Insights into Teachers' Experiences Implementing Garden Based Learning: Characterizing the Relationship Between the Teacher and the Curriculum

by Sarah J. Selmer, Melissa J. Luna & James A. Rye — 2015

Background/Context: *This study seeks insights into teachers' experiences implementing Garden-Based Learning (GBL) in an elementary school. The breadth of studies supporting the use of GBL in K–8 schools in the United States alongside the paucity of studies specific to teachers' experiences implementing GBL highlights the importance of this work.*

Purpose: *Our study uses Remillard's framework for characterizing and studying teachers' interactions with curriculum materials specifically in the context of GBL. We believe that exploring the dynamic relationship between teachers and a GBL curriculum may help those involved in supporting teachers in implementing GBL to gain a deeper understanding of the complexity of the teacher/GBL curriculum relationship. This research examined teachers' GBL implementation experiences in order to answer the following research question: How do we describe and characterize teachers' interactions with GBL curriculum materials?*

Research Design: *Twenty teachers employed from one elementary school were interviewed using a semistructured task-based protocol resulting in a teacher-created diagram of supports and challenges he/she encountered while implementing GBL over the past year. The diagram was used as a tool to stimulate and access teachers' thinking about these supports and challenges in order to provide insight into the teacher and curricular resources at play when implementing GBL.*

Findings/Results: *Using a grounded theory analysis of each participant's diagram, we characterized each teacher's participatory relationship with GBL. We found 13% of supports and challenges elicited from all teachers had a teaching and learning focus. On an individual level, supports and challenges had a substantial teaching and learning focus for only two teachers. Thirteen teachers were characterized as having a pragmatic focus. Of the seven teachers characterized to have an experiential focus: supports and challenges focused more so on what students were doing for four teachers and more so on what teachers were doing for three teachers.*

Conclusions/Recommendations: *We used Remillard's framework to investigate and characterize the participatory relationship between teachers and the GBL curriculum. The resulting characterizations provide insight for supporting GBL teacher learning contexts and will help guide future research. Based on this study, it is critical that individuals involved in educational change continue trying to understand and develop spaces for teacher learning. These spaces should move beyond traditional professional development focused on teacher participation toward experiences focused on teacher learning within and across their teaching contexts.*

INTRODUCTION

This study seeks insights into teachers' experiences as they implement Garden-Based Learning (hereafter referred to as GBL) in an elementary school. The breadth of studies supporting the use of GBL in K–8 schools in the United States alongside the paucity of studies specific to teachers' experiences implementing GBL highlights the importance of this work. Our study uses Remillard's (2005) framework for characterizing and studying teachers' interactions with curriculum materials specifically in the context of GBL. We believe that exploring the dynamic relationship between teachers and a GBL curriculum may help those involved in supporting teachers in implementing GBL (teacher educators, participating teachers, curriculum leaders, and administrators) to gain a deeper understanding of the complexity of the teacher curriculum relationship. We discuss sustainability for GBL educational initiatives and future scholarly directions as well as practical implications for professional learning. Supported by the literature and guided by theoretical frameworks and related methodological choices, this paper describes the results of a study that examined teachers' GBL implementation experiences in order to answer the following research question: How do we describe and characterize teachers' interactions with GBL curriculum materials?

LITERATURE REVIEW

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GBL programs are on the rise in K–8 schools in the United States, partly in response to reform efforts in science education that require and promote real-world, authentic learning experiences for students (Williams & Dixon, 2013). Teachers and school leaders as well as educational researchers contend that GBL learning experiences provide relevant, hands-on, inquiry-based student learning opportunities (Blair, 2009) in which science learning standards can be taught (Blair, 2009; Skelly & Bradley, 2000). Adding credence to this contention, the National Science Teachers' Association practitioner journal, *Science and Children,* has published numerous articles over the past five years that describe GBL applications for elementary teachers. Topics range from composting (Estes & Fucigna, 2013) to plant studies emphasizing measurement and inquiry (Baxter, Ruzicka, & Blackwell, 2012; Schuster & Watanabe, 2010) to outdoor learning stations including vegetable and butterfly gardens (Eick, Tatarchuk, & Anderson, 2013; Gopal & Pastor, 2013). Also the practitioner literature discusses both indoor and outdoor contexts in which GBL can take place. For example, GBL can occur *out*doors year round via simple engineering design (e.g., low tunnels) to produce and study micro-climates (Rye et al., 2012), while the *in*door classroom, too, provides abundant opportunities for GBL, ranging from vermicomposting (Carroll, 2009) to germination of seeds (Keeley, 2011) to nurturing seedlings to fruition in indoor container gardens with supplemental grow lights (Rye, Rummel, Forinash, Minor, & Scott, 2015). The fact that GBL involves indoor learning spaces is especially relevant to school systems located in colder climates in which the outdoor growing season for most produce is short in duration. GBL also engages parents and students in informal educational experiences such as serving as summer caretakers of students' projects or vending produce and presenting garden information at local farmers' markets (Selmer, Rye, Malone, Trebino, & Fernandez, 2014). Additionally, there are abundant cross-curricular GBL applications for English/language arts (Paugh & Moran, 2013) and mathematics (White et al., 2009) learning.

A synthesis of the pre-K–12 educational research literature on GBL by Williams and Dixon (2013) found a “preponderance of positive academic outcomes, especially in science, math, and language arts, giving credence to gardens serving as instructional and curricular means for covering academic content” (p. 226). For example, prior work primarily involving survey data of teachers' experiences using school gardens in their practice showed that, on the one hand, teachers were enthusiastic about the cross-curricular learning potential of GBL and reported GBL learning experiences as valuable to their students (DeMarco, Relf, & McDaniel, 1999; Skelly & Bradley, 2000). Yet, on the other hand, teachers indicated lack of time, interest, experience, and knowledge as major barriers to GBL implementation (Graham & Zidenberg-Cherr, 2005). Blair (2009) called for additional studies on how educators could best remove these (and other) barriers to implementing and keeping school gardens running. As such, Williams and Dixon (2013) specifically called for more rigorous research into the specific *learning* outcomes of GBL. We also recognize a need for more rigorous research on *teaching* in a GBL context, particularly research examining the participatory relationship between teachers and GBL curricula. Both of these lines of research on *GBL learning* and *GBL teaching* are essential to understanding how to limit or remove barriers to implementation, how to address and improve student learning outcomes, and how to sustain school garden programs. This work looks at GBL teaching in particular. Specifically, we seek to understand the relationship between the teacher and the GBL curriculum by looking for patterns in the kinds of supports and challenges teachers face in implementing GBL in their practice.

Prior work has examined the relationship between other types of science curricula or practices (i.e., inquiry based teaching) and the patterns or characterizations of how prospective and practicing teachers implement a particular curriculum (Davis & Smithey, 2009; Forbes & Davis, 2008; Forbes, 2011; Lee & Maerten-Rivera, 2012; McNeill, 2009; McNeill & Krajcik, 2008; Schwarz et al., 2008). However, we have not found studies examining the participatory relationship between GBL curricula and teachers’ implementation, particularly examining patterns of supports and challenges to GBL implementation among practicing teachers. Our study fills this gap by seeking insight into teachers’ experiences as they implement GBL. In exploring the relationship between the teacher and the GBL curriculum, we ascertain the proportion of elementary teachers in our study that had a substantive focus on teaching and learning aspects of GBL as well as characterize their patterns of supports and challenges when implementing GBL as either pragmatic or experiential.[1] We believe that such characterizations will be useful to GBL educators in their planning of professional development for elementary teachers, and ultimately, in sustaining GBL in schools. Our study was guided by a network of theories about the relationship between teachers and curriculum.

science. She recently co-authored: Russ, R. S., & Luna, M. J. (2013). Inferring teacher epistemological framing from local patterns in teacher noticing. *Journal of Research in Science Teaching, 50*(3), 284–314.

