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UNDERSTANDING THE IMPACT OF A GLOBAL UNIVERSAL DESIGN FOR LEARNING (UDL) VIRTUAL CLASSROOM ON JAMAICAN EDUCATORS THROUGH THE LENS OF HOW PEOPLE LEARN (HPL)

Kathryn W. Best
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UNDERSTANDING THE IMPACT OF A GLOBAL UNIVERSAL DESIGN FOR LEARNING (UDL) VIRTUAL CLASSROOM ON JAMAICAN EDUCATORS THROUGH THE LENS OF HOW PEOPLE LEARN (HPL)

A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy at Virginia Commonwealth University.

by
Kathryn Whitaker Best
Bachelor of Arts, University of Richmond, 1992
Master of Arts, Virginia Commonwealth University, 2000

Director: Thomas Farmer, Ph.D.

Professor, Special Education and Disability Policy

Virginia Commonwealth University

Richmond, Virginia

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SPECIAL EDUCATION AND DISABILITY POLICY

VIRGINIA COMMONWEALTH UNIVERSITY

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This is to certify that the dissertation prepared by Kathryn Whitaker Best, entitled:

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DEDICATION

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Director: Thomas Farmer, Ph.D.,Professor
Department of Special Education and Disability Policy
School of Education

This case study examined learning components and outcomes of the UDL Virtual Classroom project, a web-based professional development program that was a collaboration between educators in the United States and Jamaica. The study applied the HPL lens (NRC, 2000) in order to understand the ways that Jamaican educator-participants perceived the integration of *learner-centered* learning, *knowledge-centered* learning, *assessment-centered* learning, and *community-centered* learning in the program itself, and also examined the impact of these components, despite numerous hurdles, on teachers' mindsets and practices and the

engagement and performance of students in their schools and classrooms. The researcher's intent was to address the contextual nature of teacher learning, which must contend with the challenges of meeting the needs of individual teacher-learners, as well as obstacles and real-world situations impacting the implementation of theories and strategies. A multi-case study design was used to gather data through observations, interviews, group meetings, and surveys. Findings were analyzed using qualitative methods, focusing on the experiences of participants both as adult-learners in the professional development program and as educators themselves as they returned to their own educational contexts to implement what they had learned. This study provided insights about strengths and challenges of hybrid learning, international resource-sharing, and long-term impacts of teacher learning.

Keywords: universal design for learning, UDL, professional development, teacher learning

CHAPTER 1
INTRODUCTION

Educators who entered the field even as recently as 2000 may find themselves faced with changing populations and changing expectations. In order to prepare educators to teach diverse learners the competencies for success in the modern world, effective professional development is needed to give them the skills and knowledge to continue to integrate new practices (Baker & Zigmond, 1990; Dede, Ketelhut, Whitehouse, Breit, McCloskey, 2009; Lenhardt, Madden, & Hitlin, 2009; Smith & Tyler, 2011; Waitoller & Artiles, 2013). As noted by Hall & Hord (2011), "introducing new practices alone seldom results in new practices being incorporated into ongoing classroom practices" (p. 52). An alternative approach to the traditional, one-time workshop or presentation is one that focuses on the teachers themselves as learners and provides opportunities to expand knowledge and skills that are contextually relevant, supported, and grounded in day-to day practice and curricula (Clarke & Hollingsworth, 2002; Cochran-Smith & Lytle,1999; Hall & Hord, 2011; Lesar, Brenner, Habel, & Coleman, 1997; Owston, Wideman, Murphy, & Lupshenyuk, 2008; Schlager & Fusco, 2003; Wenglinsky, 2002). By examining teacher professional development through the lens of How People Learn (HPL) theory (National Research Council [NRC], 2000), we can begin to identify components that support teacher engagement in the process of learning as well as the reform, development, and integration of new strategies in the classroom.

Strategies used in traditional professional development, such as short workshops or lectures, often serve as poor and disconnected examples of the methods they propose (Desimone, Porter, Garet, Yoon, & Birman, 2002; Hesling, Howell, Kegan, & Lahey, 2008). Nevertheless, these models of teacher learning are still widely practiced because they are more affordable, both in terms of cost and time, resources that are often limited in school systems (McLaughlin & Talbert, 2006; Owston et al., 2008; Smith & Tyler, 2011). Research is needed to determine what works in professional development by applying existing knowledge about learning to teachers themselves, while also considering viability given the resources available.

Universal Design for Learning [UDL] (National Center on UDL, 2012c) is a research-based framework that holds potential for giving teachers in general education classrooms the tools to create settings and experiences that meet the challenges of learner variability and teach 21st century skills in inclusive settings, and since this framework is broad enough to include adult learners, it may be valuable to investigate its possibilities for the design and delivery of professional development as well. UDL is one part of a greater movement toward universal design, a term coined by architect Ron Mace, that focuses on creating spaces, buildings, and tools that are accessible to individuals regardless of physical ability (Mace, Hardie, & Place, 1991). UDL applies these principles to learning environments "to ensure that the means for learning, and their results, are accessible to all students" (Rose & Gravel, 2012, p.7). This is more than just re-structuring physical classroom space or re-designing instruction; it is a fundamental shift in the way we think about education in general. While there is a growing research base to support the ways that UDL offers flexibility and attention to the affective components of learning in the classroom (Basham, Lowrey, & deNoyelles, 2010; Basham & Marino, 2013; Coyne, Pisha, Dalton, Zeph, & Cook Smith, 2012; Katz, 2013; Kortering,

McClannon, & Braziel, 2008; Meo, 2008; Meyer, Rose, & Gordon, 2014; Price, Johnson, & Barnett, 2012; Rappolt-Schlichtmann, Daley, Lim, Lapinski, Robinson, & Johnson, 2013; Rose & Gravel, 2012; Smith, 2007; Smith, 2012), there is still much to be learned about how UDL might also inform strategies for delivering professional development.

Statement of the Problem

In order for any framework for educational change to impact students' learning, its value and practices must make it into the hands of systems, schools, and classroom teachers. However, having a theory or a tool is not enough; teachers need to know how to apply what they have learned in various contexts (NRC, 2010). And perhaps more fundamentally, teachers may need to recognize value in the learning as it applies to their goals, their students, and their curricula before they are willing to invest the time and effort into learning and implementing new approaches (Clarke & Hollingsworth, 2002; Guskey, 1986; Hall & Hord, 2011). Citing the research of Ron Heifetz (1994, 2002; Heifetz & Linsky, 2004), Hesling, Howell, Kegan, & Lahey (2008) asserted that educational leaders must make substantive shifts in their beliefs and values in addition to their practices, calling for professional development that is "genuinely developmental" and focuses on growth and transformation.

Fundamental shifts in beliefs and routines may be an especially challenging sell for veteran teachers who are skeptical of change or reluctant to jump on the bandwagon of what they perceive to be another education fad that could prove to be impractical or short-lived (Clarke, Carlin, & Peter, 1992; Clarke & Hollingsworth, 2002; Hall & Hord, 2011; Hesling et al., 2008; Wagner, 2008). For any substantive educational reform to take place, studies show that it is crucial for teachers and administrators to see the need for change and be open to learning new

methods and ideas (Avalos, 2011; Clarke & Hollingsworth, 2002; Helsing et al., 2008; Ross & Bruce, 2007).

While proponents of UDL assert that it offers a new lens for understanding learning and shaping instructional goals, assessments, and practices (Meyer, Rose, & Gordon, 2014; National Center on UDL, 2012; Nelson, 2014; Rose & Gravel, 2012), research on UDL professional development is limited, and further studies are needed to determine UDL's feasibility for teacher learning and classroom implementation. Since most of the research on teacher training in UDL has been conducted with teachers/students in graduate classes (e.g. Ayala, Brace, and Stahl, 2012; Courey, Tappe, Siker, and LePage, 2012; McGuire-Schwartz & Arndt; 2007; Schelly, Davies, & Spooner, 2011; Spooner, Baker, Harris, Delzell, & Browder, 2007), one must consider carefully the context when analyzing the results or making generalizations about the impact this training has on teachers in K-12 classrooms.

The Universal Design for Learning Series' online module, *UDL Implementation: A Process of Change*, stressed the importance of stakeholder buy-in and investment: "Starting with a clearly identified need for change is critical for success UDL implementation at a systemic level" (National Center on UDL, 2012b). Edyburn (2010) similarly identified the first phase of this transformation as "awareness training." Transforming curriculum and educational practice requires teachers' commitment to a new way of thinking, a challenge that is identified in existing professional development literature (Clarke et al., 1992; Clarke & Hollingsworth, 2002; Darling-Hammond & Bransford, 2005; Ganley & Ralabate, 2013; Gurskey, 1986; Hall & Hord, 2011; Helsing et al., 2008). While these studies show that teacher engagement is critical to learning and positive school change, there is limited evidence about the kinds of programs that can feasibly achieve this across culturally, economically, and geographically diverse contexts.

Rationale for Study

Public schools in the United States, committed to providing a quality education for all, are settings that increasingly include students with disabilities (Brownell, Sindelar, Kiely, & Danielson, 2010; National Research Council [NRC], 2010), growing numbers of English language learners (NCES, 2012), and individuals with diverse backgrounds and experiences (Shrestha, & Heisler, 2011). Around the globe, approximately 150 nations pledged, by signing the Convention on the Rights of Persons with Disabilities (CRPD), to provide an inclusive education for individuals with disabilities (UN General Assembly, 2007), and the UN Educational, Scientific, and Cultural Organization (UNESCO) asserts that "increasing attention to ethnic and linguistic minorities" is among the policies linked to improving successful access to education. There are also new requirements for the types of knowledge that students [and teachers] need in order to be successful in the 21st century, where technology and information are constantly evolving and shifting, where problem-solving and innovation are essential (National Research Council, 2012). These knowledge demands, which include demands for products and services along with communication technologies, may pose specific challenges to nations and communities with limited resources, but along with these challenges come opportunities to diversify the workforce and expand educational systems (Jules, Miller, & Armstrong, 2006).

Adapting pedagogical frameworks and instructional practices to meet the demands of 21st century classrooms may be uniquely challenging for those who have been in the classroom for years and have developed traditional methods that are comfortable and efficient (Darling-Hammond & Bransford, 2005; Hinshaw & Gumus, 2013; Jenkins, H., Clinton, K., Purushotma, R., Robinson, A. J., & Weigel, M., 2006; NETP, 2010; Wagner, 2008). It may also be difficult in schools and systems where resources (personnel, technology, facilities, supplies) are limited

(Dede, Ketelhut, Whitehouse, Breit, & McCloskey, 2009; Jenkins et al., 2006; Kennedy, 2010; Richmond & Manokore, 2010).

Statement of Purpose

Studies show that in order to result in substantive, sustainable change, effective professional development must recognize that educators, like the students they teach, are a diverse group with different backgrounds, interests, and learning needs (Avalos, 2010; Clarke & Hollingsworth, 2002; Darling-Hammond & Bransford, 2005; Helsing et al., 2008). Teachers need collaborative learning and problem-solving models that are flexible, contextually relevant, culturally responsive, supportive, and dynamic (Avalos, 2010; Desimone, Porter, Garet, Yoon, Birman, 2002; Guskey, & Yoon, 2009; Hall & Hord, 2011**)**. Findings from the National Research Council (2000) about how people learn (HPL) categorize these learning components as *learner*-centered, *knowledge*-centered, *assessment*-centered, and *community* centered.

The overall purpose of this study is to apply the HPL lens in order to investigate whether these components were achieved in an individual professional development program, a UDL Virtual Classroom project, and how they impacted participants' engagement, beliefs about learning, and classroom practices. This study provides rich, descriptive detail about the strengths, weaknesses, and impacts of this program's design and delivery.

Literature/Research Background and Conceptual Framework

The review of literature begins with a discussion of the changing school populations (Brownell, Sindelar, Kiely, & Danielson, 2010; NRC, 2010; Skinner & Dragoo, 2014, Shrestha, & Heisler, 2011), knowledge demands for the 21st century (Ayala, Brace, & Stahl, 2012; Jenkins, 2009; Jenkins, Clinton et al., 2006; Johnson & Lomas, 2005; Meyer, Rose, & Gordon, 2014; NETP, 2010; NRC, 2012; Oblinger & Oblinger, 2005; Rose & Gravel, 2012), and new

expectations for teachers (IDEA ,2004; NCLB, 2001; HEOA, 2008; U.S. Department of Education's "Blueprint for R.E.S.P.E.C.T", 2013; The National Council for Accreditation of Teacher Education [NCATE], 2008; Council for Exceptional Children [CEC], 2012; Interstate Teacher Assessment and Support Consortium [InTASC], 2011) that are the contextual basis of this study. Literature included national statistics and policy objectives for both the US and Jamaica, highlighting overlapping goals of inclusive, quality education for all students and the need to equip teachers with the tools to meet these goals. Research indicated that there is a gap between teacher knowledge and beliefs and practices (Clarke & Hollingsworth, 2002; Cochran-Smith & Lytle, 1999; Rappolt-Schlichtmann, Daley, & Rose, 2012 et al., 2005; Hall & Hord, 2011; Helsing et al., 2008; Hodkinson, 2006; Idol, 2006; James & McCormick, 2009; Katz, 2013), and this raises the important issue of translating research to practice, taking evidence about the benefits of inclusion and research-based strategies and putting them to work in school contexts.

In addition to the growing understanding of learner variability, there are new requisites for the types of education necessary for success in the technology-rich, globally connected 21st century (Ayala, Brace, & Stahl, 2012; Jenkins, 2009; Jenkins, Clinton et al., 2006; Johnson & Lomas, 2005; Meyer, Rose, & Gordon, 2014; NETP, 2010; NRC, 2012; Oblinger & Oblinger, 2005; Rose & Gravel, 2012). One critical assumption related to 21st century learning is that there is a need to transform the way teachers understand learner variability and design classrooms and curricula to meet the needs of diverse learners (NRC, 2012).

The theoretical framework of UDL (Meyer, Rose, & Gordon, 2014; National Center on UDL, 2012c; Rose & Gravel, 2012) provides a lens for preparing teachers to address learner variability and teach 21st century skills. UDL applies the principles of universal design (Mace,

Hardie, & Place, 1991) to learning environments "to ensure that the means for learning, and their results, are accessible to all students" (Rose & Gravel, 2012, p.7). Grounded in cognitive neuroscience, UDL is based on three fundamental principles that address teaching and learning: Provide multiple means of engagement; provide multiple means of action and expression; provide multiple means of representation (Meyer, Rose, & Gordon, 2014; National Center on UDL, 2012c; Rose & Gravel, 2012). While research on UDL is relatively new, there are studies demonstrating its positive impacts on student interest and engagement (Basham, Lowrey, & deNoyelles, 2010; Katz, 2013; Kortering, McClannon, & Braziel, 2008; Rappolt-Schlichtmann, Daley, Lim, Lapinski, Robinson, & Johnson, 2013; Smith, 2007; Smith, 2012), accessibility to STEM (science, technology, engineering, math) learning, which focuses on problem-solving and other important 21st century skills (Basham & Marino, 2013; Price, Johnson, & Barnett, 2012), reading comprehension (Coyne, Pisha, Dalton, Zeph, & Cook Smith, 2012; Meo, 2008), and learning for English language learners (Lopes-Murphy, 2012). UDL has also been proven to increase engagement in university settings (Courey et al., 2012; Leichliter, 2010; Rose, Harbour, Johnston, Daley, and Abarbanell, 2006; Smith, 2007, 2012).

Although incorporation of UDL instruction in teacher candidate and graduate programs is still somewhat limited, available research around UDL training has primarily taken place in postsecondary settings (Ayala et al., 2012; Courey et al., 2012; Hinshaw & Gumus, 2013; McGuire-Schwartz & Arndt, 2007; Schelly et al., 2011; Spooner, Baker, Harris, Delzell, & Browder, 2007). Professional development in UDL that is contextually situated in K-12 schools is, for the most part, undocumented. The one exception is a case study, conducted by The National Center on UDL, of four school districts that have undertaken UDL implementation through grant funding from CAST (Ganley & Ralabate, 2013). Because of the "situated nature"

of teacher learning (Avalos, 2011, p.15), further research is needed to address the gaps in the literature and determine best practices for UDL professional development across a wide range of school settings.

In order to gain insight into professional development strategies that have proven effective in K-12 settings, the literature review also included studies of teacher education outside the scope of UDL. Research in teacher education centered on themes of educating diverse learners (Dede, 2009; Wenglinsky, 2002), linking theory and practice through modeling and collaboration (Darling-Hammond et al., 2005; Hall & Hord, 2011; Sales, Traver, & Garcia, 2011; Shank, 2006), professional learning communities (Avalos, 2011; Shank, 2006; Skerrett, 2010; Wenger, 1998), self-assessment (Ross & Bruce, 2007), extended interventions (Avalos, 2011; Kriek and Grayson, 2009), and use of web-based training and participatory learning (Jenkins et al., 2006; Morris & Hiebert, 2011; Smith & Tyler, 2011).

For those who have been in the classroom for many years, adjusting one's approach to content, technology, and other aspects of inclusive, 21st century education may prove to be a demanding task (Darling-Hammond & Bransford, 2005; Hinshaw & Gumus, 2013; Jenkins et al., 2006; NETP, 2010; Wagner, 2008). Teacher buy-in is a critical element of effective professional development (Avalos, 2011; Clarke & Hollingsworth, 2002; Helsing et al., 2008; Ross & Bruce, 2007), and the frameworks of Adaptive Expertise [AE] (Hatano & Inagaki, 1986) and *How People Learn* [HPL] (NRC, 2000) offer important insights into the teacher as learner that can guide the way we develop teacher education. According to Hatano and Inagaki's 1986 conceptualization, routine experts are "lifelong learners who increasingly become adept at performing a specific set of skills in response to familiar challenges" (DeArment, Reed, & Wetzel, 2013, p.5-6). Adaptive experts, on the other hand, combine efficiency with innovation.

Bransford (2004) noted that the transformation from routine to adaptive expertise is not a quick or easy one, suggesting that it might be more difficult for those who have an efficient, developed routine expertise to become adaptive. Applied to the task of educating teachers to be inclusive, this may require different approaches for new and experienced educators. While experienced teachers may have old habits and engrained ideas, new teachers may still be learning the basics of classroom management and curriculum.

The *How People Learn* (HPL) framework (NRC, 2000) provides a guideline for understanding the learning process, and in this case it has relevant applications as an analytic framework for understanding teacher training and the promotion of adaptive expertise. The goal of professional development is to promote "deeper learning" (Pellegrino & Hilton, 2012) of UDL strategies, learning that can be transferred to new situations and applied in a variety of contexts. It is necessary, therefore, to understand both the cognitive processes of individuals and the social interactions of the community in order to promote deeper learning and transferable skills (Pellegrino & Hilton, 2012). Like other types of learning, professional development that takes into consideration the spectrum of teachers' needs, from novices to experienced veterans, is most effective when it is ongoing, supported, and contextualized (Darling-Hammond & McLaughlin, 1995; Delannoy, 2000; Pitsoe, & Maila, 2012). This complements the current literature on UDL implementation, which indicates that teachers need to "buy in" to the process by identifying a need for change (National Center on UDL, 2012b).

Darling-Hammond and Bransford (2005) summarized four components of the HPL framework and noted that effective teachers find a balance among them:

- The *learner* and his or her strengths, interests, and preconceptions;

- The *knowledge*, skills, and attitudes we want people to acquire and how they may be able to do so in order to transfer what they've learned;
- The *assessment* of learning that both makes students' thinking visible and, through feedback, guides further learning; and
- The *community* within which learning occurs, both within and outside the classroom. (p.32)

Figure 1. The Four Lenses of the HPL Framework (www.iris.peabody.vanderbilt.edu)

Each of these components provides an analytic lens to explore professional development for teachers as well as the components that influence implementation of new knowledge and strategies. As Figure 1 indicates, these components overlap and are all situated within the community, the social and cultural context (Darling-Hammond & Bransford, 2005), where learning takes place. Learning that is *learner-centered* is attentive to the "knowledge, skills, and attitudes" of learners, including cultural backgrounds, pre-existing beliefs, and experiences (Darling-Hammond & Bransford, 2005; NRC, 2000). *Learner-centered* education also pays attention to engagement by monitoring progress and providing appropriate supports and challenges along the way (NRC, 2000). Learning that is *knowledge-centered* considers carefully

"what is taught (information, subject matter), why it is taught (understanding), and what competence or mastery looks like" (NRC, 2000, p. 24). Rather than just providing learners (in this case the teacher) with new ideas or best practices, research shows that professional development needs to focus on how and when teachers use new information (Guskey & Yoon, 2009; Helsing et al., 2008; Rose & Church, 1998) and how content is relevant to teachers' goals, existing curricula, and state standards (Desimone et al., 2002). Learning that is *assessment-centered* incorporates formative assessment and feedback during the process of instruction; in this sense, assessment is itself a form of learning, not just an evaluation tool (Darling-Hammond & Bransford, 2005; NRC, 2000). Applied to teacher learning, research has indicated that effective professional development incorporates feedback and reflection as critical components of teacher learning (Antoniou & Kyriakides, 2013**;** Guskey & Yoon, 2009; Hall & Hord, 2011; Ross & Bruce; Sales, Traver, Garcia, 2011).

As Figure 1 indicates, the previous three components are situated within the community where learning takes place. According to the HPL framework, learning that is community-centered pays close attention to physical, cultural, and social factors by "providing supportive, enriched, and flexible settings where people can learn from one another" (Darling-Hammond & Bransford, 2005, p.33). The significance of contextual factors is supported by literature on professional development that shows the impact of school cultures on teacher learning (Jurasaite-Harbison & Rex, 2009; McLeskey & Waldron, 2004) and emphasizes the advantages of collaboration, sharing, and networking (Clarke & Hollingsworth, 2002; Cochran-Smith & Lytle,1999**;** Owston et al., 2008; Shank, 2006).

Research Questions

Using the analytic framework of HPL to determine the ways that program design, facilitator leadership, and collaborative strategies were learner-centered, knowledge-centered, assessment-centered, and community-centered, this qualitative study will describe the impact of the program on UDL implementation, teacher attitudes, and other classroom practices. This study will contribute to the literature on UDL training, which has primarily been limited to training in postsecondary settings, and will contribute to the broader literature related to professional development for teachers. Furthermore, by identifying both positive classroom outcomes and obstacles, this study may offer insight into the types of resources and ongoing support that teachers need to translate research into practice in the classroom.

The following research questions guided the data collection and analysis of this study.

1. How did the Virtual Classroom address the needs of participants as adult learners?
2. What obstacles to implementation of UDL existed for teachers following their participation in the Virtual Classroom project?
3. How have teachers applied UDL principles in their planning and teaching?

Methodology

A multiple-case study design (Yin, 2009) was used to examine, through the analytic lens of HPL, nine educator-participants in a web-based UDL professional development program that involved collaboration between educators from the United States and Jamaica. The units of analysis are educators, all from different schools in a coastal parish in Jamaica, members of one of three Jamaican participant groups. Because participant engagement, measured by the percentage of responses to prompts embedded in five online modules in the pilot study, was higher in this group than in the other two Jamaican cohorts, this instrumental case study

described in detail the process, leadership, collaboration, and experiences of these participants in order to gain insight into the program components that positively impacted teacher engagement. Initial communications and survey data from the group indicated that despite teacher engagement in the program, there were implementation gaps and obstacles to classroom incorporation of UDL. By studying individual teachers in this group, the researcher gained insight into the contextual factors (i.e. school setting, administrative and peer support, student populations, and resources) of their individual schools that positively or negatively impacted implementation of the ideas and strategies presented in the program. According to Stake (1995), an *instrumental case study* is one that seeks to answer a research question by studying a particular case.

As part of the initial program evaluation, data were collected from the thirty-four participants representing three core educator groups, two groups of educators in Primary to Secondary settings, and one group of faculty in a teacher-education university. Completion of module activities, specifically responses to reflective prompts, were calculated and graphed for each group. Participant comments on the Virtual Classroom site and prompt responses were analyzed and coded to identify key themes. Following participants' completion of the final learning module, two surveys were administered, one to facilitators and another to participants, to gather feedback about effective aspects of the pilot program as well as suggestions for improvement. Face-to-face and Skype discussions with facilitators and a sample of participants provided additional insight into strengths and obstacles of the program, as well as goals for next steps.

This case study analyzed collected data in order to develop interview questions designed to provide richer detail about program impact on teacher attitudes and practices. Interviews with selected participants and group facilitators, representing a range of professional roles, were

conducted via Skype, email, and in person. The researcher also conducted observations to document implementation of UDL guidelines in classroom contexts, and follow-up questions were administered to participants, via email and in a group meeting six months later, in order to collect data about the ways teachers embraced the UDL framework and used it when designing lessons.

Summary of Findings

This qualitative case study of nine participants in the UDL Classroom used interviews, observations, and anecdotal records of a follow-p group meeting to collect data about their experiences in the UDL Virtual Classroom project and its impact on their beliefs and practices. The researcher observed the classes of five participants and toured the schools of those who were not currently working as classroom teachers. A brief survey, administered at the time of individual interviews, was used to collect basic demographic data about participants and their schools. Previously-collected data (Blog Posts, Survey 1, and Group Meeting 1) also informed the study. The findings were based on the researcher's evaluation of these data sources. Analytical coding methods (Merriam, 2009) were used to identify patterns across participants and assign names to categories and descriptive examples from interview transcripts and observation notes.

Using HPL theory (NRC, 2000) as an analytic framework for understanding the components of the Virtual Classroom project, the researcher found themes related to *learner-centered*, *knowledge-centered*, *assessment-centered*, and *community-centered* learning in teachers' descriptions of the UDL Virtual Classroom and their experiences as learners. The most widely discussed topics related to *learner-centered* professional development were *getting and keeping teachers involved*, *providing teachers with tangible benefits of participation*, and

benefits/challenges of technology and resources. Two sub-themes emerged in teacher interviews that fell under category of *knowledge-centered* components of the program: *providing research-based evidence for best practices* and *exposure to and practice with resources.* The researcher identified only one theme specifically related to *assessment-centered learning*, the *feedback from facilitators and other participants* that was available in the Virtual Classroom and in meetings of the participant cohort. The final thematic category was *community-centered* learning, and participants' comments were grouped according to two sub-themes: *shared resources and expertise* and *relevance to Jamaican context*.

Classroom observations and teachers' reflections on their own teaching practices and student impact revealed two broad themes that related to the impact of the program (i.e. what teachers took away from the Virtual Classroom and implemented in their own schools or contexts). Teachers described a number of *implementation challenges*, primarily related to *physical space*, *technology*, and *classroom resources*. They also talked about the *program impacts* on *educator mindsets*, *teaching methods*, *student engagement*, and *student performance*. From analysis of these findings, the researcher was able to gain insight into the various learning components of the Virtual Classroom and their influence on education in real-world contexts.

CHAPTER 2

REVIEW OF LITERATURE

Changes in school populations, knowledge demands for the 21st century, and expectations for today's teachers are issues critical to the current state of K-12 education. An examination of educational trends reveals a need not only for learning frameworks to meet the challenges of today's classrooms but also a demand for professional development strategies that will give teachers the knowledge and skills necessary to meet these challenges. Universal design for learning [UDL] (National Center on UDL, 2012c) is theoretical framework that, according to proponents, furnishes teachers in general education classrooms with the tools they need to create settings and experiences that meet the challenges of learner variability and teach 21st century skills in inclusive settings. While UDL theory is based on research about learning and the brain, the body of empirical literature demonstrating its impact on student performance in still relatively new. Research on UDL and teacher training is even more limited, and the literature that is available is primarily restricted to higher education settings rather than K-12 contexts.

Three complementary theoretical frameworks offer insights into the way that individuals acquire and apply knowledge and skills, and through these lenses we can identify key components for professional development. In order to provide an overview of current theories about the learning process, literature related to the frameworks of UDL, Adaptive Expertise [AE] (Hatano & Inagaki,1986) and the *How People Learn* [HPL] framework (National Research Council, 2000) were explored. Most of the literature on UDL and HPL relates to students rather

than teachers; however, a few sources apply these theories to adult learners. This review will provide a synthesis of the literature that forms the theoretical basis of these three frameworks.

The foundational principles of UDL derive from universal design, which originated in architecture (Mace, Hardie, & Place, 1991), as well as cognitive neuroscience that applies these theories of accessibility to educational environments and learning theory (Meyer, Rose, & Gordon, 2014; National Center on UDL, 2012c; Rose & Gravel, 2012). In addition to providing background and theoretical basis for universal design, research on UDL also encompassed peer-reviewed studies of UDL and student outcomes, UDL and learning in postsecondary education, UDL implementation, and UDL and teacher training. Insights from presenters at the 2014 summit of the Universal Design for Learning Implementation and Research Network (UDL-IRN) are included as well.

Research on adaptive expertise was limited to a few key studies related to theoretical foundations (Hatano & Inagaki, 1986) and applications in teacher education (Bransford, 2004; Crawford & Brophy, 2006; Darling-Hammond & Bransford, 2005; DeArment, Reed, & Wetzel, 2013; Rosaen, Carlisle, Mihocko, Melnick, & Johnson, 2013).

The conceptual basis of the HPL framework was adapted from research by the National Research Council (NRC, 2000; Pellegrino & Hilton, 2012) and summaries related to teacher learning in Darling-Hammond & Bransford's *Preparing Teachers for a Changing World* (2005).

Professional development will be discussed using the four components of HPL (*learner-centered*, *knowledge-centered*, *assessment-centered*, *community-centered*) as organizing principles. Research on professional development included quantitative and qualitative studies, literature reviews, and concept papers.

Critical Issues for K-12 Teachers

Increased diversity and inclusion. Studies by the National Research Council (2010) indicated changes in the public school student population and identified three that are critical to teacher preparation: "a commitment to high standards and college for all, increasing population diversity, and the Individuals with Disabilities Education Act (IDEA) of 1975" (p. 17). Students vary in terms of language, culture, learning style, ability, and socioeconomic status, and the impacts of this diversity are apparent when one considers the task that teachers undertake, the commitment to educate all students. Martha Kanter, the United States Under Secretary of Education since June 2009, outlined the challenges that lay ahead for the United States to reach its educational goals, asserting that "educational quality and equity are essential to our economic and social prosperity" and framing education as "the civil-rights issue of our generation" (Kanter, 2011, p.7). The U.S. Department of Education's "Blueprint for Recognizing Educational Success, Professional Excellence and Collaborative Teaching (R.E.S.P.E.C.T.) " (2013) reiterates the vision of quality education for all, while acknowledging existing gaps in opportunity and performance. This report, the result of a national dialogue on education, maintains that despite challenges, "the current situation provides a unique opportunity to rethink the existing systems that have not been meeting our nation's educational goals" (p. 2). If indeed education is the right of every student, and successful completion of postsecondary education is to become a reachable goal, then schools must focus on issues of accessibility.

Today approximately 95% of students between the ages of 6 and 12 are educated to some extent in general education settings, and 65% of students identified as having disabilities spend over 80% of their time in general education classrooms (Skinner & Dragoo, 2014). The inclusion of more children with disabilities, beginning with the passage of the Education for All

Handicapped Children Act in 1975, has been a key change for classrooms in the United States. Renamed the Individuals With Disabilities Education Act (IDEA), the law called for instruction to meet the unique needs of every child in the most "normal" setting possible, and this radical shift in educational practice brought special education out of the shadows and into the mainstream (IDEA, 2004).

Many educators, regardless of school or system, feel ill-equipped to keep up with the literature on inclusive practices and to teach students with disabilities effectively (McLaughlin & Talbert, 2006; Smith & Tyler, 2011), and there is a need not only for quality preparation for new special education and general education teachers, but also for a reexamination of continuing education and personnel development for those already in the classroom. Many veteran teachers entered the field of education at a time when students with special needs were taught in separate classes or schools. Teacher education programs rarely included coursework in special education, and when they did, "teachers were prepared to serve students with specific disabilities" (Brownell et al., 2010, p. 359). This rigid categorical approach is outdated in today's inclusive classrooms, for it focuses on disability as the primary classifying factor rather than addressing the variability of all learners, variability that includes social and cultural differences, backgrounds, and preferences.

In order for teachers to meet the needs of the diverse student population, they need new skills. Studies of practices that facilitate inclusion have indicated the need for substantive reform in instruction strategy, interactive tasks, student grouping, and daily routines (Baker & Zigmond, 1990; Gehrke & Cocchiarella, 2013; Hodkinson, 2006; Idol, 2006). Changing attitudes about inclusion is also a key first step. There is evidence that teachers generally accept the notion of inclusion (Hodkinson, 2006; Idol, 2006; Katz, 2013) but feel overwhelmed due to lack of

appropriate knowledge and skills (Katz, 2013; Van Reusen, Shoho, & Barker, 2000–2001). When teachers value inclusion but lack tools to meet student needs, they may actually experience higher levels of frustration and burnout (Talmor, Reiter, & Feigin, 2005). Inclusion, when implemented effectively, has positive benefits for all students, not just those with disabilities, including improved skills in communication and leadership (Bunch & Valeo, 2004; Katz 2013), more positive attitudes toward diversity (Bunch & Valeo, 2004; Harrower, 1999; Katz, 2013; Staub & Peck, 1995), and unchanged or better reading and math skills (Cole,Waldron, & Majd, 2004; Kalambouka, Farrell, Dyson & Kaplan, 2007; Saint-Laurent, Dionne, Giasson, Royer, Simard, & Pierard, 1998; Waldron & McLesky, 1998). Inclusion offers students, those with and without disabilities, the opportunities to form friendships, work together in groups, and benefit from the additional supports provided in inclusive classrooms.

Student diversity is not a uniquely American phenomenon. Meeting the needs of all learners is a challenge that schools and systems around the world face. The United Nations' Convention on the Rights of Persons with Disabilities (CRPD) provides evidence that access to education and opportunity is indeed a global civil rights issue (UN General Assembly, 2007). Literature has identified a number of factors that contribute to education inequality, including (but not limited to) disability status, socioeconomic characteristics, race and culture, and local resources and school funding (Artiles, 2011; Breen & Jonsson, 2005; Kanter, 2011; Reardon, 2011; U.S. Department of Education's "Blueprint for R.E.S.P.E.C.T", 2013; Wagner, 2008). In order to meet these challenges, teachers need conceptual frameworks that allow them to address learner variability, develop adaptive expertise, and promote deeper learning for all students (Darling-Hammond & Bransford, 2005).

