thus as a basis for development of self-monitoring and -correction skills” (Collins, Brown, & Newman, 1988, p. 4). The conceptual model is part of the internalization process. It provides a blueprint for success within an activity, because the learner can use it as a marker to determine whether or not they have created externalizations on par with the model. Lave and Wenger (1991) use Cain’s (1991) ethnography of Alcoholics Anonymous to demonstrate how models are used within a community of practice. Within A.A. stories are:

…not something one learns through explicit teaching. Newcomers are not told how to tell their stories, yet most people who remain in A. A. learn to do this. There are several ways in which an A. A. member learns to tell an appropriate story. First, he must be exposed to A. A. models… The newcomer to A. A. hears and reads personal stories from the time of early contact with the program – through meetings, literature, and talk with individual old-timers. (pp. 82-83)

Models are socially enacted. As the excerpt shows, they emerge through interacting with other participants and artifacts within the activity system. Conceptual models are built through exposure to artifacts, these artifacts can either be physical or discursive. For example, a chair might be a model for an apprentice woodworker, while a line of code could be a model for a computer science student. Essentially, models are externalizations made by others in the community; the community agrees what constitutes a good model; and learners internalize these models to form a conceptual model. Once the novice reaches expert status, they are expected to successfully produce work on par with the conceptual model. For professional workers, genres
are often the conceptual models that represent when a novice has graduated to fuller forms of participation. Artemeva (2008) describes this process for a novice engineer who, “had multiple opportunities to both internalize concepts, principles, and genres of engineering and externalize them in his master’s thesis and in the workplace” (p. 175). Experience with genres provides newcomers exposure to the formal features and social actions within their field that can then be replicated and externalized as they gain mastery of those genres.

For open scholarship, models may be available within some disciplines, such as computer science, but they require adjusting to fit with the complexity of some scholar’s work. Building a GitHub repository using R or C++ is fairly common for scholars producing software models. The repository can be thought of as a kind of genre ecology (Spinuzzi & Zachry, 2000) containing code, R packages, and instructions. Producing a repository is then a complex process of organizing and choosing what to include and what to leave out. Even though many examples and tutorials exist for coding in R and structuring a GitHub repository, Chris finds this work challenging because while models exist, they do not reflect the complexity of his project. When I ask him about his learning process for building the GitHub repository, he responds:

**Chris:** That was more of a learning-as-we-went kind of thing. And looking at some of the tutorials that people had. But in some cases, ours wasn't as straightforward as the examples. And one thing you'll learn is everyone puts out a straightforward example...

Because it's easy to explain a straightforward example. But then when you go to do it, it's a lot harder. Just because of all the little nuances behind the scenes.

The “straightforward example” can be a helpful learning model for developing open software, but unlike models with cognitive apprenticeship, Chris is not using the model under the tutelage
of the expert who created it. Instead, he must use the models provided along with mentorship in order to build a GitHub repository.

While some scholars, such as Chris, can access conceptual models and mentors who will guide him in his scholarship, others are branching into new territory for their discipline. For these scholars, they may seek out models outside their disciplines and adapt them using rhetorical knowledge of their specific context to form a conceptual model for their work. This was the case for Maria, a teaching-track professor in the sciences. As discussed in the previous chapter, Maria incorporated YouTube into her classroom as a way of creating videos for her students made by her students. YouTube is a proprietary platform that is increasingly popular for technical instruction through video tutorials (Morain & Swarts, 2012). Because Maria’s videos were available on the platform, they were viewed globally by others who wanted to learn how to perform the experiments and use the equipment featured within the tutorials.

The videos that Maria’s students create are instructions for completing chemistry tasks and using chemistry equipment. For example, the video that Maria shows me during our interview is an instructional video for performing an infrared spectrometry. Notably, the videos are not targeted at an expert audience, rather these are tutorial videos meant to instruct entry-level undergraduates in introductory organic chemistry classrooms. To create videos that were open to her students and others, Maria used models outside of chemistry as a basis for creating her own videos. Specifically, she and her students watched YouTube tutorials:

Maria: I have watched more YouTube videos than anybody in the literal universe, I'm pretty sure. I've watched YouTube videos about how to change a tire, only because when we came up with the idea for this, we wanted to make it so that our videos were not gendered, right? Like we didn't wanna approach it as a... 'cause science sometimes comes
across as very masculine. But we didn't want the channel to be masculine or feminine, we just wanted it to be balanced. So we watch crochet videos, we watch a lot of make-up tutorials. Make up tutorials are great 'cause they're sequential and there's a purpose, there's a finished product, we watch a lot of those... And then we also watch really manly pursuits like how to change a tire, how to change all kinds of car parts that I don't even remember what they're called, your alternator. How to do all kinds of manly things that I didn't know how to do, I learned a lot. Just to get to that tone where it's not a woman telling you what to do, it is not a man telling you what to do. It's just this person, this genderless, faceless person just telling you, "This is how you do it."

The YouTube videos Maria watched allowed her to understand aspects she wanted to incorporate into her own videos. Make up tutorials were useful because, “they’re sequential and there’s a purpose.” The videos are also enjoyable to Maria even when she is not using them as a model:

Maria: There's this girl that has a channel where she tries on clothes. I love watching her videos when I don't have anything better to do, but there's no take-home. It's just silly.