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THEORETICAL FRAMEWORK

Prior research in science and mathematics education has shown that implementing a new program or curriculum into one's practice is difficult and requires an alignment of teachers' knowledge, skills, attitudes, and goals to the new program (Charalambous & Hill, 2012; Forbes & Davis, 2010; Spillane, Reiser, & Reimer, 2002). Additionally, teachers need access to resources that support this alignment (e.g., professional development, instructional materials). Blair (2009) reported that this is true for teachers who are implementing GBL into their practice as well. However, even when teachers have had access to the same resources and experiences that support this alignment, researchers have found differences in teachers' implementation of new programs or curricula (Agodini, Harris, Remillard, & Thomas, 2013; Ball & Cohen, 1996). For example in a GBL context, when implementing GBL, some teachers might integrate several learning activities connecting math, science, and language arts in their GBL instruction while others will strictly teach science. Additionally, some teachers might implement a series of connected GBL learning activities, each activity building on previous activities becoming part of extended inquiry, while other teachers will implement a series of singular, disconnected GBL activities. What accounts for these differences? Like Remillard (1999, 2005), we believe that these similarities and differences in the enacted GBL curriculum—what actually occurs during instruction—are a result of an interaction between the teacher (his/her knowledge, goals, beliefs, etc.) and the curriculum (text, media, professional development, etc.). Gaining insight into the challenging and supporting resources (both teacher and curricular) at play when teachers implement GBL is a first step toward understanding these similarities and differences.

We recognize that the participatory relationship (between the teacher and the curriculum) at play here—including factors that present challenges and factors that present supports in implementing GBL—is embedded in the nested contexts in which teachers engage: their classrooms, their schools, their districts, their homes, etc. We understand that the nature of the context/community in which the participating teachers are situated affects what they learn and how that learning informs their practices, identities, and knowledge (Borko, 2004; Cochran-Smith & Lytle, 1999). Moreover, teachers are active participants in many of these contexts/systems. Learning in context is therefore often a result of particular kinds of *social co-participation* in which the person, activities, and worlds mutually constitute each other (Borko, 2004; Greeno, 2003; Lave & Wenger, 1991). In this way the local and global contexts of our participating teachers influence the factors that challenge and support their GBL implementation. For example, like Gee (1999, 2001, 2005), we understand teachers' discourse around GBL as "language comingled with ways of acting, interacting, feeling, believing, valuing, and using various sorts of objects, symbols, tools, and technologies—to recognize yourself and others as meaning and meaningful in certain ways" (Gee, 2005, p. 7). In other words, the particular/specific garden and teaching-related discursive communities of our participating teachers position them in particular ways (e.g., garden expert, novice garden teacher, student focused teacher, learning focused teacher leader, novice teacher, expert teacher, etc.). The ways that these teachers adopt or resist their particular situation (Harré & van Langenhove, 1999) influence how they engage, discuss, and implement GBL. This participatory relationship embedded in larger and influential contexts results in both the planned curriculum and enacted curriculum (Remillard, 2005). These theoretical underpinnings guide the methodological choices for this study.

METHODS

SETTING AND PARTICIPANTS

Teachers who participated in this study are faculty at Eli Elementary School, a preK–5 school in a small city in the Mid-Atlantic region. GBL at Eli Elementary School began in Spring 2011, with assistance from faculty from a nearby university, parents, community organizations, and corporate funding. The physical infrastructure of this program now includes 20 outdoor raised beds, classroom vermicomposting and seed germination units, and indoor gardening systems (e.g., EarthBoxÒ). Eli Elementary GBL support for teachers is both formal and informal. Formal support consists of several professional development sessions conducted throughout the school year. The sessions focus on

GBL resources (practical and curricular) and the integration of core content in the context of GBL. Other formal support focuses on the development and maintenance of the outdoor and indoor garden infrastructure. Community members, master gardeners, parents, university faculty, and school administrators join weekend and afterschool work efforts to develop and maintain this infrastructure and oftentimes provide gardening resources for teachers. For example, if teachers are interested in growing green pepper plants they can ask a university faculty member or a participating master gardener to provide seeds and expertise for a class project. The more informal teacher support involves individual or small group co-teaching (e.g., university faculty with a classroom teacher or two classroom teachers), collaborative planning, and email exchanges.

Of the 29 teachers who implemented gardening activities the first two years of the program, 20 agreed to participate in a semistructured, task-based interview about GBL. The participants' years of teaching experience varied, ranging from one year to over 10 years, with half (10) of the participants having 10 or more years of experience. Of the remaining 10 participants, eight of the teachers had 4 to 10 years, and two teachers had one to three years of teaching experience. The participants' primary teaching responsibilities ranged from early childhood (two participants), to kindergarten to fourth grade (13 participants), to art (one participant), and to special education (four participants). The research team for this study consisted of three university faculty members who had assisted with the original implementation of GBL at Eli—two were from science education and one from mathematics education. The research protocol for this study was marked exemption status (#1305041085) by the university's Office of Research Integrity and Compliance.

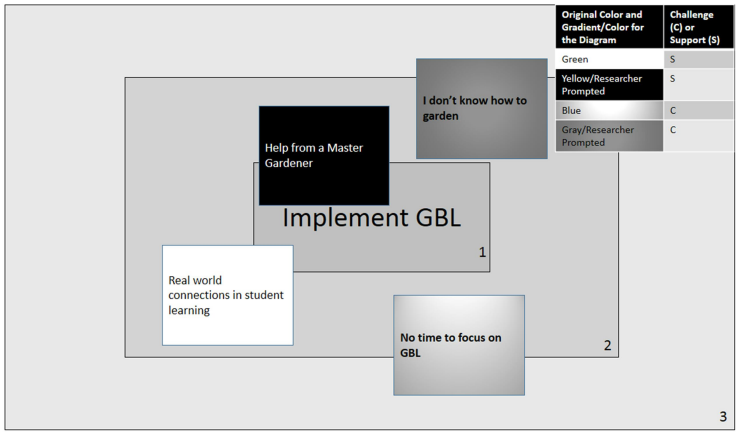
SEMI-STRUCTURED TASK-BASED INTERVIEW

The semi-structured task-based interview involved teachers creating a diagram of supports and challenges they had encountered as they implemented GBL over the past year. The diagram was used as a tool to stimulate and elicit teachers' thinking about these supports and challenges in order to provide insight into the teacher and curricular resources at play when implementing GBL. The base diagram consisted of three concentric rectangles; the inner rectangle contained the words "Implement GBL." First, the researcher asked the teacher to share his/her challenges and supports in implementing GBL without specific prompts. Later, the researcher asked specific questions to elicit further responses. Teachers wrote each challenge and support on a color-coded sticky note. Each color corresponded to whether the resource was a challenge or a support and whether it was teacher generated or researcher prompted (see Table 1). After naming the supports and challenges, teachers were asked to place each sticky note on the base diagram according to how influential each challenge or support had been to their ability to implement GBL. The most influential supports and challenges were placed towards the center while the less influential were placed further away. (See Figure 1 for an illustration of this diagram.)

Table 1. Key to Color-coded Sticky Notes on GBL Diagrams

Color Code for Sticky Notes on GBL Diagram	Sequence of Use of Colored Sticky Notes During Interviews
Green	First pass, teacher generated support
Yellow	Later pass, researcher prompted support
Blue	First pass, teacher generated challenge
Gray	Later pass, researcher prompted challenge

Figure 1. Example of diagram that emerges during the teacher interview (along with interpretive key in upper right portion)



This process was a way to both stimulate and elicit teachers' thinking about their implementation of GBL and extend teacher responses beyond those we could get in a more traditional interview format. For example, the diagram allowed the teachers to explicate the relative strength of each support and challenge through their placement on the diagram, and teachers shared their thinking while doing so. We felt that the interview and related diagram together captured the wide range of elements supporting and challenging teachers' GBL implementation. The relative positioning of each element allowed us to further characterize and study teachers' interactions with the GBL curriculum.