For teachers entering the field, frameworks for accommodating students' differences may be embedded in teacher preparation programs, but these programs vary significantly in content and field experiences (Conderman & Johnston-Rodriguez, 2009; Gehrke & Cocchiarella, 2013; Kim, 2011) and may be more theoretical than practical (Hodkinson, 2006). When considering professional development for veteran teachers, it seems like a daunting task to introduce a new way of thinking (and teaching) to those who have been doing things the same way for years. In a study with new teachers after their first year in the classroom, Hodkinson (2006) found that their attitudes about inclusion became "markedly more negative" in this short span of time, primarily due to perceived lack of support for students with special educational needs. This study raises the important issue of translating research to practice, taking evidence about the benefits of inclusion and research-based strategies and putting them to work in school contexts. Simply knowing the facts or strategies is not enough (Guskey & Yoon, 2009). Persuading teachers to let go of previously held beliefs, embrace new frameworks, and re-design instruction is not an easy undertaking, even when these changes are potentially beneficial (Clarke, Carlin, & Peter, 1992; Clarke & Hollingsworth, 2002; Hall & Hord, 2011; Hesling et al., 2008; Wagner, 2008).

New knowledge demands for the 21st century. In addition to the growing understanding of learner variability, there are new requisites for the types of education necessary for success in the technology-rich, globally-connected 21st century. The National Research Council (Pellegrino & Hilton, 2012) outlined these 21st century competencies, which include critical thinking, information literacy, flexibility, appreciation for diversity, teamwork and collaboration, and conflict resolution. This is no less than a shift in the fundamental goal of education, from "knowledge acquisition to learner expertise" (Meyer, Rose, & Gordon, 2014, p.8). This means that the role of educators is changing; teachers will need to serve as guides,

helping students master the skills necessary to evaluate and apply information (Asselin & Moayeri, 2011; Ayala, Brace, & Stahl, 2012; Lankshear & Knobel, 2006).

One key factor of 21st century learning is technology, which has shaped the way learners acquire information, connect with others, and express themselves. According to the National Education Technology Plan (NETP, 2010), schools must be aggressive in setting goals and launching strategies that will engage today's technology-savvy youth and prepare them for a changing world of knowledge, participatory learning, and communication. A study from the Pew Internet & American Life project (Lenhardt, Madden, & Hitlin, 2005) reported that the majority of teens have created and shared media content, indicating active involvement in what Jenkins (2009) calls "participatory culture." This understanding of the role of technology is more than just the use of computers or online resources in traditional classroom settings. Digital media offer flexible, customizable formats (Rose & Gravel, 2012), and innovations such as audio books, speech-to-text devices, and video provide advantages over print media. Technology also presents opportunities for interaction and creativity, which lie at the heart of participatory culture (Jenkins et al., 2006).

Upsurges in online learning and the use of digital textbooks, in part due to cost-cutting measures after the 2007 recession (Ayala, Brace, & Stahl, 2012), provide flexibility for education. The Sloan Consortium report (March 2007) *K-12 Online Learning: A Survey of U.S. School District Administrators*, found that an estimated 700,000 students in American K-12 schools were enrolled in at least one online or blended course, and a follow up study in 2009 found that number raised to 1,030,000 students. In a study with 441 high school administrators, Picciano & Seaman (2010) reported that online and blended classes make practical and financial sense for many schools and districts because they maximize faculty resources, provide greater

access to courses and materials, meet the needs of diverse student populations through flexibility and personalization, and resolve scheduling conflicts. Respondents in this survey also anticipated that the number of students taking online courses will grow by 22.8%, and those taking blended classes will grow by even more over next two years (Picciano & Seaman, 2010, p.8).

Despite growing opportunities, research indicates that there are challenges in educational change. Many students may be more familiar and comfortable with technology and participatory culture than are their teachers, having grown up with computers, cell phones, and digital media. Learning spaces and teaching approaches must adapt to accommodate these students "who prefer instant messaging to face-to-face meetings [and] are said to be part of the –'Net Generation' (Johnson & Lomas, 2005, p.23). Oblinger & Oblinger (2005) identified the net generation as students who were born in or after the 1980s and have a "preference for experiential, hands-on learning" (p. 1.3). In addition to online and blended learning environments, which clearly rely on digital formats, classroom practices in traditional settings must also take into account the way technology and participatory culture have shaped the students' learning processes and interests (James & McCormick, 2009; NETP, 2010; Pellegrino & Hilton, 2012).

New expectations for teachers. One critical assumption related to 21st century learning is that it requires a transformation in the way teachers understand learner variability and design classrooms and curricula to meet the needs of diverse learners. Since classrooms are becoming more diverse, inflexible curricula and one-size-fits-all methods raise unintentional barriers. Since IDEA and The No Child Left Behind Act of 2001 (NCLB) mandate that students with disabilities be included in state assessments, schools and teachers are held accountable for providing appropriate instruction to meet individual learning needs. The HEOA (2008) emphasizes the need for teacher education programs to prepare educators for diverse classrooms

by incorporating research-based methods, technology, and innovative instructional techniques. This high standard for teaching is reiterated in the U.S. Department of Education's "Blueprint for R.E.S.P.E.C.T" (2013) and in professional standards for teachers published by the National Council for Accreditation of Teacher Education (NCATE, 2008), the Council for Exceptional Children (CEC, 2012), and the Interstate Teacher Assessment and Support Consortium (InTASC, 2011), which incorporate requirements for providing multiple approaches to address the needs of all students.

For those who have been in the classroom for many years, adjusting one's approach to content, technology, and other aspects of education may prove to be a demanding task. Dede (2009) pointed to the lack of professional development in preparing educators and other influential stakeholders to embrace these new ideas and meet these challenges. Teaching 21st century competencies to diverse learners requires a reexamination of both the content and methods of education, as well professional development to give teachers the skills and knowledge to integrate new practices (James & McCormick, 2009).

Universal Design for Learning

UDL principles and guidelines. Proponents of UDL (e.g. Meyer, Rose, & Gordon, 2014; Nelson, 2014; Rose & Gravel, 2012) maintain that flexible design is one way to address learner variability and teach 21st century skills. UDL is one part of a greater movement toward universal design, a term coined by architect Ron Mace, that focuses on creating spaces, buildings, and tools that are accessible to individuals regardless of physical ability (Mace, Hardie, & Place, 1991). Examples of universal designs that have evolved over the years include closed-captioning, curb cuts, and automatic doors. While these features may have obvious advantages for individuals with physical disabilities, they have proven to be marketable and

useful to people with diverse abilities (Mace et al., 1991; Rose & Gravel, 2012). UD seeks to identify and reduce barriers for everyone, rather than retrofitting for individuals.

UDL applies these principles to learning environments "to ensure that the means for learning, and their results, are accessible to all students" (Rose & Gravel, 2012, p.7). Grounded in cognitive neuroscience, UDL is based on three fundamental principles that address teaching and learning: provide multiple means of engagement; provide multiple means of action and expression; provide multiple means of representation (Meyer, Rose, & Gordon, 2014; National Center on UDL, 2012c; Rose & Gravel, 2012). Research from the Center for Applied Special Technology (CAST) and the National Center on Universal Design for Learning has identified three primary brain networks that are involved in the way that individuals receive and process information: (a) affective networks, the "why" of learning; (b) recognition networks, the "what" of learning; and (c) strategic networks, the "how" of learning. According to UDL theory, each of these specialized areas of the brain helps account for individual differences, and no single educational approach will be ideal for every student (Meyer, Rose, & Gordon, 2014; National Center on UDL, 2012c; Rose & Gravel, 2012). UDL is built upon the idea that learning is a complex process, and options and flexibility assure that everyone has access to curriculum.

The cognitive neuroscience that forms the foundation of UDL theory asserts the three classes of brain networks are specialized, heterarchical, and highly variable (Meyer, Rose, & Gordon, 2014). Learners themselves are always changing, and preferences and abilities are context-specific. Skill is collaboration between person and context; it is not simply true that environment influences learning, but rather these two are interdependent (Rappolt-Schlichtmann, Daley, & Rose, 2012), and the supports and strategies that facilitate learning are context-specific, not just learner specific. Applied to classroom contexts, UDL scholars have noted that some

strategies have obvious barriers for some (i.e. written responses for a student with dysgraphia or printed directions for a student with blindness), but there are also student preferences and needs that are harder to discern (Meyer, Rose, & Gordon, 2014; Nelson, 2014; Rose & Gravel, 2012). Therefore, the principles of UDL take into consideration not only differences between learners but also within individuals (Meyer, Rose, & Gordon, 2014; Nelson, 2014) by offering flexibility and student choice.

The Center for Applied Special Technology (CAST) developed guidelines, "checkpoints," and practical examples for implementing UDL principles (Meyer, Rose, & Gordon, 2014; National Center on UDL, 2012a; Nelson, 2014; Rose et al., 2006). The UDL guidelines outline strategies that (a) provide options for engagement by optimizing levels of challenge and support (b) provide options for the ways information is presented or acquired, and (c) provide options for expression and demonstration of knowledge (Meyer, Rose, & Gordon, 2014; National Center on UDL, 2012a; Rose & Gravel, 2012). Originally, the principles and guidelines appeared in reverse order, with representation first and engagement last (National Center on UDL, 2012a). While the core principles remain unchanged, recent articulations of the guidelines put affective principle first, highlighting the key role of learner engagement and support for sustained effort (Meyer, Rose, & Gordon, 2014; Nelson, 2014). The UDL guidelines and checkpoints are meant to serve as a framework for understanding learning, a way to shape instructional goals, assessments, and practices, not a checklist to be completed by educators (Meyer, Rose, & Gordon, 2014; Nelson, 2014). The aim of the guidelines is to create expert learners who engaged, resourceful, and strategic (National Center on UDL, 2012a).

Measuring UDL in practice. There is a growing body of literature documenting the application of UDL principles in educational practice; however, specific data about the effects on

student learning are limited, in part because the framework is relatively new, but also because the very nature of UDL makes it challenging to measure. CAST founder David Rose, offering Career Reflections at the 2014 UDL-IRN Summit (2014, March), said one of his "worries" for the future of UDL is that it could become a watered down "pop term" if we try to make it a fixed thing (checklist) because we risk losing the flexibility that is essential to UDL in the first place. Basham, Marino, Gardner, Lowrey, & Coy (2014, March) outlined the challenges of operationalizing UDL as an independent variable, listing some key questions for UDL researchers to address:

- If we (researchers) use the UDL checkpoints (31) as a measurement tool, how many need to be present to be considered effective UDL implementation?
- How much of the three UDL principles (multiple means of engagement, multiple means of representation, multiple means of action and expression) is needed to be UDL? Do these have to be present in equal proportions?
- How do we consider the UDL checkpoints, and should they all be weighed equally?
- Will we consistently recognize UDL when we see it?
- How do you measure design?

Other UDL researchers and practitioners have voiced similar concerns about identifying and measuring UDL in action (Diedrich, Howery, & Ralabate, 2012, April; Edyburn, 2010; Katz, 2013; McGrath, 2014, March; Nelson, 2014; Rappolt-Schlichtmann, Daley, & Rose, 2012). Large-scale, clinical studies often require uniformity and control, but UDL in action is not an assembly of "identical activities and actions that can be identically measured;" for researchers to set up a strictly controlled experiment, they "risk weakening the application of the UDL framework and, subsequently, the learning experiences of the students" (Nelson, 2014, p. 32-

33). Edyburn (2010) argued that there "has been little research on UDL" (p.34), and in order to provide scientific validation of its principles, "we must be able to operationalize the construct of UDL" (p.36).

Much of the literature on UDL includes scholarly papers related to the potential that UDL holds for transforming curriculum or accessibility. For example, Basham & Marino (2013) and Price, Johnson, & Barnett (2012) discussed UDL as an important tool to enhance accessibility to STEM (science, technology, engineering, math) learning, which focuses on problem-solving and other important 21st century skills. Chita-Tegmark. Gravel, Serpa, Domings, & Rose (2011) described UDL's application to support culturally diverse learners, and Lopes-Murphy (2012) offered suggestions for using UDL to increase accessibility for English language learners. These articles are a first step in providing understanding of how UDL can shape curriculum and student learning, but in each case authors noted that research is needed to explore implementation and outcomes.

Several studies have looked at the links between UDL and student engagement, both in K-12 and postsecondary contexts. For example, Dymond, Renzaglia, Chun, Banks, Niswander, and Gilson (2006) used a case study design to explore the redesign of an inclusive high school science class to incorporate UDL. Researchers provided a general description of the changes (materials used, increased options for students, student grouping) and reported increased interactions between students with significant cognitive disabilities and general education peers, as well as overall increases in engagement. Researchers noted changing roles for teachers with the introduction of UDL; the co-teacher reported a broader role that included more teaching and planning, and the science teacher "expressed greater ownership for helping all students in the classroom learn" (Dymond et al., 2006, p. 298). Despite teachers' reports of positive student

affective outcomes, this project brought to light some of the challenges of the UDL redesign process, specifically the time for planning and collaboration needed. This study was conducted over the course of a school year, and teachers benefitted from ongoing collaboration with researchers; however, there is not yet enough evidence to show that effects could be subsequently maintained or expanded to other classes or curricula.

Rose, Harbour, Johnston, Daley, and Abarbanell (2006) explored the value of UDL in postsecondary education through its application in a university course called *T-560: Meeting the Challenge of Individual Differences*. The goal of this graduate class was to provide information on learning and the brain and individual learning differences, the types of research that are key components of the UDL framework. The instructors, however, recognized that it was not sufficient to teach the neuroscience of learning in a traditional way (i.e. textbooks, lecture); rather, the structure of the class should also reflect the principles of UDL. By incorporating multiple means of presentation, expression, and engagement, instructors modeled the UDL ideals they were teaching. This paper outlined the specific elements of the course and their alignment to UDL principles, offering examples and contrasting the class structure with more traditional textbook and lecture-based formats. Authors cited the popularity of the class, despite its challenging content, and the fact that it is not required for any degree concentration as evidence of its affective success. While this is by no means empirical evidence of the relationship between UDL and student engagement, the purpose of the article is to discuss ways that UDL could be used to restructure a college course and reflect on potential applications of UDL at the postsecondary level.

Similarly, Smith (2012) demonstrated that the use of UDL in the design and delivery of an introductory graduate research methods course had positive outcomes, especially in terms of

its affective aspects. Collecting both qualitative (conversations) and quantitative (survey questions) data in research conducted over four semesters, Smith documented increased alignment of goals and practices, as well as student engagement. The course instructor provided multiple media and formats (i.e. digital course materials, graphic organizers, "hands-on" activities) and ongoing, relevant feedback for students. Students also had opportunities to demonstrate learning in flexible ways (i.e. video, spell-checker for written work, web-based or digital products). The author measured the consistency of practices and curriculum elements and specific UDL principles and guidelines using a survey, "Perceptions of UDL in College Classrooms" (Smith, 2008). The relationship between students' perceptions of UDL implementation and total student interest and engagement, measured using thirteen interest and engagement survey items adapted from the Utrecht Work Engagement Scale for Students (Schaufeli, Martinez, Pinto, Salanova, & Bakker, 2002) was determined by calculating a Pearson product-moment correlation (Smith, 2012). While this study suggested that student engagement increased when faculty incorporated UDL elements, the author emphasized the need for further research across settings and "particularly related to effectiveness of UDL for the myriad of diverse learners who are and will be attending college" (Smith, 2012, p. 52).

Several studies in the past decade have begun to investigate the impact, beyond the scope of engagement, of UDL application in K-12 settings, but there is inconsistency in the way UDL components are defined and linked to particular UDL guidelines, and there is minimal empirical evidence about student learning outcomes or feasibility of implementation over time. Furthermore, these studies focused on particular student populations or subject areas, and there is insufficient overlap or replication to corroborate findings. In a recent review of 13 UDL intervention studies, Rao, Ok, and Bryant (2014) found three quasi-experimental and case studies

showed positive academic outcomes, which were attributed to UDL interventions (Browder, Mims, Spooner, Ahlgrim-Delzell, & Lee, 2012; Lieber, Horn, Palmer & Fleming, 2008; Marino, 2009). Using a multiple baseline design, Browder et al. (2009) showed that the three participants, all elementary students with multiple disabilities including intellectual disabilities, increased their independent responses during the shared story activity, which applied the principles of UDL. Researchers provided an overview of UDL, along with examples of how the planning team used task analysis and the three UDL principles to create individualized interventions based on student needs (Browder et al., 2009). In another study of academic outcomes, Lieber et al. (2008) used mixed methods (one group pre-test-post-test and case study) to show that preschool children with special needs made gains in literacy, math, and social skills when UDL-designed curriculum was used. The study identifies specific strategies, in a lesson entitled "Apples Can Be Compared in Different Ways," that illustrate UDL principles of representation, action and expression, and engagement (Lieber et al., 2008). Marino (2009) examined students with reading difficulties in a middle school inclusive science class to see how participants utilized cognitive tools and showed that low ability readers benefitted from the tools provided, performing as well as their peers who scored in the 26th-50th reading percentile on the posttest. The Alien Rescue curriculum used in this intervention "includes critical components of the UDL framework" (Marino, 2009, p.92), but the author did not link the cognitive tools or scaffolds to particular UDL principles.

While the three studies described here contributed to the literature on using UDL curriculum and tools in the classroom, the scope of each is limited, and further research is needed to understand both the academic impact of UDL and its feasibility across multiple contexts. Rao et al.'s (2014) review noted the dearth of UDL empirical research available, perhaps because

"the discipline currently is at a more nascent stage of defining and describing what UD educational models are and how they can be applied" (p.164). Rao et al. (2014) also made recommendations for further research based on existing UDL literature, calling for explicit descriptions of interventions that are linked to specific UDL principles and complete demographic reports of participants. Rao et al.'s (2014) proposals complement those of UDL-Implementation and Research Network (UDL-IRN) (http://udl-irn.org/), a network of practitioners, researchers, and developers created in 2010 in collaboration with CAST and the National Center on UDL. The critical elements identified by the UDL-IRN may serve as guidelines for identifying UDL in practice: (1) clear goals, (2) intentional planning for learner variability, (3) flexible methods and materials, and (4) timely progress monitoring (UDL-IRN, 2011). Basham et al. (2014, March) outlined efforts to develop measurement tools based on these critical elements, noting that both fidelity of implementation and flexibility are essential.

A recent study (King-Sears, Johnson, Berkeley, Weiss, Peters-Burton, Evmenova, Menditto, & Hursh, 2015) followed these recommendations in exploratory research that randomly assigned students in four co-taught chemistry classes to either a UDL treatment or comparison condition. Several aspects of this study are noteworthy. First, participant characteristics were presented in a detailed table that included ethnicity, English language learner status, socioeconomic status, and individualized assessment scores. Also, the intervention used was analyzed according to the three UDL principles, and examples of application for each were described in detail. When group averages per condition were calculated, results indicated the UDL treatment was not more effective compared with the comparison group. Authors noted that further refinements of the UDL condition are needed, and "future research should proceed cautiously and with full consideration of how to either achieve or expand the flexibility

characteristics of universally designed treatments to address the learning needs of all students" (King-Sears et al., 2014, p.10). This study raises some important questions and issues that corroborate the need for research across settings, subjects, and participant populations: What does UDL in practice look like? Do some aspects of UDL work better for some groups than others? How do we balance flexibility with treatment fidelity? These are questions that we can begin to answer only after UDL is implemented and studied in the classroom, and for that to happen, research is needed to show effective means for training teachers to understand and integrate UDL principles.

Despite the gaps in research, UDL has evolved beyond the boundaries of special education as teachers, administrators, and other stakeholders have recognized its potential impact for all learners (Meyer, Rose, & Gordon, 2014). It has been emphasized as a beneficial framework by the U.S. Department of Education's National Education Technology Plan (NETP, 2010), the National Science Foundation, and the reauthorization the Higher Education Opportunity Act (HEOA) of 2008 (20 U.S.C. 1003(24)).

UDL in higher education settings. The reauthorization in 2008 of the Higher Education Opportunity Act (HEOA) defined UDL and included guidelines for teacher preparation programs related to UDL. According to HEOA, UDL is "a scientifically valid framework for guiding instructional practice that provides flexibility in the ways information is presented, in the ways students respond or demonstrate knowledge and skills, and in the ways students are engaged" (20 U.S.C. 1003(24)). The HEOA underscores the importance of incorporating UDL principles in teacher preparation programs to ensure that new teachers have the skills necessary to implement them. A report by CAST in 2011 (updated in 2012) found that all fifty states include references to UDL in policy documents related to P-12 or postsecondary education, and nineteen states

offer faculty resources or courses in UDL for students (Ralabate, Hehir, Dodd, Grindal, Vue, Eidelman, Karger, Smith, & Carlisle, 2012). This represents a potential change in the way that new teachers are educated; however, there is limited research on content and method fidelity, as well as the extent to which UDL is embedded in teacher education programs.

Although incorporation of UDL instruction in teacher candidate and graduate programs is still somewhat limited, available research around UDL training has primarily taken place in postsecondary settings. In a survey of faculty members of college and university-based teacher preparation programs in 21 states, Vitelli (2013) found that approximately 55% of pre-service general education teaching faculty who completed a survey and demonstrated knowledge of UDL indicated that they taught it to their students. Data in this study indicated that instruction of UDL is increasingly occurring in general education teacher preparation programs; however, the depth of program integration is still "modest."

Qualitative studies, while small in scope, have described the experiences of pre-service teachers learning about UDL and using it to frame their own thinking about learning as they prepare to enter the field of education. McGuire-Schwartz & Arndt (2007) explored and documented how pre-service teachers applied UDL in their own action research and practicum experiences. These teacher candidates observed the classrooms where their practicum teaching would take place, identifying potential "problems," and then used the UDL framework to design strategies to help struggling learners. Researchers reported that participants found that even though they had particular students in mind when planning their lessons, the flexible, multisensory components of UDL were beneficial for all students. The study includes participant reflections about the perceived benefits of UDL but does not identify particular methods linked to UDL principles or guidelines. Strategies such as "graphic organizers," "flexibility, "more

student involvement," and "multiple ways of teaching" are mentioned, but specific connections to UDL or details about the implementation are lacking. Without explicit links between practices and UDL, it is difficult to ascertain the effectiveness of the UDL training provided, both in terms of participants' understanding of UDL principles and fidelity of implementation in the classroom.

In a case study with five special educators who were introduced to UDL in a hybrid (online and face-to-face) graduate course, Hinshaw & Gumus (2013) noted that the design of the course, which included numerous opportunities for reflection and online collaboration, gave participants a forum to explore UDL and make connections to their own teaching experiences. Themes that emerged from participants' blog posts and interviews were the increased use of technology to support learning, the importance of partnerships between special and general educators, and the challenges of these relationships. While the themes that emerged may lay groundwork for further investigation, this study provides vague definitions of UDL as it was presented to and implemented by students. As in the previous study (McGuire-Schwartz & Arndt, 2007), Hinshaw & Gumus (2013) did not explain specific practices in connection to UDL principles, and there is little to distinguish UDL, as operationalized by the authors, from differentiated learning, collaborative teaching, or technology integration. In order for a case study to offer substantive insight into best practices for teaching UDL to educators, both the concepts and instruction methods need to be explicitly defined.

Other research on UDL instruction in postsecondary settings looked at the ways UDL was introduced and taught. A qualitative study by Ayala et al. (2012) outlined the three phases of the UDL lesson (UDL introduction, structured discussion and guided practice, and UDL application) in a class at Sonoma State University. Students in this undergraduate course had the

opportunity, through assigned readings and in-class activities, to learn about the grounding principles and research basis for UDL, while using a UDL Solutions Worksheet designed by CAST (updated version available at www.udlcenter.org) to examine specific ways that the UDL guidelines could be applied in a classroom. The purpose of this study was to illustrate the way that UDL was taught to pre-service teachers, and a follow-up discussion with one graduate offered some insight into the application of the UDL framework in a K-12 classroom. In terms of its relevance to professional development, this study offers a model for presenting UDL that combines a theoretical introduction and hands-on training through guided practice.

In a study on student perceptions of faculty implementation of UDL, Schelly et al. (2011) conducted a pretest/posttest study using questionnaires before and after *Introduction to Psychology* professors received UDL training. Training included topics related to the three UDL principles, as well as "information and practical tips on converting course material to a variety of electronic formats" (Schelly et al., 2011, p.20). In addition to looking at how faculty members were trained in UDL, this study incorporated quantitative data in the form of student responses on a rating scale, which indicated a significant increase in the implementation of 14 of the 24 UDL guidelines evaluated. A list of survey questions related to UDL strategies is included in the paper. One noteworthy component of this study was the use of pretest results from the beginning of the semester to focus training on aspects of UDL that students perceived as being implemented relatively less than others (Schelly et al., 2011). Rather than emphasizing UDL skills that instructors had already mastered, training was more practical and targeted. For example, two areas of relative weakness identified by student surveys were related to providing course material in electronic formats. Thus, training was specifically designed to incorporate strategies for converting course material to a variety of electronic formats and presenting

material in multiple formats (Schelly et al., 2011). Student feedback and instructor input were used to design the focus of professional development, and like the previous study, the focus on practical applications in addition to theoretical background was an essential component of UDL training.

Two experimental studies (Spooner et al., 2007; Courey et al., 2012) examine the short-term outcomes, rather than the process, of UDL training. While both studies show a positive effect (measured in terms of accessibility and integration of UDL principles) of UDL training on participants' lesson planning, there may be some question about whether findings are generalizable to K-12 classroom settings and whether they are sustainable over time. In a study with in-service and pre-service general and special education teachers in four university teacher-education courses, Spooner et al. (2007) examined the implementation of UDL in instructional plans. Researchers provided one group of participants with an hour of instruction in UDL principles and applications to planning instructional lessons. Using a pretest/posttest design with a rating scale based on the three UDL principles, researchers rated the lessons designed by members of both groups on their accessibility for students described in case studies. Results indicated that with explicit instruction, pre-service and in-service educators were able to design more accessible lessons for all students, including those with specific learning needs. The study did provide some examples of UDL strategies, and the lesson plan format included "an extra section to provide examples and a clear description of how they would use the three components of UDL to make the curriculum accessible for the student with a disability" (Spooner et al., 2007, p. 111). The use of case studies in place of real-classroom application leaves room for doubt about whether this model of teaching UDL would have longitudinal effects for classroom teachers, and while this study contributes to the empirical rational for UDL instruction, there are

gaps in terms of implementation specific UDL strategies and explicit descriptions of what makes inclusive practices UDL rather than just *good teaching*.

Similarly, Courey et al. (2012) demonstrated the benefits of UDL training in a study of special education teachers in a graduate level credential program. The purpose of this study was to determine whether candidates would increase the use of UDL principles in lesson planning after participating in a 3-hour web-based instructional module on UDL, *Universal Design for Learning: Creating a Learning Environment That Challenges and Engages All Students* (The IRIS Center for Training Enhancements, 2009). Results showed a significant difference in scores (ratings of UDL implementation) across the three lesson plans (1 before and 2 after training). While teachers' lesson plans improved with respect to incorporating UDL, there remained some question about how well this study would translate into actual classroom practice:

> An interesting observation was that in the 'Materials' section of the lesson plan template, where participants list all the materials that they will be using in each area, many different modifications were listed. Later in the plan, however, when participants were required to explain how the materials would be used in each UDL area, some of the materials listed were not actually implemented or described. (Courey et al.,2012, p.17)

This suggests that there might be a crucial gap between planning and implementing UDL lessons, an idea supported by the implementation research synthesis of Fixen et al. (2005), which showed that implementation is a complex process that takes time and feedback. After the 3-hour training, teachers in the Courey et al. (2012) study were able to integrate what they had learned into a portion of their written plans, but even within the lesson description, these strategies were not maintained. The study did not include transfer to a classroom setting or any follow-up to

assess fidelity or sustainability. While the Courey et al. (2012) study provides a starting place for UDL professional development, it leaves unanswered many questions about the classroom impact of training.

UDL in professional development contexts. Since most of the research on teacher training in UDL focuses on teachers/students in graduate classes, one must consider carefully the context when analyzing the results or making generalizations about the impact this training has on teachers in K-12 classrooms. In postsecondary settings there is high support and motivation to perform. It is likely that a student in a graduate education class is going to write lesson plans that adhere to the principles of UDL (or other pedagogical framework/strategy presented by a professor) after receiving instruction; his/her grade in the class depends on it, and he/she has the professor's assistance and input. Questions remain, however, about whether that learning translates into practice when the context becomes not a graduate course but an actual classroom, when some (or all) of the supports and incentives (grades) are removed, and there are a host of other factors at play such as school setting and culture, student demographics, and available resources.

Unlike teacher education in postsecondary settings, professional development for teachers already in the field is situated in the context of schools and districts that vary considerably in terms of administrative and peer support, student populations, teacher workloads, and school cultures (Jurasaite-Harbison & Rex, 2009; McLeskey & Waldron, 2004). Avalos (2011) described the "situated nature" of teacher learning, citing several studies (James & McCormick, 2009; Jurasaite-Harbison & Rex, 2010; Sato & Kleinsasser, 2004) that illustrated the influence of context (school culture) on professional growth for educators. Despite resources such as the IRIS Center for Training Enhancements, funded by the U.S. Department of

Education and training offered by the Center for Applied Special Technology (CAST), there are numerous challenges in educating teachers on the current literature and inspiring them to do things differently. While CAST presents recommended UDL strategies and materials, teachers must understand and employ them.

While studies in postsecondary settings may offer useful information about strategies, programs, or frameworks for teacher learning, evidence supports the idea that one cannot assume this learning will transfer to school settings. Context and engagement are essential factors for successful professional development. For teachers and administrators to be invested in learning and implementing a new framework or strategy, they must first recognize a need for change and, second, see that framework as a viable solution to meet their needs (Avalos, 2011; Clarke & Hollingsworth, 2002; Helsing et al., 2008; Hall & Hord, 2011; Ross & Bruce, 2007). These studies of professional development, which represent a range of programs, showed that teacher engagement is critical to the success of teacher learning. The Universal Design for Learning Series' online module, *UDL Implementation: A Process of Change*, stresses the importance of this: "Starting with a clearly identified need for change is critical for success UDL implementation at a systemic level" (National Center on UDL, 2012b); Edyburn (2010) similarly identified the first phase of this transformation as "awareness training." Transforming curriculum and educational practice requires teacher "buy-in" to a new way of thinking, but literature that applies this understanding to UDL professional development is lacking. In teacher certification and graduate classes there is built-in incentive (grades, college/graduate credit) and a limited time frame, but when teachers participate in professional development in K-12 settings, motivation to learn and change cannot be taken for granted, and sustainability is an important

factor to consider, especially in light of the competing demands placed on school employees (James & McCormick, 2009; Owston et al., 2008).

To design effective UDL education for teachers, it is not enough to look at UDL training in college and graduate courses; we must also apply what we know about professional development strategies that have proven effective in K-12 settings to address the question of teacher engagement. In the preface to his book *The Global Achievement Gap* (2008), Tony Wagner wrote,

> One of my biggest concerns is that most high school educators do not feel a real sense of urgency for change- perhaps because their work isolates them from the larger world of rapid change and they've lived through too many failed education fads. The result is that course curricula and teaching practices have remained pretty much the same for fifty years or more. Except for increased pressures to get kids to pass the new state tests, 'Why change?' remains an unanswered question for most educators today (p. xii)

Wagner's observation illustrates the need for teacher buy-in; teachers need not only the knowledge and skills that professional development has to offer, but also the motivation to implement and maintain them. In order to integrate and sustain a new framework for teaching and learning, teacher educators must find ways to address this central question of "Why change?"

Adaptive Expertise and How People Learn: A Lens for Understanding Professional Development

Research on learning offers insight to address this question. By applying what we know about knowledge acquisition and transfer to professional development, while considering

carefully the complexities that diverse individuals and contexts of teacher-learners, we may begin to understand how to develop programs that will result in sustainable, positive change. Two learning frameworks, adaptive expertise (Hatano & Inagaki, 1986) and HPL (NRC, 2000), complement the theories of UDL and have relevant applications to the way we understand, design, and evaluate professional development.

Adaptive Expertise. Diverse, inclusive classrooms call for innovation and creativity, and the practices of fifty years ago, or even ten years ago, do not adequately address the needs of all learners. Nevertheless, the "lack of urgency" (Wagner, 2008) when it comes to change poses a challenge for proponents of educational change. The answer to this fundamental dilemma may lie in the contrast between routine expertise and adaptive expertise (Hatano & Inagaki, 1986). According to Hatano and Inagaki's 1986 conceptualization, routine experts are "lifelong learners who increasingly become adept at performing a specific set of skills in response to familiar challenges" (DeArment, Reed, & Wetzel, 2013, p.5-6). Veteran teachers often fall into this category; they find lessons plans that work, perfect them, and then become extremely efficient in delivering curriculum to students (Clarke & Hollingsworth, 2002). Antoniou and Kyrikides (2012) noted that professional development must not only provide a clear understanding of how learning will impact student learning, but also "teachers need to understand that the factors addressed are related to the effective use of teaching time, which is always limited" (p.3). Faced with increasing demands for high student scores on standardized tests, it seems logical that many teachers could become routine experts at covering state-mandated material. This efficiency, however, depends on a stable environment (Bransford, 2004), and routine experts can be inflexible in this approach (Crawford & Brophy, 2006). Asking teachers to adopt new methods or rethink their content areas can be challenging because it involves "making oneself vulnerable

and taking risks" (NRC, 2000, p. 195), and this is uncomfortable for teachers who are used to being in control. In addition to becoming accustomed to changing roles, subject matter, or practices, teachers may have limited access to new theories, practices, or learning opportunities due to time or resource constraints. Perhaps this is why many educators feel challenged by the demands of keeping up with current research and teaching students with disabilities (Smith & Tyler, 2011), and why many are resistant to change.

Adaptive expertise combines efficiency with flexibility and innovation (Hatano & Inagaki, 1986), and this approach is crucial for educators in today's diverse classrooms. Bransford (2004) noted that the transformation from routine to adaptive expertise is not a quick or easy one, suggesting that it might be more difficult for those who have an efficient, developed routine expertise to become adaptive. Applied to the task of educating teachers to be inclusive, this may require different approaches for new and experienced educators. While experienced teachers may have old habits and engrained ideas, new teachers may still be learning the basics of classroom management and curriculum.

In their recent book on UDL, CAST founders (Meyer, Rose, & Gordon, 2014) devote a chapter to "expert learning." While their distinction between fixed and growth mindsets does not refer specifically to adaptive vs. routine expertise, the principal concepts are closely related: "In contrast [to those with a fixed mindset], learners with a growth mindset are motivated by self-development through learning. They perceive and seek out challenges and opportunities to expand their intelligence and ability" (p.31).

