

Moving from Levels of Inquiry to the Flexible Phases of Inquiry Theory: A Literature Review of Inquiry-Based Teacher Education

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Abstract

In this study, we aim to examine the phases of inquiry-based learning and how to best prepare future teachers for inquiry-based teaching. While preservice teachers may leave teacher preparation with an understanding of the tenets of inquiry, their experiences in methods courses and experiences teaching in the field do not adequately prepare them to implement inquiry-based learning in classroom instruction. Part of this problem of practice relates to how the process of inquiry is ill-defined and muddy. We use a literature review methodology to investigate this problem by examining and comparing how teacher candidates are prepared with inquiry-based methods. We used Banchi and Bell's (2008) Levels of Inquiry model as a lens for reporting on different levels of inquiry-based preparation of teacher candidates. This lens was informative, though ultimately too restricting. We found that the types and degrees of inquiry-based teacher preparation vary greatly from context to context. This variation inspired our design of the Flexible Phases of Inquiry model. This model is a framework to support educators' understanding of how the levels of inquiry are not fixed, but rather overlapping and dynamic.

Key Words: Flexible Phases of Inquiry, inquiry-based learning, inquiry-based teaching, levels of inquiry, teacher education

Introduction

This article begins with a vignette of inquiry-based teaching in an elementary school classroom in the United States (US). The vignette is told by the first author and is written from the first-person perspective. As an educator, I believe that inquiry-based teaching (IBT) gives students the opportunity to engage in learning that is personal, meaningful, and challenging. Whether I was teaching science, math, social studies, or literacy, I encouraged my students to question and explore, mess around with materials, both physically and mentally, and make meaning for themselves. A preservice teacher (PST) from the local university was sent to my math classroom to observe my teaching and my students' learning. She arrived on a day when the students were engaged in an ongoing business design project applying three-dimensional geometry

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concepts to a modified engineering design model. The classroom was loud and messy, with students eagerly designing and redesigning elements of their original products. By some standards, my classroom was not “company ready”. When the class dismissed, I was able to steal a quick conversation with the overwhelmed university student. I apologized for the state of my classroom and asked her what questions she had for me. She took a deep breath and said, “Is this normal for you? How do you do it? All of the students were working and seemed legitimately excited about doing math. I’m not ready for this.” In answering her questions, I realized that I did not have a clear answer for her. Was my classroom always like this? No, but I tried to engage learners like this as often as I could. And how did I prepare to do this?

I had gone through teacher preparation at the same university as this PST a few years before. While inquiry-based pedagogies were recommended and described in theory, we had few opportunities to experience inquiry-based teaching and learning in our course and practicum experiences. I realized most of what I knew about implementing IBT came from my own trial and error as a classroom teacher. In a way, I learned about IBT through my own multiyear, inquiry-based learning cycle. According to Biggers and Forbes (2012), before preservice and novice teachers can foster inquiry-based learning environments, they must develop a strong conceptual understanding of what constitutes inquiry. In their work with preservice science teachers, they noted that most entered the course with narrow views of inquiry as being solely student-directed with little to no input from the teacher. Like the overwhelmed PST described above, this misconception of a fully student-directed approach to inquiry contributes to novice teachers’ reluctance to apply inquiry-based teaching methods (Bigger & Forbes, 2012). When identifying PSTs’ preconceptions about inquiry-learning, Lee and Shea (2016) found that the majority of PTs in their survey study equated inquiry-learning with hands-on activities and asking questions. This is consistent with findings from other studies of PST preconceptions of inquiry (Bigger & Forbes, 2012; Davis & Smithey, 2009; Haefner & Zembal-Saul, 2004). This had been my preconception before I recognized there is so much more to IBT once I had my own classroom and was able to utilize IBT through trial and error.

In the current study, we aim to examine the contours of inquiry-based learning and how to best prepare PSTs for inquiry-based teaching. As teacher educators, we have the privilege of helping to prepare PSTs and inservice teachers (IST). Our experience has taught us that there is often a divide and disconnect between pedagogical theory and the practical enactment of inquiry-based learning in the classroom. Likewise, we have noticed how PSTs often graduate from teacher education with knowledge of IBT tenets. However, their experiences—in methods courses and clinical experiences—do not adequately prepare them to implement IBT in their classrooms as novice teachers (Magee & Flessner, 2012; Zhou & Xu, 2017). For this article, we conducted a literature review to further examine PST experiences with IBT in teacher education through

an in-depth and systematic course of study. This review seeks to synthesize recent literature regarding IBT teacher preparation and support teacher educators by offering new perspectives of how to frame IBT for novice teachers.