Here, she exhibits digital multitasking (Leon & Pigg, 2011), where YouTube is a resource for both learning and entertainment for Maria. Even with videos where, “there’s no take-home,” Maria learns what not to do for technical instruction, specifically in regards to gendering the material. As a woman within the discipline, Maria told me, “Science sometimes comes across as very masculine.” With this rhetorical knowledge, she and her team of students explicitly studied how tutorial videos signaled gender to their viewers and used filming techniques to avoid gendering the scientific tutorials. For example, her tutorials do not feature the faces of the students. In fact, many of them only show gloved hands performing the experiments with a voiceover that alternates each line between a female and male narrator.
Maria’s understanding of how to make a YouTube tutorial, and specifically how to make one that does alienate women or men, comes from learning the norms of tutorials on YouTube through models. However, the conceptual models she has constructed differs from the models provided. Unlike beauty tutorials where the guru’s personality provides interactivity with the audience (Ledbetter, 2018), the chemistry tutorials aim to erase personal differences, specifically gender differences so that the scientific information is not seen as overtly masculine or feminine. Instead, Maria’s conceptual knowledge is formed based on her content knowledge of chemistry, rhetorical knowledge of the needs of her audience, and genre knowledge of the models of YouTube videos. Maria’s experience reveals how models can be found and adapted to fit the specific needs of one’s discipline through digital media. Genre remix (Fagerjord, 2009) is the splicing together of, “parts from different media and different technology” (p. 191). It allows for scholars to draw from different sources to meet the needs of a specific social action. In Maria’s case, aspects of YouTube tutorials, such as makeup videos and car repair, were used to create chemistry tutorials that were accessible to and findable by a digital audience.

In both Maria’s and Chris’ case, models help them structure how they create their open work, but because of the complexity and uniqueness of their projects, models are not exact replicas of what their project will become. In other words, they are working within new disciplinary terrain, and as Chris reflected, “learning-as-we-go.” Open scholars are drawing from diverse models to create conceptual models for their work. These models are combined with their rhetorical and content knowledge to produce conceptual models for their work. Their own work is then a creative externalization of the models that they have internalized. Success, however, is not measured by comparing conceptual models with their own externalizations (Collins et al., 1988). Rather, success depends on if their externalizations are viewed, accessed,
and reused by their own communities. And further, success depends on whether their
externalizations can serve as a model to others for learning. In the next section, I will discuss
how my participants creatively externalize their work in order to create new models for others
and, in doing so, construct their communities of practice.

Externalizing Open Practices

Externalization involves engaging in the practices of your community to produce work
relevant to that community. For academic work, this typically involves producing the genres of
your discipline, namely publishing scholarship within journals that are accessible to other
academics within your field. For open scholarship and teaching, the process of externalization
extends beyond the immediate community of practice to the public at large. This is because
openness values accessibility and often relies on the common refrain that “publicly funded work
should be publicly available.” Through externalization, open scholars construct their own
communities of practice. These communities are constructed through the models that scholars
provide through their creative externalizations and methods of instruction. Externalizations can
serve as models for others who may want to join in open activities. Further, instruction occurs
through learning situations in which the instructor of open practices acts as a curator rather than a
pedagogue. Through creative externalizations, open scholars adapt existing models to produce
models relevant to their community. This is a cyclical process of internalization and
externalization where diverse sources lead to community-building learners of open practices.

Open principles largely value accessibility, and part of accessibility involves putting your
scholarship out in the open. Open scholarship is generally publicly available to receive feedback
from others, even if they are not the direct audience of research or teaching. Chris advises me
this regarding my own project:
Chris: It's hard, but it's helpful. It's that fast feedback that you can have in an open science world that you can't have in a close science world, I find really valuable. So my only suggestion would be, [putting your work out in the open] as soon as possible.

This open orientation toward teaching and scholarship encourages participants externalize their work quickly for a public audience. This audience extends outside of the typical confines of the community of practice because openness values accessibility and transparency. These public externalizations not only allow scholars to receive feedback quickly, as Chris suggests, but also provides exemplars to others. Other learners can adapt materials to form their own conceptual models that are relevant to their disciplines. With my participants, I found that the models they provided were related more to education rather than research. What they saw as models for others were pieces of their scholarship or teaching that could be borrowed for teaching students generally or adopted for pedagogical instruction in teaching students openness specifically.

Carlos and James both provide examples of this in my interviews with them, where their models serve to advance their respective disciplines toward open practices.

Carlos deposits materials from his teaching on QUBES, a platform for sharing educational resources. QUBES is a community where Carlos can learn from others but also others may learn from him. As he explains it:

Carlos: I'm part of a community called QUBES, where's the bumper sticker?

Quantitative Undergraduate Biology Education, basically. And it's a web... Much more than the website, but it looks like a website. On the backend it is powered by Purdue and some massive computer systems on one hub, which allows you to do groups and group work and now the new thing is, it's a pre-print portal for educational resources.
Carlos describes using QUBES in relation to an NSF-funded study, where he puts teaching materials on QUBES to encourage this practice for others on the grant with him:

**Carlos**: And I'm trying to lead by example, publishing mine as an OER with version control so that they see the progress, which has been slow, but they see the progress.

**Laura**: Do you put it in, GitHub and then link it there or is it just within QUBES?

**Carlos**: It's within QUBES, but QUBES creates the UIs now. And QUBES reaches about 8000 educators. So that has been better.

Notably, when I ask about GitHub in this excerpt, Carlos affirms that he only uses QUBES, not because there is any functional reason why GitHub would not work for hosting these materials, but because QUBES reaches his designated audience of “8000 educators.” Publishing within QUBES aligns with Carlos existing activity and meets the needs of his community. Additionally, he can model to others how this open practice would fit in with their activity too. Here, Carlos is actually providing two models. One model is Carlos’ open educational resources that are posted on QUBES for educators to adapt to their own classrooms. Other teachers can use the material he provides to teach their students. The second model is for posting on QUBES. The act of posting is a model for how others in Carlos’ immediate network can incorporate openness into their teaching practice. Version control also allows for others in his activity system to see how he has developed his teaching materials over time. They can learn how to develop similar genres of teaching through observing the steps that Carlos took to construct his teaching assignments. In this way, Carlos is modeling the activity of open practice to others, and in doing so, opening once occluded procedures and nudging his community toward adopt more open practices.