How People Learn. The *How People Learn* (HPL) framework (National Research Council, 2000) provides a guideline for understanding the learning process, and in this case it has relevant applications to teacher training and the promotion of adaptive expertise. If the goal of

professional development is to promote "deeper learning," learning that can be transferred to new situations and applied in a variety of contexts, it is necessary to understand both the cognitive processes of individuals and the social interactions of the community in order to promote deeper learning and transferable skills (NRC, 2012). Looking at the ways learning occurs in the classroom, Darling-Hammond and Bransford (2005) summarized four components of the HPL framework and noted that effective teachers find a balance among them:

- The *learner* and his or her strengths, interests, and preconceptions;
- The *knowledge*, skills, and attitudes we want people to acquire and how they may be able to do so in order to transfer what they have learned;
- The *assessment* of learning that both makes students' thinking visible and, through feedback, guides further learning; and
- The *community* within which learning occurs, both within and outside the classroom. (p.32)

Professional development that incorporates understanding of the processes of learning, not just the content being disseminated, is critical. Research indicates "usable knowledge" (deeper learning) is "not the same as a mere list of disconnected facts. Experts' knowledge is connected and organized around important concepts … it is 'conditionalized' to specify the contexts in which it is applicable; it supports understanding and transfer (to other contexts) rather than only the ability to remember" (NRC, 2000, p.9). Like other types of learning, professional development that takes into consideration the spectrum of teachers' needs, from novices to experienced veterans, is most effective when it is ongoing, supported, and contextualized (Darling-Hammond & McLaughlin, 1995; Delannoy, 2000; James & McCormick, 2009; Jurasaite-Harbison & Rex, 2010; Pitsoe, & Maila, 2012; Richmond & Manokore, 2010; Sales et

al., 2011). We want our teachers to be adaptive experts and expert learners, so we need to consider carefully the *teacher as learner* when designing and evaluating professional development.

The four components of HPL provide an appropriate analytic framework for reviewing existing professional development literature, broadening the focus to include the learner, content, assessment, and context to identify effective practices, challenges, and research gaps. While these components overlap and cannot be examined entirely in isolation, it is useful to focus on each distinctly in order to better understand to multifaceted process of educating teachers. The present study will seek to examine the processes and impact of UDL professional development, which has primarily been analyzed in postsecondary settings, and since additional contextual and affective challenges come into play in real-world contexts, HPL offers a lens for identifying specific elements that either enhance or thwart the efficacy of teacher learning.

In a review of 10 years of publications (200-2010) on professional development, Avalos (2011) noted that the process of educating teachers is complex due to the interaction of learning needs and contextual factors such as "traditions, culture mores, policy environments and school conditions" (p. 17). She did, however, note a few key themes that emerged across studies: that extended interventions are more effective than shorter ones, that combinations of resources for learning and reflection are efficacious, and that teacher co-learning strengthens the professional development experience. These studies showed a movement away from traditional "one-shot" teacher workshops, which Kriek and Grayson (2009) described as inadequate and inappropriate.

***Learner-Centered* Professional Development.**

Professional development that is learner-centered may begin by attempting to answer the question of "Why change?" The classrooms of today are not like they were even ten years ago

(NRC, 2010), so in order to meet the needs of students, teachers must let go of some previous held beliefs (Bransford, Derry, Berliner, & Hammerness, 2005) and adapt, even though it could take time before efficiency and innovation become balanced. In order to have substantial and sustainable impact, professional development programs need to address teachers' fears about loss of efficiency (even if temporary) while encouraging the learning and integration of new methods and frameworks. Teacher efficacy, the expectation of success based on past performance, is central to this understanding. Teachers with confidence and high expectations are more likely to try new things and persist in overcoming obstacles (Ross & Bruce, 2007). Teachers vary in their values, experiences, viewpoints, and practices, and these differences impact both their openness to professional development and their needs in terms of content and support (Avalos, 2011; Clarke & Hollingsworth, 2002; Gurskey, 1986; Hall & Hord, 2011; Helsing et al., 2008; James & McCormick, 2009; Sales et al., 2011). Several studies demonstrate the impact of learner-centered professional development that takes into account teachers' "knowledge, skills, and attitudes" (Darling-Hammond & Bransford, 2005; NRC, 2000).

Hall & Hord (2011) outlined the Concerns-Based Adoption Model (CBAM) of professional development, which begins with "the personal/affective aspects of change," identified as "Stages of Concern" (p.55). Many participants are unconcerned at the onset of change, a process that Hall & Hord (2011) compare to crossing an "Implementation Bridge," and all participants require reassurance, coaching, and support to progress across the bridge. This is comparable to what The National Center on UDL (2011) identifies as the "Explore" phase of implementation' which focuses on "investigating UDL as a system-wide decision-making framework, building awareness with key players inside & outside of system, [and] determining willingness & interest to begin UDL implementation." While literature on UDL implementation

stresses the significance of teacher buy-in (seeing the need for change), studies of UDL teacher training in postsecondary settings do not address this concern.

The UDL implementation process, based on the research synthesis of Fixsen et al. (2005), consists of five phases: 1) Explore, (2) Prepare, (3) Integrate, (4) Scale, and (5) Optimize (Ganley & Ralabate, 2013). These phases do not occur in a fixed order; rather, they are meant to serve as a framework for understanding implementation as a complex process, not a checklist to be completed by educators, schools, or districts. The "explore" phase, while perhaps continuing to occur throughout the course of teacher education and implementation, is an important first step in addressing the central question of "why change?" This is closely tied to the first UDL principle (Provide multiple means of engagement), which includes affording options for recruiting interest and sustaining effort and persistence.

It is also important to note some other factors, aside from interest or teacher efficacy, that may impact teacher learning. Time constraints and facilitation provided by researchers or administrators may also significantly impact the way that teachers engage in learning (Owston et al., 2008). When teachers see the need for change and are given the tools and support necessary to make that change, they may be more engaged in learning tasks. Ross & Bruce (2007) showed that self-assessment is beneficial but insufficient without support to affect change. They found that teachers also needed feedback in the form of consistency checks, assistance and encouragement from peers and administration, and support for implementation (Ross & Bruce, 2007). While asserting that "teachers who accurately self-appraise a need for change but do not have support to implement change are unlikely to do so" (p. 10), they did, however, note the significant impact that teacher beliefs have on the impact of professional development: "Teachers with low self-efficacy are less likely to implement new teaching ideas" (p. 10).

The impact of teachers' beliefs and attitudes is further supported by a case study involving a two-year program that incorporated the *Immunities to Change* framework. Helsing et al. (2008) analyzed the development of one participant as she made changes in the way she understood herself and her professional role. This framework for professional development, developed by psychologists Robert Kegan and Lisa Lahey (2001), incorporates a verbal and written exercise that encourages individuals to "uncover their hidden assumptions, beliefs, or mental models" by "making explicit the contradictions between intended goals and behaviors" (Helsing et al., 2008, p. 441). By identifying and articulating these "immunities to change," the study's participant was better able to understand and challenge her attitudes and roles with regard to systematic change (Helsing et al., 2008). The authors' reports and analyses of the participant's experiences and reflections illustrated the developmental, affective components of change and the importance of applying an adult learning lens that recognizes the importance of preexisting beliefs and assumptions, many of which are deeply engrained.

Helsing et al. (2008) alluded to Ron Heifetz's (1994, 2004; Heifetz & Linsky, 2004) distinction between an "adaptive problem" and a "technical problem" to assert that it is insufficient to introduce new strategies, systems, or tools (technical solutions) without addressing the "specific psychological capacities" (Helsing et al., 2008, p.438) that adaptive work demands. Although not explicitly stated by the authors, the relevance to adaptive expertise (Hatano & Inagaki, 1986) and "growth mindsets" (Meyer, Rose, & Gordon, 2014) is clear; this case study illustrated the importance of changing one's beliefs and the impact of this on one's actions, noting that "the most powerful professional development programs will address and challenge these limiting beliefs and assumptions, thereby helping participants acquire new ones that are aligned with more effective practices" (Helsing et al., 2008, p.459).

Sales et al. (2011) used action research to help teachers develop a more intercultural and inclusive approach, and their discussions with teachers showed that when the school community saw a need for change and were given the strategies and support to make that change, positive steps toward school transformation were possible. The authors chose the collaborative, democratic model of action research because it can "provide the resources to deconstruct teachers' professional identity when it emerges as a racist and exclusionary construction, and favours empowerment of teachers and the school community" (Sales et al., 2011, p.912). The process began with sessions to stimulate discussions about inclusion and diversity, and teachers' perceptions, made evident in their comments, were pessimistic with regard to effective inclusion. Researchers noted that teachers did not have adequate knowledge and professional vocabulary to discuss or address adequately the concepts of inter-culturality or inclusion, and thus they saw these concepts as "empty terms" or theories with limited application in their classrooms (Sales et al., 2011). One teacher's comment illustrated this: 'The idea of the inclusive school is all well and good, but it's one thing to talk about the theory and quite another to put it into practice' (p.915). When teachers were able to articulate their "dreams," goals for effective inclusion, and researchers presented tools and practices to help them reach those goals, teachers saw professional development as a "process of change" rather than something imposed upon them and "perceived it more positively" (p.915). In the discussion, researchers noted several changes at the school that came about as a result of this professional learning: the development of committees and assemblies to facilitate democratic participation, increased teacher efficacy and autonomy, involvement of the broader school community in decision-making, and the use of collaboration and negotiation to resolve conflicts (Sales et al., 2011). This study did not report on changing classroom practices or student outcomes, and since results were limited to teachers'

perceptions and self-evaluation during the nine professional development sessions, the long-term impacts on inclusion and student learning cannot be ascertained. Like the previous research of Helsing et al. (2008), this study looked at ways to address teachers' resistance to change and increase participation in professional learning; gaps remain, however, in determining how this participation impacts teaching and learning.

Clarke & Hollingsworth (2002) also cited a case study where limiting beliefs and assumptions deterred modification of teaching practice, and the authors proposed a model of professional development that includes four domains of the teacher's world: the personal, the domain of practice, the domain of consequence, and the external domain. These are similar to the four domains of the change model identified by Gurskey (1986), who stated that changes in beliefs/attitudes occur after teachers have seen results of new practices. The model described by Clarke & Hollingsworth (2002), however, is more cyclic in nature, acknowledging the interconnectedness of these domains for teachers as learners and proposing multiple points of entry. This model also has obvious parallels to the components of HPL, which are also overlapping and interdependent (Darling-Hammond & Bransford, 2005; NRC, 2000) and to the UDL implementation process, which is cyclical rather than linear in nature (National Center on UDL, 2011; Ganley & Ralabate, 2013).

Similarly, an earlier case study reported by Clarke et al. (1992) demonstrated, through interviews with a single teacher-participant, the impact that a teacher's beliefs and attitudes may have on the learning process. The participant, an experienced teacher, was reluctant to participate in the training, in part because "he saw no need to modify the teaching practices that he felt had proved successful over a lengthy teaching career" (Clarke et al., 1992 Clarke & Hollingsworth, 2002). Because the teacher did not recognize a need to change, his practices remained the same,

even after two in-service sessions. When he later attempted the group work methods that had been modeled in professional development, he expressed during interviews with researchers his new value for this approach. By experimenting with new practices, seeing the results with his students, and reflecting on the process, this teacher continued to develop new group-oriented and reflective classroom methods (Clarke & Hollingsworth, 2002). In this case, the teacher did not recognize a need for change because he was satisfied with the results of the approach he had been using; only after he tried something new and saw that it increased student engagement and creative thinking did he himself engage in the professional development opportunities being provided. The study supported the need for a learner-centered approach to professional development that meets teachers where they are, focuses on teacher growth, and is non-linear in structure: "We must accord the same dignity and status to teachers' developing practices that we exhort them to accord to developing student practices" (p. 965). Like the interconnectedness of the HPL components, this attention to teacher-as-learner calls for mediating practices such as reflection and enactment that provide pathways between teachers' domains to influence change.

Both the Helsing et al. (2008) and Clarke (1992; cited in Clarke & Hollingsworth, 2002) case studies illustrated the idea that teacher growth and change is a process; having information (such as that provided in a professional development workshop) does not automatically lead to improved teaching practices. Using an experimental design with 123 teachers in a Cypriot primary school, Antoniou & Kyriakides (2013) showed that teachers benefit when this process is structured according to their own developmental stage. These researchers investigated the impact of "The Dynamic Integrated Approach" (DIA) to teacher learning, an approach focused on addressing needs of specific groups of teachers, whose developmental stages were linked to research on Educational Effectiveness Research (EER). EER looks at the impact of particular

teacher behaviors on student achievement outcomes (Antoniou & Kyriakides, 2013; Scheerens & Bosker, 1997; Teddlie & Reynolds, 2000), and these behaviors, grouped by researchers into 5 developmental levels, "move from the use of teacher-centered approaches to the active involvement of students in teaching and learning" (p.2). By identifying evidence-based practices that improve student learning, the authors of this study, using the DIA, aimed to establish stronger links between the design of professional development and the results of EER. Four basic characteristics of the DIA approach are outlined below (Antoniou & Kyriakides, 2013, p. 3):

1. Professional development should address "specific groupings of teacher factors associated with student learning" rather than an "isolated teaching factor each time."

2. Professional development should vary according to the specific needs of each teacher/group of teachers. Even teachers with similar experience or qualifications may have different needs or priorities.

3. Teachers need to be actively engaged in their own learning and "a clear understanding of why the factors addressed have an impact on student learning."

4. Teacher-educators have "an important role in facilitating, coaching and supporting teachers in their efforts to develop and implement their action plans in their classrooms."

Antoniou & Kyriakides' experimental study examined the impact of this approach on teachers' skills and on students' math achievement. Furthermore, the authors compared results with those of an alternative, holistic approach (HA), to teacher learning, which "encouraged teachers to reflect on the whole spectrum of their teaching practice and to develop action plans

for improvement without a specific focus corresponding to their developmental stage" (p.3). Results of this study indicated that teachers using the DIA approach had greater improvement than those using the HA approach, and there are a number of learner-centered components of this professional development strategy that the study's authors praised as key elements to its success: materials and case studies that differed according to the level of teacher group, monthly meetings to monitor progress and encourage reflection and critical thinking, active participation by teachers in developing their own action plans, and collaboration with group members and coordinators. While the HA professional development did include many of the same collaborative components, goals and discussions were not structured to specific developmental levels and were therefore less focused and effective. This study showed that being learner-focused does not just mean letting teachers set a professional development agenda for themselves; priorities based on teachers' strengths, weaknesses, and needs related to effective practices or EER are essential, along with clarification and explanation of objectives, sustained support, and opportunities for reflection and problem-solving.

One case study that stands out from these others because of its specific focus on UDL, looking at implementation across four school districts, identified stakeholder buy-in and collaboration as key themes (Ganley & Ralabate, 2013). In a presentation at the 2014 UDL-IRN Summit, George Van Horne, Director of Special Education at Bartholomew Consolidated School Corporation (BCSC), described his district's adoption of UDL as a framework for educating all students. He emphasized the simple but important grounding assumption that UDL is about deeper learning for all, not a framework that applies only to students in special education. One of the districts in the CAST case study, Baltimore County Schools, echoed the notion of educator buy-in: "It was necessary to convince educators that the district was

committed to using UDL as a framework and that it was here to stay" (Ganley & Ralabate, 2013). Bill McGrath of Montgomery County (Maryland) Schools also highlighted this idea, asserting that in order to make UDL "stick," it is crucial to convince teachers, to inspire them to think about student choice and learning, rather than trying to "sell" to general educators a strategy that has been successful in special education (2014, March). Cecil County Schools in Maryland, which like Baltimore County implemented UDL in part due to the state's mandate of UDL as a curriculum design framework, cited "initiative overload" as a primary hurdle (Ganley & Rabalate, 2013).

Throughout the cases studies, the theme of buy-in recurred; interviews with teachers and district leaders articulated that stakeholders must recognize the value of UDL for all learners or implementation will be superficial and short-lived. Whether initiatives originate at the school level (Perhaps a teacher, inspired by a workshop or class, re-designs his own classroom and curriculum and inspires others to adopt this framework.) or from state mandates (as in Maryland), each of the school personnel in this case study agreed that having buy-in, collaboration, and support at all levels was paramount to success. Leaders from each district outlined what had been done as a result of this program to integrate UDL, as well as plans moving forward. For example, in Baltimore County, they began the process of rewriting district-wide curriculum to incorporate UDL language, creating rubrics to measure UDL implementation in curriculum and lessons, securing grants to support a UDL leadership position, and expanding UDL professional learning communities (PLCs) across the district. Cecil County schools also began to rewrite curriculum, expand PLCs, and redesign professional development to be a model of UDL. Michael Hodnicki, Instructional Coordinator for Professional Development in Cecil County Schools, explained the rationale for a UDL model of professional development, and his

words indicated a learner-centered approach: "Teachers have different strengths and weaknesses. Professional development should not look just one way; it needs to model what we expect them to do in their classrooms. It's not just what we provide our kids, it's what we also provide for our adults" (Ganley & Ralabate, 2013).

The CAST study differed from the previous studies in its scope; professional development was district-wide and lasted for a year. The grant from CAST allowed for both training and ongoing support throughout this process (Ganley & Ralabate, 2013). Questions remain about the feasibility of learner-centered instruction for schools and districts where resources are limited, and this may be why the "one size fits all" isolated workshop model, while certainly less learner-centered and proven to be less effective, is still characteristic of much teacher education (Avalos, 2011; Guskey, & Yoon, 2009, Hall, & Hord, 2011; Hill, 2009; Rose & Church, 1998).

***Knowledge-Centered* Professional Development.**

Professional development that is *knowledge-centered* considers carefully "what is taught (information, subject matter), why it is taught (understanding), and what competence or mastery looks like" (NRC, 2000, p. 24). NRC (2000) cited evidence (Barone et al., 1996) that what is taught in professional development does not always have research to support it, and even while some learning opportunities for teachers provide instruction in evidence-based practices, professional development needs to focus on how and when teachers use new information (Guskey & Yoon, 2009; Helsing et al., 2008; Rose & Church, 1998) and how content is relevant to teachers' goals, existing curricula, and state standards (Desimone et al., 2002). When workshops cover only general pedagogy, teachers may find it more challenging to apply what they learn in their classrooms (Desimone et al., 2002; Guskey & Yoon, 2009; NRC, 2000).

Certainly there is overlap here with learner-centered education, for what is relevant and constructive varies from teacher to teacher.

At the heart of *knowledge-centered* learning for teachers is the challenge of addressing the gap between research and practice (Fixsen et al., 2005). Rose et al. (2006) noted that students need more than just knowledge; they also require a way to express that knowledge and put it to work: "Only in its expression is knowledge made useful" (p. 8). On one hand, learning about theory or strategy alone does not result in substantive changes in teacher practice (Helsing et al. 2008), and on the other, relevant strategies or practical advice may "become ritualized and mechanistic if teachers are not stimulated to think about the principles of learning that underpin them" (James & McCormick, 2009**,** p.982). Balance between theory and its implementation in specific learning contexts calls for professional development that is flexible and prolonged enough to incorporate both.

Positive outcomes have resulted from teacher learning that incorporates both outside experts and peer learning opportunities to provide both knowledge and practice (Guskey & Yoon, 2009). It can be challenging for teachers to transition to the role of learner, re-thinking their subject matter and practices, so having outside expertise along with peer support can help make teachers more comfortable and engaged (NRC, 2000).

Similarly, Cochran-Smith & Lytle (1999) offered insight into this complexity of factors at play in professional development, distinguishing among three conceptions of teacher learning: knowledge-for-practice, knowledge-in practice, and knowledge-of-practice. According to their distinction, "knowledge-for-practice" is formal or theoretical knowledge, "knowledge-in practice" is the practical knowledge gained in the classroom and through reflection on what has or hasn't been effective in teaching, and "knowledge-of-practice" brings the first two together

"when teachers treat their own classrooms and schools as sites for intentional investigation at the same time that the treat the knowledge and theory produced by others as generative material for interrogation and interpretation" (p. 250). McLeskey & Waldron (2004) examined Cochran-Smith & Lytle's (1999) perspectives on teacher learning and their implications for enhancing teaching and bridging the gap between research and practice. Their study advocated the use of longer-term, supported learning experiences instead of "one shot" professional development so that teachers have the opportunity to gain knowledge and put it to use with reflection and feedback. Both Cochran-Smith & Lytle (1999) and McLeskey & Waldron (2004) noted the multifaceted nature of teacher learning: knowledge is more than simply theoretical or practical; instead, these two influence each other through inquiry, experimentation, and reflection.

***Assessment-Centered* Professional Development.**

Learning that is *assessment-centered* incorporates formative assessment and feedback during the process of instruction; assessment contributes to learning rather than just evaluating whether learning has taken place (Darling-Hammond & Bransford, 2005; NRC, 2000). Feedback and reflection are critical for teacher learning (Antoniou & Kyriakides, 2013**;** Guskey & Yoon, 2009; Hall & Hord, 2011; Ross & Bruce; Sales et al. 2011), and in order to incorporate these components effectively, teachers need time to try out new practices and receive feedback through collaboration with peers and researchers/teacher educators. According to HPL theory, as well as adaptive expertise, feedback is essential to understanding and learning transfer (HPL, 2000). The Gurskey (1986) change model, as well as the model described by Clarke & Hollingsworth (2002), supported the idea that teachers need to try out ideas in their own classrooms and receive feedback. HPL theory asserts that this gives teachers "evidence of success" and also "opportunities to clarify ideas and correct misconceptions" (NRC, 2000, p. 196).

Fixen et. al. (2005), in a study related to the science of implementation across several fields, noted the significant role that assessment plays in measuring implementation fidelity. Attempts at innovation or the implementation of newly learned skills are not seamless; they require "education, practice, and time to mature" (Fixen et. al., 2005). Therefore, it is not enough to use frequency measures alone to determine whether a professional learning program has been effective, but rather appropriateness and fidelity should be assessed (Rose & Church, 1998). Even when teachers might appear at first to be applying newly learned strategies, subtle differences can reveal whether deeper learning has occurred or whether implementation is "more mechanical, more 'the letter,' focusing on surface techniques" (James & McCormick, 2009). It is important to note here that implementation does not have to look the same way for everyone, and, in fact, deeper learning (NRC, 2000) allows for flexibility and creativity when putting knowledge to use. Bell, Wilson, Higgins, & McCoach (2010) maintained that researchers need to look for reasons behind weak implementation, and rather than wasting time identifying irrelevant differences in practices, one must balance between what needs to be "tight" and "loose" in implementation.

Like Clarke & Hollingsworth (2002), Fixen et al. (2005) discussed feedback "loops," assessment that is formative and ongoing, informing future practice rather than serving as a final measurement of program success. Frequent assessments that continue for prolonged lengths of time (months or even years) allow purveyors, those who work to implement a practice or program, opportunities to learn from mistakes, identify barriers or supports, and generate solutions for future problems (Fixen et. al., 2005). This kind of information can inform not only future implementation but also future learning. The challenge, however, is that these require patience and persistence (Fixen et. al., 2005).

Within the framework of UDL, *assessment-centered* learning also plays a key role. Research on UDL and learning (Rappolt-Schlichtmann et al., 2012) has indicated that understanding and skills are better understood as a range, not a point on a scale, and "in optimal contexts- with high support, familiar tasks, & motivation to perform- children show a true upper limit on performance, called their optimal level. In spontaneous contexts- with minimal support- children show a much lower upper limit, their functional level. The optimal level develops in a stagelike way, while the functional level develops slowly and gradually" (p. 118). The research here relates to children and learning, but it also applies to teachers as learners and reinforces the need for ongoing to support the integration and maximization of new skills. Formative assessment throughout the process is essential to determine what supports are needed. In this way, assessment is used in a *learner-centered* way.

There are a number of ways that assessment-based learning can occur; self-assessment is one important component. While teacher educators have an obvious role to play in this, professional development research has indicated that rather than collecting assessment data in isolation, teacher educators are more effective when they guide reflection and partner with teachers to assess and shape learning (Avalos, 2011; Ross & Bruce, 2007; Sales et al., 2011). Ross and Bruce (2007) provided teachers with a tool for self-assessment, and their research, influenced by social cognition theory (Bandura, 1997) examined the ways that teacher change occurred through reflection on one's experiences. In addition to guidance from researchers, peers also played a significant role in providing feedback and support. In this explanatory case study of 10 mathematics teachers in grades 7-9, researchers guided teachers in self-assessment using the following strategies: (1) individual self-assessment using an interactive website; (2) in-service on peer observation and teaching strategies; (3) peer observation of teaching; (4) in-service on the

use of peer observation data and input on teaching strategies; (5) classroom experimentation over 4 weeks; (6) peer observation; and (7) in-service on teaching strategies (Ross & Bruce, 2007). The self-assessment tool created for this study consisted of 10 characteristics of standards-based mathematics instruction, defined by National Council of Teachers of Mathematics (NCTM, 1989, 1991, 2000). The article used the experiences of one participant to discuss in detail the process of reflection and teacher change, noting improvements in teacher self-efficacy, use of common language between peer teachers, and teachers' perception of improved outcomes for students. Researchers cited agreement between teacher self-evaluations and those of peers and researchers as supporting the credibility of findings.

While all participants in the study used the self-assessment tool, six of the other nine participants showed smaller positive changes in practice, measured by the rubric, and three participants were identified as "negative data" (Ross & Bruce, 2007). Researchers noted that these three cases nevertheless provided important insights about the use of self-assessment, for in each case pre-existing beliefs about the need for change (from more traditional to standards-based) influenced the outcomes. Other studies have demonstrated that when teachers reflect on their own beliefs and practices, both before and after professional development, they build awareness of the need for change (Sales et al., 2011), assume responsibility for their own learning (James & McCormick, 2009), and make adjustments based on observed outcomes, especially when they believe that their actions have benefitted student learning (Clarke & Hollingsworth, 2002; Gurskey, 1986; Ross & Bruce, 2007). These understandings of assessment represent a shift away from programs that change teachers to a model of professional development in which teachers are active learners, who actively shape their professional growth through reflective participation (Clarke & Hollingsworth, 2002). However, Ross & Bruce's

(2007) "negative data" showed that when teachers did not recognize a gap between beliefs and existing practices or if they failed to see the benefits or relevance of what was being taught in professional development, the impact of self-assessment was minimal. For these teachers, what may have been missing was a *learner-centered* component that addressed the question of "why change?" according to their individual assumptions, knowledge, and beliefs, as well as a *knowledge-centered* component to insure that what was being taught was relevant and constructive for participants. Ross and Bruce (2007) concluded that the provision of a self-assessment tool alone was insufficient to bring about change, and its impact was enhanced when combined with strategies such as peer coaching, observation and input from "external change agents," and focused feedback on teaching strategies.

***Community-Centered* Professional Development.**

According to the HPL framework, community-centered learning considers physical, cultural, and social factors by "providing supportive, enriched, and flexible settings where people can learn from one another" (Darling-Hammond & Bransford, 2005, p.33). Professional development studies have shown the impact of school cultures on teacher learning (Jurasaite-Harbison & Rex, 2009; McLeskey & Waldron, 2004) and the benefits of professional collaboration and communication (Clarke & Hollingsworth, 2002; Cochran-Smith & Lytle, 1999; Owston et al., 2008; Shank, 2006). Rather than merely teaching specific "best practices," most effective professional development comes from adaptation of varied practices in specific contexts (Guskey & Yoon, 2009). Avalos (2011) described the "situated nature" of teacher learning, citing several studies (James & McCormick, 2009; Jurasaite-Harbison & Rex, 2010; Sato & Kleinsasser, 2004) that illustrated the influence of context (school culture) on professional growth for educators.

Meyer, Rose, & Gordon (2014) stressed the importance of rich, participatory learning experiences for teachers, ones that allow them to form communities of practice in order to incorporate new knowledge effectively in meaningful ways: "Teachers, of course, are learners too. Effective learning involves deep participation rather than mere performance. Practices require selective and dynamic use of knowledge- *discernment* of what is and is not useful *in context*" (p.159). The four districts in the CAST case study (Ganley & Ralabate, 2013) illustrate strategies for training and support that are contextually relevant for teachers in their schools. Baltimore County, Cecil County, and Chelmsford Schools utilized cross-curricular professional learning communities (PLCs) to allow teachers to learn and plan together, sharing ideas and offering knowledge and encouragement. Working with UDL coaches and mentors, PLCs expanded professional development beyond one-time workshops or classes and served as systems for ongoing support and collaboration. McGrath (2014, March) asserted the advantages of PLCs in fostering collaborative learning, noting that his own district's cross-disciplinary teams encouraged teachers to take risks, be creative, and engage in self-reflection. At this point there is little systematic research, aside from these case studies, on the impact of UDL training and support for teachers in school settings; however, earlier studies of professional development corroborate the importance of interaction and storytelling for teacher growth and change.

Shank (2006) found that when teachers worked together to investigate, learn, and reflect together, they were more engaged learners, better able to make sustainable changes in their pedagogical practices: "Through collective deliberation, teachers could capitalize on the social nature of learning, and break through the wall of privacy and individualism that so often characterizes teaching" (p. 712). This qualitative study looked the effect of storytelling, and found that teacher sharing increased risk-taking and creativity. This echoes what McGrath (2014,

March) reported observing in his own district, and these characteristics are important for the type of innovation that adaptive expertise or a UDL approach calls for. Drawing on the research of Wenger (1998), Skerrett (2010) distinguished between communities of practice, groups with shared objectives and tools (resulting often from standardization), and learning communities, which require engagement and reflective practices. This collaboration and reflection is consistent with the UDL affective principle, for when teachers work together to learn, sharing ideas and supporting each other, they are more likely to be engaged in the learning process. The type of real-world advice and concrete examples that teachers-collaborators can offer each other serve as a bridge between the conceptual and practical (Hall & Hord, 2011; Shank, 2006), and research has shown professional development is most effective when it is long-term, collaborative, and grounded in teachers' own day-to day practice and curricula (Hall & Hord, 2011; Owston et al. 2008; Schlager & Fusco, 2003; Wenglinsky, 2002).

Richmond & Manokore (2010) analyzed "teacher talk" in order to collect data about critical elements of professional learning communities, and their study highlighted the impact of context, as well as collaboration on teacher learning using an analytical lens based on the Spillane, Halverson, & Diamond's (2001) model of distributed leadership. According to Spillane et al. (2001), situational context impacts interactions, and there are three essential factors to consider: physical capital (resources necessitating money), human capital (teacher knowledge and skills), and social capital (relationships among individuals). As in the case of Richmond & Manokore's study in a Title 1 urban school, many schools and districts face challenges of limited financial resources, decreasing enrollment, high student mobility, low state achievement test scores, inadequate staffing, and high poverty rates. These factors impact both teacher morale and professional support for teacher learning (Richmond & Manokore, 2010), and their collective

influence illustrates the ways that learner-centered and community-centered learning are interrelated in professional development. Despite these challenges, their study found that participants valued the collaboration of PLCs and reported learning "more about teacher practice from their PLC peers than from discussions with nonproject colleagues" (p. 567). While participant interviews offered evidence about the positive impact of community-centered learning, reservations about district support and sustainability of outcomes, particularly when students move on through the system, highlighted the broader question of community context: What happens when teachers make changes in an unchanged environment? Richmond & Manokore (2010) cited Grossman, Wineburg, & Woolworth's (2001) observation of this dilemma, but also described the satisfaction of some teachers who felt they "were being successful *despite* expectations of their superiors" (p. 867).

Because schools, like individuals, have particular strengths and needs, development of learning communities is not automatic or uniform. McLaughlin & Talbert (2006) identified three stages of PLC progress, classifying many of the barriers that schools face between the "macro" policies of states and districts and the "micro" experiences teachers in classrooms. According to McLaughlin & Talbert (2006), and reiterated by Dooner, Mandzuk, & Clifton (2007), the novice stage is often dominated by data collection and management, and the identification of shared goals or focus of study can prove to be a daunting ask. Effective leadership, an environment of inquiry, and trust among professionals are paramount as schools transition to the intermediate stage, where shared goals and language are clearly articulated and inquiry begins to guide learning (McLaughlin & Talbert, 2006). Dooner et al. (2007) described the challenges of group problem-solving and need to establish "open conflict norms" (Jehn, 1995) that respond to group tensions. Even when these components are in place, however, not all teachers are necessarily

involved in the process; McLaughlin & Talbert (2006) described resistance by some to the "overarching professional culture of inquiry" (p. 32) and the time and work demands of this cultural shift. When schools reached the advanced stage, sometimes after several years, a culture of inquiry had been established so that "faculty discussions often probed deeply into patterns of student outcomes" (p. 34), not with a tone of blame, but with a collective commitment to improve them. This study of PLCs contained a number of parallels to studies discussed with regard to learner-centered professional development (Avalos, 2011; Clarke & Hollingsworth, 2002; Gurskey, 1986; Hall & Hord, 2011; Helsing et al., 2008; James & McCormick, 2009; Sales et al., 2011); change is a process, and communities or individuals need buy-in, time, support, and evidence of positive effect in order to make that change sustainable.

Community-centered learning expands beyond organized PLCs, such as those described by McLaughlin & Talbert (2006) and Dooner et al. (2007), and also includes opportunities for informal learning created by school cultures (Jurasite-Harbison & Rex, 2010). In an ethnographic study of three schools, one in the Midwestern United States and two in Lithuania, these researchers examined the contexts (school mission, traditions, physical features, organizational structure, and professional relationships) that impacted the way that teachers shared ideas and learned from each other. While shared goals and commitment to cooperation and learning promoted informal learning, this study found that "top-down efforts to get teachers to comply" (Jurasite-Harbison & Rex, 2010, p. 276) resulted in teacher defensiveness and reduced collaboration. This study confirmed the role that school culture plays in teacher learning, noting that these cultures are complex and dynamic. Applied to the creation of professional development opportunities, this calls for culturally sensitive and responsive teacher education rather than a one-size-fits-all approach.

Web-based opportunities expand community beyond school walls by changing the way that teachers and students interact and share information. Recognizing that enrollment in graduate classes is not feasible for all teachers, given financial and scheduling constraints, Smith & Tyler (2011) advocated the utilization of web-based resources for professional development, citing advantages such as convenience, universal access, instructor support, interactivity and multimedia experiences, and relative affordability. Technology also opens doors for networking and collaboration among teachers through social media. Using educational social networks, educators can access knowledge through online modules and learn from one another in online learning communities. For example, teachers interested in remaining abreast of Web 2.0 and social media for education, Classroom 2.0 (http://www.classroom20.com/) offers a network of over 70,000 members from 188 countries. Classroom 2.0 is a social network that provides opportunities for peers to share knowledge and resources through social media projects, professional learning communities, events, and labs. Networks such as Web 2.0 are forums for learning about educational technology from others around the globe, and they offer supportive communities and discussions for both technology novices and experts alike. For teachers looking to incorporate new and innovative technologies, social media allows them flexibility and community beyond the limitations of their own schools or districts.