DATA SOURCES

Interviews were 30–60 minutes in length and were audio-recorded. A sticky note diagram was constructed during each interview and collected. Data consists of the 20 diagrams and 20 interview transcripts.

ANALYSIS OF THE DATA

The 20 diagrams were initially analyzed using grounded theory (Charmaz, 2002; Creswell, 2012; Glaser & Strauss, 2009; Strauss & Corbin, 1990) by two research team members. We chose to develop codes from the bottom up based on the sticky note instances because this allowed us to be open to capturing and articulating all of the different supports and challenges teachers identified as influencing their GBL implementation. As such, we rejected using a pre-existing coding schema because it would have limited our analysis and prevented us from seeing the nuance and patterns in the supports and challenges to GBL implementation that teachers identified as having an impact on their practice. In other words, by taking a grounded data driven approach, we believe we were able to gain greater insight into the participatory relationship between teacher and GBL curriculum that we sought. The two research team members identified initial categories and subcategories in the data. Table 2 shows our initial coding schema.

Table 2. Initial Major Categories and Subcategories for GBL Diagram Sticky Notes.

Major Category	Associated Subcategories
Teaching & Learning (T&L)	T&L-Integrated focus
	T&L- Science focus
	T&L-Assessment focus
	T&L--General
Resources (R)	R-Garden Supplies
	R-Garden Information/Teaching Materials
	R-Garden Infrastructure
Stakeholder Interaction (SI)	SI-Helping
	SI-Collaborating
	(Expert, Admin, Colleague, Student, Community)
Stakeholder Experience (SE)	SE-Teacher
	SE-Student
	SE-Community Members
Stakeholder Characteristic (SC)	SC-Teacher
	SC-Student
	SC-Other School Members
	SC-Community Members
Time (T)	T-Planning
	T-Students/Curricular
	T-Maintenance

Based on the initial coding schema, the entire research group conducted three iterations of testing codes for group consistency, refinements, and shared understandings. Table 3 describes the final coding schema. In the final coding schema, the *Teaching and Learning* subcategories—*Integrated*, *Science, Assessment, and General*—were collapsed into the two subcategories of *Teaching* or *Student Learning*. The *Resources* and *Stakeholder Interaction* major codes and related subcategories stayed the same from the initial to the final coding schema. The *Stakeholder Experience* sub categories—*Teacher, Student,* and *Community Member*—expanded to include the code *Administrators*. The *Time* subcategory—*Planning, Student and Curricular*, and *Maintenance*—expanded to include the code *General*.

Table 3. All Final Major Categories and Subcategories for GBL Diagram Sticky Notes

Major Category	Associated Subcategories
Teaching & Learning (T&L)	T&L-Teaching
	T&L- Student Learning
Resources (R)	R-Garden Supplies
	R-Garden Information/Teaching Materials
	R-Garden Infrastructure

Stakeholder Interaction (SI)	SI-Helping
	SI-Collaborating
	(Expert, Admin, Colleague, Student, Community)
Stakeholder Experience (SE)	SE-Teacher
	SE-Student
	SE-Other School Members
	SE-Community Members
Stakeholder Characteristic (SC)	SC-Teacher
	SC-Student
	SC-Other School Members
	SC-Community Members
Time (T)	T-Planning
	T-Students/Curricular
	T-Maintenance
	T-General

Once a final coding schema was established, three team members coded the data independently. Interrater reliability for three out of three raters was 90% for the 385 diagram instances that were coded. The instances without complete coding agreement all had two out of three rater agreement, and these instances were coded according to that agreement.

After coding and establishing interrater reliability, the researchers relabeled each participant's diagram using these major and subcategories. We looked for patterns in order to characterize the supports and challenges that resonated with each teacher and impacted their ability to implement GBL. Additionally, we examined the diagrams for categories of identified supports and challenges that were minimally present or absent in order to reflect more accurately the teacher and curricular factors that did not necessarily impact their ability to implement GBL.

From the initial structural analysis, three patterns in particular stood out among the teachers' diagrams: (1) a lack of emphasis on teaching and learning; (2) an emphasis on practical resources and interactions or an emphasis on experiences; and (3) a focus on either teachers or students. Table 4 outlines each characterization, description, the related analytical rule, and codes.

Table 4. Participant Characterizations, Descriptions, the Related Analytical Rules, and Utilized codes

Characterization of the Teacher/GBL Participatory Relationship	Description	Diagram Focus	Analytical Rule	Related Codes and Subcodes

Teaching and Learning	A teaching and learning characterization of the teacher/GBL participatory relationship indicates that what is being taught and what students are learning are considered by the teacher in GBL implementation.	Whole map	This characterization of the teacher/GBL participatory relationship is determined by looking at the overall percentage of *Teaching and Learning* coded sticky notes on an individual participant's diagram. In order to be characterized as having a teaching and learning focus, this percentage had to be ≥ 25%.	*Teaching and Learning* (all subcodes)
Pragmatic or Experiential	A pragmatic characterization of the teacher/GBL participatory relationship indicates a focus on practical, necessary, supportive and helpful resources for implementing GBL. An experiential characterization of the teacher/GBL participatory relationship indicates a focus on things that happen (either to students or teachers) during GBL.	Centermost and second concentric rectangles	The pragmatic or experiential characterization of the teacher/GBL participatory relationship is determined by the majority of the sticky notes coded towards one tendency (i.e., > 50% of total sticky notes). If there are an equal number of pragmatic and experiential instances then the full map including the third concentric rectangle and interview transcripts are considered in determining the overall tendency.	Pragmatic: *Resources* (all subcodes) *Stakeholder Interactions* (all sub codes) *Time* (all subcodes) Experiential: *Stakeholder Characteristics* (all subcodes) *Stakeholder Experiences* (all subcodes) *Teaching and Learning* (all subcodes)

Teacher-focused or Student-focused	This characterization of the teacher/GBL participatory relationship is determined only for teachers with an experiential characterization and indicates whether the participant is more focused on herself as the teacher of GBL or on her students who are engaged in GBL.	Centermost and second concentric rectangles	The teacher-focused or student-focused characterization of the teacher/GBL participatory relationship is determined by the majority of the sticky notes coded towards one tendency (i.e., > 50% of total sticky notes). If there are an equal number of teacher-focused and student-focused instances then the full map including the third concentric rectangle and interview transcripts are considered in determining the overall tendency.	Teacher-focused: *Stakeholder Characteristics (teacher subcode)* *Stakeholder Experiences - (teacher subcode)* *Teaching & Learning (teaching subcode)* Student-focused: *Stakeholder Characteristics (student subcode)* *Stakeholder Experiences (student subcode)* *Teaching & Learning (student learning subcode)*

In particular, based on these patterns and the original interview diagrams, we used three analytical rules to arrive at the ways in which we characterized the participatory relationship between the teachers and the GBL curriculum (in Table 4):

1)

In order to characterize a teacher's participatory relationship with GBL as teaching and learning focused, the percentage of the total number of *Teaching and Learning* coded sticky notes on her diagram had to be greater than or equal to 25%.

2)

In order to characterize a teacher's participatory relationship with GBL as either pragmatic or experiential, the majority of the sticky notes had to be coded towards one tendency in the centermost and second concentric rectangle—representing the most influential supports and challenges—on the diagram. The codes that constitute a pragmatic tendency include all subcategories of *Stakeholder Interactions*, *Resources*, and *Time.* The codes that constitute an experiential tendency include all subcategories of *Stakeholder Characteristics*, *Stakeholder Experiences*, and *Teaching and Learning*.