Theoretical Framework

Before describing the literature review methodology, we explain the theoretical framework that provides a lens for the review. We found Banchi and Bell's (2008) Levels of Inquiry model to be an instructive frame for making sense of the levels of inquiry-based learning that are often prevalent in teaching. Additionally, we selected the Banchi and Bell (2008) framework because it is frequently used in education literature related to inquiry-based teaching and learning. Banchi and Bell (2008) discussed the Levels of Inquiry to help educators better understand inquiry instruction and evaluate the level of inquiry used in classroom activities. Inquiry is classified into four levels: *confirmation*, *structured*, *guided*, or *open inquiry*. Classifications are based on the amount of information and guidance provided to students.

The lowest level of inquiry is *confirmation inquiry*. According to Banchi and Bell (2008), at this level, learners "confirm a principle through an activity when the results are known in advance" (p. 27). Students are given both the question and the methods to arrive at a predetermined outcome. Studies of IBT in teacher preparation falling within the *confirmation inquiry* level were not included in this review. As the most teacher-centered form of inquiry, characteristics of *confirmation inquiry* fall more in line with teaching practices teaching candidates are likely familiar with from their own experience as students. The next level of inquiry is *structured inquiry*. As with *confirmation inquiry*, learners are provided with both the question and the procedure in *structured inquiry*. However, the outcomes of *structured inquiry* are not determined in advance. Rather, students are meant to generate their own explanations based on the evidence they collected in following the teacher-directed procedures. *Guided inquiry* gives the learner even more agency as only the question is provided by the teacher. Learners are able to design their own methods to answer the research question and generate explanations based on the outcomes of their self-selected procedures. The highest level of inquiry according to Banchi and Bell (2008) is *open inquiry*, what some may classify as "pure inquiry" (Herron, 1971). In open inquiry, learners develop methods to investigate questions they generate themselves.

Research Questions

We investigate the literature on inquiry-based teaching and learning using the Banchi and Bell (2008) Levels of Inquiry. Specifically, we have two research questions that guide our study:

1. How are teacher candidates being prepared with inquiry-based methods?
2. How does teacher preparation with inquiry-based methods correspond

to Banchi and Bell's Levels of Inquiry?

Methodology

To investigate our research questions, we use an integrative literature review methodology. Integrative literature review methodology allows for the simultaneous synthesis of existing research and analysis that offers new perspectives to frame research around a given topic (Torraco, 2005). This literature review seeks to synthesize what is known about how IBT is used and framed in teacher preparation in an effort to narrow these divides. We analyze the studies in this review with the following levels from Banchi and Bell's (2008) Levels of Inquiry framework: *structured*, *guided*, or *open inquiry*. We focus on these three levels for the literature review as these levels represent more student-centered forms of inquiry that were likely less prominent in their previous schooling experiences. Creswell and Creswell (2017) explain how a literature review should include a systematic way for conducting an initial summation of knowledge about a problem or phenomenon under study. They recommend that the systematic method of conducting a literature review includes: (1) developing a set of research questions to guide the study; (2) identifying the selection criteria for the literature review including key terms or words to begin the search for the literature; (3) locating the literature in reliable databases and from international reports and peer-reviewed journals; (4) checking the relevance of the literature; (5) reading the literature and coding into initial categories; and (6) re-reading the literature, organizing the categories into themes, and reporting out the findings. Creswell and Creswell's (2017) outline for a systematic method of conducting a literature review serves as the foundation for this review.