James had a similar perspective of posting his manuscript transcription online. Although James, as a doctoral student, is more of a novice in his disciplinary studies, he views sharing his
open work through a pedagogical lens. When I ask about his goals for the transcription, he responds:

**James:** Two things I wanted with this was, one, that could it be something that could be attached to the manuscript at the library that they could use for referencing in the folio, and two, that I can use this in my own classes as an example of manuscript studies. So, it's a teaching tool, it's a pedagogical tool primarily, but it's just two different ways of using it, I suppose.

As a pedagogical tool, James’ transcription can serve as a conceptual model for students about how to incorporate openness into their practices. It can also serve as a model to colleagues as a part of the library. Notably, James does not use the term “open” when he discusses it as an example. Instead, he refers to it as an example of “manuscript studies.” Essentially, James is using his model as an example of manuscript studies. In doing so, open becomes part of the work of the discipline.

A unique aspect of my study is that while many participants are seeking to learn how to be more open in their work, they are no longer novices to their professions. While two of my participants were advanced graduate students, the rest were teaching or research professors who were already enculturated into their discipline. Both advanced and early-stage researchers and teachers were shaping how openness takes place within their discipline and constructing the practices for their communities. While graduate students discussed their processes for being mentored, more advanced researchers and teachers highlighted the mentoring experiences they provided for students. This is noticeable in my discussions with Maria, Carlos, and Chris, especially. For these participants, they provided learning experiences for others through directly
mentoring others, creating open learning situations for students, and creating publicly available models for open work.

As teaching faculty, both Maria and Carlos fostered open learning situations for their students, where they could participate in creating materials that would be shared publicly. These learning situations allow students to create materials that will be used by others. I use the term “learning situations” to borrow from Lave and Wenger’s (1991) “learning curriculum,” which involves, “situated opportunities…for the improvisional development of new practice” (p. 97). Learning curriculum contrasts with teaching curriculum, which is much more ordered and mediated by the instructor role. Learning curriculum allows novices to discover knowledge through practice. Within a learning curriculum, the instructor provides situations that the student must act within. These are real situations, rather than constructed, where students must participate in a professional activity. Carlos discussed several learning situations he created for students to work openly. Importantly, these learning situations involved research that related to his own research interests. In other words, he aligned his pedagogical and research goals so that students could help him discover properties of a microbe and share that information with others.

Carlos: And for my science undergraduate researchers, I'm stuck on this microbe, the delftia, and I said to students, "Okay, if you want to sign up for the undergrad research in addition to doing the wet labs can you describe, in a page or two with references, what you're doing and we'll make chapters in our delftia book. So we created the little delftia book. That's in Pressbooks. And it currently has four chapters.

The book is an open access book that gives students experience writing within the discipline, but also writing for a public audience. With students as the creators of the materials, the educator’s role becomes that of a curator. Carlos succinctly describes his part as, “My job is just to facilitate
then curate.” As a curator, the teacher is not providing didactic instructions to the students; instead, the instructor is correcting mistakes, ensuring quality outcomes, and providing feedback for the open learning experience.

Curation allows open scholars to cultivate learning situations. Curation is evident in the process Maria uses to create video tutorials for her course. Her students script, film, and narrate the videos with help from instructional documents. Previous students created most of the materials in these instructional documents. As such, students are structuring the videos through knowledge passed down by peers who took the course. Maria’s role is not to create the videos or even necessarily to tell the students how to create the videos, but instead to foster the activity in which the videos can be created. She oversees the process so that tutorials are acceptable for use. This is a time-consuming process but ensures the quality of the videos shared and also ensures that future students can learn from the materials. Maria describes herself as the “weeder”:

**Maria:** And there's a ton of effort that goes into making sure that the stuff that does become part of the record is good. So there's a lot of weeding that needs to happen. This semester I have 230 students, I will be very lucky if I end up with 10 really good usable things: videos, experiences, tutorials, whatever. That's a very small percentage. So the amount of weeding that needs to happen is enormous. And I'm the weeder.

Here, Maria is externalizing her experience with tutorial videos. She no longer needs to watch various videos to internalize the appropriate tone or decide how to approach the task. She knows enough about the process her choice in what becomes “part of the record” what is and what is not successful for a YouTube video tutorial. These are models to her future students and perhaps others in her disciplinary community.
In comparison to these direct curriculum-based externalizations, Chris’ work reaches out to collaborators, contributors, and stakeholders who are invested in his research. Chris’ research team has created a modelling software to map the potential spread of plant pathogens given certain data inputs. His model is used by land managers and government agencies to decide the best course of action when faced with an invasive plant pathogen. His GitHub repository is a direct externalization of his project. It is both the basis for the modelling software he provides to clients and the instruction manual for collaborators who want to assist with the project. The project is successful to Chris if it works. He elaborates on this:

Chris: I guess the less questions per person using it I get means that I've done a better job explaining it as time progresses, is one way to look at it. The other way is just the pure volume of people that are doing work with it, increasing over time, is what I would be looking for. I guess you could think of that as like adoption.

Unlike Maria and Carlos, Chris is not using the repository as a teaching tool or as a model for others. Instead, its value as an externalization is whether it correctly models plant pathogen spread and whether it can be used by others. For researchers like Chris, externalizing open work is about advancing knowledge with your community of practice. Stakeholders can make decisions with Chris’ tool, collaborators can contribute to the code, and colleagues can use the repository as a model in their own work.