3)

In order to characterize teachers with an experiential characterization of their participatory relationship with GBL as being either teacher-focused or student-focused, the majority of the sticky notes had to be coded towards one tendency in the centermost and second concentric rectangle—representing the most influential supports and challenges—on the diagram. The codes that constitute a teacher-focused tendency include the major and subcategories of *Stakeholder Experience-Teacher*, *Stakeholder Characteristics-Teacher*, and *Teaching and Learning-Teaching*. The codes that constitute a student-focused tendency include the major and

subcategories of *Stakeholder Experience-Student*, *Stakeholder Characteristics-Student*, and *Teaching and Learning-Student Learning*.

RESULTS

Using the analysis of each participant's diagram, we characterized each teacher's participatory relationship with GBL as being: (1) teaching and learning focused or not, (2) pragmatic or experiential, and (3) if experiential, as either teacher or student-focused. In what follows, we discuss each of these individually. We provide frequency counts across the 20 participants and illustrate each characterization further with excerpts from teachers' interview transcripts. Each participant was given a pseudonym to maintain their anonymity.

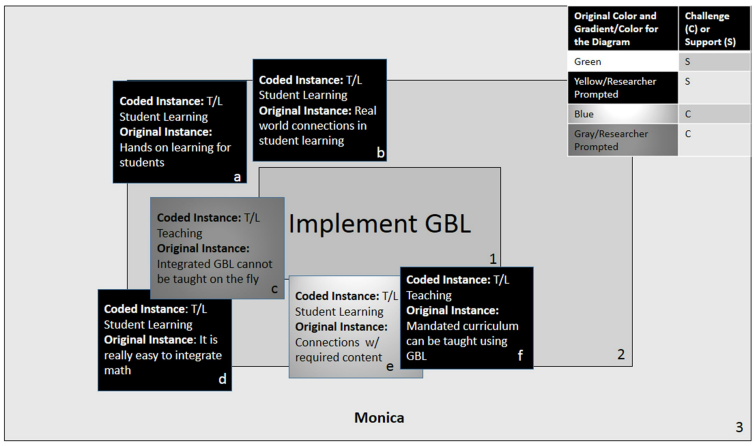
TEACHING AND LEARNING CHARACTERIZATION

Characterizing a participant as having a teaching and learning focus in his/her participatory relationship with GBL requires that at least 25% of her supports and challenges to implementing GBL be related to teaching and student learning specifically. For example, such sticky notes might include general mentions of the integration of core curricular areas in the context of GBL or how GBL supports teaching science content and practices. Alternatively, they may include specific mentions of targeted content (e.g., teaching the water cycle) or mention of specific skills and practices (e.g., supporting students writing about their scientific observations). Considering the 20 participant diagrams as a whole, *Teaching and Learning* coded sticky note instances were infrequent (total of 51 instances or approximately 13% of total sticky notes). Looking individually, we found only two teachers meeting the 25% or greater threshold to be characterized as having a teaching and learning focus. For example, Rachel placed 12 sticky notes on her diagram, three of which were coded as *Teaching & Learning*; thus because exactly 25% of her sticky notes were related to teaching and student learning, she is characterized as having a teaching and learning focus in her participatory relationship with GBL. The other teacher who has this focus is Monica. We use Monica's diagram and excerpts from her interview transcript to illustrate further the teaching and learning characterization (Figure 2).

Monica, a Participant with a Teaching and Learning Focus

Monica is a GBL teacher leader at Eli Elementary, and at the time of her interview, had just completed her second full year of implementing GBL. She had taught second grade for three years in her current position but previously spent five years teaching middle school mathematics and science. Figure 2 shows Monica's relabeled diagram of teaching and learning coded instances and the original diagram excerpts. Monica's interview diagram shows 6 (out of 21) coded teaching and learning instances (29%). Four of the six instances are supports and the remaining two are challenges. Four of the instances are subcoded *student learning* and two of the instances are subcoded *teaching*. All six teaching and learning instances (a, b, c, d, e, f) touch the second rectangle (see Figure 2)—representing a more central impact on her GBL implementation—with *instance f* overlapping the first rectangle and *instances a, b, and d* overlapping the third rectangle. Closer examination of both her diagram instances and excerpts from her interview provides further insight into Monica's teaching and learning related supports and challenges.

Figure 2. Monica's diagram showing teaching and learning instances



Monica's interview transcript and raw (uncoded) diagram reveal her focus on teaching and learning in the context of GBL. In her interview, she shares both general ways that her students were learning and specific integration of mathematics and writing in the context of GBL. For example, in the following excerpt Monica talks generally about how GBL provides hands-on learning and real world connections for students. She also explains why she put *instance a* (hands-on learning for the students) and *instance b* (real world connections in their [student] learning) primarily in rectangle 2 during her interview:

That's definitely a huge impact, because the kids are more involved with hands-on learning. That helps get them excited and want to do it. And the real world connections that they're learning, I want them to be able to say that 10 years from now, and remember they did that in Ms. [XXXXX]'s class. So helping them make those connections, or helping them see that they can do what they do here at home, or use it somewhere else in their life. It's a huge impact. So, without those things, I don't know that it would be worth the time.

Notably, Monica mentions that, while GBL is engaging and provides a real world learning experience for students, it is also challenging because limited classroom time requires teachers to actively integrate core curricular content into GBL. She states in her interview:

Because you can teach the garden-based learning, but we don't have time to just teach that, if you don't integrate, then you're making more work for yourself and I think that's what a lot of people misunderstand from the beginning, so they're doubling up when they don't need to.

Monica describes integrating core curricular content in the context of GBL as both a support and a challenge to her GBL implementation in general. She discusses the power of GBL as a context for implementing core curricular content (*instances d* and *f*), but also talks about the challenge of providing meaningful integrated experiences for students (*instances c* and *e*).

I would say my mandated curriculum, my common core standards can be taught by doing this [GBL]. It's easy to integrate math; it helps me teach reading or writing and math while doing garden-based learning. [But] we have to figure out how and get it all planned first. You can't do this kind of thing on the fly. It doesn't just happen.

Monica re-emphasizes that integrating core curricular content into GBL takes planning when she states: “It's definitely a challenge, because you have to think ahead. You can't just say, today I'm going to teach you germination and integrate writing and reading.”

In sum, Monica and Rachel were the only two teachers to be characterized as having a teaching and learning focus in their participatory relationship with GBL. The other 18 teachers did not meet the 25% threshold needed for such. Table 5 summarizes by teacher the frequency data for the *Teaching and Learning* coded sticky notes.

Table 5. The Frequency Data for Participants’ Teaching and Learning Stance Toward Implementing GBL

Teacher	#*Teaching & Learning*/#Total Coded Sticky Notes	% of Total *Teaching & Learning* Sticky Notes
A	2/20	10%
B	2/22	9%
C	3/20	15%
D	3/18	17%
E	1/14	7%
F	0/10	0%
G	2/16	13%
H	4/24	17%
I	1/17	6%
J	2/18	11%
K	3/20	15%
L (Rachel)	3/12	25%
M	4/22	18%
N	2/21	10%
O	2/20	10%
P	3/28	11%
Q (Monica)	6/21	28%
R	2/15	13%
S	3/25	12%
T	3/20	15%

PRAGMATIC VERSUS EXPERIENTIAL CHARACTERIZATION

All 20 participants were also characterized as either having a pragmatic or an experiential focus in their participatory relationship with GBL. (Note: a participant has either a pragmatic or an experiential focus—not both). We use the term *pragmatic* to

describe a teacher focus on practical and usually tangible resources and interactions, and we use the term *experiential* to describe a teacher focus on the experiences related to GBL. Thirteen of the teachers were determined to have a pragmatic focus. Characterizing a participant as having a pragmatic focus required that the majority of her sticky notes in the centermost and second concentric rectangles of her diagram have a tendency toward pragmatic matters as described previously. For example, such sticky notes might have included supports and challenges related to practical and concrete considerations such as “garden infrastructure” or “help from an expert.”