Owston et al. (2008) analyzed three program evaluations and showed that blended learning for teachers, a mixed model that combines online and face-to face instruction, offered flexibility and accessibility along with hands-on learning and community building. Their research focused on four issues related to blended programs:

1. Program design: relevance of learning experience, time between face-to-face sessions

2. Teachers' sense of community and collaborative skills: teacher time, relevance of topics, online facilitation
3. Teacher influence: impact on teaching, teacher confidence
4. Student influence: student attitudes, student achievement

All three programs allowed opportunities for teachers to try out what they had learned in their own classrooms, but they "varied in the extent to which they were directly related to teachers' needs" (Owston et al., 2008, p.205). One program was teacher-driven and therefore most relevant to individual needs; however, its impact was not as far-reaching because only a minority of teachers completed the projects. This finding demonstrates a need for further research to determine best practices for developing programs that effectively integrate these learner-centered and community-centered learning components. In other words, if teacher-driven programs are effectively learner-centered, how can community-centered components (supportive settings, time, collaboration) be enhanced to increase participation and completion?

According to this study, blended learning may be a way to offer professional development that incorporates both individualized relevance and hands-on experimentation with community support. On one hand, computer-based learning gives teachers access to online facilitation and content that can be personalized, along with opportunities to try out ideas in their own classrooms, and these programs can be extended over longer periods of time (Owston et al., 2008). On the other hand, face-to-face sessions build community in a different way, and as one teacher's comment reflected, this more personal interaction can be a unifying component for participants, while promoting creativity and motivation: "I think we feed off each other… you feed off each other's energy and you feed off each other's cues but I can't do that on a computer" (Owston et al., 2008). Another insight offered in this study was the advantage of professional

development that pulls teachers out of their own environments. While research has shown that learning needs to be contextually relevant and applicable to teachers' own schools and classrooms (Desimone et al., 2002; Guskey & Yoon, 2009; Helsing et al., 2008; Rose & Church, 1998), blended learning offers multiple contexts and may inspire teachers to think in new ways, especially when the school culture is resistant to change (Owston et al., 2008).

Technology has the potential to reduce barriers to learning for both educators and students, and therefore its roles in professional development, ongoing collaboration, teaching, and sharing information cannot be understated. Its significance to learning is highlighted by the NETP (2010) as a thread that ties together theories HPL, 21st century competencies, and adaptive expertise. Web-based or blended programs may be more suitable to teachers' demanding schedules, while also offering resources and support not available locally (Dede et al., 2009). Nevertheless, technology is a tool, not an initiative or overarching framework (Van Horne, 2014, March), and teacher educators should be cautious about implementing technology without a broader perspective about learning, Since teachers vary in technology knowledge and resources (Lenhardt et al., 2005; NETP, 2010; Oblinger & Oblinger, 2005), it is important to assess teachers' level of comfort and experience with technology, as well as the availability of computers and internet access, and provide appropriate technology training based on teacher needs. Teachers' attitudes about cyber learning and internet self-efficacy have been shown to impact motivation toward professional development that incorporates online components (Kao and Tsai, 2009; Kao, Wu, & Tsai, 2011). Since "learners differ significantly in what attracts their attention and engages their interest" (Meyer, Rose, & Gordon, 2014; National Center on UDL, 2012c; Rose & Gravel, 2012), technology training that meets individual teachers where they are and takes them where they want to go is more likely to be engaging and meaningful. While

online learning opportunities for teachers are becoming more abundant, there is inadequate research about their effectiveness or about best practices for their design and delivery (Dede et al., 2009).

When professional learning is limited to one session or one context, there may not be adequate opportunities for teachers to expand their thinking, try out new ideas, or receive feedback. HPL theory (NRC, 2000) emphasizes the importance of *learning transfer*, similar to adaptive expertise (Hatano & Inagaki, 1986) or "growth mindsets" (Meyer, Rose, & Gordon, 2014), and outlines the key characteristics necessary to promote this type of deeper learning and application:

- Initial learning is necessary for transfer, and a considerable amount is known about the kinds of learning experiences that support transfer.
- Knowledge that is overly contextualized can reduce transfer; abstract representations of knowledge can help promote transfer.
- Transfer is best viewed as an active, dynamic process rather than a passive end-product of a particular set of learning experiences.
- All new learning involves transfer based on previous learning, and this fact has important implications for the design of instruction that helps students learn.

In terms of professional development, this calls for opportunities that combine learner-centered, knowledge-centered, assessment-centered, and community-centered components to provide rich, relevant, engaging learning for teachers.

Conclusions

Research has indicated that classrooms are becoming increasingly diverse, inclusive settings where the expectations for 21th century knowledge and skills for all students call for

educational reform and professional development for teachers. In order to meet the challenges of learner variability, which also includes the interests and preferences of today's students, and to keep up with changes in technology and global connectedness, teachers need new skills. While UDL has been identified as a framework for addressing these challenges, research on UDL professional development is minimal, and literature pertaining to UDL implementation is still in its early stages.

Since the goal of professional development is to bring about positive classroom change, the HPL framework provides guidelines for helping teachers achieve "deeper learning" (NRC, 2012) and adaptive expertise (Hatano & Inagaki, 1986) to integrate what they have learned and apply it across contexts. While many of the professional development studies discussed in this literature review highlighted successful practices that fall within one or more of the HPL domains, there is still much to be learned about the types of educational opportunities that can integrate these components and successfully provide training in evidence-based practices, increase participant engagement, bring about sustainable change in classrooms, and help teachers become adaptive experts who can flexibly apply knowledge across contexts and situations. By focusing on the teacher as learner, we can begin to apply what is known about knowledge acquisition and transfer in order to create learning opportunities that incorporate these elements.

Professional development research (i.e. Avalos, 2011**;** Clarke & Hollingsworth, 2002; Gurskey, 1986; Hall & Hord, 2011; Helsing et al., 2008; James & McCormick, 2009; Sales et al., 2011) has shown that teachers vary significantly in terms of assumptions, experience, beliefs, and needs, and programs that begin by meeting teachers where they are and addressing the question of "Why change?" have had positive results in terms of engagement and learning (Antoniou & Kyriakides, 2013; Clarke & Hollingsworth, 2002; Ganley & Ralabate, 2013;

Helsing et al., 2008; Sales et al., 2011). What is taught (*knowledge-centered* learning), how it is measured and how feedback is provided (*assessment-centered* learning), and the contexts where learning and implementation take place (*community centered* learning) are likewise essential elements to professional development, and it is important to examine the ways in which these elements overlap and influence each other. These elements are equally varied and complex; content relevance is not the same for each teacher or setting, and the types of feedback that best support learning may be unique to each learner.

While the studies in this review examine the various aspects of the HPL domains, often focusing on one or two, no study examines systematically the ways in which learner-centered, knowledge-centered, assessment-centered, and community-centered components work together in professional development. In UDL-specific literature, most of which has taken place in postsecondary settings, the community-centered factors are an obvious deficit.

Research on outcomes, the long-term impact on classroom practices, is quite limited, perhaps because it is challenging to measure implementation in a manner that looks beyond frequency measures and assesses appropriateness, fidelity, and deeper learning (Bell et al., 2010; James & McCormick, NRC, 2000; Rose & Church, 1998). Since skills often take time and practice to develop (Fixen et al., 2005), the true influence of professional development is not likely to be apparent until weeks or months after instruction has taken place. The challenge of examining impact may be especially true for a framework like UDL, for which creativity and flexibility are central tenets. In a lecture entitled "It's a Lens, Not a List" (2014, March), Bill McGrath of Bartholomew County Schools noted that it is sometimes attractive to think about UDL as a list of tools for teachers to use and share, but this does not lead to integration and connections. Instead, we need to find a way for teachers to make deeper connections

(reminiscent of the "deeper learning" of HPL framework), best achieved through conversations about teaching and learning through a UDL lens. This process needs time and space to develop (Edyburn, 2010), and assessment of these programs and practices may lend themselves to qualitative, rather than quantitative, measures. McGrath (2014, March) also described change as a social process; rather than broadcasting results, substantive educational reform can be achieved through storytelling that allows people to see themselves in the narrative. There is great insight to be gained from teachers talking about the impact of UDL on them as educators, about their relationships with students, and the effects on student engagement. Collaboration and sharing through PLCs, online communities, and case study research are venues through which stories about UDL implementation can be shared, and documentation and publication of these stories provide rich data.

CHAPTER 3

METHODOLOGY

By examining the UDL Virtual Classroom project through the lens of How People Learn (HPL) theory (NRC, 2000), this multiple-case study identified ways that program design, facilitator leadership, and collaborative strategies were *learner-centered*, *knowledge-centered*, *assessment-centered*, and *community-centered* in order to better understand the impact of these components on teacher attitudes and classroom practices. The researcher followed up with participants approximately one year following their completion of the project, and through interviews, observation, and a focus group meeting (six months following interviews), data were collected to identify the obstacles to implementation of UDL that existed for participants and how these teachers applied UDL principles in their planning and teaching.

Analyzing the components and outcomes of web-based, community-centered teacher learning in UDL is critical to understanding ways that this framework can be taught so that it is implemented effectively. If effective implementation is lacking, it is important to identify gaps and barriers. This case study investigated the impact of a professional development program for Jamaican educators exploring the application of the UDL framework (Meyer, Rose, & Gordon, 2013) through collaboration with professors and doctoral students at an urban university in the southeastern United States. Ongoing needs assessment was an essential component of this program, as faculty and students explored critical elements of UDL through online modules and

Skype sessions and developed resources for Jamaican educators to implement in the classroom. This study aimed to investigate teachers' experiences, both as participant-learners and as educators in their own classroom contexts.

Three cohorts of Jamaican educators participated in this professional development program, each led by facilitators, who conducted virtual meetings with U.S. faculty and subsequently met with participants to support completion of each module. Since participation varied among the three groups of Jamaican participants, this study analyzed the leadership strategies, collaborative practices, and teacher implementation outcomes of the group with the highest participation rates in order to provide insight into effective methods and models for professional development, as well as learning and implementation gaps and obstacles, which may be applicable in other contexts. By studying participants of this group as individual cases, this research provided insight into the specific components of learning, through the lens of HPL (*learner-centered*, *knowledge-centered*, *assessment-centered*, and *community-centered*), that impacted the transfer of knowledge and skills to classroom practices in a variety of school settings.

Research Approach

The overall purpose of this study was to apply the HPL lens in order to understand the ways that *learner-centered* learning, *knowledge-centered* learning, *assessment-centered* learning, and *community-centered* learning were incorporated into the UDL Virtual Classroom project and to investigate their impact on individual educator-participants, both as learners themselves and in their school and classroom contexts. Rather than measuring the frequency with which these factors were integrated, the aim of this study was to describe their implementation in the Virtual Classroom and gain insight into the ways they impacted participants' engagement, attitudes, and

classroom practices. Similarly, participant interviews, researcher observations, and the follow-up focus group meeting were designed to collect descriptive data about UDL implementation in the classroom, rather than to quantify the number of UDL components in isolated lessons.

Because it focuses on meaning and understanding rather than measuring cause and effect, a qualitative multiple-case study methodology was used. Qualitative research, which draws principles and practices from the philosophical traditions of constructionism, phenomenology, and symbolic interactionism, is "interested in how people interpret their experiences, how they construct their worlds, what meaning they attribute to their experiences" (Merriam, 2009, p. 14). The National Research Council affirmed the value of qualitative methods "to describe complex phenomena, generate theoretical models, and reframe questions" and cited "rich descriptions of the nature of educational change" among the specific research topics conducive to a qualitative approach (Feuer, Towne, & Shavelson, 2002, p. 8).

The following research questions guided the data collection and analysis of this study.

1. How did the Virtual Classroom address the needs of participants as adult learners?
2. What obstacles to implementation of UDL existed for participants following their completion of the Virtual Classroom project?
3. How have teachers applied UDL principles in their planning and teaching?

Because there is limited research available related to UDL professional development, case study research serves as an important tool for identifying factors that facilitate or hinder teacher learning and classroom implementation. Participants themselves may have meaningful insights to share about their successes and frustrations, and by collecting, analyzing, and sharing these insights, researchers may produce evidence, not for the purpose of generalization, but to

inform the field "based of the exploration of specific contexts and particular individuals" (Brantlinger, Jimenez, Klingner, & Richardson, 2005, p. 203). Since UDL is not a uniform set of practices that are easily measured across, or even within, contexts and participants (Diedrich, Howery, & Ralabate, 2012, April; Edyburn, 2010; Katz, 2013; McGrath, 2014, March; Nelson, 2014; Rappolt-Schlichtmann, Daley, & Rose, 2012), the characteristics of qualitative research offer a way to capture "what works" and identify "the structural and ecological circumstances" that foster or impede success (Gutierrez & Penuel, 2014, p.19).

Case study research involves the detailed description and analysis of a bounded system (Merriam, 2009), and Yin (2009) identified this as the "preferred strategy" to address "how" and "why" questions, especially when the researcher has limited control over the events, which take place in real-world contexts. The bounded system, which in the context of this research was the group of program participants in Jamaica, serves as the focus of the study and unit of analysis (Merriam, 2009). While Creswell (2013) noted that some (e.g. Stake, 2005) consider case study research to be a choice of subject matter rather than a methodology, others (Creswell, 2013; Merriam, 2009; Yin, 2009) have used the term to describe both the bounded system under consideration and the approaches used. Yin (2009) has categorized multiple-case designs as variants of the single-case study, which can be seen as more robust (Herriott & Firestone, 1983) by offering comparisons across contexts in which each school (or teacher) serves as "the subject of an individual case study, but the study as a whole covers several schools" (Yin, 2009, p.53).

Research Setting/Context:

The research for this case study took place in one of Jamaica's fourteen parishes and through online communication with Jamaican educators who were participants in the web-based UDL professional development program. Jamaican schools, like those in the United States and

around the world, face the challenge of providing access and opportunity for all students to prepare them for success in the 21st century. This lofty goal is reaffirmed by the national shared vision of Jamaica's Ministry of Education (http://moe.gov.jm/about):

> Each learner will maximize his/her potential in an enriching learner centred education environment with maximum use of learning technologies supported by committed qualified competent effective and professional educators and staff. The education system will equitable and accessible with full attendance to Grade 11.
>
> Accountability, transparency and performance are the hallmarks of system that is excellent, self-sustaining, resourced and welcomes full stakeholder participation.
>
> Every Child Can Learn…Every Child Must Learn.

Making this vision a reality calls for educational reform and transformation, an objective outlined in a proposal by the Caribbean Group for Cooperation and Development (CGCED). According to this task force's report, *A Caribbean Education Strategy*, education systems in the small and often economically vulnerable nations of the Caribbean are struggling to meet the demands of an increasingly global and technological society (Jules, Miller, & Armstrong, 2000). Among the challenges faced by these small island developing states (SIDS) are sexual and physical abuse, high incidence of rage among young people, youth unemployment, gang violence and use of firearms, drug and alcohol abuse (Jules, 2008). In Jamaica, as in other SIDS, education may offer "opportunity for personal advancement, better jobs, and a way out of poverty" (Jules, 2008, p. 205); therefore, there is significant need for "Caribbean educators to be

bold in their thinking and to be willing to question and rethink the foundations of education" (Jules, 2008, p. 204).

The Jamaican educational system is divided into four levels: (1) Early Childhood (3-5 year-olds); (2) Primary (6-11 year-olds); (3) Lower and Upper Secondary (12-16 year-olds), with provisions for "postsecondary" education (17-18 year-olds) offered in sixth form (grades 12-13) or pre-university program; and (4) Tertiary (19-24 year-olds), which is comparable to postsecondary education in the United States. Because of limited facilities and resources, some schools in Jamaica operate on a *shift system*, with students in some grades attending school from approximately 7am to noon and the others from approximately 12:30 pm to 5:30 pm. There is no transportation provided for students, so many walk to school or take taxis if their family does not own a car. Two of the teachers interviewed for this study reported that it is not uncommon for pupils to miss school one or two days each week because they cannot afford cab fare, and they also expressed concern about the negative impact of the *shift system* on both instruction time and student safety (i.e. traveling during dark hours). While the Ministry of Education has asserted efforts to bring about a gradual end to the *shift system* (Dennis, 2015), teachers reported skepticism about the proposed timeline, funding, and the availability of physical space necessary to make this happen.

Vision 2030, the Jamaica National Development Plan, was published in 2009, and this plan included important components for education. The following strategies were among those proposed to improve educational outcomes for Jamaican students (EFA, 2015, p.3):

- Ensure that every child has access to early childhood development.
- Improve the learning environment at the primary and secondary levels.
- Ensure that graduates from the secondary level are ready to go on to higher

education, training or work.

- Promote and use standards to measure performance of the education system based on results.
- Ensure that adequate high-quality tertiary education is available.
- Ensure access to education and training opportunities for disadvantaged groups including unattached youths and persons with disabilities.
- Develop partnerships with the private sector, parents and communities to create quality schools.

As part of the Ministry of Education's recent *Child Find* initiative (Thwaites, 2015, April 8), efforts have been made across Jamaica to identify students who have intellectual and learning disabilities so that both schools and government institutions can plan for accommodating these students and offer them the necessary resources and services. A program for special education in Jamaica has been in existence since 1975, established through a cooperation between the governments of Jamaica and the Netherlands; however, many students with learning needs continue to be marginalized because of inadequate resources, lack of qualified teachers in special education, limited assessment facilities, and misconceptions about disability and inclusion (ESTP, draft 2015).

Educating all students and providing increased access to secondary education demand that systems provide the needed student support services to promote academic success, and the CGCED's report notes that "in the smaller countries in particular, there will be a need to search for creative approaches to offer the diversified curriculum and services in a cost-effective way" (Jules, Miller, & Armstrong, 2000, p. xi). Clearly, there is a need for professional development opportunities to prepare educators to meet these challenges. Research indicates, however, that

professional development often relies on *pull-out* workshops, "which produce limited change in classroom practice" (Gaible, 2009, p. xvii). The program that informed this case study research sought to expand professional development for participants beyond the scope of special education to the more UDL approach of minimizing barriers and increasing engagement and learning for all.

Case Study Setting

The parish where the research was conducted, located on Jamaica's north shore, is one of 14 parishes and is home to 81 public institutions that serve students in grades comparable to American schools' Pre K-12 (3 infant, 47 primary, 15 all age, 6 primary and junior high, 2 special, 7 secondary high, 1 technical high). While schools within the parish varied in terms of size and resources, several challenges were common across the area and reflected challenges identified across the country as a whole: students who lack parental care, students who have behavioral challenges, engagement of parents in their children's learning, engagement of boys, limited access to technology/internet in some places, and multi-age classes.

The six schools that were observed as part of this case study represented a range of educational settings. A summary of all observed schools appears in Table 1.

Table 1.
Summary of Observed Schools

	Grades served	Average Class Size	Internet Access?	School setting	Approximate number of students enrolled
Resource Center (RC)	Grades 1-7	11-15	Yes	urban	35
Bay School	All-Age	31-40	Yes	rural	500
Hillside School	All-Age	25-30	No	rural	200
Teachers College	Tertiary	11-15	Yes	rural	900
Town School	Secondary	25-30	Yes	urban	500
Meadow School	Primary	6-10	No	rural	65

The RC served as the cohort's meeting place for the Virtual Classroom. Both of the group facilitators were employed here as clinical psychologists, conducting student assessments and overseeing the operations of the RC's classes and programs. One other participant, Ms. Buxton, worked as a classroom teacher at the RC. The educational setting offered at the RC differs from other schools in the study because it is a private organization, subsidized by the Jamaican government. Attending students do pay some tuition, but the cost is considerably below that of local private schools. Tuition is free for some (e.g. wards of the state), and there is a sliding scale based on family income. All students at the center are "attached" to other schools; they attend the RC for remedial services, particularly in the areas of reading and math (in Jamaica more commonly referred to as *literacy* and *numeracy*), and most stay at the center for one-two years before returning to their home schools. The RC is also responsible for individualized and group assessments that indicate need for remediation; children come to the center for assessments, and

evaluators also go to schools to assess students. Sometimes a school will be referred for diagnostic assessments due to low scores on national tests, and in such cases, RC personnel visit the school to conduct group assessments.

Students at the RC are grouped into three primary age classifications, and then there are clusters within these larger groups to address particular areas in need of remediation. Based on individual learner profiles, the RC creates an IAP (Individual Action Plan) for each student that outlines strengths, weaknesses, and academic/behavioral needs. In addition to providing more personalized instruction, the RC's classes are much smaller than in many public schools and generally range from 10-15 students.

By coincidence, the researcher was observing on the day that the RC's Board of Managers was meeting to discuss current needs and future plans. Attending the meeting were the president of the teachers' college associated with this and other RCs throughout Jamaica, along with several other board members, including one woman from overseas whose family had been involved with the college and served on its board of managers for several generations. The purpose of the meeting was to discuss the work that this facility had been doing, both in terms of school-based services (i.e. intervention plans for schools and identification of students in need of special services) and in-house programs (i.e. literacy and numeracy instruction and positive behavior plans). While overall recent improvements in the attention and resources devoted to special education by the Ministry of Education were noted, some key obstacles were also identified. Various meeting participants summarized these, including the need for teacher training in reading diagnostics and additional research and intervention for students with autism. Because the RC had a waiting list, board members deliberated need for more space and discussed

several options, including sharing facilities with a school for the deaf that was currently being under-utilized.

Of all the schools visited as part of this study, the RC was by far the most technologically equipped; however, it must be noted that according to several members of the staff, the availability of computers and other learning tools fell short of what was appropriate to meet the needs of their students. Since technology is often considered to be a key component of UDL strategies (e.g. digital texts, assistive technology, computer-based activities for representing content and demonstrating learning), the researcher assessed the technological resources available at each school. Teacher responses to embedded questions on the UDL modules, responses to the follow-up survey (Appendix H, Appendix I), and the group meeting in October, 2014, indicated that the scarcity of technological resources was perhaps the greatest obstacle teachers faced in Jamaica, both in terms of accessing online professional development opportunities and implementing UDL in their own schools and classrooms. While low-tech UDL options are available, most of the literature and resources offered through CAST (www.cast.org) focus on technology integration, and the researcher was attentive to the challenge that educators face when trying to implement UDL in settings without these means.

Schools visited by the researcher shared several key features, especially those identified as primary or multi-age schools. Three of the schools (Bay School, Hillside School, and Meadow School) fell into this category, serving students in grades 1-6 or 1-7. These schools were all single-story, painted cement buildings with tin roofs. Bay School and Hillside School were both constructed in a U-shape, with classes opening into a central courtyard. Classrooms typically had one or two windows covered with a metal grate or shutters but no glass. Similarly, doorways had metal grates or solid pieces that could be closed and locked. All of the schools were surrounded

by tall, metal fencing, usually topped with barbed wire, and had a gate at the entrance that was kept locked during the school day. Classrooms were equipped with individual or two-student desks, with metal chairs that were usually attached, and these were arranged in rows or "tables" of 4-5 students. At the front of each classroom were chalkboards and/or whiteboards, and a larger desk for the teacher. Sometimes this board served as the sole divider between classes, and in other cases classes were divided by partial walls that left a gap of approximate 3 feet between the wall and roof. As a result, many classes were quite noisy because of activity in neighboring classes or outside.

Teachers College and Town School (grades 7-9) were both larger, campus-style facilities that served larger numbers of students. Like the other, smaller schools, both were surrounded by tall, metal fencing, and both schools had security gates at the entrance. Classrooms at these institutions had full walls (rather than partitions between classes), and both had windows and doorways that were open to the outside. Classrooms were equipped with the same types of desks and metal chairs, whiteboards, and teacher desks. Unlike the smaller, primary and all-age schools, both Teachers College and Town School had cafeterias where students and faculty could purchase lunch and eat together. Buildings at these schools were also made of cement, and because classrooms had no air conditioning, windows (shuttered but without glass panes) and doors were kept open.

Summary of the Global Classroom Study

The *Global UDL Virtual Classroom* was designed in 2014 through online collaborations between Jamaican and US faculty and doctoral students. The project began through conversations about UDL at the 2013 annual conference of the Division of International Special Education and Services (DISES). Two university professors from the United States and a

professor from Jamaica, all teacher-educators, developed a plan to create an online learning platform that would provide Jamaican educators with training and resources related to UDL. Doctoral students, taking a course entitled Personnel Development in Special Education, spent the semester working with faculty to collect data and develop online learning modules.

According to program designers (Reed, Smith, King, Wojcik, & Temple, 2014, May), the goals of this program were:

- Build a meaningful and sustainable online learning community in Jamaica to explore UDL and its applications in Jamaican educational settings.
- Engage doctoral students and international educators in building a virtual global classroom through collaboration and multi-tiered needs assessment
- Pilot applications of innovative pedagogical methods in Jamaican educational contexts.
- Evaluate the efficacy of online resources in varied settings.
- Use open platforms to make learning visible & constructive.
- Create opportunities for learning that include online dialog, interactive demonstrations, resource curation, and evaluation that are engaging and culturally and contextually relevant.

To launch this initiative, faculty and doctoral students in the U.S. assessed the state of technology in Jamaica and generated key questions to determine current educational practices and needs. Jamaican faculty identified potential participants using purposeful sampling measures in order to select educators who would be willing to participate in the program and build support for using UDL and AE in their own classrooms and schools. Jamaican leaders included policy makers from the Ministry of Education, university deans and chairs, clinical staff at regional education specialty centers, and community school and agency representatives. In late February,

2014, U.S. faculty met with leaders in Jamaica to discuss UDL and AE frameworks in relationship to their programs, gathered information about specific interests and challenges, and introduced the prototypes for the virtual classroom.

Interest in the project exceeded expectations (Reed et al., 2014, May; Smith, Reed, & Arnold, 2015, March), and the originally planned cohort of 8 grew to include 34 participants from 3 sample groups. Each group had designated project facilitators on-site whose roles included meeting face-to-face with Jamaican participants and communicating directly with U.S. collaborators to ensure that content adequately reflected the needs and interests of participants. To start, Jamaican educators submitted questions about UDL to U.S. graduate students, and with data from these initial queries and ongoing needs assessment prompts, faculty and students explored solutions, developed online UDL modules, and curated and shared resources relevant to Jamaican interests.

Online modules were designed using Wordpress, a blog platform provided through VCU's online learning office (http://rampages.us), to give educators the opportunity to explore UDL principles and practices, identify classroom connections, and apply what they learned in their own schools and classrooms (Smith, Reed, & Arnold, 2015, March). The classroom site explained the choice of this format: "We've chosen a blog platform to develop this virtual classroom. We're using a Wordpress platform provided through the VCU Online Learning office as our tool since this is both freely available and offers many features to promote and incorporate open source resources" (http://rampages.us/jamaicaudl/getting-started/why-are-we-using-a-blog/). Design considerations for the virtual classroom also included cultural appropriateness, accessibility, and technology access of users (Reed et al., 2014, May). It was important that the sight itself modeled the principles of UDL: "As a framework, it is very strong, and has some

fairly easy to follow guidelines. The challenge (and really, fun part) was taking those guidelines, taking the input of our collaborators in Jamaica regarding what they wanted/needed, and making it all work together" (Reed, Arnold, Best, DeArment, & Onorato, 2014, July). Doctoral students in the U.S., as part of a course on personnel development, took lead roles in co-designing the online space and curating resources in response to requests of Jamaican educators. Students also collected survey data and feedback from participants and group facilitators about effective aspects of the initial stage and ideas for future improvement (Smith, Reed, Arnold, & Evering, 2014).

Between May 7 and September 30, 2014, five modules were provided to Jamaican participants to explore UDL theory and its applications to classroom practice. These modules included online prompts (Appendix J) to survey participant interests and document their comments. The virtual classroom provided links to UDL resources such as CAST Bookbuilder (http://www.cast.org/learningtools/book_builder/index.html), a free tool that allows users to create, share, and publish digital texts. Links to additional articles, videos, and books were also included to encourage participants to dig deeper into the content. Each module of the Virtual Classroom centered on a particular aspect of UDL. An overview of each module is provided in Table 2.

Table 2.
Overview of the UDL Virtual Classroom Modules (http://rampages.us/jamaicaudl/)

UDL Module 1: Getting Started	• Joining the online community. • Exploring UDL ideas and resources.
UDL Module 2: Focus on Engagement	• Develop an understanding of options for gaining students' interest, developing learners' self-regulation skills, and helping students sustain effort. • Learn new strategies for engaging students throughout the entire lesson. • Discuss how engagement is the "why" of learning.
UDL Module 3: Focus on Representation	• Explore multiple means of representation. • Compare traditional text and UDL text. • Discuss the potential benefits of the UDL representation concepts.
UDL Module 4: Focus on Action and Expression	• Explore multiple means for action and expression. • Expand understanding by exploring strategic tools that could be used for a task. • Brainstorm ways to provide multiple means of action and expression for students.
UDL Module 5: Putting It All Together	• Review 3 principles of UDL. • Practice using CAST Bookbuilder. • Reflect on the application of UDL in CAST Bookbuilder. • Provide feedback about this UDL classroom & additional UDL education.

Participants in three Jamaican cohorts met bi-weekly to discuss the learning modules and classroom applications. Group facilitators communicated by Skype with U.S. faculty in order to familiarize themselves with content and prepare for each group meeting. Because facilitators had the opportunity to preview modules, explore resources, and clarify concepts ahead of time, they were able to guide participants through the learning process.

Content analysis of responses to module prompts revealed strong support for UDL principles, their application to classroom teaching, and access to broad array of free and open tools (Reed et al., 2014, June). Among the accomplishments of the program was an investment in upgrading the technology lab at one regional center, which improved the resources available to conduct synchronous online discussions and share resources with educators (Reed et al., 2014, June). Challenges, identified by facilitators, included technology access, website interface, scheduling, time commitment, and applying resources; however, participants did note the importance of UDL in their current settings for supporting struggling learners, teaching diverse learners, integrating technology, and training teachers (Reed et al., 2014, June).

Case Study Participants

The present case study focused on the participants from Group *A*, one of the three cohorts of Jamaican educators in the Virtual Classroom project. This group of 10 educators included two facilitators, who purposefully selected participants based on recommendations from principals and teachers' expressed interest in the pilot program and willingness to commit the time necessary. The researcher was able to reach only six of the participants because one was no longer on the island, and contact information was not available. The other participant not included in this study had dropped out of the program after the first session, and the researcher was not able to make contact. Since three participants had changed schools in the year since the project's conclusion, the researcher's initial email contacts were incorrect; however, the lead facilitator, who maintained contact with most of the participants through her work across schools in the area, was able to procure current email addresses. Upon visiting the regional resource center to meet with facilitators and one teacher, the researcher had the opportunity to interview a participant of another cohort who was visiting the center for a meeting. This participant, while

working as a teacher at the time of the program, was employed by the Ministry of Education at the time of the interview, and her responses were included because they offered additional insight into the impact of the program across Jamaican contexts.

All participants in this case study were female; the one male member of the cohort was not available, having dropped out of the program after the initial group meeting. Their experiences in education ranged from 0-5 years to 21+ years, and there was considerable variety among participants in terms of educational roles. Most participants had little or no prior knowledge of UDL. Each participant was given a pseudonym to protect anonymity. In order to reflect the formality with which teachers address each other in Jamaica, the researcher chose pseudonyms that were last names rather than first names. A summary of participant demographics is provided in the table below.

Table 3.
Demographic Characteristics of Retained Participants (n=9)

Participant	Years in field of education	Highest Degree Held	Educational Role(s)	Prior Knowledge of UDL?
Ms. Evans (facilitator)	21+	Master's Degree	Clinical Psychologist	Limited
Ms. Elmore (facilitator)	0-5	Master's Degree	Clinical Psychologist	Limited
Ms. Buxton (participant)	0-5	Bachelor's Degree	Classroom Teacher	No
Ms. Williams (participant)	6-10	Bachelor's Degree	Classroom Teacher	No
Ms. Berry (participant)	11-15	Master's Degree	Principal	No
Ms. Green (participant)	6-10	Master's Degree	Teacher-Educator/Lecturer	Moderate
Ms. Turnage (participant)	0-5	Associate's Degree	Classroom Teacher	No
Ms. Adams (participant)	11-15	Bachelor's Degree	Teaching Principal	No
Ms. Carter (participant)	10	Master's Degree	Former Principal/Ministry of Education	No

The group facilitators were both employed at the regional child assessment and research center (RC) where the group met during the Virtual Classroom project. Ms. Evans, the lead facilitator, was a veteran educator with experience in a number of school settings, including the Ministry of Education. Ms. Elmore, a recent graduate in clinical psychology, worked alongside Ms. Evans, both at the RC and as a facilitator for the learning cohort. Both had offices at the RC, where they administered individual assessments for students once per week and conducted administrative business. On other workdays they usually traveled together to schools throughout the region to provide educational testing and services.

Two participants in this case study were trained as special educators, while the others worked as general education teachers or administrators in primary, multi-age, or secondary schools. Ms. Buxton, one of the special educators, taught a class of ten elementary-school-aged students at the RC. Ms. Green, the other teacher who was working as a special educator at the time of the program, was later employed as a lecturer at a nearby teachers' college. She had been in one of the few area schools that had "units" designated for special education; these classes were part of a larger primary school, but had smaller class sizes and one assistant who moved from class to class. Ms. Green's new position at the teacher's college involved instruction and practicum supervision for pre-service teachers.

Another participant, Ms. Williams, was not trained as a special educator, but because her school did not have anyone on staff with that educational background, she was teaching a "pull-out class," made up of second graders who were struggling with literacy skills in the regular second grade classroom. She had been at the school for eight years, and she had previously worked as a second and third grade teacher. Regular classes at her school had between 30-45 students, but her class of ten was smaller to allow for more individualized attention.

One teacher-participant, Ms. Turnage, worked in a secondary school setting as an English teacher in a seventh-grade class. Her school of approximately 500 students had been built about five years previously, and it was located in more urban setting than the others (with the exception of the RC). Ms. Turnage's class was equipped with a computer, and students at the school were part of a *Tablets in Schools* pilot program. Despite the availability of these technology resources, inconsistent internet access often interfered with their use in the classroom. This was a source of frustration for Ms. Turnage, who said that despite her efforts to incorporate technology into her lessons, she was frequently forced to find alternatives.

Two participants, Ms. Berry and Ms. Adams, both served as school principals at small, rural primary schools. Ms. Adams was a *teaching principal*, meaning that she was a classroom instructor (fifth grade) in addition to her administrative role. Both principals had experience as teachers and had recently been promoted. Their primary schools were each located in rural settings, without technology in classrooms or internet accessibility, and each served students in multi-age classes.

Ms. Carter, the participant who had been a part of another Virtual Classroom cohort, served as a school principal before her job with the Ministry of Education. Her new role, which she had had for two years, was with the Special Education Administrative Unit. This department, within the Ministry of Education, was responsible for overseeing special education programs across Jamaica, identifying students in need of services through the *Child Find* program, and sharing information and providing training for teachers, parents, and other stakeholders. In her work with the Ministry, Ms. Carter had the opportunity to work with educators throughout the country.