Through these kinds of modelling practices we can see the internalization and externalization processes that Vygotsky (1978), and later Engeström, discuss. Conceptual models, largely internalized through genres, provide newcomers with knowledge about the situations, systems, and culture of their activity. For open scholars, these conceptual models are adapted through rhetorical finessing and remixing to meet the demands of their novel
disciplinary projects. Rather than the protracted process of internalization and externalization, open scholars quickly externalize their work to their disciplinary communities for feedback, reuse, adoption, and teaching. It may be helpful then to think of this process as a more iterative, agile form of internalizing and externalizing, where scholars quickly access, borrow, and repurpose. Consequently, scholars such as Carlos and James are externalizing their knowledge of their disciplinary communities and, through openness, advancing these disciplines into new terrains. This sort of externalization functions as different to the one that Vygotsky and Engeström suggest, where oldtimers are the status quo that determine the shape of the field. Instead, open practices can be shaped by relative newcomers to the discipline, like James who can use his manuscript as a model for coding manuscripts in TEI. Since there is a no standard already established, his work can immediately become the model for others.

**Conclusion**

The spiraling between internalization and externalization that academics face is not unique to open science. As Prior (1998) describes in his study of disciplinarity:

Learning is not a one-way flow from external to internal, nor is action a one-way flow from internal to external. Activity is always an interpenetrated confluence of internal and external. Internalized practices are constantly being externalized, to be distributed among people, embedded in fleeting or durable artifacts, and (re)internalized (p. 29)

This was clear in many of my interactions with participants. They were all creating externalizations for their disciplinary communities, while also participating in learning experiences, such as the Open Incubator. What is unique to my study is that many of my participants were internalizing and externalizing without the guidance of old-timers. For many,
they were drawing from sources outside of their disciplines to construct an open community of practice.

This study reveals the importance of mentors and socialization for adopting a relatively new practice, like openness. Although some of my participants did not have old-timers to rely on, they did draw on others as mentors to help guide their practices. This occurred outside of the disciplinary space of courses or instruction. For example, while James was able to learn about openness within his introduction to digital humanities course, it wasn’t until his independent study under the direction of Tim where he began making choices that cultivated his disciplinarity and positioned him as an open scholar. While tool-use can expand newcomers’ knowledge of openness, as seen in Chapter 4, it is engagement in activity and practice that cement openness as a potential scholarly identity. The enculturation of practice cannot happen through workshops, one-shot instruction, or interdisciplinary training sessions. This sort of enculturation should be grounded in disciplinary-specific situations and with disciplinary colleagues or mentors. Instead, generalized training is useful questioning practices, learning transferable skills, and using open tools.

While mentors should be within the discipline, models can come from anywhere and be remixed and reused by learners to apply to new situations. While the traditional models of internalization and externalization draws models from within the community of practice, I found that participants were using artifacts from diverse sources to construct their own conceptual models. Maria viewed makeup and car repair videos to learn about the format of video tutorials. In this vein, social media may be repurposed by academics to enable open scholarship and educational materials, such as Maria’s YouTube tutorials. Chris used other GitHub repositories as a model for how to set up his own. These artifacts were inspiration for new conceptual models
of open practices. These relied on my participants having knowledge not only of the artifacts they borrowed from, but also of the unique rhetorical context of their activity. Essentially, rhetorical knowledge of their discipline plus an existing artifact led to open externalizations applicable to their discipline.

Further, to be open and to be an open scholar means creating work that is public. To cultivate an open community then, requires participating in this openness and sharing work with your community. Externalizing your work through sharing is a way to shape the community of open scholars and help grow this community. This chapter reveals the importance of externalizations to new communities of open practice. I found that my participants believed in the value of their externalizations to progress their disciplinary communities. This progress occurs in several ways. One, these externalizations were pedagogical and could be models to others to develop their open practice. Two, participants felt that by making their work open they were adding to the knowledge of their disciplinary community. Three, externalizations themselves are a way of learning. They allow the learner to practice in the activity of the community. This aligns with the findings of many works in writing studies, which contend that practice in writing genres is the best way of cultivating genre knowledge (Artemeva, 2009; Artemeva & Fox, 2010; Dias et al., 1999; Freedman, 1994).

In sum, learning to be open is an activity like any other. It involves observing, reflecting, and creating through a process of internalization and externalization that exists in relation to an activity system, but without a stabilized status quo enforced by oldtimers in the community. This chapter posits that learning open practices involves cultivating disciplinarity and learning through participation in open activities. These open activities are loosely defined. In Maria’s case, viewing a YouTube video inspired her undergraduate chemistry tutorial and eventually led
her to create VR lessons. For James, openness was encultured through disciplinary participation in digital humanities courses and experiences with digital humanities faculty. Wherever scholars find inspiration for pursuing openness, they must locate like-minded individuals who support their open work. Individuals in the discipline, who embrace and cultivate open practices, provide peer support and learning to others. These are the emerging communities of practice that will sustain openness beyond institutional affiliations or departmental requirements. With this disciplinary reinforcement, academics can then draw from diverse sources, pursue complex projects, and attempt new genres, which then enrich their disciplinary communities through the externalizations they create.
CHAPTER 6: Conclusion

Openness is an activity that is enacted in scholarly communities through activity systems. These systems have objects, artifacts, communities, divisions of labor, and rules, which together enable academics to produce open scholarship. Understanding openness as an activity untangles its complexity and may lead to an appreciation for how openness operates differently for different disciplines and communities. Although there are similarities between systems, there are variations in how these systems achieve openness. These reflect the broadness of open practices. Openness for computer science may align itself with commercial interests through software and product development, where open source tools allow for quick adoption and reuse. Openness for biological sciences may involve citizen science and open educational resources that encourage public participation and greater access. The rhetorical flexibility for these different practices of openness rests with the objects for these systems, as objects are the “linchpins” (Spinuzzi, 2011) of activity systems.