Literature Search

The initial search for this review drew on the broader literature of teacher education related to IBT. All of the studies included in this review are empirical and published in peer-reviewed journals. We included articles published internationally, but focused on articles published in English-language journals. All included studies focus on questions related to the PSTs' experiences with inquiry-based pedagogical practices. To get a thorough understanding of IBT experiences in teacher education, we included studies from multiple content areas and grade levels (i.e., elementary, middle, and secondary) that had been published between 2010 and 2020. Studies included in this review were selected through a multi-step screening process that relied on broad searching through multiple databases including ERIC, JSTOR, and EBSCO. We also searched Google Scholar for additional empirical studies related to teacher education and IBT. Key search terms included *teacher preparation*, *teacher education*, *preservice teachers*, *teacher candidate*, *inquiry-based teaching*, *inquiry teaching and learning*, and *inquiry pedagogies*. In addition, we completed multiple targeted searches

through a process of bibliographic branching (Lammert, 2020) from relevant studies.

Screening Process

All studies generated from database searches went through a multi-step screening process to determine inclusion or exclusion in this review. During the initial screening stage, we read the abstracts of the 88 articles critically to determine inclusion or exclusion. This process yielded 27 articles. We excluded theoretical studies or any studies without a clearly defined methodology section. If the research purpose or research questions were not readily identifiable in the abstract, we located this within the study to determine fit. All studies included in this review contained a research purpose or research questions that explicitly addressed “inquiry-based” teaching or learning in the context of teacher preparation. As a result, we selected 14 studies for the next stage of analysis.

We conducted bibliographic branching (Lammert, 2020) using the references from the studies included after the initial steps in the screening process. Bibliographic branching yielded an additional three studies to include in the review. Next, we conducted full-text analysis to confirm inclusion based on our established criteria and purpose. Though the initial search included studies at all grades, the majority of the studies identified focused on the elementary level. Since the variety of studies would not allow for fair representation of middle and secondary levels, we narrowed the focus to studies that included elementary or primary-level PSTs. Studies that addressed IBT in teacher preparation in general were also included. Full-text analysis with the refined research focus resulted in the 13 studies included in this review.

Findings

We organize the findings of our literature review by answering the two research questions that guide this review. First, we report on how teacher candidates are being prepared with inquiry-based methods. Second, we describe and report on how these inquiry-based teacher preparation studies correspond to the Levels of Inquiry (Banchi & Bell, 2008).

Inquiry-based Teacher Preparation

Based on the studies we reviewed, elementary PSTs are prepared with inquiry-based methods in a variety of settings and a range of different strategies for teaching and learning. For example, the studies of inquiry-based teacher preparation were situated in community-based settings—like a community garden (e.g., Rosenthal, 2018), in school-based practicum experiences (Gunckel, 2011; Wallace & Coffey, 20219), university-based methods courses (i.e., Magee & Flessner, 2012; Zhou & Xu, 2017), and a combination of all these settings (e.g., Blumenreich, 2012). Table 1 shows the reviewed studies by subject areas and grade levels.

Table 1.
Grade Levels and Subject Areas of the Studies in this Literature Review

Study Author(s)	Grade Level Foci						Subject Matter Foci			
	K	1	2	3	4	5	ELA	Math	Science	Social Studies
Betts, et al. (2017)						X		X		
Biggers & Forbes (2012)			X	X	X	X			X	
Blumenreich (2012)					X	X				X
Cartwright et al. (2014)		X	X	X	X	X			X	
Diego-Medrano et al. (2016)	X	X	X	X	X	X	X			
Eckhoff (2017)	X								X	
Forbes (2011)	X	X	X	X	X	X			X	
Gunckel (2011)						X			X	
Kazempour et al. (2013)	X	X	X	X	X	X			X	
Magee & Flessner (2012)	X	X	X	X	X	X		X	X	
Rosenthal (2018)				X					X	
Wallace & Coffey (2019)	X	X	X	X	X	X	X		X	
Zhou & Xu (2017)						X		X	X	

As Table 1 illustrates, the studies featured inquiry-based teacher preparation practices related to preparing elementary PSTs across content areas—such as math, science, and social studies—as well as across grade levels spanning from the early elementary levels of kindergarten to second grade to the upper elementary levels of third grade to fifth grade. Most of the studies in our literature review were focused on the subject area of science. There were also a couple of studies that focused on the integration of science and math or the integration of science and English Language Arts (ELA). There were multiple studies related to preparing elementary PSTs for all the grade levels at the elementary school level. A few studies (e.g., Eckhoff, 2017; Rosenthal, 2018) focused on an inquiry-based learning project for a particular grade level such as kindergarten or third grade. There was variation in the level to which inquiry-based learning practices were modeled and practiced in these studies.