Research Sample and Data Sources

Of the three participating Jamaican cohorts in the Virtual Classroom project, *Group A* had the highest participation rate, and therefore this study identified these participants as the sample case "from which the most can be learned" (Merriam, 2009, p. 76). Non-probability sampling methods, also called purposive (Chein, 1981) or purposeful (Patton, 2002), are most appropriate for qualitative research, which seeks to identify not "how much" or "how often" but to gain insight into what occurs (Merriam, 2009).

Despite high participation rates, compared to the other two cohorts, participants in *Group A* identified numerous challenges, both in terms of the Virtual Classroom program itself and of UDL implementation in their own lessons. The researcher, accompanying program designers, met with participants in 2014 (Group Meeting 1) and noted the group's enthusiasm for the project, especially that of Ms. Evans, the group facilitator. Nevertheless, participants were candid, both in this meeting and in earlier blogs and Survey 1, about the obstacles they faced both during and after they had completed the learning modules. Initial teacher engagement was not a factor because participation in the Virtual Classroom had been voluntary, and participants were invited based on recommendations of those who recognized their leadership skills and desire to learn. Therefore, this case provided an opportunity to examine the other factors that may have impacted teacher learning and UDL implementation. By looking closely at a case where initial buy-in was already in place, the researcher could focus on components of professional development related to maintaining engagement and other aspects adult learning. Because participants came from a wide variety of school settings, this case also offered opportunities to understand barriers to implementation of theories and strategies beyond professional development. Among teacher concerns about the relevance of UDL in Jamaica

(expressed in blogs, Survey 1, and Group Meeting 1) were the issues of physical space, classroom design, and large class sizes. One teacher's question, expressed during the first group meeting, summed up this hurdle: "How do we make UDL work in chaos?"

For the purposes of this case study, participants were informed of the possible benefits and risks associated with participation in this phase of the study, as well as how confidentiality would be assured, through a recruitment email that included an attached information and consent form (Appendix A). Because the proposed study was characterized as exempt by the university's institutional review board, participants were not required to provide written consent. Participants were also given the researcher's contact information, should they have questions or concerns. Participants had the option to print this information to retain for their personal records. A reminder email (Appendix B) was sent two weeks later as a follow-up to participants who did not respond to the initial recruitment email.

In the recruitment email, participants were asked about their willingness to meet with the researcher in October, 2014, for an interview to talk about their experiences in the *UDL Virtual Classroom* project and to be observed in order to identify specific examples that illustrated their application of UDL in planning and lessons.

Instrumentation

Several sources of previously-collected data were incorporated into the findings of this study. Participants' responses (blogs) to embedded questions on Virtual Classroom modules were a key component the project's ongoing needs assessments; participants reflected on their own practices, needs, and learning. A list of these prompts is provided in Appendix C. In their blogs, participants discussed the three principles of UDL and how they had applied them in their classrooms. Interview questions were created, in part, to expand on these reflections in order to

assess whether teachers had continued to implement what they had learned in the year after completing the modules.

Also, as part of the initial *UDL Virtual Classroom* project, a questionnaire (Survey 1) was sent to participants and facilitators, with questions pertaining to the design of the classroom itself, specifically accessibility, ease of use, and available resources. A copy of Survey 1 for participants is provided in Appendix D, and a similar questionnaire, sent to facilitators, also by email with a link to a survey on surveymonkey.com, is provided in Appendix E. Results from Survey 1 were used to inform interview questions, which were designed to provide a more comprehensive, in-depth look at individuals' experiences and insights. Results of Survey 1 indicated challenges related to platform access (i.e. difficulties logging onto various websites), but over 75% of respondents also said that the Virtual Classroom was engaging and offered opportunities for feedback and reflection. Therefore, in interviews, the researcher asked participants to clarify the components of the Virtual Classroom that either hindered or promoted learning. Data from both the blogs and Survey 1 were used to substantiate findings.

Participants were given an initial paper questionnaire (Survey 2) consisting of items to collect demographic data related to years of work experience in the field of education, degrees held, grades and student populations served, current educational roles. Additional survey questions assessed school demographics, technology resources, class sizes, and information about recruitment to the pilot study, and prior knowledge of UDL (Appendix F). Participants also had the option to complete an electronic version of the survey, but none chose to do so.

The researcher used a semi-structured interview protocol to guide initial interview questions with each participant (Appendix G). The researcher used an interview script (Appendix H) to provide consistency across interviews and to request each participant's permission to

audio-record. Interview questions were organized according to the components of HPL in order to capture learning components of the Virtual Classroom that might be analyzed in comparison to previous studies of professional development. *Learner-centered* questions were designed to capture details about participants' own characteristics (i.e. strengths and interests) that may have impacted engagement. *Knowledge-centered* questions sought to learn more about the relevance of program content, particularly whether participants felt that UDL theories and practices complemented and built upon what they were already doing in their classrooms. *Assessment-centered* questions focused on feedback, particularly whether feedback had continued after the program. This had been a key issue raised during Group Meeting 1: teachers said they were eager to find ways to continue the collaborative aspects of the Virtual Classroom that had allowed them to share ideas and problem-solve with colleagues. Finally, *community-centered* questions were designed to learn more about the ways that participants were able to implement UDL in their individual teaching contexts. Blogs, Survey 1, and Group Meeting 1 had each revealed numerous obstacles, particularly in terms of classroom and technology resources, so these questions gave participants an opportunity to expand on previous comments and describe contextual factors in depth.

Since classroom observations preceded and also informed individual interviews with participants, additional questions related to specific classroom lessons or procedures were added to those on the initial interview protocol. Of particular interest were the ways that current practices had been influenced by participation in the UDL Virtual Classroom program, along with perceived impacts of UDL incorporation on student engagement and performance, obstacles and challenges, and resources available or needed to facilitate UDL implementation. In individual interviews, the researcher asked participants about specific strategies, activities, and

learning tools observed in the classroom.

The researcher used an observation template during classroom visits and made analytic memos during observations and interviews. This template was organized according to the components of UDL in order to document specific strategies that represented multiple means of representation, action/expression, and engagement. Additionally, the researcher recorded student behaviors, teacher/student interactions, and details of classroom settings and resources.

Approximately six months after meeting individually with participants, the researcher met with a focus group of participants in March, 2016, to follow up on topics previously discussed. The researcher contacted the group's lead facilitator, who arranged a meeting between the researcher and participants at the RC. At this time, only four participants and the two facilitators were available to meet. This meeting was informal, and the researcher revisited the key topics covered in interviews, blog, and previous surveys in order to clarify earlier participant comments and corroborate earlier findings. The researcher asked participants for additional information about Jamaica's national curriculum, special education program, and national exams. Participants offered details about topics they covered over the course of the school year, timelines for testing, and student placement and progression based on national test results. The researcher also discussed with participants their earlier comments about feedback in the Virtual Classroom project, specifically what aspects were helpful to them and what they would like to see as next steps for ongoing collaboration.

Procedures

Initial questionnaires. Survey 1 was sent to the school email address of participants (Appendix D) and facilitators (Appendix E) of all three cohorts by email, with a link to a survey on Surveymonkey.com, to gather information about the usability of the Virtual Classroom

format. This survey was sent approximately one month (September, 2014) after groups had completed the Virtual Classroom modules (timelines varied slightly among the three cohorts). Participants had to complete the survey in one sitting. If they had not completed the survey within two weeks of receiving the initial email link, a reminder email containing the survey link was sent. A paper copy of Survey 2 (Appendix F) was administered in person at the time of individual interviews (October, 2015). Participants had the option of providing verbal responses, recorded by the researcher, or completing the survey in digital format.

Classroom observations. The researcher arranged to visit teachers' classrooms over a period of 1-2 weeks after obtaining the required permissions to gain access to each site. Each classroom observation lasted approximately 45 minutes to 1 hour. The researcher recorded descriptive field notes (Creswell, 2008) communicating the details of the classroom setting, students in the class, and activities taking place. The researcher also asked participants to share copies of representative lesson plans and student-generated work. Only one participant provided a written lesson plan. In order to assess the use of UDL in the classroom, the observer used a template that incorporated components from the Guidelines 2.0 Educator Checklist (CAST, 2011) as a guide (Appendix I). Rather than generating a quantitative evaluation of UDL implementation, the researcher's objective here was to generate descriptive field notes (Creswell, 2008) that identified UDL strategies in place and to write reflective field notes (Creswell, 2008) regarding perceived obstacles or gaps in implementation.

Interviews. Participants were individually interviewed in depth to gain greater insight into their experiences in the UDL Global Classroom and the impact of this professional learning on their beliefs and teaching practices. Interviews took place in person, but participants also had the option of answering questions through email correspondence or by phone if an in-person

interview was not possible. Interviews lasted approximately 30 minutes to one hour. With participants' permission (see Appendix H for Interview Script), the researcher audio-recorded in-person interviews for subsequent transcription and analysis. In two cases, the researcher did not audio-record interviews, but instead took detailed notes in order to capture participants' responses. In each of these instances, the researcher and teacher met in the classroom where students were eating lunch, and the researcher determined that the use of the audio-recorder would be disruptive.

Individual transcripts were shared with each participant for member-checking (Doyle, 2007; Merriam, 2009) to enhance the credibility of the data. In this way, participants had the opportunity to review all transcribed data and clarify, change, or omit their comments as deemed necessary. Doyle (2007) called the process "participative member checking" (p. 908) and asserted that researchers should view qualitative research as a "negotiated process" (p. 899) of constructing meaning with participants in a way that affords them power, voice, and engagement throughout. Furthermore, in keeping with Doyle's (2007) suggestions for member checking, participants in this study had options for how transcripts were shared: hard copies, electronic copies, or audio copies. Participants had approval power for narrative selections the researcher chooses for publication. Credibility and dependability (Creswell, 2008; Merriam, 2009) were established through "member checking" and "rich, thick description" provided by writing out detailed descriptions of the participants and setting under study.

Group meetings. Group Meeting 1 took place at the RC in October, 2014, approximately four months after participants had completed the final module of the Virtual Classroom. The researcher traveled to Jamaica with Virtual Classroom designers to meet with participants in order to learn more about their experiences and to discuss possible next steps for

the program. For Group Meeting 2, the researcher made arrangements through email with the group's lead facilitator to conduct a follow-up meeting with participants in March, 2016, approximately six months after observations and interviews were conducted. The researcher was able to meet with the two facilitators and four of the participants. The purpose of this meeting was to discuss findings from previous data sources, as well as the researcher's analysis of findings, in order to verify and expand upon the results.

Data Analysis

According to Patton (2002), the goal of qualitative data analysis is to uncover emerging themes, patterns, concepts, insights, and understandings. The researcher transcribed recorded interviews verbatim and wrote extensive notes, including participant comments copied verbatim in the cases where audio-recorded interviews were not available. The researcher read through individual transcripts in order to compose analytic memos of first impressions and direct interpretation of individual interviews (Bogdan & Biklen, 2007; Merriam, 2009; Stake, 1995). In this way the researcher was able to use observations and impressions of individual participants in conjunction with aggregation of instances to draw meaning from the qualitative data as a whole (Stake, 1995).

The researcher employed Atlas.ti qualitative coding software for data management and to facilitate analysis of participant interviews throughout coding. In order to understand the case as a whole, the researcher looked for "corroborating incidents and disconfirming ones as well" (Stake, 1995), defining variables and patterns as they emerged in analysis and were meaningful to the research questions of the study. Coding occurred in two principle stages. The first stage of coding examined individual participant cases, and the second stage examined the group as a whole.

The first stage of coding consisted of three specific coding methods to analyze participant interviews and individual classroom observations: attribute coding, open coding, and analytical coding. At the initial phase of the coding process for each interview data set, the researcher used attribute coding in order to identify participant characteristics and organizing information (Saldaña, 2013). This phase, the *within-case analysis* (Merriam, 2009), allowed the researcher to learn about the experiences and characteristics of each individual participant. Codes recorded teaching level/grade, teacher roles, experience level, and other relevant details about participants' teaching contexts. Next, the researcher applied open coding techniques, which is an expansive process that allowed the researcher to identify potentially useful or meaningful segments of data (Merriam, 2009). The researcher assigned codes to pieces of data in interview transcripts in order to begin constructing categories. This process was repeated for classroom observations and field notes. Grouping open codes into categories relevant to research questions constituted the third method, called axial coding (Corbin & Strauss, 2007) or analytical coding (Merriam, 2009). During this phase of coding, the researcher distinguished "categories or themes that capture some recurring pattern" (Merriam, 2009, p. 181) in individual participant cases.

In the second stage of coding, the *cross-case analysis* (Merriam (2009), the researcher used analytical coding methods to identify patterns across participants and assign names to categories that were, according to Merriam (2009), *exhaustive* (account for all relevant data) and *mutually exclusive* (one unit of data fits into only one category). Continued analysis of these categories allowed the researcher to examine the way they were linked together and develop a theory that seeks to explain the trends of the group as a whole (Merriam, 2009). Thematic categories were displayed in a table in order to give an organized synthesis of data.

Summary of key themes. Several key themes emerged through analysis of interviews with participants and classroom observations. To address the first research question (How did the Virtual Classroom address the needs of participants as adult learners?), qualitative data was analyzed according to the various aspects of learning, and several sub-themes emerged under each of the components of HPL (NRC, 2000). Since interview questions were organized according to these components, participant responses fell naturally into these broad categories. It is important to note, however, that there was considerable overlap among these. Overall, teachers reported that the hybrid model (online and face-to-face) of the Virtual classroom was an effective design because it combined flexibility and access to web-based resources with context-specific collaboration and feedback. While most of the teachers in the program were unfamiliar with UDL at the start of the program, they found many of the principles and strategies to be complementary to what they were already doing in the classroom. There was a shared perception that the course was beneficial, both because it provided exposure to and practice with new teaching methods and resources, and because the research-based theories of UDL gave teachers the validation and language to communicate with stakeholders about learner variability and accessibility. In addition to the sub-themes that fell within the scope of HPL and addressed the program itself and its impact on teacher-learners, other findings were grouped under the codes "Implementation Challenges" and "Program Impacts." These two themes were originally grouped under the "Community Centered" heading in the interview protocol, but because they address research the second and third research questions (What obstacles to implementation of UDL existed for teachers following their participation in the Virtual Classroom project? How have

teachers applied UDL principles in their planning and teaching?), both of which shift the focus of study to the participant as teacher rather than learner, they were coded separately. Furthermore, participants discussed these themes in the greatest detail. A summary of key themes and corresponding research questions appears in the table below, and a more detailed codebook containing inclusion and exclusion criteria appears in Appendix L.

Table 4.
Summary of Key Themes Organized by Research Question.

Research Question(s)	Summary of Key Themes
1. How did the Virtual Classroom address the needs of participants as adult learners?	Learner-Centered • Getting (and keeping) teachers involved • Providing teachers with tangible benefits of participation • Challenges of technology and resources Knowledge-Centered • Providing research-based evidence for best practices • Exposure to and practice with resources Assessment-Centered • Feedback from facilitators and other participants • Need for ongoing support Community-Centered • Shared resources and expertise • Relevance in Jamaican context
2. What obstacles to implementation of UDL existed for teachers following their participation in the Virtual Classroom project?	Implementation Challenges • Technology • Classroom Resources • Physical Space
3. How have teachers applied UDL principles in their planning and teaching?	Program Impacts • Student Engagement • Student Performance • Educator Mindsets • Teaching Methods

Quality and Rigor

Ratcliffe (1983) asserted that reality is indeed subjective since data are always interpreted by the researcher, and therefore validity in a qualitative study must be measured in terms of credibility rather than reality. Maxwell (2005) asserted that validity is likewise relative, and according to Merriam (2009), "What is being investigated are people's construction of reality-how they understand the world" (p.214). There are, however, strategies that can be employed by the researcher to increase the internal validity of the findings. Triangulation (Denzin, 1978; Yin, 2009) will be employed by using multiple sources of data (blogs, surveys, classroom observations, interviews, documents, and focus group meeting) and by using "triangulating analysts" (Patton, 2002), having an additional researcher independently analyze data. Yin (2009) also noted that validity and reliability of case study evidence might be enhanced when the researcher creates a case study database and maintains a chain of evidence. The case study database was created and maintained in the form of a digital portfolio that included observation notes, documents such as lesson plans and student-generated work that were converted to portable document format (PDF) for electronic storage, interview transcripts and notes, survey data, and any follow-up email correspondence with participants. The purpose of the chain of evidence (see Figure 2) is to allow an external observer to "follow the derivation of any evidence from initial research questions to ultimate case study conclusions" (Yin, 2009, p.122).

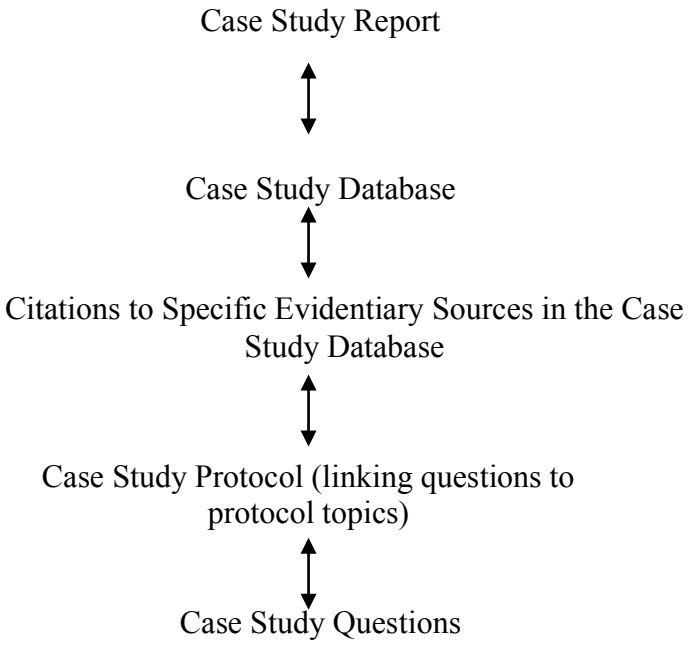

Figure 2. Maintaining a Chain of Evidence (Yin, 2009, p.123).

The researcher developed a codebook of researcher-generated codes (Appendix J), which included descriptions and examples and was used for member-checking and reliability checking through inter-coder agreement. To support the coding scheme and dependability of data analysis, the researcher employed a second coder as a reliability check. This individual was a recent graduate of a. M.Ed. program in Curriculum Design who had experience with qualitative data analysis and was familiar with both the UDL and HPL frameworks. She had 10+ years of experience in both special education and general education at the middle and high school levels. While knowledge of UDL and classroom practices was important for a peer reviewer to accurately identify implementation, the selection of peer-reviewers was limited to persons not affiliated with the UDL Virtual Classroom Project in order to limit bias.

The researcher identified approximately 20% of the full data set for dual coding. The selected portion represented one page of data per participant interview, with responses

representing all standard questions across the interview protocol, and one page of data per observation. Prior to independent coding, the researcher provided the second coder with a copy of the UDL guidelines (CAST, 2011) and a chapter from Darling-Hammond and Bransford (2005) that outlined the components of HPL theory and provided examples of how these components were operationalized. The researcher also provided the second coder with a qualitative study (Jurasaite-Harbison & Rex, 2010) that employed similar coding techniques based on interviews and school-based observations. The researcher and second coder thoroughly reviewed and discussed each entry in the codebook, the set of standard interview questions, and the template used for classroom observations. The researcher and second coder collaboratively coded one page of data, not included in the selected 20% or codebook examples, and discussed the application of codes. After independent coding of the data selection, the researcher and second coder met to discuss coding and address questions and insights. At this time, the researcher and second coder determined the percentage of coding agreement, calculated as the percentage of agreements divided by agreements plus non-agreements. Furthermore, participants had the opportunity to review data analysis in order to provide feedback about the credibility of data analysis and researcher interpretation (Crosby, 2004; Merriam, 2009).

Dependability of coding scheme. Initial coding agreement was calculated to be 75% (40 agreements out of 53 possible). The researcher and second coder reviewed each instance of coding disagreement and discussed each instance in terms of the codebook. Consensus was reached in all cases, and the researcher made clarifications in the codebook in circumstances where criteria for inclusion and/or exclusion were ambiguous.

The instances of coding disagreement were most often the result of a lack of clarity in two areas: the term *learner* (participant as learner in Virtual Classroom and students as learners

when participants acted as instructors), and the distinction between components of the learning process in the Global Classroom itself and the learning process that occurred in classrooms during implementation. For example, in one instance the second coder had identified a quotation as *Assessment-Centered/Feedback*, while the researcher had identified the same quotation and applied the code *Program Impacts/Teaching Methods*. The coding disagreement was due primarily to a misunderstanding about the context of the quotation. In this case, the teacher providing feedback was the participant, and the situation she was describing occurred after she had completed the Virtual Classroom; she was leading a professional development workshop for other educators and was sharing what she had learned about UDL. Once the broader context was explained, researcher and second coder were in agreement about code application.

Because learning is a multifaceted process, and distinctions between teacher and learner can be cyclical or overlapping rather than distinct or linear. When coding disparities or difficulties occurred due to the indistinctness of these terms, the subsequent discussions between researcher and second coder proved valuable, not only to increase confirmability of codes and dependability of data analysis, but also to challenge the researcher to look at the research findings in novel ways. For example, the one segment of text from the researcher's interview with Ms. Green describes a professional development workshop conducted at a nearby school. In this instance, Ms. Green, a Virtual Classroom participant, was teaching other educators about UDL, and the principal of the school later reported to her the impact of the workshop on student test scores. The second coder had identified this passage as Assessment-Centered/Feedback," while the researcher had coded this as "Program Impacts/Student Performance." While Ms. Green was indeed receiving feedback, it was relevant to the indirect impact that her learning had made on students. In this case, Ms. Green, a learner in the Virtual Classroom context, was acting

as an educator and applying UDL in her own teaching (She also talked about how she had incorporated UDL into the actual professional development presentation). The teachers in this case were first learners (in the professional development workshop) and then educators when they returned to the classroom. While this teacher/learner distinction becomes rather muddled here, it speaks to the complex processes involved with teacher learning. When examining any professional development program, it is important to recognize that educating teachers does not end with them; professional development is only effective if teacher-learners can then translate what they have learned to have positive benefits for their students.

The researcher also used member-checking to enrich the credibility of qualitative data analysis. The researcher provided teachers with their individual interview transcripts and a summary of the overall themes identified by the researcher during qualitative data analysis. Teachers were invited to review these items and contact the researcher with any clarification or feedback. No teachers responded with changes, questions, or clarifications; therefore, the researcher assumed that the transcripts and themes were reliable according to participants' perspectives. Teachers were again offered the opportunity in person (March, 2016) to make changes. All participants approved qualitative data analysis as written by the researcher.

Transferability of findings. While generalizability from a random participant sample is not possible in qualitative research (Merriam, 2009), the lessons learned from this case study may be applied in other contexts according to the concept of *transferability* (Lincoln & Guba, 1985). Cronbach (1975) identified these transferable theories as working hypotheses, which reflect situations of specific contexts but can inform decisions in others. In order to allow the reader to "transfer" findings of this study to other situations, the researcher provided *rich, thick description* (Geertz, 1973; Maxwell, 2005; Merriam, 2009) of the setting, participants, and

findings. This is presented in the form of quotes from interviews with participants, descriptive field notes, demographic specifics of participants, and details about the school and regional contexts. Since participants represented a range of experiences and educational roles, their diversity also enhanced transferability (Merriam, 2009). Table 5 presents characteristics of the proposed research that address strategies identified by Merriam (2009) to promote validity and reliability in qualitative research.

Table 5.
Study Design Features Promoting Validity and Reliability (Merriam, 2009)

Strategy	Study Design Characteristics
Triangulation	• Data sources include participant questionnaires, classroom observations, interviews, and documents such as lesson plans. • Data collected during the initial phase of the project included. • Peer review of observation notes, interview transcripts, and collected documents.
Member Checks	• Opportunity for participants to review transcribed data and clarify, change, or omit their comments as deemed necessary. • Participants have approval power for narrative selections chosen for publication. • Opportunity for participants to review data analysis and provide feedback.
Adequate engagement in data collection	• Follow-up correspondence will allow for clarification and further discussion when needed.
Researcher's position or reflexivity	• Researcher will engage in critical self-reflection regarding assumptions and biases, particularly related to the researcher's participation in the initial professional development program and theoretical orientation related to UDL.

Peer review/examination	• Peer review of observation notes, interview transcripts, and collected documents to provide independent analysis. • Chair/committee review throughout development of inferences and conclusions
Audit trail	• Case study database (digital portfolio) • Chain of evidence: detailed account of methods and procedures linking research questions to the case study report.
Rich, thick descriptions	• Detailed descriptions of all aspects of study such that readers will be able to determine the contextual similarities in order to assess transferability.
Maximum variation	• Participants represent range school contexts, teaching specialties, grade levels, experience, and education.

Limitations

Despite extensive steps taken to ensure quality and rigor across study design, implementation, and interpretation of results, this research study has several limitations.

The primary data in this study were collected through classroom observations and interviews. Limited time was available because of the overseas location of the participant group, and the researcher did not have the opportunity to spend multiple days in each participant's classroom. Therefore, the researcher had only a snapshot of classroom practices, rather than a collection of data over long periods of time, which LeCompte, Preissle, and Tesch (1993) claimed would increase internal validity. In order to address this possible limitation, the researcher closely examined the classroom context over the course of a several hours, compiled extensive field notes, and sought clarification and insight from participants during subsequent interviews and a follow-up focus group meeting. When possible, the researcher also gathered classroom data in the form of photos, copies of lesson plans, and examples of student-produced work. Since interviews relied on participants' perceptions and self-reports, there may be

limitations due to perceived social desirability or demand characteristics (Fowler, 2009; Merriam, 2009; Mitchell & Jolley, 2010). To address these issues, the researcher informed participants of the research purpose to gain insight into the effectiveness of the UDL Virtual Classroom in order to identify obstacles to UDL implementation and make improvements in future teacher-learning projects. Furthermore, participants were informed that data collected in interviews and classroom observations would be kept confidentially and reported in aggregate form to encourage honest responses.

Since participation in this case study research was voluntary, there was a possibility that some participants from the initial pilot study would not agree to be interviewed. This, however, was not the case. The researcher was able to reach only six of the participants because one was no longer on the island, and contact information was not available. The other participant not included in this study had dropped out of the program after the first session, and the researcher was not able to make contact with him. Because not all participants were available for interviews and observations, findings may not represent the full range of experiences, and some meaningful data and interpretation may be lost. However, blog posts and responses to Survey 1 were available for the participant who was out of the country at the time of the researcher's visits, and these data sources were included in analysis.

The researcher was involved in the execution of the original Virtual Classroom study and assumed the value of UDL implementation; therefore, there is some risk of researcher bias as a limitation of this study. While the researcher played a role in the initial evaluation of the program, the present study seeks to look beyond initial participant engagement to learn more about the ways that school context influences implementation of learned practices. For the field of teacher education, both related to UDL or other frameworks, there is much to be learned from

both positive and negative outcomes. In order to address possible limitations related to bias, the researcher has clarified her assumptions, experiences, and perspective (Maxwell, 2005) to provide reflexivity- "the process of reflecting critically on the self as researcher, the 'human as instrument'" (Lincoln & Guba, 2000, p. 183). In addition, the researcher employed a second coder, one familiar with UDL but not associated with the *UDL Virtual Classroom* project, during qualitative data analysis to help control for researcher bias by supporting the reliability of coding.

The goal of the study was to gain understanding about the impact of this professional development project on teachers' attitudes and practices, which is part of the researcher's long-term goal of identifying components of teacher training that will improve accessibility and engagement for students in a variety of contexts. Because the researcher also worked as a classroom teacher, she was aware of the challenges that educators face when applying educational theory and learned practices in the context of the classroom, and this insight served to provide some balance to any bias she may have had as a researcher.

Summary of Methodology

This case study applied the HPL lens in order to identify the ways that *learner-centered* learning, *knowledge-centered* learning, *assessment-centered* learning, and *community-centered* learning were achieved in the UDL Virtual Classroom project. The study also identified obstacles to teacher learning and UDL implementation in order to address gaps in the literature and inform future UDL professional development opportunities. The qualitative case study methodology consisted of responses to questions embedded in Virtual Classroom modules (blog posts), responses to a usability survey (Survey 1), collection of demographic information through participant survey (Survey 2), classroom observations, semi-structured interviews, and a focus-

group meeting. Throughout development of the study design, the researcher implemented measures to ensure design quality and accuracy of resulting interpretations and conclusions.

CHAPTER 4

RESULTS

The purpose of this study was to apply the HPL lens in order to understand the ways that *learner-centered* learning, *knowledge-centered* learning, *assessment-centered* learning, and *community-centered* learning were incorporated into the UDL Virtual Classroom project and to investigate their impact on individual educator-participants, both as learners themselves and as teachers in their schools and classrooms. The problem addressed by this study was the contextual nature of teacher learning, identifying supports and barriers to the implementation of theories and practices beyond professional development. In order to meet the demands of diverse classrooms and changing expectations for teachers in 21st century classrooms, research is needed to identify practices for teacher learning that will have positive, lasting impacts. While proponents of UDL assert its potential to address learner variability and teach 21st century skills, most of the research on teacher training in UDL has taken place in postsecondary settings, and significant questions remain about the impact, especially over time, of UDL training on classroom practices. HPL theory offers a lens through which one may analyze the teacher as learner, and it is through this lens that we might begin to recognize the factors at play in professional development. By examining the impact of the Virtual Classroom on teacher-learners, this study identified strengths and weaknesses of this model of professional development, and subsequently, by identifying the challenges and impacts as teachers applied what they had learned in real-life

contexts, the study shed light on how UDL training may influence teacher mindsets and practices.

The following research questions guided data collection and analysis.

1. How did the Virtual Classroom address the needs of participants as adult learners?
2. What obstacles to implementation of UDL existed for teachers following their participation in the Virtual Classroom project?
3. How have teachers applied UDL principles in their planning and teaching?

This study used observations and individual interviews (October, 2015) with participants in the UDL Classroom to collect qualitative data about their experiences in the UDL Virtual Classroom project and its impact on their beliefs and practices. A brief survey (Survey 2), administered in person in conjunction with individual interviews, was used to collect basic demographic data about participants and their schools. Other qualitative data included survey responses (Survey 1) and blog posts, which were part of the original program, as well as participants' comments during a follow-up meeting with UDL classroom designers, faculty at a U.S. university, and the researcher in October, 2014 (Group Meeting 1). At a third meeting (Group Meeting 2), a focus group in March 2016, the researcher met with participants collectively to ask follow-up questions; information collected at this time also informed results and conclusions. The research findings reported in this chapter are based on the analysis of these data sources (see Table 6).

Table 6.
Qualitative Data Sources Organized By Research Question

Research Question	Data Source(s)
Research Question 1: How did the Virtual Classroom address the needs of participants as adult learners?	Blog Responses (Spring-Summer, 2014) Survey 1 (Summer-Fall, 2014) Group Meeting 1 (October, 2014) Individual Interviews (October, 2015) Group Meeting 2 (March, 2016)
Research Question 2: What obstacles to implementation of UDL existed for teachers following their participation in the Virtual Classroom project?	Blog Responses (Spring-Summer, 2014) Group Meeting 1 (October, 2014) Individual Interviews (October, 2015) Observations (October, 2015) Group Meeting 2 (March, 2016)
Research Question 3: How have teachers applied UDL principles in their planning and teaching?	Blog Responses (Spring-Summer, 2014) Group Meeting 1 (October, 2014) Individual Interviews (October, 2015) Observations (October, 2015) Group Meeting 2 (March, 2016)

Research Question 1: How Did the Virtual Classroom Address the Needs of Participants as Adult Learners?

Learner-Centered Components

Findings revealed three key themes related to the ways that the Virtual Classroom project addressed the "strengths, interests, and preconceptions" (Darling-Hammond & Bransford, 2005) of adult learners: (1) Getting and keeping teachers involved; (2) Providing teachers with tangible benefits of participation; and (3) Challenges of technology and resources.

Getting (and keeping) teachers involved. Since reviews of professional development studies have revealed the key role that participant buy-in plays in the success and impact of any given program, the researcher asked both facilitators and participants about the recruiting process in order to gain insights about the characteristics of group members that may have had a bearing on participation and follow-through. Interviews with facilitators and participants revealed that

participants for the Virtual Classroom project were chosen, in part, because they possessed qualities that the lead facilitator believed would make them successful in the program itself; she added that she chose people who were not only motivated to learn but who would also "be innovative leaders when they returned to their schools." Participation was voluntary, so it is important not to take the buy-in of participants for granted. Nevertheless, one member of the group dropped out after the first session (for reasons unknown), and another, Ms. Williams, reported that she did not complete the last module because she felt the program had not met her expectations. This participant reflected that she was hoping to learn more about educational practices in the United States, to see what techniques teachers were implementing, how classes we arranged, and what technology and resources were being utilized. She felt that the Virtual Classroom focused too much on theory, with insufficient attention paid to practical applications she could adopt in the classroom. Ms. Williams, while not trained as a special educator, was teaching a class of second-graders who had failed national assessments; she was working in a rural school without any technology resources, and she indicated that the demands of her job afforded her little time for theoretical learning and reflection.

The other five group members completed all five online modules, and Ms. Evans, the lead facilitator for the group, described the process of recruitment:

> I contacted principals at area schools and asked them to recommend teachers who were interested in learning and enthusiastic. I wanted people who would go back and share what they learned. We had a strong group, and several of those teachers have been promoted to higher positions.

Of the six teachers who took part in the online classroom, two had been promoted to administrative positions as school principals, and another, who was working as a special

education teacher at the time of the project, had recently become a lecturer at a nearby teachers college. The participant from the other cohort, whose interview was included in this study, held a position at the Ministry of Education, overseeing programs in Special Education across Jamaica. When asked if she thought program participation was a factor in the career advancement of these individuals, Ms. Evans said she thought it was more likely that their personalities and drives, their willingness to learn and try new things, were the significant contributing elements. Ms. Green, a participant, speaking about her own recruitment, confirmed this:

> And so she [Ms. Evans] knew; she knew what I was like as a teacher, and she liked that because I went all out, was vey intense, if you want to put it that way, but I am very motivated. I love learning myself, and I want to transfer that to the students I teach, even if they have disabilities, even though they have disabilities.

Ms. Green was an enthusiastic member of the UDL Classroom group, and she shared with the researcher stories about how she brought back what she had learned to teachers at her own school and in other schools when she was brought in as a guest lecturer to do professional development. “I want UDL to spread like wildfire!” she remarked, and it was clear that she had a high level of buy-in and motivation.