Within my study, openness was not the sole object for any one activity system. Instead, my participants illustrated negotiated, compound objects, such as an “Open Incubator,” “open pedagogy,” or “open source software development.” Affixing open to existing practices led to contradictions for several of my participants, specifically contradictions between ongoing practices of the academy and new principles of openness. The Open Incubator, for example, was a negotiated object between the demands of the modern entrepreneurial university and the values of library studies. “Open” implied that the workshop was about instilling open values, making scholarship more public and accessible. Meanwhile, incubators are commonly associated with innovation and product development. I chose optimism as my orientation towards openness throughout this study and consequently, viewed the negotiated object of the Open Incubator as
an opportunity to develop a third space for discourse between competing values and objects. A third space exists between formal and informal spaces of learning and between different activity systems. Facilitating this hybrid space requires someone who can navigate both formal and informal learning spaces: a boundary spanner. Within the third space, subjects can question their practices as they are exposed to other activity systems where practices are different. The boundary spanner guides this questioning and diverts it toward productive exchanges. As such, the third space is a zone for envisioning and transforming a person’s current activity system. While a workshop like the Open Incubator is not adequate for discipline-specific learning, it is effective for introducing participants to alternative worldviews through which they can question their current activities.

Within participants’ activity systems, I viewed the contradictions between academic expectations and open values as opportunities for expansive learning and cultural change. As scholars engage with other activity systems, they embrace aspects of these systems. My participants generally reported adopting open tools within the teaching and research practices. Yet once my participants moved beyond open tools to open principles and practices more generally, they perceived tensions between the norms of openness and the norms of academia. Academia often enforces competition through rewarding individual findings and accomplishments to the exclusion of openness and collaboration. Rather than viewing the contradictions between openness and traditional academia as an impasse, these contradictions are an opportunity for scholars to rethink and reshape their research and teaching practices and for others within academia to consider ways of rewarding openness. For both Maria and Carlos, the open educational resources (OER) they have developed may have some effect on their assessments within their departments, but ultimately, the teaching awards and grants they have
received because of their OER are more significant markers of their success. Departments, administrators, and campus organizations may consider new ways of rewarding open work to create an alternative to the competitive environment of academia.

Despite my positive view of contradictions, the susceptibility of openness to corporatization is a lurking potential. Within my study, I found some evidence that openness was tied to platform capitalism, aligning with Mirowski’s (2018) criticisms of open science futures. Umesh related to me how TensorFlow, a platform by Google, had cornered the market for deep learning software by becoming open source in 2014 and had motivated Facebook to follow suit with its own PyTorch. By opening up their algorithm, a move that could be considered quite risky, Google solidified its place as a leader in machine learning. While not touched on in my study, academics working with software should be aware of who develops the software they use. Each tool comes with its own tool-producing system, and as such, academics should be cognizant of these before adding them to their own systems of practice. Further, openness is susceptible to abuse both large scale, such as by software monopolies, and small scale, such as by whoever pays for the labor involved with open practices. This was a topic of discussion in my conversations with Maria, who has very legitimate concerns about the sustainability of openness when it requires extra work that is often unpaid.

This brings up a related point, which is that openness entails vulnerability. Graduate students, adjuncts, postdoctoral researchers, and early-career faculty are especially vulnerable in pursuing openness. If an academic’s research is “scooped,” potential ramifications include setbacks in graduating, publishing, acquiring grant funding, finding a job, or receiving tenure. It should also be noted that the conditions that give rise to scooping entail closed-publication models, where only those who are first to publish receive credit for new findings. In other words,
closed models of scholarship are also precarious for academics. Traditional academic practices involve genres, such as journal articles and grants, that obfuscate who did what work. During the incubator, it was brought up that postdoctoral researchers are not allowed to be principal investigators on NSF grants. Other documents that clarify who did what work, like applications for human subjects research, are occluded (Swales, 1996) and do not receive significant attention. Essentially, while some might be concerned about the risks that openness brings, we should also recognize the risks that already permeate current academic systems of teaching and scholarship.

If we want to avoid a nihilistic future for openness and move beyond traditional academic systems, documentation is one key way forward. Documentation organizes openness. By this, I mean that documentation provides structure for open work and can allow or disallow certain practices of openness. My participants wrote or oversaw documentation that organized their open practices. For example, Maria’s YouTube tutorials are technical instructions for operating chemistry equipment. These video tutorials were further organized through instructions shared within a Google Drive folder, where students would contribute documents, such as how to include captions and how to do a storyboard. Similarly, Chris’ GitHub repository contains sets of instructions for how to contribute. These documents structure open work and look toward a future audience, who, because of openness, will add to it, use it, or adapt it. As such, openness involves creating documents that tell people how to use what you have created, wherever or whenever they may come across your work. Documentation, therefore, is a means of managing the risks involved with pursuing openness.

Based on the results of this dissertation, when looking to intercede through documentation, we should consider how this documentation functions within an activity system.
Often in genre studies of activity theory, text is a mediator between subjects and objects. However, within open activities, I have found that documentation saturates all components of these systems. It is apparent in the rules of open scholarship. Copyrights protect and allow the individual to define what they mean by open in a legal sense. Creative Commons has licenses that allow creators to choose how if at all their openly shared work can be used for commercial purposes. Further, guidelines and agenda-setting items can enable disciplines to embrace specific sets of open practices. As an example, Chris’ GitHub repository includes contributor documents because he wants to frame how collaborators interact with his project. His code of conduct follows the Contributor Covenant, a free/open source code of conduct that aims to welcome marginalized people and “be overt in our openness” (Ehmke, 2014). From an activity systems perspective, these would be the rules that govern open practice.