Seven of the teachers were determined to have an experiential focus. Characterizing a participant as having an experiential focus required that the majority of her sticky notes in the centermost and second concentric rectangles of her diagram have a tendency toward experiential factors as described previously. Such sticky notes included supports and challenges related to the experiences and dispositions of the various stakeholders and reflect what happens while implementing GBL. For example, a teacher with an experiential focus might have recorded something students or teachers did (e.g., professional development or student presentations at a parent night) or learned (e.g., a teacher learning how to garden or students writing in the context of GBL) on her different sticky notes.

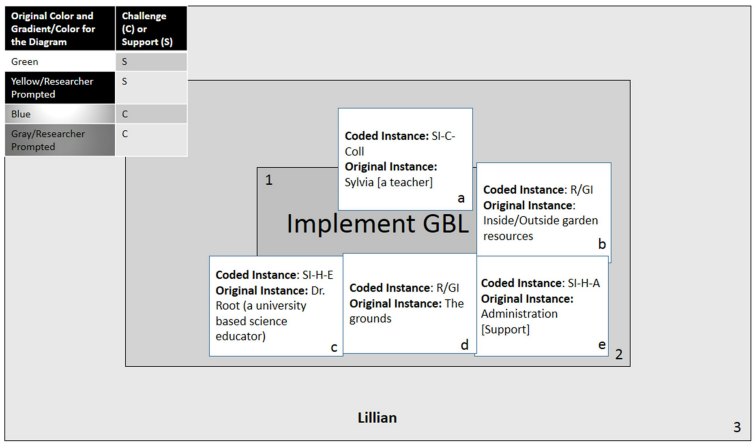
We further characterized the participatory relationship with GBL of these seven experiential teachers as being either teacher-focused or student-focused. Three of these teachers were identified as teacher-focused. A teacher-focus reflected a tendency toward sticky notes that described what the teacher had to do or what was happening to the teacher. For example, a participant with a teacher-focused experiential characterization might have mentioned the time she spends maintaining the garden or the difficulty she has in learning gardening concepts herself. The remaining four teachers were identified as student-focused. A student-focus reflected a tendency toward sticky notes that described what students were doing or experiencing. For example, a participant with a student-focused experiential characterization might have mentioned students’ engagement and motivation while experiencing GBL, a specific student experience (e.g., a tasting party) or what students were learning (e.g., science and mathematics).

In what follows, we present three teachers’ diagrams and interview excerpts to further illustrate a pragmatic, a teacher-focused experiential, and a student-focused experiential characterization.

Lillian, a Participant With a Pragmatic Characterization

Lillian has taught a variety of grade levels (sixth, fifth, fourth, second, and first) at the elementary level for 10 years. She currently teaches in a 3rd–4th grade looping position at Eli Elementary. Figure 3 shows Lillian’s relabeled diagram with the central pragmatic coded instances and related original diagram excerpts. Lillian has five pragmatic instances centrally located on her diagram. All five instances are supports. Two of them relate to garden resources and three relate to the people who help Lillian or collaborate with her to implement GBL. Closer examination of her diagram instances and excerpts from her interview provide further insights into Lillian’s pragmatic focus in her participatory relationship with GBL.

Figure 3. Lillian’s diagram showing pragmatic instances



Lillian's diagram instances and related interview transcript reveal that her central supports to implementing GBL are practical and concrete things or people. Lillian discusses both the human resources she uses to implement GBL as well as the tangible things that she needs. As Lillian places her central instances on the diagram she explains her thoughts: "Well, things that I'm putting here [Central], Dr. Root, administrative [support], the grounds, the resources, both inside and outside, I think those [instances] impacted [my GBL] implementation the most." Support and help from Dr. Root, a university-based science educator, is central to Lillian's GBL implementation. Lillian describes Dr. Root's support as actions such as obtaining necessary resources, helping her maintain the class garden, and assisting her in her curricular classroom endeavors. In the following excerpt Lillian further describes how Dr. Root helped her implement GBL:

I'd say Dr. Root was a big factor. Like, if we had a question, and say I emailed Dr. Root, if he didn't know, he would ask someone, or he would find the answer. It was nice to have that support there.

As Lillian discusses the importance of having people support her GBL implementation, she also mentions her colleagues and administrators. She describes how individual(s) from each of these groups helped her in practical ways. Here, Lillian explains how a colleague supported her GBL implementation:

I would also say Emily [fellow teacher], because I was new to all of this, and she'd been into it for a few years. So I felt like I was treading water, not knowing what to do. She really helped guide a lot.

Additionally, Lillian mentions the importance of administrative support when placing a sticky note about administration on her diagram: "I think our administration [should be centrally placed], because they were very supportive in giving us time to collaborate and work with resources."

Lillian also discusses tangible, practical things like garden resources and materials as well as how essential it is to have the school garden infrastructure already in place. Lillian sums up the critical importance of these tangible resources: "The grounds and also all of the resources we have on the grounds. The fact that we have the garden out there. Look at it out there. It's amazing."

In sum, like Lillian, the other 12 participants with a pragmatic focus in their participatory relationship with GBL had similar patterns in their diagrams and statements in their interview transcripts. These teachers were focused on the practical and tangible aspects of implementing GBL. Table 6 includes a summary by teacher of the frequency data for the pragmatic associated sticky notes. Recall, any percentage greater than 50% is indicative of a pragmatic focus.

Table 6. The Frequency Data for Participants' Pragmatic or Experiential Instances Toward Implementing GBL

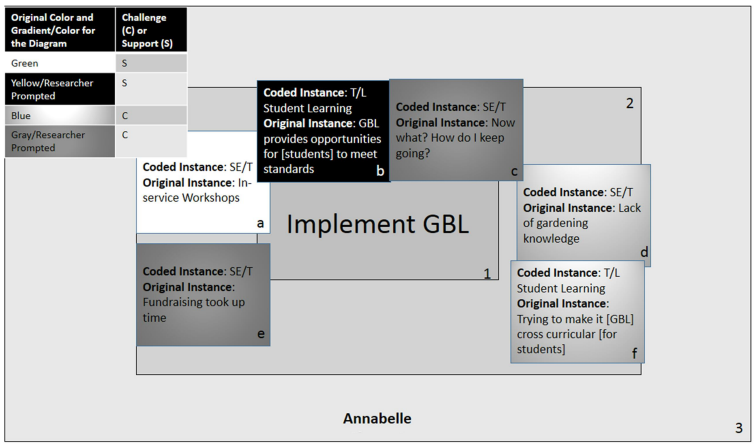
Teacher	#Pragmatic : #Experiential Sticky Notes (in 2 centermost rectangles)	%Pragmatic : %Experiential Sticky Notes	Teacher's Focus
A	5:4	56% : 44%	Pragmatic
B	7:8	47% : 53%	Experiential
C	10:7	59% : 41%	Pragmatic
D	4:8	25% : 75%	Experiential
E	6:5	55% : 45%	Pragmatic
F	6:4	60% : 40%	Pragmatic
G (Annabelle)	3:6	33% : 67%	Experiential
H	10:6	63% : 37%	Pragmatic
I	6:5	55% : 45%	Pragmatic
J	10:8	56% : 44%	Pragmatic
K (Sally)	4:5	44% : 56%	Experiential
L	3:5	38% : 62%	Experiential
M	7:5	58% : 42%	Pragmatic
N	4:4	50% : 50%	Experiential
O	8:6	57% : 43%	Pragmatic
P	10:4	71% : 29%	Pragmatic
Q	6:9	40% : 60%	Experiential
R (Lillian)	7:3	70% : 30%	Pragmatic
S	11:5	69% : 31%	Pragmatic
T	7:6	54% : 46%	Pragmatic