Another participant described how she became involved; she was not recruited to participate, but when she heard about the group, she asked to join.

> Actually, I followed somebody to the… I carried somebody to the [RC]. When I went there I realized it was this group, and so I stood there and listened a little bit, and then I asked [Ms. Evans] if I could be a part of it because I found it to be interesting. And she did accommodate me, and I

> enjoyed every bit of it. You know, because I learned…I learned that there were some things we would take for granted when we see children not getting it.

All of the teachers who stayed with the program were characterized by facilitators as dedicated and driven, and the enthusiasm and commitment with which they approached participation were evident in their own words and stories. However, also central to understanding the buy-in of participants is the role that the group's leaders played in getting and keeping teachers involved. Ms. Evans, who is the director of the RC, is a veteran educator of over twenty years who held a position in the Ministry of Education and according to some was "supposed to retire" some years ago "but just can't quit." Upon meeting Ms. Evans for the first time a year prior to this study, the researcher was impressed with her knowledge and leadership skill, evident in the respect others showed her in meetings and at a national teacher's conference. The researcher had numerous opportunities to observe this on her visit to the RC; when Ms. Evans led meetings and made phone calls, she conveyed authority and influence while also demonstrating humor and exuberance. It was her energy and obvious passion for education that really stood out, and field notes from the researcher's visit to the RC reflect this: "[Ms. Evan's] enthusiasm is infectious- She gets things done and people listen to her!" Almost all of the participants mentioned Ms. Evans as a motivating force, one who not only got them involved but also kept them involved. One teacher, when asked about how she joined the group, laughed and said, Well, you know [Ms. Evans]!" She then elaborated, "You know, I told my staff and all at that time she had this exciting edge, and the way she sold it, you just would not refuse, I'm telling you!"

Even the teacher, Ms. Williams, who did not complete the final module, remarked that the leadership provided by group facilitators was a motivating force. The researcher asked her whether she would have continued with the program as long as she did had it not been for the interactive, face-to-face component, and she replied that she would not have. There were several instances throughout the interviews with participants that collaboration and feedback were mentioned as program strengths, and while these findings are described more extensively under the headings *Assessment-Centered* and *Community-Centered*, they were double-coded by the researcher because their role in supporting participant engagement could also be identified as *Learner-Centered*.

Having Ms. Evens as a lead facilitator for the Virtual Classroom most likely provided credibility and relevance because her work with the RC took her to schools throughout the area, and she was able to articulate specific areas of need (e.g. low student test scores, problems with student engagement) to inspire teachers to see a need for change and be open to learning new practices. According to information provided by program designers and reiterated in facilitators' survey responses (see Appendix I), facilitators met via Skype with faculty from the university in the U.S. to talk about each module and familiarize themselves with the content before presenting it to group participants. This allowed them to act more effectively as program leaders and to identify lesson components that would be the most relevant to group members. Because they were familiar with both the teachers and their schools, they were able to provide a more individualized learning experience, which lies at the heart of *learner-centered* professional development. Certainly, the strong leadership of the group was a strength for participants in this cohort, but it does raise some issues in terms of program evaluation because it is difficult to

discern the impact of the program itself without taking into consideration the role that individual leaders played in participant engagement.

Furthermore, because the recruitment process was quite selective, the teacher population represented in this study was not illustrative of teacher-learners in general. In fact, research on professional development has indicated that teacher buy-in is often a primary challenge (Antoniou & Kyriakides, 2013; Clarke (1992; cited in Clarke & Hollingsworth, 2002; Ganley & Rabalate, 2013; Helsing et al., 2008). Here, the teacher-participants were recognized leaders and innovative instructors, and the facilitators were likewise characterized as dynamic and inspiring. While there was indeed an advantage to teacher engagement based on recruitment and leadership alone, this "ideal" participant group still experienced challenges, both in terms of the Virtual Classroom itself and in implementation of learned practices in the year-long period that followed. This can certainly be seen as a liability for this study; however, the benefit of this for the purpose of analysis is that it offers an opportunity to isolate factors in even in a "best case" scenario may need to be addressed in order to improve professional development in UDL.

Providing teachers with tangible benefits of participation. One criticism of the program by several group members, presented primarily as a suggestion for future professional development, was that the class did not provide any sort of official record of completion, course credit, or certification for participants. This, they believed, would add incentive for participation and would give teachers tangible proof of their expertise in UDL, allowing them to be credentialed teacher-educators who could share their knowledge with others through professional development workshops. While nine of the ten teachers in this cohort were willing to devote the time and resources necessary to participate without some form of external incentive, they did speculate that if the program were to expand and reach a wider audience of teachers, the

inclusion of a certificate or graduate credit would be a key motivator. They saw this as a way to validate participation and to encourage more educators to get involved. Teachers often had to purchase their own classroom materials, download online resources at home, and fund further education opportunities with little or no assistance. Because of these demands, seven of the nine participants interviewed indicated that there should be incentives for teachers to take on the added work of engaging in ongoing professional development. In addition to completing online modules, teachers in the Virtual Classroom committed to meeting with the group numerous times over the course of the project, and this required travel to the RC and the dedication of after-school hours. It seemed reasonable to the researcher that their efforts be formally acknowledged in a way that could be reported to their school principals and colleagues.

Ms. Berry asked if there were any plans to have a doctoral program for educators in Jamaica, saying that a "formal education setting" with "the Ministry of Education on board" would be something of interest to many teachers. The researcher responded that she was not aware of any plans to start a graduate program, and Ms. Berry followed that even without graduate course credit for teachers, it would be advantageous to document participation in an official way:

> Have it be rewarding, rewarding so that at the end of the day they get a certificate. Just to say, "Yes, I did this, and I have practice in this." So that when you're called upon, you can also share because, of course, it was a formal kind of setting that you learned these things in.

This was echoed in statements made by Ms. Adams:

> Going forward, I would say, give us some sort of certification or something to say that we actually did this and, you know, maybe it could go to some sort credit to some sort of studies in the future at university.

While the absence of formal documentation did not dissuade teachers from participating in the Virtual Classroom project, the inclusion of this tangible benefit was among the most common suggestions made by participants for future programs. Further research is needed to see what kinds of incentives would encourage teachers to further their knowledge of effective practices, whether under the umbrella of UDL or other research-based frameworks, giving them the opportunity to grow professionally while keeping them in the classroom where their acquired expertise has the potential to benefit students directly.

Tangible benefits recommended by participants also included resources and tools that teachers could take with them to use in the classroom. The six teachers interviewed all articulated that they preferred professional development options that gave them opportunities to build lessons or activities. Ms. Berry said that this type of workshop model was important because sometimes teachers need help translating research to practice or utilizing technology and other tools.

Benefits and challenges of technology and resources. This study revealed that technology in Jamaica tended to be a complex issue; teachers had many positive things to say about the online components of the Virtual Classroom (e.g. flexibility of pacing, access to materials and resources), but there were also considerable obstacles and frustrations. Since the UDL classroom utilized an online format, the researcher asked participants about the role that virtual learning had on their experience, specifically the components that either improved or

posed obstacles to learning. Several teachers articulated the obvious benefits, including flexibility and access to resources and expertise beyond what is currently available within the Jamaican educational system. This aligned with participant responses collected through the online survey sent at the conclusion of the project (see Appendix H, Appendix I). According to that survey, about half of the participants had previous experiences with online learning, and among the noted advantages of this format were "links to other sites for more information," convenience and self-pacing, and removal of "barriers to accessibility for all learners." However, despite these benefits, some participants experienced difficulty with site access and saw a need for additional tech support.

Most educators interviewed by the researcher (eight of the nine) said that they prefer a hybrid model that allows for the self-pacing and vast resources of online learning, but also includes face-to-face interaction among facilitators and participants. This was most clearly articulated by Ms. Buxton:

> Even though we're adults, we're different kinds of learners. I prefer hybrid classes for professional development. There's much to be learned from reading body language…it's lost in online learning… how to see if someone is confused or needs more. There is a benefit to teachers coming together and sharing ideas, and this works better in person. There are also advantages of online learning such as flexibility and pace…best idea would be a combination.

Ms. Buxton's comment spoke directly to the subject of learner-centered professional development, and to the question of *How did the Virtual Classroom address the needs of participants as adult learners*? Her insights here confirmed the assertion that learning

opportunities for teachers are more effective when they are designed with teacher-learners in mind, incorporating learner-driven pacing with guidance and support, rather than one-size-fits-all lectures or strictly learner-created agendas (Antoniou & Kyriakides, 2013; Avalos, 2011; Clarke, 1992; Clarke & Hollingsworth, 2002Helsing et al., 2008; Owston et al., 2008).

Likewise, Ms. Berry, who noted some difficulty she had at first accessing the website, said she thought the "workshop model" that included online resources and group meetings was important, especially since some educators are not comfortable or proficient with technology:

> B: …so, giving teachers the opportunity to learn to use them or to integrate them into their lessons. For example, some persons really don't know how to download stuff from the internet and put them into action for the students to see. So, even though you use the multi-modal form of teaching, teachers are afraid of technology. So, that is a way of using it to teach your lesson and to get trained... In terms of planning, sometimes they have all of these resources, but they don't know how to put them together…
>
> Researcher: Do you think the face-to-face is important?
>
> B: Yes, it is. 'Cause one of the challenges people have too is that sometimes when you are online and you get an assignment to do, you're not sure of what to do … people want it to be reinforced… even if you have the online, you need to have face-to-face.

Here, Ms. Berry identified a potential mismatch between an online program, designed by U.S. educators, and participants whose teaching contexts differed significantly in terms of technology resources and know-how. Virtual Classroom designers noted that technology access and

capabilities of users were among the primary design considerations, and both the classroom platform itself and the resources curated for the modules were chosen deliberately to meet the needs of learners; however, Ms. Berry's remarks highlighted the fact that not all teachers, even within a given community, share the same skills and preferences. For this reason, other learning components, including ongoing feedback and collaboration, were important to meet individual needs.

The cohort met at the RC every two weeks throughout their participation in the UDL classroom, and Ms. Berry said she wished they could have met more often. Since some teachers worked in schools where internet access was not available and resources were scarce, meeting at the RC not only afforded them access to these things, but it also brought them together with educators from around the region. Furthermore, two participants, Ms. Adams and Ms. Williams, noted that the in-person support and feedback they got from facilitators at the RC was crucial. These leaders, having previewed each module and met with American classroom-designers via Skype, were able to communicate ideas and lead collaborative discussions as teachers reported on their experiences trying out ideas in the classroom.

Knowledge-Centered Components

Two central themes related to the "knowledge, skills, and attitudes" (Darling-Hammond & Bransford, 2005) addressed in the Virtual Classroom: (1) Providing research-based evidence for best practices; and (2) Exposure to and practice with resources.

Providing research-based evidence for best practices. The researcher, in addition to gathering information about application of new ideas, asked participants about the things they did before the virtual classroom project, practices that they might have later recognized "as UDL." The goal of this question was to understand how the theories presented in the UDL

classroom aligned with or built on current practices. Most of the teachers identified earlier teaching components that they later recognized as falling "under the UDL umbrella," but having the research and theoretical understanding allowed them to better understand why certain strategies may have been effective. This experience also gave them the language to share ideas and talk about teaching practices and learner variability. Since teachers in the Virtual Classroom said that what they learned in this program often reinforced existing practices, rather than presenting something entirely new, this may appear at first to be a shortcoming: Why spend time learning theories and strategies that are not likely to bring about significant changes in teaching? Ms. Williams, the teacher who did not complete the final model, saw it this way; she wanted more from the course in terms of specific tools and practices that were different from those she was currently using. She did note, however, some specific strategies related to student grouping and interactive games that she adopted after learning more about the UDL principles of engagement and representation. As Ms. Williams explained, "Most of the ideas of UDL were things already happening at my school… same practices but different terminology. It is good to think about different learning styles."

Ms. Buxton said that with her students at the RC, all of whom had been identified as having learning deficits, she uses lots of "manipulatives" and interactive lessons: bottle caps to teach counting and reinforce colors, a sand box to write letters, songs and games to teach basic skills. Many of these could be considered UDL strategies and were things she did before. She reflected, "UDL puts a name to it and supports the use of these practices. It is like a new language for talking about engagement and multiple tools and formats." Similarly, Ms. Carter, employed by the Ministry of Education at the time she was interviews, recalled her days as a principal in a private school where she tried to empower her teachers and students to find

creative solutions to problems through collaboration. She said that she always put students "at the top" and strove to create an environment that was accessible and honored individual strengths. While Ms. Carter had not considered these to be UDL strategies, the researcher recognized that she was incorporating a lot of UDL terminology (e.g. accessibility, understanding different learners, individual strengths, hands-on learning):

> Researcher: It is funny, listening to you, some of what you were doing before sounds like UDL.
>
> C: Sounds like it. Exactly.
>
> Researcher: So, in a way, when you were doing this course, was it giving a name and giving structure to something?
>
> C: Absolutely. It was validating. It gives credence to some of the things.

The conversation between the researcher and Ms. Berry, a school principal, reflected similar themes about the way knowledge gained during the UDL project validated the use of multi-sensory tools and strategies:

> B: Well, yes, in terms of teaching math, I had to teach maths with a lot of manipulatives … Normally, I would use them, but never thought of UDL … But then, when I realized this is what UDL does, it gives me the opportunity to use them more to teach the students because I realize that yes, it was helping, but I didn't know why it was helping. You know how you sometimes do something that you don't even know what is the end result, but then at the end of the day the students were grasping. So the UDL only helps me to reinforce what I was actually doing myself.

> Researcher: So, you think it helps to have the knowledge behind the practices?
>
> B: Yes. Yes because, as somebody would say, “What did you do there?” Like, seeing the UDL, never knowing what it was, but when you learn about it you say, ok, this is what I was doing all along… this is one more strategy that we can use to engage the students.

In the case of Ms. Berry, UDL was building on what she was already doing in the classroom to engage students and help them master content; She did not find the strategies introduced in the program to be entirely new, but rather complementary. Edyburn (2010), however, argued that statements like "UDL is just good teaching" or "Many teachers are already doing UDL; they just don't know that's what it is called" represent fundamental misunderstandings about “the emphasis that UDL places on functions of design, proactively valuing diversity, and intentionality” (p.38). Edyburn’s assertion may seem at odds with Ms. Berry’s reflection, and perhaps she had not achieved the full understanding of the construct in the way that Edyburn proposes; however, there was in Ms. Berry’s statement a sense of the deliberateness of design intended to overcome the “ marginalization of low-performing students” (Edyburn, 2010, p.38).

Other participants said that while UDL theory did not present ideas or practices that were entirely new, it did provide research-based validation and a language for talking about learner variability and accessibility. By identifying *why* particular strategies were more effective for engaging learners or supporting skill mastery, teachers could build on and expand these. This was seen as especially constructive in political climates that, according to Ms. Green, often discouraged creativity and innovation by focusing only on curricular mandates. Four teachers noted that having principles that addressed learner variability and inclusion could help reframe

conversations about learning to examine *how* students learn, not just *what* students learn. These teachers saw this knowledge as an instrument for empowering them to communicate with stakeholders, at both the local and national level, about the need for more innovative practices to address the challenges that learner diversity and underperformance create. Ms. Green described the validation of the research behind UDL as empowering for teachers. Unlike Ms. Williams, who thought the Virtual Classroom was too laden with theory, Ms. Green found this component to be valuable:

> That science behind it, you know, there's much more credence given to that… of course, there's empirical data that supports it, so more power to it for that reason, you know? There's more power to the fact that teachers have been doing it, and it's backed by all of this research and work that has gone on.

The knowledge component of the UDL classroom was not entirely new to teachers; however, the terminology and the way the framework pulled together ideas about accessibility and learner variability seemed to fit with goals these educators had for reaching struggling students and improving their performance.

Exposure to and practice with resources. Central to the idea of knowledge-centered learning for teachers is the challenge of addressing the gap between research and practice (Fixsen et al., 2005). Teachers said that they would like to leave a workshop or program with ready-to-use tools and resources that could be implemented when they returned to their classrooms. Ms. Buxton, the teacher at the RC, said that she felt like the UDL classroom gave her a "glimpse of UDL," but she felt like she needed "a longer period with the instructor," a chance to get "more information about specific strategies, more practical experience, practice putting together

lessons, trying things out." Similarly, Ms. Williams said that she didn't complete the last module because what she really hoped to gain were "more practical examples of how to use it in class." She went on to explain:

> Jamaica does not have a special education curriculum. We need resources to teach these students who get left behind and cannot pass their examinations. I need ideas for activities to teach literacy to students who are not able to do things at their grade level. There isn't much support from the Ministry for this.

Ms. Turnage, who worked with students in seventh grade, described the students at her school as "struggling learners" and said that she needs specific, age-appropriate activities and strategies to "promote literacy." Ms. Adams said she too wanted take-away resources to use in the classroom:

> I think the materials… all right, when we went on [the UDL classroom site] and it showed you the how, and the what, and so forth. If we had the materials first, even like the original… maybe we could just get it there, and we try to copy. Something like that would have been helpful in terms of how that works.

For these teachers, a weakness of the Virtual Classroom program was that the modules offered much in terms of theory but had limited take-away tools to use in the classroom. Indeed, one of the challenges of professional development design is striking a balance between the theoretical and practical. Virtual Classroom developers (Reed et al., 2014) described the process of curating resources as ongoing and responsive to teachers' needs; because of the diversity of student populations (grade, ability, school context) and subject matter, there were limits on the

number and scope of practical lessons and tools that could be incorporated into the modules themselves. In the meeting in October, 2014 (Group Meeting 1), teachers indicated a need to expand the program to include additional tools and materials, perhaps shared through an online community of Jamaican educators. This would, however, require extensive leadership initiative to get off the ground, which is challenging given the time and resource constraints of teacher-participants and facilitators. For the Virtual Classroom, a group of U.S. doctoral students and faculty devoted a semester to designing the classroom itself, conducting ongoing needs-assessment through embedded participant questions, and collecting and reviewing potential resources (Reed et al., 2014). At the time of this study, it remained to be determined what might be feasible for an ongoing resource-sharing forum.

In contrast to others who identified the lack of take-away resources as a program weakness, Ms. Green saw the practical examples provided as program strengths in the Global classroom. Describing her initial meeting with university professors visiting from the U.S. to launch the online course, Ms. Green recollected:

> When they came, it just cemented everything because it's a lot at first, when you first encounter UDL... And so for me the course, doing the virtual classroom course, was extremely valuable because although I had been exposed to it, it never provided me the opportunity to engage with the content and to practice it. So, working with each module, working with each mode of representation, the three arms of it… So after we focused on representation, I would just take that into my classroom and just work. Even though I had information about everything, I would focus on one thing at a time, and I just picked one objective that I would incorporate

> into my plans and into everything that I did. And so by the time I was through with the virtual classroom, I had tried multiple means of representation. I had tried the when, the how, the why. I had tried all of it. And it wasn't hard; it made it seamless. And because I was adding on, you know, I would have started to do the first, the representation, the multiple means of representation; I would have that under my belt, and so when the engagement, the ways to engage came about, that was already a part of what I was doing. I just added another piece to it.

Ms. Green, who became a teacher-educator the year after program participation, said that she tries to give her own students practical examples of UDL that they can apply when they become teachers. She noted that she helps them build tools and resources and tries to model these practices for them.

Assessment-Centered Components

Themes related to the feedback, reflection, and support that were components of the Virtual Classroom project fell into two categories: (1) Feedback from facilitators and other participants; and (2) Need for ongoing support.

Feedback from facilitators and other participants. Since teachers, especially those is remote, rural schools, often do not get regular feedback from peers on the work they do in the classroom, the opportunity learn from other educators and to engage in self-reflection were components of the program that participants found beneficial. While the knowledge-centered aspects of the course gave teachers access to ideas and strategies, it was the opportunity to put this knowledge to work in context that they found meaningful. After teachers in the UDL classroom completed each module, they were encouraged by facilitators to return to their schools

to try out what they had learned. When they reconvened, teachers shared their experiences and offered each other ideas and suggestions. Teachers were able to reflect upon their successes, failures, and challenges and communicate with others in order to gain understanding and brainstorm solutions. Ms. Berry noted that most teachers do not get these types of opportunities because of other demands, but when "teachers would have challenges with some things," the advice from other group members and leaders allowed them to "share best practices" and understand that "it doesn't have to be 'this way;' … we can do it other ways." Unlike a formal observation by an administrator, this type of peer assessment is low-stakes; teachers can try out ideas, make mistakes, and work together to find solutions.

Many participants agreed that the group's leader were key to its success because they encouraged them to think about new ways to approach problems. Teachers described the group leaders as "inspiring" and "supportive," and several talked about their desire to create formats for ongoing collaboration and idea-sharing. Ms. Buxton said she wanted a "longer period with an instructor" to "practice ideas," noting that "even though we're adults, we're different kinds of learners" and need guidance to grow. She said that she plans to go back to school to pursue a graduate degree.

For some teachers, the Virtual Classroom was an opportunity to grow, especially when feedback was targeted and individualized While the feedback component was identified as valuable, participants said they would like to see it continued beyond the timeframe allotted. Ms. Turnage explained that she often does not get a lot of constructive criticism from administrators or peers because "there just isn't time" during the school day. Ms. Berry also noted that as educators, it is sometimes challenging to know "what's expected from us as teachers" because opportunities for feedback are not built into the system. She did say that she got a positive

response from her principal when she integrated new strategies to get students involved, but she did not elaborate on this.

Ms. Carter talked about the role that positive feedback and collective problem-solving can play in teachers' self-confidence:

> I think time and just understanding their own strengths too, as teachers … I do believe that the answers… you have the answers. Just to get them to think, to come up with… and often they would come up with brilliant things just through that. It was very empowering… To make mistakes because that is how we grow. Just accepting that kind of empowerment was new because too often a system is a top-down thing where you are told what to do, and you do it… As opposed to "let's share. Let's collaborate."

One of the key features of the UDL classroom itself was the incorporation of open platforms "to make learning visible & constructive" (Reed et al., 2014, May). The program included online dialog, embedded prompts (see Appendix J), and communication between Jamaican facilitators and American designers. Based on feedback, designers made program adjustments so that content and technology resources would match the needs and interests expressed by participants. One of the student-designers captured the importance of incorporating teacher-feedback:

> When implementing any research related idea, we need to listen to the teachers. Their concerns often voice the real challenges faced any new idea. The teachers asked many real, practical How questions. One teacher challenged us to consider implementing Universal Design for Learning

> (UDL) in a class with 40 students using Shakespeare for a topic and without teacher planning time. Listening to the teachers' voices helps to ground ideas. I think in the end, listening to teachers helps to build real classrooms for real situations. Without listening to the teachers' concerns we would have imagined the classroom conditions; we would have proposed imaginary solutions for imaginary problems, and the knowledge transfer would likely have been imaginary.

While this was clearly a carefully considered component of the program, participant interviews revealed that more opportunities for online instruction and feedback related to the implementation of specific tools and strategies would have made the program stronger. One of the online tools, CAST's Bookbuilder, posed some difficulties for participants, and while many liked the idea of being able to create and share digital texts, some said they needed more guided practice before using it effectively. Also, because communication between educators from the U.S. and Jamaica took place in a blog format, feedback was not immediate. This was especially challenging for teachers whose internet access was limited. Furthermore, some teachers cited that feedback in the form of real-time technical support would have been helpful when they were experiencing challenges with online resources such a web link and videos.

When asked whether they were still getting feedback a year later, all teachers reported that this was something that they missed and would like to see continue in some way. Ms. Williams recalled, "I got feedback from the leaders [at the RC]. The participants were a mixture of specialties and situations. I want more information about UDL for different situations: to help with a large group, how to work with a child with real needs or those who just need to catch up." Ms. Adams said that after being part of this program, she sought new opportunities to learn from

other teachers, noting that feedback from teachers with different backgrounds and situations can provide innovative solutions to problems. Teachers reported that they would like to investigate alternative ways to continue the collaboration and peer feedback, perhaps by organizing periodic meetings or through social media or another online format. While this learning experience had certainly extended beyond the typical professional development timeframe, which research has shown to be largely insufficient in terms of providing ongoing support (Dede et al., 2009; Gaible, 2009; McLeskey & Waldron, 2004), teachers reported, both shortly after and a year following the program, that they needed more time to practice new skills and get advice. Having the Virtual Classroom in place provided a structured system for feedback. Even while teachers were not uniform in the strategies they tried to implement in the classroom, each two-week session centered on a particular UDL principle, so there was a shared overall objective. In the year since they completed the program, participants had not found a way to keep the feedback going, and so it remained unclear what kind of leadership is necessary to organize and sustain a system for implementation feedback.

***Community-Centered* Components**

Aspects of the Virtual Classroom that related to "the community within which learning occurs" (Darling-Hammon & Bransford, 2005) were divided into two categories: (1) Shared resources and expertise; and (2) Relevance in Jamaican context. These themes captured the ways that the group collaborated, both among participants and with program designers, and the context-specific applicability of the program.

Shared resources and expertise. There was considerable overlap between the community-centered components of the program and assessment-centered learning because feedback was central to the benefits of teachers coming together and sharing ideas. Despite co-

occurrences, participants' reflections on the importance of access to resources and expertise, beyond what was available to them in their individual schools, were more aptly categorized as community-centered. Professional relationships, and in many case friendships, developed among participants, and several reported that they remained in contact after completing the project. These relationships, especially the sense of camaraderie that came with collaborative learning and sharing, were aspects of the group meetings that Ms. Berry appreciated because she had found it difficult to get together with other teachers at her own school:

> Because even when you plan and say, "All right, we're going to meet as a group and put things in place," it never materializes because persons are… probably because of demand that people have, but they tend not to… Then you will find some persons who are always willing to share… [The cohort was] a varied group… And sometimes when you hear about what is happening in some schools, you're like, ok, then, I don't have these challenges, but then I'm trying to make things better and then they realize, no, based on the challenges that some people had before… what they did to make the changes.

Ms. Adams remarked that this type of learning was "a plus" because, unlike the kinds of professional development she had experienced in the past, there was a lot to be gained from sharing ideas and resources across settings:

> A: People see that, all right, this exists in the multi-grade, this is the situation that is there… you can share ideas among other colleagues who might be having some other challenges… the group that was there we learned so much from each other. The feedback that worked from the

different schools…or the high school or primary school… People were excited, and they came back and they shared what they were doing in the classroom as somebody listened to them… We talk about… what's the term for it…these professional groups…

Researcher: Professional Learning Communities – PLCs?

A: Right. I think we need to broaden those. Networking… its really like networking. See if you can get that because, you know, we don't really have that here. We have our professional development…it's more like a lecture. Boring presenters present and do several things. We need more working workshops firstly. More practical things that people can relate to. And I think it would be more meaningful… more than in general…

She added that she would have liked for her group to meet more frequently but that she also understood the value of "stretching it out." Ms. Adams went on to brainstorm possibilities for expanding professional development across Jamaica, suggesting that participants who have already been trained conduct workshops that bring new groups together.

Following their completion of the online modules, other teachers also investigated new ways to come together, either in person or through online platforms such as a social media group. Several participants said they would like to have an online place where teachers could post pictures and videos of what they were doing in their classes so that others could get ideas and acknowledge their accomplishments.

Ms. Evans and Ms. Elmore, group facilitators, discussed the option of creating a space within the RC where teachers could meet and share resources on an ongoing basis. Ms. Williams also suggested that the RC could serve as a meeting place for teachers around the region because

of its central location and the availability of technology resources there. Some schools in the area, such as Hillside School and Meadow School, did not have internet availability, and teachers at these schools said they would appreciate the opportunity to explore and share online materials with others. Following the end of the UDL classroom program, participants were still able to access resources and post questions or comments; however, none of the participants interviewed reported having done so. The researcher, along with the lead UDL-Classroom creators, visited with facilitators approximately two months after the groups had completed the online modules, and they brainstormed about ways to provide ongoing collaboration and perhaps to build a "resource lab" where teachers could come together to design lessons, access and borrow materials, and meet with others. When interviewing participants a year later, the researcher noted that no definitive action had been taken to make these ideas come to fruition, primarily because time, resources, and space had not been available.

Relevance to Jamaican context. Since one goal of the program was to create UDL professional development that was sensitive and relevant in "diverse cultural contexts" (Reed et al., 2014), the researcher looked at the ways responses to the program in relation to participants' own national and local circumstances. The creators of the UDL Virtual Classroom described the collaborative development of the program that brought together educational leaders from the United States and Jamaica, along with American graduate students, to explore resources and learning platforms that would address the needs expressed by Jamaican participants and would be flexible and accessible enough to work in a variety of contexts. After meeting with Jamaican facilitators and visiting schools, university program-developers made initial design choices based on several key criteria: cultural appropriateness, accessibility for all learners (i.e. accessible Wordpress theme and accessibility coding with a clean and intuitive interface), technology

access of end users, capabilities for an open platform, and resources that would be free to access and implement (Reed et al., 2014, May). Because there were some key differences between Jamaican and American education systems, it was important to designers that they be attuned to issues related to context. Nevertheless, some contextual issues became apparent only after participants began engaging with online modules and applying what they learned. In interviews with participants, the researcher learned more about Jamaican education in general, as well as details of individual school cultures and practices, that could have impacted the way that Jamaican teachers were able to translate UDL theory to practice.

Questions of relevance arose both in terms of the teacher-learners themselves (as participants in the Virtual Classroom) and the application of UDL when teachers returned to the classroom. There were a number of striking differences between typical American and Jamaican schools (while there was, of course, great variability within either educational system), and several questions arose as the researcher considered information gathered from classroom observations and participants' comments: Is the UDL framework flexible and comprehensive enough to be effective in diverse educational settings (not only in Jamaica, but also across the United States and internationally)? What does learner variability look like in settings where IDEA is not in place? What are some benefits and challenges of international collaboration for teacher learning and resource-sharing?

One factor that distinguished Jamaican education was its national curriculum and system for student assessment. The national assessments seemed to be a common concern for teachers; many said they had students who had fallen behind and could not pass, and they expressed the need for resources specifically geared toward helping with the necessary skills in literacy and math. Furthermore, teachers referred to the particular concern that they had about the

engagement and performance of boys in the Jamaican school system. Ms. Buxton's comment captured the sentiment expressed by other participants and facilitators: "More boys are not performing. I want to know what's happening. It is really alarming… Some things you expect them to know, they don't. You can't take anything for granted." Others said that they felt the national curriculum was more favorable to girls and said that boys were often less engaged, had higher dropout rates, and performed lower on assessments. Ms. Williams, who was working with a pull-out group of struggling second-graders, had over twice as many boys as girls in her class (7 boys and 3 girls); likewise, Ms. Buxton's class at the RC was made up of 8 boys and only two girls. Both teachers noted the disparity and said that it reflected a trend across Jamaica. Concerns about special education services in Jamaica and the lack of qualified teachers were also topics raised by participants. Ms. Williams said that she had never been trained in special education and wished there were some sort of special education curriculum for students in Jamaica:

> I am not trained in special education, and Jamaica does not have a special education curriculum. We need resources to teach these students who get left behind and cannot pass their examinations. I need ideas for activities to teach literacy to students who are not able to do things at their grade level. There isn't much support from the Ministry for this. Students take tests in grades 1, Readiness Inventory; 3, Diagnostics in Math and Reading; and 4, Literacy and Numeracy; and they have to pass to move on. In grade 6 they take the G-SAT to move on to high school. The national exams aren't working. Here we go to grade 7. This is the Alternative Secondary Transitional Education Programme (ASTEP).

Other teachers also reflected on the role of the Ministry of Education and the mandated tests for students. Ms. Green said that ongoing formative and summative assessments, in addition to the year-end tests, were relatively new in Jamaica:

> You are also required to collect assessment data from other sources like homework, graded classwork, artifacts, or projects, that kind of thing. So they do, they have a wide variety of submissions that form the body of formative work... That's something that's come out of the ministry for a couple of years now. They require that continuous assessment to track students' progress.

For schools where students were placed in multi-grade classrooms, which are not uncommon in Jamaica, it can be especially challenging for teachers to provide appropriate instruction. One teacher said that this problem was due, in part, to a statement from the Ministry, a few years prior, that fewer teachers were needed in Jamaica: "This led to drops in enrollment in teaching colleges, when they said Jamaica had too many teachers. Many new teachers left island to find jobs." She saw this as a contributing factor to large class sizes, which often range from 35-50 in urban settings, and as several others noted, these classes often include students who are struggling to keep up with the national curriculum. Ms. Green explained that when she had a student who was far behind grade level [7th], she was told to use 2nd grade curriculum with him. She found this to be frustrating for him because the materials were not interesting or suitable for a student his age. Ms. Green said she tried to "work in grade-level content" but "had to do it under the radar because [teachers were] penalized for not sticking to the prescribed curriculum." Ms. Berry's approach to multi-grade teaching was to "pull the grade 3 along with the grade 4" and then "when they get over to grade 4 they can pull back because the workload is heavier."

Textbooks and other curriculum materials are provided by the Ministry of Education, and some teachers said that they felt limited by this. Online resources, such as videos and printed materials that teachers can download, are often designed by American educators or publishers, and these do not always translate seamlessly into a Jamaican context. For example, the audio cd's and videos used by Ms. Buxton featured American voices and American students, who neither sounded nor looked like the students in her class. While creators of the UDL classroom purposefully incorporated Jamaican images on the website to make the site more culturally sensitive (Smith, Reed, & Arnold, 2015, March), images, examples, and resources often used to illustrate UDL components (CAST, n.d; IRIS Center, 2009; Mace et al., 1991; Meyer et al., 2015; National Center on UDL. 2012; Pellegrino & Hilton, 2012; Rose & Gravel, 2012; Rose & Meyer, 2002) feature settings and students that are representative of American schools. For example, classrooms pictured in these sources often have computers, Smart Boards, and other educational technology not readily available in Jamaica. Classes appear to be much smaller than those typically found in Jamaica, and modern settings bear little, if any, resemblance to the cement buildings with aging desks and chalkboards that are more typical in Jamaican schools.

While sources of UDL research may seem on the surface to lack relevance in a Jamaican context, several teachers who were interviewed said they embraced some of these theories and practices because the models of inclusion and accessibility they offer make sense in a system that does not have adequate special education programs or resources in place. Some students with disabilities attend special schools [there was one in the region in addition to the RC, which takes students from their regular schools for 1-2 years], and only a few schools have within-school programs for students who are struggling. One of the issues is identification through individualized assessment. The two facilitators of the UDL classroom group test students who

come to the RC and travel around the region to conduct assessments, but they agreed that many students go undiagnosed because resources are not available to reach everyone. One of the participants, Ms. Green, who worked as a special educator, was a particularly vocal advocate for UDL, in part, she said, because there was so much diversity within the group she taught and she needed flexible, accessible strategies:

> This last year I had students from 8 all the way up to 13… They come from different grades, so when they come to the unit, some of them have had assessments, some of them don't. Some of them never get assessed… We have not been able to truly treat them the way that we ought to because we don't have an assessment; we don't have the assessment data that would identify the areas, the specific areas of deficit… Different age, chronological age, developmental age, interests… It's a mixed bag.