Not only does documentation mediate and rule, but it can be found in every other component of the system. For example, it produces subjects through participation in texts that build one’s identity as an open scholar. When James chose to work with open tools and data visualizations for his dissertation topic, he positioned himself as a digital humanist who does open work. Further, documentation metes out divisions of labor through documents that guide others in how to contribute to an open project. For openness, institutions and organizations have created taxonomies to acknowledge different roles in the research process. Casrai (Consortia Advancing Standards in Research Administration Information) has produced CRediT, a contributor roles taxonomy, to recognize the work involved in processes like validation and project administration. Contributor taxonomies encourage collaborative work because they reward labor outside of authorship. Finally, documentation builds communities. This can happen formally, but also informally. As an example, Tweets to colleagues about openness can build an
open community. This was seen in Chapter 5 when Maria explored openness more because one of her colleagues began Tweeting about it. Each of these components of the activity systems is a place for intervention and a place to improve the future of openness.

Against the dystopian futures of open science that Mirowski (2018) speculates, I provide a set of open futures for the different stakeholders I have identified throughout this study. These open futures are ones that may strengthen openness and point it towards a sustainability that does not involve increased corporatization or vulnerability for academics.

**Open Futures for Professional Writers and Technical Communicators**

Because of the importance of documentation, writers are central to the future of openness. As a new activity for many academics, the practices of openness are not yet codified. Disciplines and even institutions are writing guidelines for engaging in open practices. Yet, many of these guidelines are unclear on how to follow these rules and what the consequences are for failing to follow them. As Levin et al. (2016) indicate,

Policies have different terms and requirements for researchers…, institutions have different infrastructures for repositories and databases, and scholarly communities have different commitments and goals. This often means that researchers do not know how, and in what way, to practice Open Science (p. 129).

These sorts of agenda-setting documentation require communication expertise and analysis to determine if they are effective and operable. This is an expertise that professional and technical communicators can contribute towards openness. Technical communicators may intervene by helping define clear and precise terminology, developing usability studies that ensure policies are understandable to a broad audience of academics, and editing policies so that they adopt plain language. Using skills in content strategy, they can create content that is both comprehensive and
meaningful to audiences. For example, they may consider whether an agenda-setting document considers all facets of the topic, is accessible to those with disabilities, and is delivered in a format that is appropriate to the audience.

Open projects and scholarship, like the ones I have described in this study, would benefit from the skills that professional and technical writers possess. Like commercial software, open source software and technologies require manuals and instructions. Without corporate backing, this software will often lack the streamlined manuals that accompany commercial products. Writing professional can work with open projects to create the documentation necessary to guide the audience’s experience. Chris’ team already employs a science communicator, but beyond this, projects may employ professional writers who can test documents for precision, accessibility, and usability. This professional writer can also work with academics as they begin drafting documentation for collaborators and potential stakeholders.

Further, teachers of technical and professional writing have an opportunity to teach open practices of writing to influence the future of openness. This works best through practice-based instruction, where students can begin participating in open communities of practice relevant to their disciplines. Technical communication instructors may form a partnership with a software creator so that students can help create, edit, or evaluate instructional material. GitHub repositories provide a unique opportunity for content auditing. These content audits may provide a more authentic experience for students than auditing a commercial website, as some GitHub repositories may include content aimed at both collaborators and users. Outside software documentation, some open scholars are creating vast open projects that need documentation, particularly ones within open pedagogy. Here, classes could be co-taught with a professional writing instructor who could advise students in creating instructions for future students who will
take the course. As a more modest step, teachers of professional writing can introduce open software into the classroom, like Gephi or Figshare. Working with these tools, as I found in my study, can be a gateway to adapting more open practices and learning about open communities.

Open Futures for Libraries

Libraries are on the forefront of the open movement, and as my study demonstrates, they are well-positioned to help academics move towards openness. They can seek to provide “open interventions,” as Micah calls it, where the librarians may broker open alternatives or solutions that can be implemented into academic practices. As with the professional writing class, these interventions involve incorporating different open tools, such as adopting Zotero for reference management or using Hypothes.is to openly annotate as a class. These are small-scale tactics that draw scholars towards openness in a gradual but applicable way. In my study there are a few instances where this happened. For example, James began using open source tools more often after learning to use Gephi. Maria became involved in OER through adding her class tutorials to YouTube. These small-scale tactics can also lead to eventual culture changes as academics become comfortable with using these tools for their teaching and scholarship.

For expansive learning, librarians can engage in boundary spanning activities. These are ones in which they facilitate conversations between academics of different experiences and backgrounds, or even between academics and administrators or academics and students. Expansive learning challenges the status quo of a system, and the boundary spanner works between these different orientations to facilitate dialogue and listening. Librarians are well positioned to be disruptive to the status quo because they are inherently intermediary. They mediate between the mission of the university, the mission of the libraries, and the goals of students and faculties. Many librarians work alongside faculty in research projects, but they are
awarded through a different system of evaluation and assessment. As such, they can operate outside of the constraints that faculty may perceive for organizing boundary spanning activities.

In my study, the Open Incubator was one example of boundary spanning that negotiated between the corporatization of the university and the open values of the library, but other possibilities are available for this kind of boundary spanning work. These might include discussions such as how to put together a tenure package with open scholarship, how to mitigate risks when working with open data, or when to share your research as a graduate student. The point of these discussions is not to bring about immediate changes but instead to challenge the status quo, and in doing so, bring conversations of openness into the forefront. In this way, librarians can adopt what Kimball (2017) describes as tactical technical communication. Librarians can enact tactics through direct interventions and strategies to encourage cultural change through provoking conversations about openness and its role in academia.