Annabelle, a Participant With a Teacher-focused Experiential Characterization

Annabelle has taught kindergarten for four years. Prior to her current position she taught first, fourth, and fifth grade at a private school and one year as the talented and gifted teacher at Eli Elementary. Figure 5 shows Annabelle's relabeled diagram of experiential coded instances and related original diagram excerpts. Annabelle's

interview diagram shows six centrally located experiential instances. Four of the six instances are teacher focused (a, c, d, e) and include both supports (a) and challenges (c, d, e). The remaining two are student focused (b, f). *Instance b* is a support and *instance f* is a challenge. As the majority of Annabelle's diagram instances are teacher focused, she is identified as having a teacher-focused experiential participatory relationship with GBL. Closer examination of her diagram instances and excerpts from her interview further illustrates her focus.

Figure 4. Annabelle's diagram showing teacher-focused experiential instances



Annabelle's diagram (Figure 4) has one teacher-focused experiential instance that indicates a support to her GBL implementation, i.e., in-service workshops (*instance a*). In the interview, while placing this sticky note on her diagram, Annabelle discusses how her experiences in a series of GBL professional development workshops supported her GBL implementation. Annabelle's diagram has three teacher-focused experiential instances that indicate a challenge to her GBL implementation. These challenges reflect her lack of experience gardening, her experiences as an overflow teacher, and the various professional pressures she feels as a teacher at Eli Elementary. During her interview, Annabelle says that she has very little gardening experience and she feels like she is learning about planting and growing along with the students. She expresses her apprehension about knowing how to successfully grow vegetables in the garden:

I think my biggest thing is that I have the lack of knowledge, and so in that sense I have, I don't want to say fear, but it's like if we plant things in this bed, what do we do from there?

She further clarified:

We've planted this, now what? I didn't know anything about the fact that you had to harden plants. So we've been taking our things out on the playground each day for so many hours to start getting them used to the temperature. I never knew that. And then I don't know how to transplant things.

In addition to struggling with a lack of gardening experience and knowledge, Annabelle tells about being asked to teach an overflow class at the beginning of the school year.

(An overflow class is a class which is added because of increased, unanticipated student enrollments.) She explains how teaching the overflow class affected her GBL implementation:

This year was a very unique year for me, because we were all excited to dive into the garden, and then I was asked to do the overflow class. So we have a new teacher come in, and it seems like every other week we were getting a new student. And so it seems like the garden project kept getting pushed further back and further back. And we didn't intend for that to happen, but it seems like when push came to shove, if we had to put something aside, it had to be that unfortunately. And so that made it difficult.

Annabelle also discusses how the other pressures she feels as a teacher at Eli Elementary impact her GBL implementation:

I felt like, especially this year, there were several other new things that came up during the end of the year, and it was like I couldn't put the attention into the garden project. Because it seemed like every week we were like [told] “oh we want you to do this; oh we need you to do this". And in talking with other teachers we were like, "how are you keeping your heads above water right now?” In kindergarten, I have an aide that is helping me in the garden and I don't know how you guys are doing it without one.”

Part of this pressure was an emphasis on teachers' fundraising efforts for the school (*instance e*). Annabelle explains her role in these fundraising efforts:

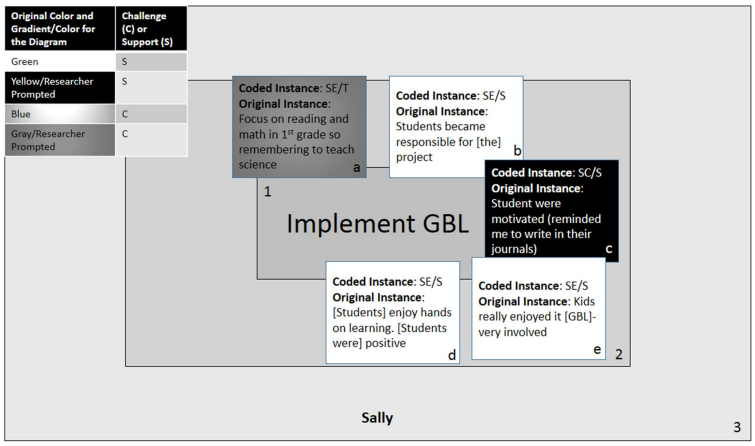
Because this year we had a lot more fundraising than we've had in the past, and so that in turn had teacher involvement. And we've got this calendar party coming up this Friday that has been taking a lot of time; we had the class paintings that we had to do for the art auction. And I know that this is all a new thing for all of us, but at the time I felt like I'm the only one who didn't do my garden-based plan.

In sum, like Annabelle, the other two participants with a teacher-focused experiential participatory relationship with GBL had similar patterns in their diagrams and statements in their interview transcripts. These teachers were focused on their own experiences as a teacher of GBL and the things they found both challenging and supporting in these experiences. Table 6 includes a summary by teacher of the frequency data for the experiential associated sticky notes, and Table 7 includes a summary of the frequency data for teacher-focused sticky notes for these three teachers.

Sally, a Participant With a Student-focused Experiential Characterization

Sally has taught first grade for two years. Prior to her current position she taught second grade for two years and as a talented and gifted teacher also for two years. Figure 5 shows Sally’s relabeled diagram of experiential coded instances and related original diagram instances. Sally’s interview diagram shows five centrally located experiential instances. Four of these five instances are student focused (b, c, d, e) and all of them are supports. The single teacher focused instance is a challenge (*instance a*). As the majority of Sally’s diagram instances are student focused, she is identified as having a student-focused experiential participatory relationship with GBL. Closer examination of her diagram instances and excerpts from her interview further illustrates her focus.

Figure 5. Sally’s diagram showing student-focused experiential instances



Sally's diagram shows four student-focused experiential instances reflecting three areas: students were motivated and engaged *(instances c* and *e*), students exhibited responsibility (*instance b)*, and students enjoyed the hands-on learning in the classroom (*instance d*). During her interview, Sally shares how her students were motivated and engaged and this made them responsible about their garden projects. She explains: "The students liked it, and they really wanted to use their journals. That's what kept me using it, I think. [That is what kept me] using the garden-based learning." She then discusses how the students' motivation led to them taking on more responsibility: "and then the students were more responsible, because it helped me realize that I didn't have to do it, all of the kids wanted to do it. So that helped me."

Sally also explains in her interview that it was initially difficult to turn the responsibility for the garden maintenance over to her students. However, she found that she let go of that responsibility as her students became responsible for watering the garden, feeding the classroom worms, and making sure that the classroom lettuce was thriving. She expresses this initial teacher challenge (not placed centrally on her diagram) and related student experience (*instance b*) in the following excerpt:

A challenge was passing on the responsibility. I don't think I'm a control freak, but I worried if I gave them too much [to do], or they will forget. Later in the project it was actually me that forgot about the worms. I found they [the students] become really responsible for the garden. But first it was hard to pass on the responsibility, to let them take over the work.

Sally also discusses specific hands-on GBL learning projects that her students experienced. Sally mentions a variety of class projects during her interview. These various class projects are reflected in *instance d* of her diagram. In her interview she elaborates on this and discusses students' experiences working both on a lettuce project and with vermicomposting. One component of the lettuce project was a pen-pal writing project with another class. She describes this project during her interview and her reasoning for placing *instance d* centrally on the diagram: "I'm going to put this one in learning and staying positive, because it really made me want to do more garden-based learning. The kids were very involved. And that motivated me with the garden-based learning."