Analyzing the Levels of Inquiry of the IBT Preparation

For our second research question, we report on the reviewed studies in relation to the levels of inquiry described by Banchi and Bell (2008). Table 2 groups the studies according to the Level of Inquiry they were most readily aligned.

Table 2.

Reviewed Studies Grouped by Banchi and Bell's (2008) Levels of Inquiry

Study Author(s)	Level of Inquiry
Diego-Medrano et al. (2016)	Structured Inquiry Studies
Gunckel (2011)	
Kazempour & Amirshokoochi (2013)	
Wallace & Coffey (2019)	
Biggers & Forbes (2012)	Guided Inquiry Studies
Cartwright et al. (2014)	
Eckhoff (2017)	
Forbes (2011)	
Magee & Flessner (2012)	
Zhou & Xu (2017)	
Betts et al. (2017)	Open Inquiry Studies
Blumenreich (2012)	
Rosenthal (2018)	

Structured Inquiry Studies

As Table 2 shows, there were four structured inquiry level studies. These studies were set primarily in university-based methods courses (Diego-Medrano et al., 2016; Gunckel, 2011; Kazempour & Amirshokoochi, 2013; Wallace & Coffey, 2019). According to Banchi and Bell (2008), both structured inquiry positions learners to investigate teacher-presented questions. Structured inquiry also prescribes the procedure for investigation, while guided inquiry allows learners to design their own procedures. We organize these structured inquiry studies into two categories: (1) planning models to support IBT planning and (2) experience inquiry-based instruction as a learner

Planning Models to Support IBT Planning

In both the Gunckel (2011) and Wallace and Coffey (2019) studies, PSTs were provided with planning models or templates to design inquiry-based lessons. Planning models offer structure and guidance for PSTs who are unfamiliar with planning lessons with IBT in mind. PSTs in the Gunckel (2011) study used the Inquiry-Application Instructional Model (I-IAM) to design lessons incorporating scientific inquiry and enact these lessons in their practicum placements. In the Wallace and Coffey (2019) study, PSTs used a researcher-designed lesson plan template to collaboratively plan lessons incorporating both science and literacy skills into a lesson planning assignment. These lessons were analyzed for content and were not enacted by the PSTs who created them.

The template was designed “to emphasize sense making for the hands-on activities,” (Wallace & Coffey, 2019, p. 522). Though students were not explicitly required to include elements of inquiry-based teaching, all lessons included opportunities for elementary learners to answer questions of scientific interest, though most were teacher-directed. According to Wallace and Coffey (2019), the results of this learning experience “indicate that many integrated science and reading lesson plans have the potential for implementing inquiry-based strategies with students” (p. 521). Preparing PSTs to incorporate inquiry-based teaching practices was the focus of these studies.

Preparing for IBT as a Learner

Part of preparing PSTs to implement IBT practices is giving them the opportunity to experience inquiry-based instruction as a learner. In Kazempour and Amirshokoohi’s (2013) study, PSTs participated in an action research project in which they took on the learner role in a revised inquiry-based science lesson on changes in matter as part of their methods course. While PST learners had some freedom in developing their understanding of the criteria for physical versus chemical changes, the procedures for the lesson were largely set by the instructor, as is common in structured inquiry. The researchers noted that this experience allowed PSTs the opportunity to experience the cyclical nature of inquiry firsthand as active learners.

PSTs also take on the role of learner in a methods-based experience in Diego et al. (2016) as students work collaboratively to modify literature-based inquiry circles for exploration of informational texts. While PSTs were familiar with the strategies and procedures common to literature circles, they were not given guidance on how to modify these procedures for informational texts, therefore blurring the line between structured and guided inquiry. In justifying their instructional methods, Diego et al. (2016) state “future educators must understand the relevance of active and student centered classroom instruction. Engaging PSTs in literature/inquiry circles can provide them with an opportunity for meaningful practical experience and critical reflective thinking as they prepare to teach children” (p. 66). Like Kazempour and Amirshokoohi (2013), the researchers found value in instructional experiences that allowed PSTs to experience IBT as learners to be effective teachers in the future.