**Open Futures for Academics**

For academics considering openness, this is an opportune time to open your research and teaching activities. Technologies are supporting open work; platforms are catering to open research; and universities are starting to require open forms of publishing and pedagogy. Based on this study, connecting with a community of practice should be the first priority for anyone pursuing open work. A community of practice can be local, such as a trusted peer or advisor who practices openness, or global, such as colleagues on Twitter who tweet about their work. Graduate students may research to see who is pursuing open work, as James did when choosing a doctoral program. Graduate students can even begin mentoring and creating these networks to shape their disciplines. As my research shows, mentoring and modeling should begin before a scholar feels that they are an expert in their field, because mentoring and modeling are part of the
learning process. Those active within an open community of practice can provide models of their open work through social media or academic platforms. These people may not appear to be part of a formal community at first glance, and because open is new, practices will still be developing for whichever community you choose. But, through peers and mentors, an open activity can begin to emerge.

Part of finding and building a community for an academic is also defining what openness means to them. What is the object of their open activity and what activity systems do they operate within? Do they want to publish in open access journals and participate in post-publication peer review? Do they want to contribute open educational resources to peer? Their vision of openness should align with the community of practice that they are creating or joining. From an activity theory standpoint, if the object aligns with activity system that an academic participate in, then they will experience fewer contradictions and double binds. While contradictions can lead to expansion and change, they also are difficult to navigate, especially for early career academics in precarious positions. For example, publishing data sets before results and findings derived from those data sets could be a risky move for a new scholar. Consulting mentors and taking stock of one’s positionality within activity systems (academic and otherwise) should guide how one approaches openness. And ultimately, this may reduce the potential risks of pursuing open scholarship or teaching.

Open Futures for Openness

After discussing the potential futures for writing scholars, librarians, and academics, I would like to close by considering the future for openness as a topic of research and teaching. Redundantly perhaps, I have titled this last section “Open Future for Openness” to indicate that there are many research trajectories for studying openness. The flexibility of openness as a
concept lends itself further rhetorical study as open proliferates to modify different existing practices, genres, and instruments. In this study, I have encountered open educational resources, open research, open source software, open data, and the Open Incubator, to name a few. I have only scratched the surface in how openness is being deployed in each case with different objects in mind. Further studies building on this dissertation can go more in-depth into ethnographic research, apply other aspects of activity theory, and explore nonhuman composition.

More in-depth ethnographic studies can follow individuals and their open practices to understand how these practices change over time. My study included multiple scholars who had participated in the Open Incubator. But, any one of these scholars could be the focus for a long-term ethnographic study. This kind of study could research their writing practices in relation to open work. For example, are they creating new genres to sustain their open work? Does openness eventually become untenable for some academics? What documentation is needed to support openness long term? As such, I would encourage scholars to engage further in small-scale studies that follow one participant or a small group of participants as they learn and practice openness.

Developing the use of activity theory in this dissertation, researchers could approach openness and open practices through fourth-generation activity theory (4GAT). While openness is prone to the problems of runaway objects, it could be possible to theorize openness through mycorrhizae activities. Rather than using activity systems, as seen in this dissertation, studies using 4GAT would construct networks of different activities that interact in complex formations. To study this, scholars could engage with open research groups over long periods of time to understand how these groups operate and expand their practices. 4GAT with its focus toward
networks and knotworking would reflect the complexity of this open work and look beyond individual systems to understand how open objects are coordinated.

Studying students in computer sciences and data sciences may offer interesting insights into learning about writing for openness and structuring open projects. Part of this work may be considering how scientists write for nonhuman audiences. Nonhuman audiences were mentioned both within incubator and in interviews with my participants. Essentially, making projects findable and accessible to others means composing for a nonhuman audience. For example, a computer must be able to “read” the infrastructure of the repository so that it can execute the code effectively. Scholars of writing may want to explore what this means for writing as a discipline when we are writing for non-human audiences. How does this change the rhetorical exigence of writing and what it means to write and compose? These are philosophical questions that our discipline must confront as writing (and assessing writing) becomes increasingly more automated.

I have only outlined a few potentialities that I can foresee from my study, but there are many other potential futures for openness. As the movement grows and changes, it may be that any study of writing or academia also involves openness, either overtly or subtley. At this point in scholarship, we can no longer avoid or ignore moves towards openness. Open forms of publishing, data, research, and teaching are entrenched enough that they will continue even if traditional academic systems persists. Rather than fighting against openness altogether, we can steer the direction for what open futures we would like to embrace. Will this be one of accessibility, equity, and diversity? Or will it be one for silozation, corporatization, and vulnerability? The future is murky for what academia will be, but open principles inscribed by documentation and practice are a means to light the way.
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APPENDIX A: Survey Questions

1. What is your name?
2. Why did you choose to attend the Open Incubator?
3. What motivates you to make your work more open?
4. What steps are you going to take toward openness in your project(s) after attending the incubator?
5. Is there anything else that would you like to say about the Open Incubator or openness in your work?
APPENDIX B: Interview Protocol

First Interview

General Questions.

1. How did you first hear about openness in relation to your work?
   a. How long have you been doing open science?
   b. Tell me about (your most significant/characteristic/representative) OS projects?
   c. Who introduced you to openness in your discipline/field/research/teaching?
2. Open science is vast. How is your work open?
   a. What does open mean to you?
   b. Why is openness important to your work?
   c. Do you participate in any of the following: open access, open data, open methodology, open source, open peer review, or open educational resources?
3. Do you think someone can be an open science or openness expert?
   a. What would that look like in your opinion?
   b. Would you consider yourself a novice or expert under that definition?
4. What tools and technologies have you had to learn in order to do open science in your work?
   a. What websites, platforms, or repositories have you had to use?
   b. How long did it take to learn how to use and navigate these?
   c. How did you learn to use them?
   d. How are they helpful for your work? How are they unhelpful?
5. What non-open tools, technologies, websites, or platforms have you had to adapt for openness in your work?
   a. How did you figure out how to adapt these? Did you turn to others for help or use trial and error?
   b. Why do you choose to use these non-open resources instead of open ones?
6. What types of documents have you had to learn how to write or adjust your writing for to do open science? This could be informal, small pieces of writing, like a to-do list for yourself, or larger documentation, like user guide.
   a. How did you learn to write them?
7. Have you participated in trainings outside the Open Incubator related to open science?
   b. Where did you find out about this training?
   c. Have you trained others to do open science? In what setting did that occur?
8. If yes to 6, how did that help you prepare to do open science? How did it not prepare you to do open science?
9. What conflicts have you had with others about your open science work?
   a. Have you had pushback from colleagues, mentors, your department, or students?
Second Interview
Document-based portion of the interview: Before the interview, I will ask participants to print out or pull up examples of content they have contributed to that they associate with openness. Preferably these will be documents mentioned in their incubator materials. During the interview, I’ll ask about these documents, as well as documents produced during the incubator.