In addition, Sally describes her students' work with vermicomposting and some related classroom experiences: "We had a worm presentation, and the parents came and each group had a worm song that had worm facts. That was really fun for the students." Sally also discusses students' learning surrounding their experiences with

the vermicomposting,

Well, they began with what do they eat, and just the different types of worms. They would find one and try to bring it in, and they would try to add it to the worm bin. They would have to talk about how they weren't the same types of worms and why we couldn't add a new worm with the others.

In sum, like Sally, the other three participants with a student-focused experiential participatory relationship with GBL had similar patterns in their diagrams and statements in their interview transcripts. These teachers were focused on their students' experiences in learning content and in participating in GBL activities. Table 6 includes a summary by teacher of the frequency data for the experiential associated sticky notes, and Table 7 includes a summary of the frequency data for student-focused sticky notes for these four teachers.

Table 7. The Frequency Data for Participants' Student Focused Sticky Notes Toward Implementing GBL

Participants with an Experiential Stance	#Teacher-focused: #Student-focused Sticky Notes (in 2 centermost rectangles)	%Teacher-focused: %Student-focused Sticky Notes	Participant's Focus within Experiential Stance
B	4:3	57% : 43%	Teacher-focused
D	5:2	71% : 29%	Teacher-focused
G (Annabelle)	4:2	67% : 33%	Teacher-focused
K (Sally)	1:4	20% : 80%	Student-focused
L	2:3	40% : 60%	Student-focused
N	2:2	50% : 50%	Student-focused
Q	3:6	33% : 67%	Student-focused

To summarize, our results characterizing teachers' interactions with GBL indicate two participants with a teaching and learning characterization, 13 teachers with a pragmatic characterization, seven teachers with an experiential characterization, and of these seven teachers, three with a teacher focus and four with a student focus.

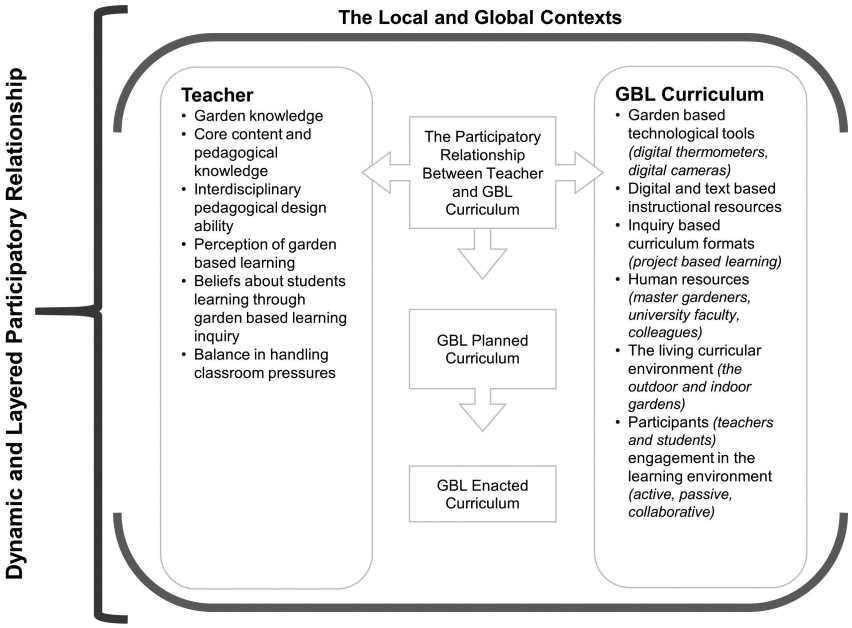
DISCUSSION

THE PARTICIPATORY RELATIONSHIP BETWEEN THE TEACHER AND GBL CURRICULUM

It is not surprising that these findings show both similarities and differences among teachers who are implementing GBL. Prior work suggests this is often true when teachers implement a new program or curriculum into their practice (Roehrig, Kruse, & Kern, 2007). What is interesting about these findings is that they provide some insight into the teacher/curriculum relationship specifically in a GBL context. Recall that, like Remillard (1999, 2005), we believe that the similarities and differences we see among teachers implementing GBL are the result of an interaction (see Figure 6) between

teacher resources (e.g., their garden knowledge, core content and pedagogical knowledge, balance in handling classroom pressures) and GBL curriculum resources (e.g., digital and text based instructional resources, learning environments that make use of the outdoor and indoor garden infrastructure). In order to illustrate how our findings inform this participatory relationship, we have placed in Remillard's framework the frequent GBL resources that our findings indicated are at play when teachers implemented GBL. Additionally, we have applied Remillard's framework to illustrate that the participatory relationship in this context is not only unique to a teacher (as is inherent in Remillard's framework), it is also dynamic and layered.

Figure 6. Remillard's (2005) framework applied in the GBL context



Dynamic Participatory Relationship

A dynamic participatory relationship is one in which the teacher and curricular resources at play vary and change according to context. For example, in their interviews, teachers named supporting and challenging factors to their GBL implementation. These supports and challenges varied across teachers and were directly related to teachers' particular GBL contexts. (Recall that for the different teachers the GBL contexts varied, involving both indoor and outdoor spaces as well as cross-curricular learning contexts.) Therefore, the sticky notes on many teachers' diagrams included things that had happened in a specific environment and impacted their specific, enacted GBL curriculum. For example, one teacher whose GBL project involved growing herbs in a tea garden named very specific factors from that project (e.g., "we had a tea tasting party" and "we invited the tea lady"). Additionally, some of the teachers who used an indoor container garden in their GBL practice named "bugs" as a challenge, a specific factor in the indoor environment that impacted their GBL implementation. The fact that teachers identified factors specific to their varied GBL contexts suggests that the teacher and curricular resources at play in each context varies. In other words, the participatory relationship is dynamic. This is important. If people involved in supporting GBL initiatives can enhance supporting and mitigate challenging factors in a given context, they can impact the participatory relationship and thus impact a teacher's GBL implementation. For example, if GBL educators simply provide resources that control the indoor gnats, they change the context, the participatory relationship changes, and the enacted curriculum is impacted.

Layered Participatory Relationship

By layered we mean that some resources are more at play in the participatory relationship than others. The central and peripheral placement of sticky notes showed us the layered nature of the participatory relationship; it demonstrated that some factors had more impact than others on teachers' GBL implementation. Demonstrating this relationship as layered allows us to account for both the similarities and differences we see in the teachers' GBL practice because, although participants may have identified similar teacher and curricular resources at play, the impact of specific resources may have varied. This layered-ness helps explain the difference between a teacher who is focused on the pragmatic factors versus one who is focused on the experiential factors impacting their implementation of GBL. As a result, on the one hand we see teachers who have more of a pragmatic participatory relationship, and on the other hand we see teachers who have more of an experiential participatory relationship. Both types of relationships impact the GBL curriculum that a teacher enacts.