Ms. Green worked in a relatively urban school, one that had a specific *unit* for special education, but in smaller or more rural settings, remediation was offered in the form of pull-out classes (Bay School) or after-school programs (Hillside School). Because teachers without training in special education often staffed these programs, educators expressed a need for materials they could use to teach literacy and math, specifically materials aligned with Jamaican curricular goals and assessments.

Ms. Carter, whose job with the Ministry of Education was a recently added position that reflected a new national focus on special education, talked in depth about recent changes in Jamaican education and the role that UDL might play moving forward:

> The thing I liked was that we got an opportunity… to look at everything in context. Especially in my work, I had to zero in on what it is that I could

> apply here, given the constraints, the realities of what is happening in my country at this time. But what can I do to explore the idea of a classroom that caters to all, provides equity for all? …We have 6 priority policies, and special ed is number 2 of the 6 priority policies. And so we're giving much attention now to special education. In fact, my position never existed 5 years ago. It is a new position, and that alone speaks to the forward thinking of the government and the position to some degree.

Ms. Carter described the recent *Child Find* activity, a national project to identify children in need of services so that systems can be put in place over the next ten years to accommodate them. One of the challenges she noted was an existing mindset across Jamaica, a lack of understanding about learning disabilities and other differences that are not always clearly visible. For Ms. Carter, one benefit of the UDL framework in a Jamaican context was its focus on inclusion within a general education setting, since many schools around the country are not equipped to offer self-contained or alternative classes:

> So how do we think about UDL given the realities of what is on the ground, the fact that we really don't have the resources? And the fact that in Jamaica, it is still new. We have persons that still don't believe that there are learning disabilities and there are things that whether through genetics or heredity, that their children really present with barriers to their learning. So it is very interesting, what is happening now. We are making strides, we are educating as we go along, parents and students as well.

In 2014 the Jamaican Ministry of Education passed new legislation related to special education, calling for inclusion in least restrictive environments and a "non-discriminatory approach to

educational provision for students with special needs (ESTP, draft 2015). While, as noted by Ms. Carter and confirmed by other participants during the group meeting in March, 2015, there had been a recent shift in special education policy, many obstacles remained in place, often due to educator mindsets and insufficient resources:

> The reluctance of some principals in the mainstream schools to accept students with specific disabilities may be due to the anxiety, misunderstanding, and fear of over-burdening or overloading the classroom. The reluctance may be explained also as the demand on staff with limited or no experience; or the absence of resources to implement any special intervention. Reluctance poses a significant barrier to equitable access to education, and is a direct infringement of the child's right (ESTP, draft 2015).

Similarly, Ms. Green noted that "differentiated learning" had been an unpopular buzzword in Jamaica, and because UDL moves beyond the idea of different practices for different students by taking a more "universal" approach, she saw it as a preferable model:

> When teachers hear differentiation they don't like it, they don't like it in Jamaica, and so I said to them, "This is not differentiation." I said, "Imagine being able to reach everybody, without it feeling like you are. And you are actually engaging, and you are reaching everybody because of the things you are doing."

Several times during the conversation with the researcher, Ms. Green commented, "We need to ground everything in a Jamaican context." Both she and Ms. Carter said they felt hopeful about the impact that UDL could have on Jamaican educational practices, but given the structure and

resource challenges of Jamaican schools, both educators acknowledged that it would take some time, stakeholder education, and creativity to make it happen.

Research Question 2: What obstacles to implementation of UDL existed for teachers following their participation in the Virtual Classroom project?

Implementation Challenges

The previous results address questions related to the UDL Virtual Classroom itself and the learner-centered, knowledge-centered, assessment-centered, and community-centered components that impacted the design, delivery, learner-community, and context of this program; in contrast, the following results focus on the participants' implementation of ideas and strategies in the following year. While these components are closely related to the learning experiences of participants and the way that the Virtual Classroom was designed and executed, the findings that follow reveal a shift in the roles of study participants, from learners (in the professional development context) to educators (in their individual schools or broader educational contexts).

Physical space. When asked about the aspects of their schools that either served as resources or obstacles in terms of UDL implementation, every teacher interviewed pointed out limitations related to the physical settings where learning occurred. One significant issue was finding adequate settings to build or expand classrooms. This was a key agenda item at the meeting of the Board of Directors at the RC; the center had a waiting list, and there was no space available to accommodate additional students. The group discussed several options, including sharing facilities with a school for the deaf that was currently being under-utilized; however, the funds necessary were not available, and outside funding sources would need to be investigated before moving forward with any expansion plan. Ms. Carter, who was attending this meeting as a representative from the Ministry of Education, explained later to the researcher that the concern of space was one faced by schools across Jamaica:

> We are also looking at creating spaces, and now that is a great challenge. So what we've decided to do, we are looking to see how we can repurpose some buildings that we already have. So that's it, UDL also tells us to look at that we have, to think about what exists and what we can do with what exists, rather than reinventing the wheel.

Schools operating on the shift system were one example of a temporary solution to this problem, but this was not an ideal situation because of the burden it placed on all stakeholders, including families and school personnel.

Some of the space inadequacies were the result of inadequate funding for schools, and so when schools were closed, students were often placed in large classes. This posed a number challenges, not just for implementing UDL, but also for instruction in general. Ms. Green worked in a special education unit at her school; as a more urban school, hers was the only one in the study that had classes for students with disabilities staffed by special educators (with the exception of the RC, which was a separate facility where students attended for 1-2 years, away from their home schools). Ms. Green said that her classes had about 16 students, and that was much smaller than the mainstream classes. She discussed the implications of the physical space challenges, including the stress placed on teachers, overcrowding, and learning atmosphere:

> No class was less than 35, and I think they probably went up to 42. One teacher had 42 students, one teacher and no assistant. And it was 5 day, 5 hours of school. And so they get a half hour lunch break, and they're back. And this is for grade 1… A number of schools have been closed, and so… if you are at a school where the numbers are low, then they turn them into multi-grade schools… But, in most instances the classes are overcrowded.

> And if the classes aren't overcrowded, space is limited. And so the aesthetics, the environment, isn't very pleasant to be in. So, you'll have partitions separating the classes. Sometimes the partition is a board, a writing board, a chalkboard, that doesn't go all the way up. And you hear everything that is going on next door. So that doesn't make for really efficient and effective learning practices, and it's not very good for students.

In contrast, she said that her unit not only had smaller classes, but it also had partitions that went "all the way up" so that noise was not such a distraction. She remarked that when students were moved from regular classes to the unit, "immediately they start doing better because they're more comfortable."

One of the first things noted by the researcher upon visiting Bay School, Hillside School, and Meadow School was the fact that classes were separated by partitions that did not block out noise from one class to another. Windows and doors opened into common areas, most often a central courtyard, and there were usually other teachers and students talking outside while class was in session. Because there was so little separating one class from another, it seemed that there would be obvious limitations on the activities that a teacher could have students engaged in; lessons could not involve too much noise or movement because of the impact this would have on other classes. Ms. Wilson did describe activities when she took her students outside the classroom to learn, and as Ms. Green humorously remarked, "For me, I think, it takes a little more ingenuity and a little bit more thought, but we live in a tropical climate, we can always go outside!"

Town School, which was a larger and newer facility, had walls between classes, but like the others it had windows with only shutters, and noise from the outside was great distraction. This was a two-story school with approximately 500 students. The stairs and hallway ran along the outside of the classrooms, and windows and doors from classrooms faced this corridor. Often the noise outside got so loud that the teacher almost had to yell to be heard, and because the room was equipped with old, heavy metal chairs and desks, there were loud scraping sounds on the concrete floors whenever a student moved.

In addition to noise and overcrowding, which every teacher noted in some way as obstacles to implementation of UDL, classrooms were small, and the furniture was often too heavy to allow for alternative set-ups. Since teachers in *shift schools* had to share classroom space with another instructor and grade level, there was reluctance to rearrange furniture even when it was possible. Ms. Green recalled one teacher's frustration:

> The desks don't move. I can't group my students because the desks can't be grouped that way… not only is it that you could not figure a way out to arrange the classroom, but you have another teacher coming for the rest of the day, from mid-day to five. Another person is going to be using the room, and it's going to take up half an hour to forty-five minutes to arrange the room to accommodate her students, who may be more in number, and she's not necessarily going to need or want to use the layout that you have.

This teacher's concerns demonstrate the challenge that many faced when trying to re-imagine practices that have traditionally been in place; in this case the physical structure of the classroom presented a barrier, and the teacher was unable to see a way to adapt

without losing valuable time. Most classes had desks arranged in rows or in "tables" made of 4-5 desks. At Bay School, desks were attached to benches so that two students shared each desk. It would be quite challenging to work with existing resources to create classrooms that were accessible for students with physical disabilities or even to create flexible learning spaces.

Technology. Perhaps the most widely discussed obstacle to UDL implementation was the lack of available technology in the schools. While there are certainly low-tech options for UDL, much of the literature and resources available from CAST (www.cast.org) relates to computer-dependent resources. Teachers in this study said they were interested in tools for presenting content in multiple ways (e.g. digital texts, multimedia presentations) and for letting students demonstrate knowledge, but these resources were rarely available. Schools in rural areas (Hillside School and Meadow School) did not have any internet access, and in schools where access was available, teachers usually had to use their personal laptops or phones to download materials. Ms. Buxton, who did have access to a computer and a computer lab at the RC, said she wished she had a Smart Board to allow for more student interaction, noting that it would be easier for students to see than computer screen at front of class. She remarked, "Gone are the days of just book and pencil. We need more technology in schools!"

While research on 21st century learning has indicated that technology is a key factor in shaping the way learners acquire information, connect with others, and express themselves (Jenkins, 2009; Johnson & Lomas, 2005; Lenhardt, Madden, & Hitlin, 2005; NETP, 2010; Oblinger & Oblinger, 2005), many Jamaican schools are not equipped to address this. Teachers discussed this challenge when meeting as a group in March, 2016; concerns were raised about preparing students for a technology-rich, globally connected workplace when many schools in

Jamaica do not integrate technology in the classroom. Ms. Turnage, whose school has tablet computers as part of a national pilot program, said that even with this tool in the hands of students, the school lacks the digital infrastructure and teacher training to make the most of it. She explained that internet access is unreliable and often shuts down when too many students are online; she also noted that teachers were not adequately prepared to create lessons and access relevant resources.

One of the tools presented in the Virtual Classroom project was CAST's Bookbuilder (http://bookbuilder.cast.org/), a site that allows users to create, publish, and read digital texts. Teachers said that they recognized the value of this tool, but because of limited technology, most said it was not feasible to use it in their schools or classrooms. Ms. Berry noted this challenge at her school, Hillside, where there was no internet availability and very little, if any, technology in the classrooms:

> So... internet. Yes, yes, so I remember doing the story book; that was a challenge because there is no internet at this school, so you'd have to go to [the RC] to do it there. We couldn't do anything on our own. It's the same thing in the schools; you'll find that the schools that are in the remote areas or the rural areas, don' have access to that facility. Also, in terms of the financial resources, there is not much in terms of what we can buy to make teaching and learning more interesting. So, for example, you need a multimedia projector, you might have persons who are able to give, but you have to source from stakeholders outside. You know, because the Ministry of Education doesn't have those kinds of resources.

Three of the six classes observed by the researcher had a computer, but in each case there was only the teacher's laptop that was used to present material. Jamaica had started a *Tablets in Schools* pilot program, but none of the classes observed in this study were part of that initiative. Ms. Green explained that "when it's no longer a pilot program, students will have to pay for using the tablets," and she noted that many families did not have the financial resources to do that. She also recalled that at her previous school they had to hold fundraisers to earn money to pay for internet access, and even when they had procured the necessary funds, there were some "issues with the provider," so they never did get access.

Most teachers said that they used their personal computers at home to download videos and other resources, and they agreed that there were many innovative, engaging learning tools online that were valuable additions to the materials supplied by the Ministry of Education. Ms. Berry recalled:

> You have to purchase on your own because, as I say, whatever financial resources that you are given, it has to stretch to do other things, so priorities come first, and whatever is left, you are left on your own. You have to work with that… We would use our personal laptops, and sometimes we would download games and stories and all of those things from Youtube, and then get it on the laptop so we can show it at school since we know that internet is not there. Now we use our phones, so students listen because, as I say, you have to try to engage them in whatever way.

Ms. Adams, who also didn't have internet access at school, advised, "that's why its necessary for you to prepare your materials before."

Classroom resources. In addition to limited technology, teachers also faced obstacles related to other types of materials that could be used in the classroom to implement UDL. For example, because printer and copier ink were expensive and in short demand, teachers often relied on chalkboards or whiteboards as the primary means for representation. In most classes, teachers wrote notes on the board and gave verbal instruction, while students copied notes into their composition books.

There were, however, some creative solutions utilized to provide hands-on learning experiences through the use of manipulatives, usually teacher-made. Ms. Buxton said that she tries to use objects that are readily available whenever she can and showed the researcher bottle cap "counters" for math lessons, noting that she also used these for sorting activities to reinforce color-identification skills. Ms. Berry said that teachers in Jamaica sometimes refer to this as "trash to cash" and offered examples of the ways that teachers have made the most of everyday items as teaching tools:

> [When] you're teaching Geometry, they use the cardboards to make your rays and your line segments and all of those things… your angles. You use the cardboards to do that. We have beads, beads and buttons and all of those things. We use those for counters. You have people finding leaves and use leaves to teach lines of symmetry. Yes, so those things we do. We try to get the content out to the students in whatever way we can. Sometimes it's really difficult, but you have a job to do… You see them on the road collecting the cardboard boxes, the empty bottles, and all of those things to get what they have to do done.

This ingenuity, reminiscent of what Hatano & Inagaki (1986) described as adaptive expertise, was evident in every classroom observed: student folders made from old advertising posters, graphic organizers that had been "laminated" using packing tape so they could be reused, and letters cut from magazines or newspapers. Nevertheless, teachers agreed that it was often a struggle to find or create resources and that this was a significant challenge.

Town School was one of the few schools that did have internet access and a projector, but when the researcher observed Ms. Turnage's 7th grade English class while they were learning about adjectives, the resources she provided for students illustrated the some of the challenges of using computer-sourced materials and printables that are either not age-appropriate or not grounded in a Jamaican context.

Ms. Turnage used a Powerpoint presentation with accompanying audio to begin the lesson. The song was a parody of popular tune "All About That Bass" by American pop artist Meghan Trainor. The parody, entitled "All about that Adjective," included lines such as "I put describing words in all the right places." It was clear that the teacher was trying to make the lesson entertaining, to use technology and popular culture references to engage her students. However, the outcomes of this lesson seemed to fall short of the goal because students did not appear at all interested. The researcher wondered if perhaps this presentation was more appropriate for younger students. The students in the class may have recognized the song, but their body language indicated that they did not find it relevant or appealing. Later in the lesson, the teacher handed out a poem called "The Policeman" and an accompanying picture of a police officer. She asked student to write about the picture, using adjectives to describe. The image was a not a photograph, but rather a cartoonish clipart image of a man who appeared to be Caucasian. The picture did not look at all like a Jamaican police officer, but when the teacher wrote a

sample sentence on the board, she used the name of the Jamaican Commissioner of Police, Dr. Carl Williams. It was evident to the researcher that the teacher was using what she had in terms of resources and was trying to bridge the gap by adding details to make it more relevant to her students.

Because most of the resources available online are produced outside of Jamaica, or the Caribbean in general, it can be difficult for teachers to find stories, poems, images, and activities that are relatable. Several teachers added that it was especially challenging to find high-interest materials for students who were reading well below grade level.

Research Question 3: How has this program has impacted teachers' planning and implementation of lessons in the classroom?

Program Impacts

Despite obvious obstacles, teachers reported that participation in the UDL Virtual Classroom did have some influence on their own practices, as well as the methods and mindsets of other educators. Most said that they had shared what they learned in the program with colleagues, either through formal professional development opportunities or through informal communication. A few teachers also provided anecdotal evidence of perceived impacts on student engagement and performance, both in their own classes and those of fellow educators.

Teacher mindsets. For Ms. Carter, the participant employed with the Ministry of Education, the most significant impact of participation in the Virtual Classroom and introduction to UDL was that it offered a new way of thinking about teaching and learning that has the potential to change the way educators understand and design for learner variability:

> And just in terms of planning, how do we think in, as it were, a universal way about teaching and learning. Usually we are so linear in our thinking,

> and so we take into consideration everything from perhaps how you construct a school, and as vast as that to very minor things like how to organize your classroom and how to look at the individuality of each learner… and it almost sounds contradictory, universal and individual…

According to Ms. Carter, the UDL "mindset" offered a way to educate Jamaicans, to encourage them to embrace the idea that learners have different needs and strengths. She offered examples, including the Ministry's new special education initiatives, as evidence that previously held beliefs about disability were becoming outdated:

> And the fact that in Jamaica, it is still new. We have persons that still don't believe that there are learning disabilities and there are things that whether through genetics or heredity, that their children really present with barriers to their learning. So it is very interesting, what is happening now. We are making strides, we are educating as we go along, parents and students as well. That is it with UDL too; it does not leave out, if you will. It takes in all stakeholders. So we look at not just teacher and the child, we also look at all the persons involved including parents too; what it is that you need to do to ensure that your child benefits from his school and that your child gets the best opportunity to learn?

Ms. Williams, working with struggling learners at Bay school, said that while she had employed many of the UDL strategies in her classes before being in the program, she valued the fact that the course encouraged participants to think about learning styles, something that educators need to do to help their students succeed. Similarly, Ms. Berry said she had been "doing it over time" but "didn't pay keen attention to it." She felt that the course encouraged her

to "rethink how [she] was teaching" and "put better plans in place." She saw this as an encouraging change in perspective because it focused on finding creative solutions rather than accepting that some students would inevitably fail:

> Because sometimes you would just be want to say that child is not managing, but then you realize you can find another way to teach this child and get this child engaged. Because sometimes it's how you do it and, um, bearing in mind the multiple intelligences of your students you realize, ok you might have to find another way to get this one because this one is not going to take it this way; this one is a, like, a tactile learner… I think that that those forms helped me to reorganize or reflect on my teaching practice and be able to present better lessons to my students.

Ms. Green described a palpable shift in teacher mindsets when she conducted a professional development workshop for teachers at a nearby parish. While teachers at her own school had been open to trying out the new strategies she had brought back from the Virtual Classroom, Ms. Green said that teachers in the group she went to teach were skeptical at first. Her workshop was a 3-hour "introduction to UDL," and after providing teachers with its background, principles, and examples, Ms. Green had the teachers work in grade-level groups to "pick one thing, one topic from their curriculum, and once they had chosen a topic, they were to 'UDL it.'" She provided each group with chart paper and had them record their ideas; Ms. Green said that she was quite impressed with the results of this activity, even though initially she was not sure how it would be received:

> One group picked writing, and … after the presentation, they filled that chart, and it was amazing what they were telling me. One teacher… [had]

> such an awesome idea. And when I walked in [at the start of the workshop], she seemed like, "Why am I here? I don't want to be here. I just want to go home." But, by the end of it, it was phenomenal to see how… I mean, this was the first taste of UDL, they'd never heard of it before, and just to say to them, "I know you think this is more work; this is just one topic" … And so each grade…They each presented some aspect of it, and… the buy in. So, this is it. Because they did it on the spot, just after having learned about it that one afternoon.

Ms. Green credited some of the buy-in to the fact that she had made a point to distinguish UDL from differentiation, a framework that had been introduced in Jamaica but was not well-received: " You know, they tried differentiation, and it's not working because it's so hard to do." She explained that teachers were much more likely to embrace a framework that would allow them to build on what they had already in place and would focus on inclusion and flexibility.

Teaching methods. The first UDL principal presented in the Virtual Classroom was multiple means of representation, and most teachers in the program reported that this was the easiest to implement. Teachers said that this was not an entirely new concept; they had tried previously to give students information in multiple formats, but for some this type of instruction became more deliberate. One teacher contrasted this multi-modal approach to teaching with the more traditional "chalk and talk" models. Teachers agreed that when they presented information in innovative ways, students were much more engaged. Similarly, teachers of students who had traditionally underperformed on standardized tests said that they enjoyed looking for alternative ways for students to demonstrate what they had learned.

Ms. Buxton described the many different approaches she used to reach her students, all of whom had struggled to perform in mainstream classes: "Representation works. Most of these kids [at RC] have memory problems, and it helps them to see and hear and say. So, they need repetition in a various formats."

Ms. Berry described the new methods she had utilized as student-driven rather than "teacher-directed." By allowing students to investigate and problem-solve, she found that they benefitted more than when information was presented in the form of notes written on the board by the teacher:

> When I give them projects to do, I allow them to the research with help, to find the information… So they were actively engaged right through the process. And I realized that doing that, it helped them… it boosted their self-confidence… how they presented. I love, of course, how when they were finished and some of them said, "Miss, I didn't know we could do this" … just giving them an opportunity to get involved… I realized that they learn more because when they were able to ask some questions, these children were able to tell you about it in more detail than if you had done teacher-directed instruction.

Another teacher explained that Jamaican educators most often had followed a more traditional, lecture-style format, but concerns about low test scores, dropout rates, and discipline issues were leading many to look for new approaches to reach students. All of the participants in the program said that they had tried, even before the UDL classroom, to incorporate more multi-sensory, engaging lessons; nevertheless, most agreed that the program's online resources and idea-sharing through collaboration had shaped the methods they now employed.

The table below highlights UDL strategies observed in each class by the researcher. Hillside School is not included in the table because Ms. Berry, the participant interviewed by the researcher, was an acting principal and did not teach a class. All information about Ms. Berry's own teaching practices and students was ascertained from the interview with the researcher. The challenge of reporting data on UDL practices observed in classroom settings is that *more* (great numbers of "UDL strategies") does not always mean *better* (measured in terms of student engagement or performance). As McGrath (2014, March) noted in a lecture entitled "It's a Lens, Not a List," it is sometimes appealing to think about UDL as a list of tools for teachers to use and share, but this does not lead to integration and connections. The table below (Table 7) is indeed a list, which the researcher included here for the purpose of recording activities and resources utilized in the classrooms that were observed in October, 2015; it serves only as a snapshot and should not be used to infer the extent to which individual teachers benefitted from the Virtual Classroom or make deeper connections between UDL principles and practices.

Table 7.
UDL Components Observed in Classrooms

School	Multiple Means of Representation	Multiple Means for Action and Expression	Multiple Means of Engagement
Resource Center	• Options for Perception: music, letter sheets, CD, letter cards • Computer: video on letter e- sing along- multiple media • "What do we know about this word?"- Associations to activate background knowledge • Pairing verbal responses with writing on board	• Choral reading, singing, individual verbal responses • Pointing to letters on page • Circling letters on board • Individual oral response with teacher support	• Teacher moved around room to help students stay on task- guides hand of student who was not engaged ○ Students allowed to stand and participate ○ After-lunch activity

Bay School	• Options for Perception: songs, writing on board, pictures • Drawings to help students remember letters: K "kicks" and B "has a big belly out front" • Pairing visual with audio	• Choral reading, singing, individual verbal responses • Echo reading • Student who was not able to write letters was able to trace letters drawn by teacher • Writing, coloring • Markers (squares of colored paper) to mark letters	• Teacher moved around room to help students stay on task • Song activity with movement to break up the lesson- partner and clap hands • Students clapped when others answered correctly
Teachers College	• Powerpoint presentation- visual and auditory • Guiding questions- on board and read aloud • KWL chart- advance organizer • Examples to emphasize key ideas	• Groups had choice of how to present on case studies: skit, oral report with handouts, Powerpoint. • Class discussions: small group and whole-class to address questions on board. • Rubric for group presentations provided beforehand. • Guiding questions on board for class discussion	• Students/groups chose case studies for presentations and were able to choose how to present information. • Guiding questions to inspire thought/debate about relevant issues surrounding giftedness. • Use of case studies for presentations to demonstrate learning disabilities/ADHD in context. • Instructor offered example from her own teaching experience to describe a student who was referred for assessment due to poor performance but was found to be gifted. • Guiding questions on board to focus discussion

			• Rubric for presentations • Small group discussion followed by whole-class discussion • KWL chart • Teacher provided verbal feedback throughout class

Town School	• Powerpoint Presentation, Audio on computer
	• Printed poems/read aloud by teacher
	• Writing on whiteboard/reading aloud
	• Adjective in bold print in poem for emphasis
	• Clarifying vocabulary- introduction of term "adjective"- examples provided and definition repeated throughout class period
	• Illustration through multiple media: song, poem, pictures, sentences
	• Teacher provided models (examples) and immediate feedback/corrections
		• Varied means of response: oral response in unison, individual oral response, written response
		• Models/examples provided
		• Time limit established for small-group activity
			• Teacher attempted to recruit interest by using Powerpoint/audio using parody of a popular song. This, however, did not successfully engage students.
			• Poem/pictures not socially/culturally relevant or age-appropriate. Teacher did try to make activity more culturally relevant by using name of Jamaican chief of Police to describe picture.
			• Students worked in cooperative learning groups (by table), but roles or within-group expectations were not articulated
			  • Teacher provided immediate feedback.
			  • Teacher redirection when class

			became too noisy or disengaged.
Meadow School	• Teacher writing on board, using textbooks • Teacher discussed material as she wrote notes • Place value chart • Using words, fraction, and decimals to depict same number- showed multiple ways to express a number	• Students answered questions orally and copied notes/solved addition problems in composition books	• Teacher moved around room to help students stay on task and to offer feedback

Student engagement. Perhaps the most significant impact of the Virtual Classroom project, as reported by participants, was the principle of engagement, and teachers were eager to report strategies they had implemented to get their students more involved in the learning process. Several teachers described games and activities that they tried to incorporate, moving away from more traditional lecture formats that are perceived to be less effective means of engaging learners in their classrooms. Ms. Berry said that when she used high-interest reading materials and collaborative learning, students showed more interest in learning, and classroom behavior improved:

> It really helped to guide those students who are not comfortable with just the "chalk and talk" but, getting involved in what they are learning… when you are teaching reading, so they are engaged in reading, but they have the book and they can relate to their learning experience or life experience, and the story is something similar to what they are learning, then it helps them to be more engaged… I now started using games as a form of start-up for my lessons, and I realized that the students were more

> engaged because everybody become a part of what is happening… Every day you come with something new; they're now anticipating what you are going to do the next day, which really helped… It does help in terms of class control because once everybody is engaged then you find that you have more time to teach and less time to deal with discipline. It does, it does help.

Since classes were sometimes large, and teachers did not typically have an assistant, several participants reported that discipline was a major concern. Many teachers explained that they often had difficulty with boys in their classes; this was a topic raised not only in interviews during this study, but also in participant comments on the Virtual Classroom blog and in Group Meeting 1. Ms. Green said that she focused on the engagement piece of UDL to try to get the boys in her class to play a more active role in the classroom. She sought content and materials that would interest them and gave them classroom responsibilities and leadership roles:

> First of all, I recognized the engagement; engagement was the biggest thing, ok? And so going in, how did I engage? What did I need to prepare to engage my boys? And so, I recognized that, of course, they like tv, any video-type thing… each week I used something that they liked. So it was using a video, a YouTube video. That's usually free, and because it's free I could access it and use it. And they would just really have a good time. And we would have long discussions about it. And it was finding things that they liked, tapping into their learning style and using some of the things that they would come to school and talk about, you know? And one of the other things, too, was making them responsible for things.

Ms. Green also described the set-up of her classroom, which she made student-accessible. She made sure that supplies such as crayons and scissors were organized and located where students could get them. She said that she wanted them to feel as if "the entire classroom was their domain," and so she tried to keep on-hand puzzles and other high-interest learning activities for students to use when they had finished their regular work. She laughed and said that despite the fact that reward for completing classwork was "more work," students took advantage of these opportunities and were excited about them.

Ms. Green also described a change in the engagement of students in the class of another teacher at her school, one with whom she had shared some strategies and other content from the Virtual Classroom. This teacher had a class of third and fourth graders who were "low performing," and when she started using music and video in her class, she saw a significant improvement in behavior. Ms. Green recalled:

> I came back and did just a mini overview of UDL and just encouraged them to use different things in the classroom… One teacher, she took the video content, and she used a lot of singing with the children… Most of them were at the grade 3 level; some were at the grade 4 level… But, none of them could read. None of them could function above a pre-primer. And so … they would sing, they would chant; they would watch the videos, and they were highly engaged; they were highly engaged. They had severe behavioral problems also, but during learning, there's a difference. If she didn't come to school one day, there was a difference. If they weren't engaged, there was a difference in their behavior. It was horrible, beyond horrible. When she was there, they were just soaking it up.

While these examples demonstrated improved engagement, there were also situations observed by the researcher in which students were clearly not engaged in learning or perhaps needed additional guidance to stay on task. In Ms. Berry's class, students were permitted to stand at their desks during activities, and she moved continuously from student to student to offer feedback, even guiding the hand of one learner from letter to letter on an alphabet worksheet. Her class of ten students afforded her the space and flexibility to do this, and since all of the students in her class had special learning needs (including autism, learning disabilities, and selective mutism) she seemed to be constantly vigilant to make sure that no one fell behind or missed what was happening in class. Ms. Turnage had a much larger class, thirty-five 7th graders, and despite her attempts to use high-interest materials, many of her students were off-task throughout the class. While she showed a Powerpoint presentation with accompanying audio, several students were distracted and talking to their peers. As noted earlier in this chapter, the resources employed in this class, while perhaps engaging to younger students, seemed to have little relevance to the students here. Students worked in groups to describe a picture that had been given to each table, but group work appeared to fall short of the teacher's expectations. Students were instructed to create rich descriptions using adjectives (the focus of the lesson), but most groups generated only a few words and then resumed individual conversations. This instance served as a counterexample to other reports of increased student engagement, and it was a valuable example the need for ongoing feedback and self-evaluation to determine what works in the classroom; it also illustrated the need for culturally relevant, developmentally appropriate materials for older students with weak reading skills.

Student performance. While it is more difficult to link changes in student performance to the utilization of particular practices, some teachers did note that their students scored better

on assessments and seemed to master more content when they were engaged in learning. Teachers tied this increased engagement to their incorporation of UDL practices: multiple means of representation, multiple means of action and expression, and multiple means of engagement. Ms. Berry said that these practices improved student participation and associated that with skill mastery:

> For example, you have students at the same grade level but within that grade level there are different groups. How do you get all of them on one? Yeah, so use UDL as a form of reinforcement, when you teach it before it is reinforcement to get the small groups involved. Then you are able to pull everybody along with you. So at the end of the day your literacy and numeracy rate can go up so you are able to find that you have students mastering all years...
>
> I keep pulling my students then, so when they get to grade 4 they are able to manage, and so over time I have 100% passes in these groups, and um, but UDL too has helped me 'cause looking back you never realize that this is what you were doing, but it works.

She noted that some of the strategies she employed were in place before her participation in the Virtual Classroom, so it is not feasible to claim a direct link between what she took away from the program and the performance of her students; however, she did explain that her experience and the knowledge she gained made her more purposeful in planning these kinds of impactful lessons.

Ms. Green described what she called "my proudest UDL moment," when, after she had conducted a professional development workshop for teachers at a nearby school, the principal called her to report positive outcomes in student performance:

> The principal called me; she left a voice mail message… I think I may have deleted it, and I wish I hadn't, and… she said, "I just wanted you to know that over 50% of the students mastered the grade 4 literacy tests. And the students who did not master are near mastery. Of the group of students who sat the exam, I think less than ten of the cohort was no mastery." She said like 5 of the students were no mastery. She was like, "Thank you so very much for the work that you did." And I thought, it's not really me; it's the teachers.

Ms. Green explained that at first the teachers were skeptical about embracing a new framework and strategies, but after she had introduced the key principles and guidelines, the teachers worked in grade-level groups. Their task was "to pick one thing, one topic from their curriculum, and they were to 'UDL it,' and Ms. Green cheerfully recalled that even those who seemed resistant at first became engaged in the project. She credits some of this buy-in to the collaborative process, teachers coming together to create lessons and resources and share ideas.

For several teachers, the impact on student performance was closely linked to engagement; they saw improved skill mastery when students were interested in learning. They also noted that struggling learners benefitted from new strategies that emphasized multisensory approaches to content. Ms. Berry described "UDL as reinforcement," a way to get all students, even students who in traditionally-structured classes may have been left behind, to grasp the content:

> When you look at how some teachers present their information, some students have challenges. And so you realize that some students will not learn without being engaged and without visualizing it in that sort of way, and so using that will give them one more chance to get to the student, even the ones at the bottom, and bring them up… So at the end of the day your literacy and numeracy rate can go up so you are able to find that you have students mastering all years.

Instead of grouping students by ability, Ms. Berry, as well as some of the other Virtual Classroom participants (e.g. Ms. Williams, Ms. Adams), began grouping students by interest or learning style, and they reported that mixed-ability grouping had a positive impact on student performance. Higher-achieving students helped "pull up" others, and because groups shared certain preferences, teachers were able to introduce materials that were engaging. Other takeaways from the Virtual classroom that teachers felt were beneficial for students were graphic organizers and "chunking" material (i.e. presenting lessons in smaller segments). Participants expressed concern about the number of students whom they felt were not being served by more traditional lecture methods. Ms. Williams' statement to her class captures teachers' dedication to mastery and inclusion: "We are not leaving anybody behind."

Summary

This study used interviews with nine participants in the UDL Classroom to collect qualitative data about their experiences in the UDL Virtual Classroom project and its impact on their beliefs and practices. The researcher observed the classes of five participants and toured the schools of those who were not currently working as classroom teachers. A brief survey, administered at the time of individual interviews, was used to collect basic demographic data

about participants and their schools. Previously-collected data (Blog Posts, Survey 1, and Group Meeting 1) also informed the study. The findings reported in this chapter were based on the researcher's evaluation of these data sources. Analytical coding methods (Merriam, 2009) were used to identify patterns across participants and assign names to categories and descriptive examples from interview transcripts and observation notes.