Guided Inquiry Studies

As Table 2 shows, we reviewed six studies of IBT preparation that demonstrated characteristics of guided inquiry. While the previously described studies have varying degrees of structured inquiry, these six studies fall firmly within Banchi and Bell’s (2008) description of guided inquiry. As such, these approaches to teacher preparation for IBT include instructor-designed questions or tasks, but PST learners are not restricted by methods or procedures to meet the learning goal. We organized these findings related to the level of guided inquiry into two themes: (1) studies about adapting

resources for IBT and (2) collaborative IBT experiences.

Adapting Resource for IBT as a Learner

As PSTs transition into their roles as classroom teachers, they may discover their placement includes mandated curricular materials. It is important, therefore, to provide PSTs with opportunities to modify preexisting curricular resources to meet the essential elements of inquiry-based teaching and learning. Several of the guided inquiry experiences included in this review gave PSTs lessons or curricular materials to adapt for inquiry-based learning (Biggers & Forbes, 2012; Cartwright et al., 2014; Forbes, 2011). While the provided materials gave PSTs a starting point for learning, PSTs were granted autonomy in adapting the resources to meet the goal of the assigned task, therefore positioning these experiences within guided inquiry. As Forbes (2011) states, “it is particularly important for preservice elementary teachers to learn how to use and adapt curriculum materials to engage students in science inquiry as part of their formal teacher education” (p. 930), as those transitioning into teaching often rely heavily on these curricular resources for support in the early stages of their professional career.

PSTs in the Cartwright et al. (2014) study adapted science lessons to provide inquiry-based learning experiences for students in a community-based, after-school program. The community-based setting granted the PSTs an opportunity to “teach without the pressure of a school-time placement” (p. 480), flexibility that resulted in an increased awareness of the depth of knowledge needed in inquiry-based science teaching and learning. In both Forbes (2011) and Biggers and Forbes (2012), PSTs modified science curricular materials to enact inquiry-based lessons in their school-based practicum assignments. Outcomes of these experiences include changes in PST beliefs about the inquiry process (Biggers & Forbes, 2012; Forbes, 2011) and increased confidence in their ability to implement IBT (Cartwright et al., 2014).

Collaborative Experiences for Supporting IBT

In guided inquiry, learners are working toward solutions to teacher-generated questions. Research shows how IBT teacher preparation includes collaborative experiences (Eckhoff, 2017; Magee & Flessner, 2012; Zhou & Xu, 2017). According to Eckhoff (2017), “[PSTs] need direct experiences with inquiry-based teaching in order to appreciate the strengths and challenges associated with the approach” (p. 226). In Eckhoff’s (2017) practicum-based study, PSTs collaborated with cooperating teachers to design, implement, and evaluate inquiry-based science instruction with kindergarten students. While PSTs collaborated with cooperating teachers to design and implement lessons, the question that guided their design, “why do leaves change color in autumn,” was set by the cooperating teacher and university instructor, falling within the guided inquiry framework. Guided inquiry experiences also utilize collaborative learning opportunities to position the PST as both a learner and a teacher in different phases

of the experience (Magee & Flessner, 2012; Zhou & Xu, 2017). In Magee and Flessner (2012), collaboration between the elementary science and mathematics methods courses allowed for PSTs to experience three different types of inquiry to help increase understanding of IBT. As part of the science methods course, PSTs developed questions for inquiry-based lessons based on a topic assigned by the cooperating teacher in the assigned practicum setting.

Collaborative inquiry-based learning was also part of a Microteaching Lesson Study (MLS) approach (Zhou & Xu, 2017). According to Zhou and Xu (2017), “The [microteaching lesson study] exercise was not only a practical opportunity for the teaching group, but also provides an opportunity for the rest of the class to learn from peers” (p. 241). While microteaching is a common practice in methods courses used for a variety of learning outcomes, the lesson study component of this microteaching experience directly connects to inquiry learning through cycles of intentional reflection and revision based on observed learning. Time constraints did not allow PSTs to revise and reteach lessons based on reflective feedback, as is typical in lesson study (Ni Shuilleabhain & Bjuland, 2019). Collaborative teaching experiences, like those described in both Magee and Flessner (2012) and Zhou and Xu (2017), guide PSTs to take more control of their own learning as they transition into the role of professional teacher, therefore opening up the level of inquiry.