Open Document Questions.

10. What is this document?
   a. Who is it written for?
   b. What is its purpose? How will it be used?
   c. Who else contributed to writing it?
   d. Does anyone review/edit/change this document?

11. Explain the process for writing this document.
   a. What did you try to do? What did others do?
   b. What was easy about writing this?
   c. What was challenging about writing this?

12. Did you apply anything you learned from the incubator to this document?
   a. What other skills did you use?

13. Where did you learn to write this document?
   a. What resources would you turn to for support in writing it (tools, forums, websites, people, mentors)?

14. How do you know if this document is successful/unsuccessful?

Incubator and Incubator Document Questions.

15. Did the incubator change your practices or definitions of openness?
16. What is the most important product of this project that you discussed during the incubator?
   a. Has this product been developed since the incubator? How so?

17. In your project outline/application/proof of concept, discuss _(writing goal or document specific to project)____?
   a. Why is it important to your work?
   b. What have been the challenges or opportunities of implementing it?

18. What advice/tools/technologies discussed in the incubator have made their way into your open science work?

Questions for Facilitators.

19. Can you tell me more about the process for creating the incubator?
   a. What programs did you model the incubator on?

20. Where did the idea of the project outline, proof of concept, and document narrative come from?
   a. How did you generate the list of questions for the project outline?
21. During the incubator, you asked us how things were done in our disciplines. Why was this important for the workshop?
22. On the first day of the incubator, we discussed principles and practices. Can you say more about why you chose to lead with these two concepts?
   a. How do you see the relationship between principles and practices?
23. What was your goal for the incubator?
   a. Do you feel like you achieved this goal?
   b. What did you not achieve?
24. How do you plan to change future iterations of the incubator?
   a. What will stay the same?
## APPENDIX C: Table of Participants

<table>
<thead>
<tr>
<th>Participant Name</th>
<th>Position</th>
<th>Discipline</th>
<th>Project Synopsis/Interests</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carlos</td>
<td>Assistant Teaching Professor</td>
<td>Sciences</td>
<td>Open educational resources about microbes</td>
</tr>
<tr>
<td>Chris</td>
<td>Research Scholar</td>
<td>Modelling and Data Visualization</td>
<td>Modelling spread of plant pathogens</td>
</tr>
<tr>
<td>James</td>
<td>Doctoral Student</td>
<td>Humanities</td>
<td>Visualization of medieval manuscripts</td>
</tr>
<tr>
<td>Maria</td>
<td>Assistant Teaching Professor</td>
<td>Sciences</td>
<td>YouTube and virtual reality tutorials</td>
</tr>
<tr>
<td>Micah</td>
<td>Librarian</td>
<td>Libraries</td>
<td>Open knowledge</td>
</tr>
<tr>
<td>Sarah</td>
<td>Assistant Professor</td>
<td>Humanities</td>
<td>AI-tools for health and medicine</td>
</tr>
<tr>
<td>Umesh</td>
<td>Doctoral Student</td>
<td>Modelling and Data Visualization</td>
<td>AI and machine learning</td>
</tr>
<tr>
<td>Will</td>
<td>Librarian</td>
<td>Libraries</td>
<td>Copyright and fair use</td>
</tr>
</tbody>
</table>
APPENDIX D: Structure of the Open Incubator

Each session of the incubator was organized in a way to move our projects forward but also emphasized principles, norms, and opportunities for doing open work. The weekly discussions tended toward ways of discovering open interventions in our work. Here, I will give a brief overview of the sessions for each week.

**Week 1 - Practices and principles:** After presenting our project pitches and hearing about the goals of the program, we discussed open principles and practices. The discussion began with an overview of “what is FAIR data?” FAIR data, which stands for findable, accessible, interoperable, reusable, is a set of guiding principles developed in relation to eScience (Wilkinson et al., 2016). We considered what each letter of the acronym FAIR (findable, accessible, interoperable, and reusable) meant to our respective fields.

**Week 2 - Contributorship and copyright:** The second session began with discussing collaboration in our respective fields. We were introduced to research taxonomies for classifying roles within projects. We then completed an exercise where we used a research taxonomy to describe our research projects. The second half of this session was devoted to copyright. Will took over to explain what ownership means and the different available options for copyrighting our work. We reviewed which options would allow for openness and which options were for commercial work.

**Week 3 - Tools and Infrastructure:** In this session, we discussed infrastructure and tools for open projects. We were asked what was included in our definition of infrastructure and how we differentiated this from the tools we use. Then, we were paired up to write out the tools we use for discovery, analysis, writing, outreach, and assessment. Following the activity, Micah
provided us with recommendations for tools to incorporate for open scholarly work. We considered how scholarly workflows could be either open or closed.

**Week 4 - Implementing open:** This session focused on individual projects. We examined issues with Maria’s project and how she might find a solution for storing the open resources she has for her class. We then considered my project and how I could make a more open dissertation.

**Week 5 - Communication:** The final session of the incubator was a question and answer session with communication experts associated with the university about how to communicate your work to the public. Once the communication experts left, the remainder of the session was spent discussing assessment and evaluation of our projects.