CONSIDERING THE CHARACTERIZATIONS OF THE PARTICIPATORY RELATIONSHIP BETWEEN THE TEACHER AND GBL CURRICULUM

Absence of Teaching and Learning Related Resources at Play in the Participatory Relationship

Also important to consider is the fact that teaching and learning related factors were mostly absent in the teachers' diagrams suggests that teaching and learning related resources do not readily come into play in the participatory relationship that results from the enacted GBL curriculum. We find this concerning for the sustainability of GBL initiatives. We had expected (perhaps naively) that teachers would identify more teaching and learning related supporting and challenging factors in their interviews. These would have indicated how they think about, plan for, and consider teaching and student learning in their GBL practice. Only two teachers included at least 25% teaching and learning related factors on their sticky notes. This suggests that teachers may not be seeing the teaching and learning potential of GBL, including the cross-curricular and extended learning opportunities it affords. In fact, some teachers told us that GBL is not part of the required curriculum. In other words, some teachers see GBL as something added beyond their regular, mandated curriculum. This result concerns us because local, state, and federal initiatives create mandates which result in limitations on teachers' curricular classroom time. We cannot expect the initiative to be sustainable if teachers simply use GBL as an add-on to their existing curriculum. Teachers need to see GBL as an extended cross-curricular inquiry—not as fixed, one-time classroom activities. Monica (one of the teachers who did focus on teaching and learning) stated such in her interview: "Because you can teach the garden-based learning, but we don't have time to just teach that, if you don't integrate, then you're making more work for yourself."

All of the teachers in our study did attend at least one formal professional development session in which the facilitator emphasized that GBL needs to be a means to accomplish science, mathematics, and other curriculum standards, and examples of such were provided. As such, we can only hypothesize and emphasize the need for further research into why teachers did not mention teaching and learning more in their interviews and related diagrams. Perhaps participating teachers did not see teaching and learning aspects as either supporting or challenging factors in implementing GBL, or they did not see GBL as something that could support robust, cross-curricular, extended inquiry learning. Some teachers perhaps thought that the time involved to implement GBL well (creating a robust, authentic extended inquiry learning context) would become too great of a restraint. In this case, the teaching and learning aspects of GBL did not come into play. One teacher, for example, talked about managing what core curricular content is best taught in the GBL context and what core curricular material is not. Speaking about a specific curricular experience of integrating mathematics (data analysis and number sense development) into the context of GBL, Linda pondered this important curricular balance: "Do I spend an extra two days on this lesson to march them outside three times [to work with numbers in the garden]? Or is it more efficient to just teach it with blocks on the table . . . there's efficiency that way too." As discussed above, if we see the participatory relationship between the teacher and curricular resources as unique, dynamic, and layered, then it makes sense to look at the available resources as a means of changing the factors that impact teachers' enacted GBL curriculum. In other words, if we want teachers to consider teaching and learning factors as impacting their GBL practice, then we need to pay attention to the dynamic, layered contexts and individual teacher's learning needs in GBL initiatives.

This work contributes to the field by offering a lens to view, consider, and discuss the participatory relationship that Remillard (2005) described between the teacher and the curriculum. We discuss how that participatory relationship results in the planned and enacted GBL curriculum specifically in a GBL context. We agree with Remillard in her contention that “the designers of curriculum materials, as well as those who adopt them, must carefully consider how they frame and support the teacher-curriculum relationship.” Further, we recognize that this support should be grounded in professional learning, incorporating not only what we know about effective professional development (Briscoe, 1991; Desimone, Porter, Garet, Yoon, & Birman, 2002; Desimone, Smith, & Phillips, 2007; Goldman & Scardamalia, 2013), but also what we now know about changing the available resources in a GBL context so that teaching and learning are highlighted.

The necessity of GBL support is true for all teachers (Blair, 2009) regardless of whether the participatory relationship is more pragmatic or experiential. Such support can certainly take many forms, and regardless of the form, it necessarily should focus on teacher learning situated in the dynamic, layered, and individual contexts that impact teachers’ GBL planned and enacted curriculum. If the relationship relies more on pragmatic factors (e.g., a teacher's knowledge of how to use garden-based technology tools, or a teacher's time to use inquiry based curriculum), then we need to maximize teacher learning through understanding influential contexts (e.g., time) and provide teacher learning opportunities that emphasize pragmatic teaching and learning resources. This could involve: using GBL developed lesson plans with related core curricular content as an “artifact of practice” in professional development; co-teaching so that paired teachers can work together to integrate GBL across the curriculum; or using the existing standards as a springboard to plan GBL teaching and discuss related student learning. If, on the other hand, the relationship relies more on experiential factors (e.g., a teacher's use of interdisciplinary pedagogical design knowledge to create an inquiry based outdoor curriculum experience), then we need to provide teacher support and learning opportunities that emphasize experiential teaching and learning resources. This could involve viewing and discussing video of authentic GBL classroom experiences or supporting teachers to include explicit consideration of how the GBL experiences target specific learning goals and curriculum integration in their own GBL planning.

CONCLUSION

In this study, we used Remillard’s framework to investigate and characterize the participatory relationship between teachers and the GBL curriculum and then discussed the implications of this for teacher learning. We learned that this relationship in this particular school context is dynamic and layered, that there are or are not teaching and learning related resources at play, that it involves pragmatic and experiential aspects, and that it can be teacher or student focused. We believe, like Cochran-Smith and Lytle (1999), that understanding and supporting teachers' learning contexts is essential as we try to maximize the potential of curriculum reform initiatives, such as GBL. These characterizations provide several insights for understanding and supporting GBL teacher learning contexts and will help guide future research. We would like to offer two examples of how this work does this. In the first example, we discuss contexts that can impede teacher learning around implementing GBL specifically and new curriculum more generally, and in our second example, we discuss contexts that promote and support teacher learning.

In reference to the first example, return to Annabelle, our teacher-focused experiential exemplar, who shared her lack of experience gardening, her experiences as an overflow teacher, and the various professional pressures she feels as a teacher at Eli Elementary. If we as educational stakeholders don’t pay attention to her teacher-focused (most central) experiences that challenge her implementation of GBL, it is likely that she will respond to the immediacy of her environment rather than maximize the teaching and student learning potential of GBL. We know that the teacher and curriculum relationship is dynamic, and Annabelle (as well as other teachers) needs support that addresses her challenges specifically and equips her with the tools necessary to change her individual context and create a space for her own learning.

Absent such consideration and support, teachers will continue to respond to the immediacy of the environment rather than the bigger, enduring issues related to teaching and learning.

Beyond addressing factors that can impede teacher learning, individuals involved in educational change (teacher educators, curriculum specialists, and teachers) need to continue trying to understand and develop spaces for teacher learning. These spaces should move beyond traditional professional development focused on teacher participation toward experiences focused on teacher learning within and across their teaching contexts. These learning spaces must, moreover, consider teachers' individual contexts (what supports their individual GBL implementation and what challenges it). For example, we know that if students are to learn successfully, teachers must focus on student learning, they must evaluate their own teaching, they must make explicit and implicit decisions during the planning and enactment of learning experiences, and they must assess student understanding (Darling Hammond & Bransford, 2010; Morris, Hiebert, & Spitzer, 2009). In other words, teachers need to have an intentional focus on the teaching and learning aspects of their practice. In this study, we found that only 2 out of the 20 teachers had this focus as they talked about their GBL practice. Future research needs to establish an empirical basis of the teaching and learning aspects of GBL. Such research will allow us to more effectively support the professional growth of teachers participating in various GBL educational initiatives that emphasize teaching and student learning. As previously discussed, the characterization of teachers as pragmatic and experiential, teacher or student focused, could inform the design and empirical study of these professional learning spaces for future research. Such research in other contexts could explore whether the lack of a teaching and learning focus is generally true of teachers implementing curriculum or whether it is a particular concern for any new educational initiative.

Ultimately, future research will investigate how a characterization of the participatory relationship changes and evolves in varied research contexts. Such scholarly efforts could lead to the development of comprehensive and transferable ways to characterize, understand, and consider the relationship between a teacher and the curriculum.

Notes

1. Later we will describe the pragmatic and experiential characterization fully, but it is important to make clear that our use of the term *experiential* is meant to describe *teachers' experiences* implementing GBL, not to comment on the experiential learning that can occur in a GBL context.

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