Open Inquiry Studies

The remainder of the studies (Betts et al., 2017; Blumenreich, 2012; Rosenthal, 2018) included in this review correspond with the open inquiry level. According to Banchi and Bell (2008), in open inquiry, learners design the procedures to arrive at an unprescribed solution. Indeed, an open inquiry approach allows learners to work towards solutions to questions they generated themselves. This does not mean that learners are free to investigate whatever they choose without context or assignment parameters, instead they can delve into questions that arise organically through their learning and explore these questions how they see fit (Rosenthal, 2018). We review the studies related to the level of open inquiry level and organize the studies by two themes: (1) project-based learning and (2) community-based inquiry learning.

Project-based Learning

Open inquiry models were supported by project-based learning experiences. For example, Betts et al. (2017) investigated how PSTs had control over their learning through action research projects. This project aimed to position the PST in the role of teacher through the investigation of authentic problems of practice in the classroom. The objective of the Betts et al. (2017) study was to help bridge the gap between theory and practice with IBT through action research. As such, PSTs not only planned and enacted inquiry-based mathematics lessons with primary students, they also acted as co-researchers developing their own theories of IBT based on experiences planning

and enacting lessons. Building personal theory through practice is what characterizes this experience as open inquiry.

Another example of project based learning to support IBT was Blumenreich's (2012) learner-designed projects to support historical inquiry in social studies. Blumenreich (2012) provides an example of how IBT experiences in teacher preparation can allow for open inquiry even when the PST remains in the traditional role of student. PSTs in this study were introduced to inquiry-driven instruction through the design of oral history projects as part of an undergraduate course. Oral history projects were designed around students' own questions, one of the features of open inquiry. PSTs were encouraged to be creative in both how they gathered information for their project and how they presented their findings, something Blumenreich (2012) noted was extremely motivating to learners. Through this project, PSTs were able to experience the recursive nature of open inquiry as one piece of data led to new understandings, and ultimately, new questions.

Community-based Inquiry Learning

Community-based projects were also found to be a way to support inquiry (Rosenthal, 2018). The PSTs engaged in IBT through experiential learning in a community-based learning garden. Rosenthal (2018) explains how this experience organically developed the PSTs' authentic concept for IBT through hands-on learning. The PSTs worked side-by-side with kindergarten students to help plant a school-based community garden. This project aimed to support the PSTs development of IBT practices in science by engaging them in actual science learning experiences alongside children. Rosenthal (2018) puts it like this, "Whereas many likely experienced science instruction as textbook based during their own schooling, most now describe activities such as observing, measuring, questioning, investigating, and communicating as valuable science practices" (p. 26). The community-based setting allowed PSTs to develop a sense of IBT without the constraints of a traditional classroom. What makes the current study open inquiry is that PSTs designed science instruction for students by closely observing interactions in the garden, generating questions from their own observed curiosities and the natural curiosities of the kindergarteners with whom they worked.

Discussion

Elementary teacher preparation provides a ripe opportunity for preparing PSTs for the implementation of inquiry-based practices. Our review identified and reported on 13 studies that illustrated ways to do this across elementary school grade levels and subject areas. We found that most of the teacher preparation models for IBT were at the guided level of inquiry (Banchi & Bell, 2008). Open-inquiry, which may be the gold standard of IBT (Herron, 1970), seems to be less common in terms of implementation

for IBT in teacher preparation. However, IBT and learning situated in collaborative experiences and project-based learning opportunities, such as Rosenthal's (2018) school garden experience, provide fruitful ways to support IBT preparation and practice for PSTs. Even so, we found it striking that we could only find 13 studies related to IBT experiences for PSTs. Clearly, there is a gap in the literature related to course-based experiences and programs to support the IBT preparation of preservice teachers.

Until that gap is addressed, the sighs of PSTs will remain. We recall the instance in the first author's vignette where the prospective teacher sighed and took a deep breath while observing what an IBT-driven classroom looks and sounds like. Why is IBT overwhelming for PSTs? The answer to that question seems related—in part—to the fact that there are few, consistent opportunities for PSTs to engage in lengthy IBT experiences during their teacher preparation program. Thus, the whole notion of implementing IBT in the classroom—especially at the open inquiry level—is rather daunting. The answer also relates to the ill-defined nature of inquiry that can lead to confusion or uncertainty of how to facilitate different levels of inquiry. There are few models for IBT in elementary education teacher preparation. Likewise, in teacher education, there is infrequent modeling of what IBT actually means and how to plan for it (Polly, Byker, & Putman, 2020). Planning for inquiry seems to be paradoxical (Byker et al., 2018), because of the notion that inquiry just happens without much planning or support. However, Byker and colleagues (2016) assert that PSTs benefit from a framework—like the Inquiry Processing Cycle—to support the conception and implementation of inquiry. We have developed the Flexible Phases of Inquiry Theory, which is a framework to show flexibility related to the implementation of IBT experience.

Flexible Phases of Inquiry Theory

The Flexible Phases of Inquiry Theory is a framework to support educators' understanding of how the levels of inquiry are not fixed but overlapping and dynamic. If PSTs are not exposed to a range of IBT phases and experiences, they can develop an unnecessarily narrow conception of what qualifies as inquiry. For example, PSTs in the Biggers and Forbes (2012) study initially defined IBT solely as student-centered and open inquiry. As the PSTs gained experience with guided inquiry, their definitions shifted to a new definition for inquiry; that it could be teacher-directed. Their perceptions about the dynamic nature of IBT were expanded as they gained more experience with putting IBT into practice. Biggers and Forbes (2012) explain, "While PSTs still held onto the ideal of student-directed inquiry, each increasingly emphasized teacher-directed inquiry over the course of the study as a means to promote student learning" (Bigger & Forbes, 2012, p. 2213). The Flexible Phases of Inquiry theoretical model captures the expansive notion of inquiry. Likewise, our Flexible Phases of Inquiry Theory addresses the challenge of preparing prospective teachers for IBT by first acknowledging the fluidity of what inquiry looks like in practice (Anderson, 2007; Ma-

gee & Flessner, 2012).

The Flexible Phases of Inquiry captures what Freire (1970) explains as the process of how “knowledge emerges only through invention and reinvention, through the restless, impatient, continuing, hopeful inquiry human beings pursue in the world, with the world, and with each other” (p. 72). We designed the model with flexible phases rather than confining PSTs to narrowly-defined levels of inquiry. While Banchi and Bell’s (2008) Levels of Inquiry model provides definitional structure for inquiry-based teaching and learning, the unstructured and unpredictable nature of inquiry learning experiences can be difficult to define by a rigid classification. We used the Banchi and Bell (2008) Levels of Inquiry model to inform the Flexible Phases of Inquiry model that visually represents levels of inquiry as phases, rather than as compartmentalized. Figure 1 provides a visual representation of the Flexible Phases of Inquiry Theory.

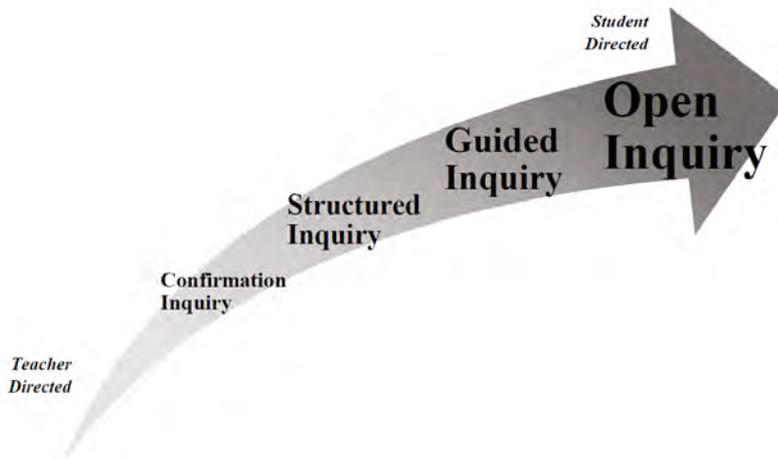


Figure 1: A Visual Illustration of the Flexible Phases of Inquiry Theory

As Figure 1 illustrates, the undefined nature of inquiry-based teaching and learning makes it difficult to restrict experiences to a distinct level of inquiry as some experiences can blur the boundaries between one level of inquiry and another. Several studies included in this review can easily span multiple levels of inquiry based on learner experiences and the level of support provided. For example, with more time to revise and reteach, the microteaching lesson study experience described in the Zhou and Xu (2017) study would transition between the guided inquiry phase and open inquiry phase as a teacher educator supports the PSTs to explore ways to improve lesson content and delivery. If the teacher educator in the Zhou and Xu (2017) study had a more active role in the revision process—providing PSTs with explicit procedures to improve lesson enactment—the experience could shift to a more structured inquiry phase.

Thus, our Flexible Phases of Inquiry Theory illustrates how the different levels of inquiry are blended. We represent this blending in Figure 1 with a color gradient to demonstrate how one level can fluidly transition into another as structure and support are added or removed. An experience that was designed to be open inquiry may transition into guided inquiry as the teacher notices learners' unproductive struggle. Likewise, a task intended as guided inquiry can evolve into open inquiry as learners begin generating their own questions based on initial discoveries and the instructor begins to release support gradually. The Flexible Phases of Inquiry Theory represents how flexibility is a necessary feature in describing inquiry-based teaching and learning experiences. It captures how learning happens from experience and from experience and trial and error. We assert that our Flexible Phases of Inquiry Theory reflects the dynamic process of inquiry, which includes moving in and out of phases to question, explore, mess around with ideas, design and redesign, try, fail, try again, and discover.

Recommendations for Future Research

A future research agenda would go deeper into examining the PSTs perceptions of inquiry related to Flexible Phases of Inquiry Theory. Likewise, more research is needed—especially using action research models (Putman & Rock, 2016) and applying the Inquiry Processing Cycle (Byker et al., 2017)—about mapping how PSTs and teacher educators move in and out through the phases of inquiry in supporting IBT and learning. Most of the studies in our literature review belonged to the purview of science and mathematics. However, a future research agenda would broaden the scope of inquiry to include IBT in social studies—especially related to the Inquiry Arc method—and language arts. Investigating teacher educator modeling as a pedagogical practice for the demonstration of IBT is also an area that needs further research. Polly and Byker (2020) found that modeling builds the PSTs efficacy for teaching. Kazempour and Amirshokoohi (2013) explain how modeling is a way of supporting PSTs to “gain more in-depth and robust understanding, be actively involved in the process of scientific inquiry and discourse, take pleasure in their learning experience, and finally feel a sense of achievement” (p. 152). Modeling when coupled with rehearsal types of teaching experience also provides PSTs with opportunities to experience inquiry-based methods as learners and opportunities to enact planned lessons in the role of a teacher. A future research agenda would investigate and analyze the relationship between modeling and the Flexible Phases of Inquiry Theory. More research will uncover cases of high-impact IBT practices in multiple contexts to demonstrate the contours of the Flexible Phases of Inquiry Theory.

Conclusion

IBT supports the constructivist notion that knowledge is a process of discovery. Yet, inquiry as a process is ill-defined and messy. Using Banchi and Bell's (2008) Lev-

els of Inquiry model, we have reviewed the literature to report on elementary education teacher preparation models that prepare PSTs with the tenets of inquiry. The literature review included IBT preparation practices for preparing elementary PSTs across various content areas and elementary school grade levels. We found a gap in the literature related to course-based experiences and programs to support the IBT preparation. To make sense of the messy process of inquiry, we developed the Flexible Phases of Inquiry Theory to support teacher educators and PST in facilitating and enacting inquiry as a dynamic experience. The Flexible Phases of Inquiry is an instructive theoretical lens for capturing how inquiry happens in flexible phases rather than at pre-ordained levels. We would suggest that such flexibility carries a sense of freedom and relief for PSTs as they transition from IBT theory to IBT practices. In conclusion, we believe that the Flexible Phases of Inquiry Theory will benefit teacher educators in facilitating and supporting PSTs inquiry processes in teaching and learning.

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