Using HPL theory as an analytic framework for understanding the components of the Virtual Classroom project, the researcher found themes related to learner-centered, knowledge-centered, assessment-centered, and community-centered learning in teachers' descriptions of the project and their experiences as learners. The most widely discussed topics related to *learner-centered* professional development were *getting and keeping teachers involved*, *providing teachers with tangible benefits of participation*, and *benefits/challenges of technology and resources*. Two sub-themes emerged in teacher interviews that fell under category of *knowledge-centered* components of the program: *providing research-based evidence for best practices* and *exposure to and practice with resources.* The researcher identified only one theme specifically related to *assessment-centered learning*, the *feedback from facilitators and other participants* that was available in the Virtual Classroom and in meetings of the participant cohort. The final thematic category was *community-centered* learning, and participants' comments could be grouped according to two sub-themes: *shared resources and expertise* and *relevance to Jamaican context*. Furthermore, classroom observations and teachers' reflections on their own teaching practices and student impact revealed two broad themes that related to the impact of the program (i.e. what teachers took away from the Virtual Classroom and implemented in their own schools or contexts). Teachers described a number of *implementation challenges*, primarily related to *physical space*, *technology*, and *classroom resources*. They also

talked about the *program impacts* on *educator mindsets*, *teaching methods*, *student engagement*, and *student performance*. From analysis of these findings, the researcher was able to gain insight into the various learning components of the Virtual Classroom and their influence on education in real-world contexts. Figure 3 illustrates the ways that the UDL Virtual Classroom impacted teacher-participants, both as learners and as educators.

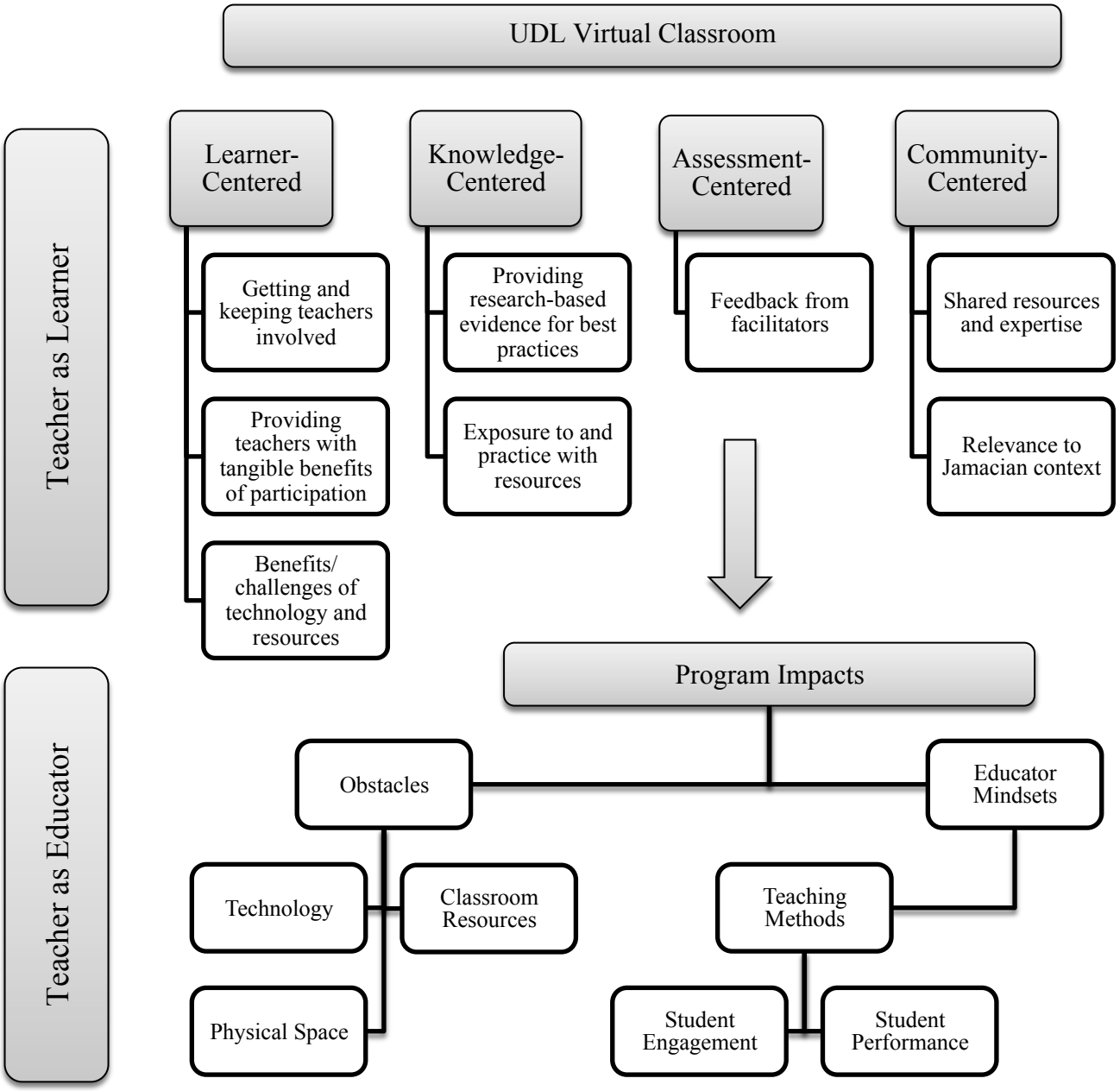

Figure 3. Impacts of the UDL Virtual Classroom

CHAPTER 5

DISCUSSION

This study applied the HPL lens (NRC, 2000) in order to understand the ways that educator-participants perceived the integration of *learner-centered* learning, *knowledge-centered* learning, *assessment-centered* learning, and *community-centered* learning in the UDL Virtual Classroom project. This study also examined the impact of these components, despite numerous hurdles, on teachers' mindsets and practices and the engagement and performance of students in their schools and classrooms. The researcher's intent was to address the contextual nature of teacher learning, which must contend with the challenges of meeting the needs of individual teacher-learners, as well as obstacles and real-world situations impacting the implementation of theories and strategies. Research that distinguishes long-lasting, instrumental professional development methods and programs is vital in order to prepare teachers to meet the demands of diverse classrooms and changing expectations for 21st century classrooms.

UDL is a relatively new framework for learning, applying the principles of universal design (Mace, Hardie, & Place, 1991) to learning environments, and the field of research is still somewhat limited. There are considerable gaps in the literature related to UDL and professional development, since most of the research on teacher training in UDL has taken place in postsecondary settings rather than in diverse schools and classrooms. Questions remain about whether UDL theories and practices, when taught to teachers, will have sustainable impact in real-world contexts. Furthermore, there is still much to be learned about professional

development for teachers beyond the scope of UDL training: what works or doesn't work and why? The researcher used HPL theory as an analytical framework to gain understanding about the components that made up a hybrid professional development program, which was a collaboration between university faculty and doctoral students in the United States and educators in Jamaica. The study examined the experiences of teacher-learners in order to identify the factors in the Virtual Classroom that made an impact or that participants felt needed improvement, as well as what happened when teachers returned to the classroom after completion of the program. This qualitative research sought to address the following questions:

1. How did the Virtual Classroom address the needs of participants as adult learners?
2. What obstacles to implementation of UDL existed for teachers following their participation in the Virtual Classroom project?
3. How have teachers applied UDL principles in their planning and teaching?

The study employed a multiple-case study design (Yin, 2009) to assemble qualitative data about participants' experiences in the UDL Virtual Classroom project and its impact on their beliefs, practices, and student outcomes. Research centered on observations and interviews conducted approximately one year after teachers completed the program, but it also incorporated survey responses and blog posts that were part of the original program, participants' comments during a follow-up meeting in October, 2014, and a group meeting between participants and the researcher in March, 2016. Participants also completed a brief survey, which was used to collect basic demographic data about the educators and their schools. The research findings reported in Chapter IV were based on the analysis of these data sources. The units of analysis were educators, all from different schools in a coastal parish in Jamaica, members of one of three

Jamaican participant groups. An interview with one additional participant, who was a member of another cohort, was also included because she was visiting the Resource Center (RC) on the day the researcher was observing. While she was not a part of the particular group in this case study, her responses were deemed significant by the researcher because her job with the Ministry of Education afforded her insight from a broader, national perspective.

While participant engagement, measured by the percentage of responses to prompts embedded in five online modules in the pilot study, was relatively high in the group studied (of the ten participants, one dropped out of the program early on, and one did not complete the final module), initial communications and survey data indicated that there were still challenges in terms of providing effective professional development, as well as noteworthy implementation gaps or obstacles to classroom incorporation of UDL. By studying individual teachers in this group, the researcher gained insight into the contextual factors that either positively or negatively affected teacher learning and the implementation of the theories and practices introduced in the program.

Summary of Findings

Analysis of interviews with participants and classroom observations revealed four key themes and eight sub-themes, which addressed Research Question One: How did the Virtual Classroom address the needs of participants as adult learners? These themes were organized according to the components of HPL in order to examine more closely the various aspects of learning identified and discussed by participants. Because the researcher had structured interview questions according to HPL components, participant responses fell naturally into these broad categories: *Learner-Centered* learning (Getting and Keeping Teachers Involved, Providing Teachers with Tangible Benefits of Participation, and Benefits/Challenges of Technology and

Resources), *Knowledge-Centered* learning (Providing Research-Based Evidence for Best Practices and Exposure To and Practice With Resources), *Assessment-Centered* learning (Feedback from Facilitators and Other Participants), and *Community-Centered* learning (Shared Resources and Expertise and Relevance to Jamaican Context). There was, however, considerable overlap among these, and in some cases quotations from interviews were double-coded.

Facilitators and participants indicated that educators chosen for the Virtual Classroom project were dynamic individuals with motivation to learn. The lead facilitator, Ms. Evans, explained that she had sought recommendations from area principals in order to recruit innovative, passionate teachers and leaders, who would make the most of the opportunity and would return to their schools to share knowledge with other professionals. Similarly, participants indicated that leadership played a key role in their motivation, and certainly some success of the program may be attributed to purposeful selection rather than the Virtual Classroom itself. Nevertheless, while the majority of participants remained engaged throughout the course and overwhelmingly agreed that they valued their experience in the Virtual Classroom, they did identify areas for improvement and made recommendations for forthcoming projects. For example, as a way to validate participation and to encourage more educators to get involved, several teachers suggested that future participants be awarded a certificate of completion or course credit.

Participants' reflections indicated that the hybrid design of the Virtual Classroom, which combined online modules and face-to-face meetings of facilitators and teacher-learners, was preferable to the one-time workshop/presentation or exclusively online courses that are more often customary for professional development (Avalos, 2011; Kriek and Grayson, 2009). Participants said they benefitted most from the opportunity to come together with other educators

on a regular basis, sharing ideas and feedback, and these group-learning experiences were important complements to the online modules. While the Virtual Classroom's design and resources were developed in response to ongoing needs assessment, and creators noted cultural sensitivity and relevance among the core considerations in program design (Reed, Smith, King, Wojcik, & Temple, 2014, May), collaboration with local facilitators was a key strength of this particular program because these on-site leaders had much greater contextual insight and were able to take steps to bridge any cultural gaps.

Most of the teachers in the program had no prior knowledge of UDL theory; however, they all said that the principles and practices aligned with and/or expanded upon what they were already doing in their classrooms, especially in terms of reaching struggling learners. Because of its focus on inclusion and accessibility within general education settings, UDL was seen by many to be a viable approach for Jamaican education, where special education settings and services have historically been limited, and newly instituted special education policy has called for expanded inclusion and provisions for students with disabilities (ESTP, draft 2015). Furthermore, the emphasis that UDL places on engagement as a vital component of learning was appealing to educators, especially as they have sought more effective strategies to engage boys, who seem to underperform in the current system.

In addition to the sub-themes that fell within the scope of HPL, others findings were categorized under the codes *Implementation Challenges* (Physical Space, Technology, and Classroom Resources) and *Program Impacts* (Educator Mindsets, Teaching Methods, Student Engagement, and Student Performance). Participants discussed these two themes extensively, so while they were originally grouped under the *Community-Centered* heading in the interview protocol, the researcher assigned separate codes because these questions most directly answered

Research Question Two: What obstacles to engagement and implementation exist? (*Implementation Challenges*), and Research Question Three: How has this program impacted teachers' planning and implementation of lessons in the classroom? (*Program Impacts*). Findings from survey responses and blog posts, which were part of the original program, participants' comments during Group Meeting 1 (a follow-up meeting with UDL classroom designers and the researcher in October, 2014), and comments during Group Meeting 2 (a focus group in March, 2016) also contributed relevant data regarding challenges and impacts. These two themes pertained not to the Virtual Classroom program itself, but rather to the effects of the professional development, as participants' roles shifted from learners to educators (teaching other professionals or students in their classrooms). When asked about implementation of UDL strategies following the Virtual Classroom program, all teachers noted the dearth of resources available in Jamaica, especially limited technology and facilities. Despite these challenges, teachers described several UDL "successes," evaluated in terms of changing attitudes about inclusion, student engagement, and student performance.

Interpretation of Results

Findings from this study provided insight into the ways that the Virtual Classroom project, both the online modules and the group learning components, addressed the needs of participants. Following up with participants approximately a year after their completion of the project, the researcher was also able to learn more about the ways that knowledge was translated into practice in classroom contexts and the factors, both positive and negative, that had an impact on UDL implementation. Results are interpreted first in relation to participants' experiences as adult learners in the Virtual Classroom project and the factors that impacted their engagement and learning. Results are then interpreted in terms of UDL application, when participants' roles

shifted from learner to educator in learning contexts outside the scope of the Virtual Classroom project.

Learning components of the UDL Virtual Classroom. According to Darling-Hammond and Bransford (2005), *learner-centered* learning takes into account individual strengths, interests, and preconceptions, and research on teacher-education has indicated variability in values, experiences, viewpoints, and practices of educators; these differences affect both their motivation to participate in professional development and their content and support needs (Avalos, 2011**;** Clarke & Hollingsworth, 2002; Gurskey, 1986; Hall & Hord, 2011; Helsing et al., 2008; James & McCormick, 2009; Sales et al., 2011). Professional development that is *learner-centered* may begin by addressing the concept of buy-in, and it also focuses on providing teachers with the tools and supports necessary to keep them engaged and efficacious throughout the process. Since involvement in the Virtual Classroom project was voluntary, and participants were purposefully selected because of their innovative practices and commitment to professional growth, one cannot attribute successful engagement to the design or content of the project itself; however, the enthusiasm with which participants approached this learning experience was certainly a factor in its effectiveness, and this is consistent with what has been shown in professional development literature (e.g. Avalos, 2011**;** Clarke & Hollingsworth, 2002; Helsing et al., 2008).

The role of the facilitator was likewise a contributing influence, for several teachers alluded to Ms. Evan's excitement and dedication and said it motivated them to get and stay involved. The researcher noticed this right away; Ms. Evans was a dynamic leader whose passion was not only evident, it was infectious. She was well-known throughout the parish, as well as in other parts of Jamaica; as a former member of the Ministry of Education and a veteran educator,

she had earned the respect of others in the field of education. This was obvious in the way that others talked about her and interacted with her. Furthermore, because she and the other on-site facilitator worked with struggling students at the RC and at schools throughout the region, they were well-versed in the current educational circumstances, and their insights at both the local and national level were valued by teachers. The significance of supportive leadership (Jurasaite-Harbison & Rex, 2010; NRC, 2000; Ross & Bruce, 2007) and motivation to make changes based on current situations or needs (Clarke et al., 1992 Clarke & Hollingsworth, 2002; Ganley & Ralabate, 2013) have been identified as driving forces of participant buy-in, and this study supported the assertion that enthusiastic and involved leaders can make a difference in the way teachers approach and interact with a learning experience.

Because of the program's structure, which combined online resources and expertise from U.S. faculty with local leadership, participants were able to benefit from both the self-pacing and flexibility of online learning (that included theory, research, and innovative methods), and the collaborative and context-specific learning that group meetings provided. These elements have been identified as crucial components for teacher learning (Dede et al., 2009); theoretical knowledge and evidence-based practices must be integrated with instruction about how to use this knowledge in ways that align with teachers' goals, existing curricula, and mandated standards (Barone et al., 1996; Guskey & Yoon, 2009; Helsing et al., 2008; NRC, 2000; Rose & Church, 1998). Most teachers said they preferred the hybrid model of professional learning because it offered the benefits of both web-based instruction and hands-on, face-to-face interaction. Their preferences mirrored what has been shown in the literature by Owston et al. (2008), who advocated the use of blended learning for professional development because it offers both individualized relevance and hands-on experimentation with community support and

relevance. The Virtual Classroom design certainly aligned with this model, and because its Wordpress platform and online modules were flexible enough to allow for context-specific customization, it had the capacity to be utilized in diverse cultural settings. Program designers were deliberate in their development of both the learning site itself and the resources provided, using a multi-tiered needs assessment to identify learners' particular areas of interest, along with technology preferences and needs (Reed et al., 2014). Despite their commitment to creating a relevant, culturally sensitive learning platform, there were areas of weakness identified by users (e.g. the usefulness of Bookbuilder in classrooms without computers or internet, or the need for particular strategies for classrooms with large numbers of students and inflexible seating), and certain gaps between American and Jamaican contexts that became more apparent only after participants had gone through the modules. These were by no means fatal flaws, but rather issues that could be evaluated and fine-tuned in future projects. Further research is needed to examine application of the Virtual Classroom with additional cohorts, not only in Jamaica but also in other American and transnational settings, for there is much to be learned from international partnerships for teacher education and resource sharing.

Teachers in many schools had to purchase their own classroom materials, download online resources at home, and fund further education opportunities with little or no assistance. This is certainly not unique to Jamaican educators. According to an online survey by the NPD Group of over 1,000 educators in public and private K-12 schools in the United States, over 85% of teachers purchase classroom supplies using their own money (Meyer, 2015, March 30). A similar study conducted by The National School Supply and Equipment Association (NSSEA, 2013) found that 99.5% of teachers reported spending their own money on school supplies, a total of $945 on materials for their classrooms during the school year. In schools with limited

resources such as the ones observed in this study, the burden on teachers to create or purchase tools for learning, including basic supplies such as paper and writing instruments, can be significant, and this issue was raised numerous times in blogs, interviews, Survey 1, and group meetings. Because of these demands, participants voiced support for incentives to encourage teachers to take on the added work of engaging in ongoing professional development. In addition to completing online modules, teachers in the Virtual Classroom had committed to meeting with the group numerous times over the course of the project, and this required travel to the RC and the dedication of after-school hours. It seemed reasonable to the researcher that their efforts be formally acknowledged in a way that could be reported to their school principals and colleagues.

This idea of incentives for teachers to engage in professional learning is supported in the literature. Hill (2009) reported that teachers in the United States generally "engage in only the minimum professional learning required by their state or district each year" (p. 471), in part because of competing demands, but also because "teachers face only modest inducements to invest in their own learning" (p. 473). Hildebrandt and Eom (2011) examined motivational factors of teachers, including improved teaching, financial gain, collaboration, self and external validation. They cited Ingersoll, Alsalam, Quinn, and Bobbitt's (1997, p. vii) definition of teacher professionalization, the "movement to upgrade the status, training, and working conditions of teachers," and include in this the credentials, induction, professional development, authority, and compensation of educators. For countries like Jamaica, where resources are lacking and graduate opportunities are limited, teachers may be able to use a certificate of program completion (or similar documentation) to increase their own professionalization and open doors to leadership opportunities. Literature related to teaching as a profession has revealed a rather fixed career trajectory, one "lacking adequate recognition and leadership roles" (Taylor,

Yates, Meyer, & Kinsella, 2011) for veteran classroom teachers who pursue professional development related to teaching and learning; often teachers who want to advance in their careers must take on administrative or management roles rather than staying in the classroom. While the absence of such documentation did not dissuade teachers from participating in the Virtual Classroom project, perhaps due to the purposeful selection of participants, the inclusion of this tangible benefit was among the most common suggestions made for future programs. After receiving feedback from participants during Group Meeting 1, program designers created a certificate of completion and shared this with facilitators; however, it did not appear that this had been subsequently distributed to participants. Further research is needed to see what kinds of incentives would encourage teachers to expand their knowledge of effective practices, whether under the umbrella of UDL or other research-based frameworks, giving them the opportunity to grow professionally while keeping them in the classroom where their acquired expertise has the potential to benefit students directly.

While a certificate or credit hours might be incentive for a teacher to participate, at least in terms of allocating the minimum number of hours necessary, program material must be deemed applicable and worthwhile by teachers in order to encourage real engagement and potential for change and growth. Hill's (2009) analysis of existing problems with professional development outcomes noted that most teachers in the United States take part in "only the minimum professional learning required" and, according to available evidence, "teachers apparently have little use for their learning experiences" (p.471). The researcher could not find analogous data specific to professional development in Jamaica, but anecdotal evidence (interviews, Group Meeting 2) indicated similar experiences among participants and their teaching peers. While educators in the program did note that the principles and practices of UDL

were not entirely new, most did say in blogs, group meetings, and interviews that what they learned in this program often reinforced and built on existing practices. There are several questions that this finding raised: Was there enough *new material* here to make UDL professional development worthwhile? Were teachers in the program able to distinguish UDL from other frameworks or strategies (e.g. differentiated instruction)? Did the Virtual Classroom provide an effective balance between theory and practice?

There may be a need for additional, focused studies to address these questions in depth, especially because without explicit links between UDL and strategies, it is difficult to determine accurately the impact of UDL training on teachers' understandings of the content. Participants in the Virtual Classroom reflected that in many cases they had already been *doing UDL*, noting strategies such as the use of manipulatives or other engaging tasks, and they also described learned practices that complemented what they were already implementing in the classroom. While Edyburn (2010) disputed statements like "UDL is just good teaching" or "many teachers are already doing UDL; they just don't know that's what it is called," previous studies (Courey et al., 2012 ; Hinshaw & Gumus, 2013; McGuire-Schwartz & Arndt's, 2007; Spooner et al. (2007), in addition to this one, have indicated that the distinction of UDL from other learning frameworks is still quite blurred. For some teachers in the Virtual Classroom project, the fact that UDL built on what they already knew was an advantage; it gave credence to what they saw working in the classroom and offered ways to expand their repertoire of effective practices to reach struggling students. Smith & Tyler (2011) found that teachers have limited access to new theories, practices, or learning opportunities due to time or resource constraints, and this may influence the way that educators feel about the demands of keeping up with current research and teaching students with disabilities; this study supports the need for the kind of deeper learning

and deliberateness of design to reach low-performing students advocated by Edyburn (2010). Concern for students who were struggling or disengaged was universal among participants, and while one teacher did say that she wanted more in terms of practical applications and examples, no teacher indicated a conflict between UDL and existing beliefs about inclusion or learner variability. Because the content of the Virtual Classroom aligned with teachers' pre-existing goals, they tended to view it more positively. This finding is consistent with the research of Sales et al. (2011), who found that when teachers saw a need for change and were given the strategies and support to make that change, positive steps toward school transformation were possible.

Central to the idea of *knowledge-centered* learning for teachers is the challenge of addressing the gap between research and practice (Fixsen et al., 2005). Literature has shown that when teachers learn only generalized theories or pedagogy, they often have difficulty applying what they have learned when they return to the context of their classrooms (Desimone et al., 2002; Guskey & Yoon, 2009; Helsing et al., 2008; NRC, 2000; Rose & Church, 1998). Conversely, many professional development programs teach strategies without research to support them (Barone et al., 1996; Hill, 2009; NRC, 2000), and finding the balance between research and practice is certainly a challenge in all instances. In the Virtual Classroom, teachers showed some variation related to their evaluation of the effectiveness of the theory-practice balance, and this may have been, in part if not primarily, a matter of personal preference. The researcher noted, while reflecting upon the differences of opinion among participants, the potential of the Virtual Classroom platform to examine and address this variability. Because of its flexibility and capability for individualization, the digital format of the UDL Classroom could be utilized to offer participants options for further exploring the components, whether theoretical or practical, that they deem to be most relevant to their own learning needs by allowing them to

choose links to expanded materials that best suit their teaching contexts and interests. If this further development were to be incorporated, one might be able to evaluate which options were most accessed and then build additional resources accordingly. This was a stated goal of Virtual Classroom project designers, who described the curation of resources based on expressed needs and interests (Reed et al., 2014), and future prototypes may be able to extend this element further so that teacher-learners would have options for personalization of content.

Professional development that encompasses understanding of the learning processes in addition to content is critical. Research indicates that "usable knowledge" (deeper learning) is "not the same as a mere list of disconnected facts. Experts' knowledge is connected and organized around important concepts … it is 'conditionalized' to specify the contexts in which it is applicable; it supports understanding and transfer (to other contexts) rather than only the ability to remember" (NRC, 2000, p.9). One of the strengths of the Virtual Classroom's blended model of online and face-to-face learning, extended over a period of several months, was that it afforded teachers the opportunity to try out new practices or tools throughout the course of the program. The length of the program distinguished it from the more typical "one shot" professional development, and this type of longer-term, supported learning experience has been advocated by researchers (Cochran-Smith & Lytle, 1999; McLeskey & Waldron, 2004) because teachers have the opportunity to acquire knowledge and put it to use with reflection and feedback.

This study's findings about the benefits of longer-term, blended learning, which combines theoretical knowledge with hands-on application of learned strategies, were consistent with McLeskey & Waldron's (2004) study that concluded that longer-term, supported learning experiences offer an advantage over one-time workshops or lectures. Cochran-Smith & Lytle

(1999) identified this as *knowledge-of-practice*, which brings together *knowledge-for-practice* (theoretical knowledge) and *knowledge-in practice* (knowledge gained in the classroom about what is or is not effective). Likewise, positive outcomes have resulted from teacher learning that incorporates both outside experts and peer learning opportunities to provide both knowledge and practice (Guskey & Yoon, 2009), and this was certainly an advantage of the Virtual Classroom project's collaborative design. Participants benefitted from UDL expertise provided by American faculty through the learning modules, and group meetings with local facilitators and other teachers gave them the opportunity to explore these ideas in contextually specific ways.

Teachers said that they liked being able to gradually integrate strategies, building on what they had done previously and making adjustments as needed. Some, however, reported a need for more specific takeaways, materials they could take with them to apply in the classroom. Because of limited time and resources available at their individual schools, teachers said it would have been helpful to have materials readily available. The challenge of this, of course, is that what is relevant and constructive varies from teacher to teacher. Discussions among participants, both in interviews with the researcher and in group meetings, introduced the proposition of creating a centralized resource library and workspace, perhaps at the RC, where teachers could borrow tools such as learning games or activities and access technology tools like copiers, printers, and computers that may not be readily available at their own schools.

Feedback was an integral part of the collaborative learning experience, as teachers tried out ideas and came together to share, and participants identified this type of peer learning as the most beneficial component of the Virtual Classroom program. While course modules provided UDL principles and strategies, teachers identified the opportunity to apply in context what they had learned as a significant strength of the program. Teachers were able to reflect upon their

successes, failures, and challenges and communicate with others in order to gain understanding and brainstorm solutions. This feedback, so often a rarity in education, has been shown to be critical to teacher learning (Antoniou & Kyriakides, 2013**;** Guskey & Yoon, 2009; Hall & Hord, 2011; Ross & Bruce; Sales et al. 2011). Participants in the Virtual Classroom said that they valued this feedback, and since the group met every other week over an extended period of several months, they had the time and flexibility to implement various strategies and make modifications when needed. HPL theory supports the importance of this type of learning because it gives teachers "evidence of success" and also "opportunities to clarify ideas and correct misconceptions" (NRC, 2000, p. 196). Research has shown, however, that the typical professional development timeframe is insufficient in terms of providing ongoing support (Dede et al., 2009; McLeskey & Waldron, 2004). Even in light of the program's extended duration, teachers in the Virtual Classroom reported, both shortly after and a year following the program, that they needed more time to practice new skills and get advice; however, in the year after they had completed the program, participants had not found a way to maintain feedback and collaboration. It remains unclear what kind of leadership is necessary to organize and sustain a system for implementation feedback, and this is certainly an aspect of the program requiring further research and development. Other studies have advocated PLCs or other cooperative learning structures for achieving this (Clarke & Hollingsworth, 2002; Cochran-Smith & Lytle, 1999; Dooner et al., 2007; Owston et al., 2008; Richmond & Manokore, 2010; Shank, 2006), as well as researcher-driven assessments of implementation fidelity (Bell et al., 2010; Fixen et. al., 2005; James & McCormick, 2009; Rose & Church, 1998). The challenge, nevertheless, in contexts such as the Jamaican schools where this study took place is that resources (financial, physical, and personnel) to implement these types of structured systems of feedback and

assessment are not readily available. Richmond and Manokore (2010) looked at Professional Learning Communities (PLCs) in a Title 1 urban school, which shared some characteristics with Jamaican schools (i.e. limited financial resources, low test scores, inadequate staffing, and high poverty rates), and their work highlights the need for collaborative learning opportunities in settings where contextual factors impact both teacher morale and professional support for teacher learning. Alternative or modified structures for ongoing feedback such as virtual PLCs, perhaps through social media or other online platforms, may offer possible solutions, and this is an area where future inquiry may lead to improved professional development outcomes for teachers in schools with limited means.

Longer term professional development also offers opportunities for self-assessment, which numerous studies (Clarke & Hollingsworth, 2002; Gurskey, 1986; James & McCormick, 2009; Ross & Bruce, 2007) have indicated is beneficial for professional growth; however, in most of these cases, teachers were prompted to reflect on their own practices in a structured way, through the use of a self-assessment tool or questions posed by a researcher or peer. In the Virtual Classroom, this prompting came in the form of embedded questions in learning modules and group discussions. During interviews, teachers reflected on what they had implemented in the classroom, but no teacher indicated that she had been doing this on her own in any formal way, either before or after participation in the Virtual Classroom. While teachers may learn from mistakes (e.g. a lesson that fails to engage students or produce content mastery) throughout their careers, they need guidance and support to make substantive changes in practices. Ross and Bruce (2007) concluded that a self-assessment tool alone was insufficient to bring about change without incorporating strategies such as peer coaching, observation and input from "external change agents," and focused feedback on teaching strategies Fixen et al. (2005) discussed

feedback "loops;" formative and ongoing, assessment, that continues for prolonged lengths of time (months or even years) to allow opportunities to learn from mistakes, identify barriers or supports, and generate solutions for future problems (Fixen et. al., 2005). This kind of information can inform not only future implementation but also future learning. The reality, however, when one considers the feasibility of feedback "loops" in diverse educational settings, is that they require patience and persistence (Fixen et. al., 2005), not to mention time and personnel. It may be especially difficult to create these kinds of opportunities in schools with limited resources, and questions remain about the type and duration of feedback and reflection needed in order to be effective.

Queries about ongoing feedback and implementation fidelity highlight an important gap in the literature related to UDL professional development (e.g. Courey et al., 2012; Spooner et al., 2007), which has primarily taken part in postsecondary settings where there is high support and motivation to perform. Because teacher preparation and graduate classes typically take place over the course of a single semester, there is limited data about the long-term impacts of any reported changes that particular training may produce. In the Virtual Classroom blogs, teachers reported incorporating learned strategies over the course of completing each module, and the structure of facilitated group meetings encouraged deliberate planning and reflection. Nevertheless, classroom observations a year later offered only snapshots, making it difficult to provide any sort of comprehensive evaluation of UDL, and teachers' remarks about obstacles and the desire for further collaboration/feedback indicate that the shift from professional development to the classroom was not an easy one.

Program Impacts. Classroom contexts were vital to understanding numerous aspects of both the UDL Classroom itself (i.e. its relevance and efficacy) and the impact of the program on

teachers' practices and student incomes. Just as the components of HPL theory are all situated within the context of community (see Figure 1), participants' experiences as both adult learners and educators were grounded in their settings and circumstances. While particular aspects of the Jamaican education system (e.g. national curriculum, policies for general and special education) were unique to this study and may initially seem irrelevant outside of Jamaica, there are numerous components that are indeed shared by a myriad of classrooms internationally. In order to close the gaps of educational inequality (Artiles, 2011; Breen & Jonsson, 2005; Kanter, 2011; Reardon, 2011; U.S. Department of Education's "Blueprint for R.E.S.P.E.C.T", 2013; Wagner, 2008), it is crucial to understand the way teachers learn and implement strategies in schools with limited resources and technology in order to develop professional learning that will meet their needs and bring about positive educational outcomes. According to the Caribbean Group for Cooperation and Development (CGCED), similar challenges are faced by small island developing states (SIDS), and the group's proposal calls for positive, innovative educational reform: "In the smaller countries in particular, there will be a need to search for creative approaches to offer the diversified curriculum and services in a cost-effective way" (Jules, Miller, & Armstrong, 2000, p. xi). In these areas with limited technology, research will need to find low-tech, applicable solutions, and UDL strategies that have been shown to be effective with small groups of students will need to be applied and studied in settings where class sizes are larger and furniture is inflexible. Educational inequality is a global issue, and contributing factors include (but are not limited to) disability status, socioeconomic characteristics, race and culture, and local resources and school funding (Artiles, 2011; Breen & Jonsson, 2005; Kanter, 2011; Reardon, 2011; U.S. Department of Education's "Blueprint for R.E.S.P.E.C.T", 2013; Wagner, 2008). Several of these issues proved to be challenges identified by this study's participants.

Since many of the tools and strategies available through CAST involve the use of technology to provide multiple means of representation, action/expression, and engagement, further research is needed to explore options that require few or no electronic components. By focusing on creativity and flexibility, teachers may find ways to increase accessibility without technology, but most UDL research spends little time exploring these options. This research could be an important step towards designing professional development for teachers in impoverished districts or schools. A new study of the role that technology plays in UDL is currently in submission to journals for publication (Rose, Gravel, & Domings, n.d.), and a summary (http://www.udlcenter.org/resource_library/articles/udlunplugged) indicated that authors examined the question of "whether technology is central to the foundations of UDL or whether UDL is useful as a pedagogical framework that goes beyond technology." This research will be valuable for understanding ways that UDL may be translated into practice in low-tech ways, and looking beyond technology could be crucial for developing a deeper knowledge of UDL and the ways this framework seeks to address issues of accessibility and deeper learning.

All of the UDL literature reviewed for this study included the incorporation of technology into lessons (e.g. using multi-media presentations or digital texts) as evidence of UDL application, but in some cases (e.g. McGuire-Schwartz & Arndt, 2007; Hinshaw & Gumus, 2013) authors did not explain specific connections to UDL principles. When there is little to distinguish UDL, as operationalized by authors, from technology integration, there is indeed a risk of thinking about UDL as merely a list of tools (McGrath, 2014, March) or implementing technology without a broader perspective about learning. Edyburn (2010) warned that such thinking represents fundamental misunderstandings about "the emphasis that UDL places on functions of design, proactively valuing diversity, and intentionality" (p.38). Other UDL

advocates have voiced similar concerns, pointing out that technology is a tool, not an initiative or overarching framework (Van Horne, 2014, March), and suggesting that educators should be cautious about implementing technology without a broader perspective about learning. In the context of this study, it was evident in participant blogs and interviews that some teachers still had a surface understanding of UDL and had not achieved the "deeper learning" (NRC, 2000) that Edyburn (2010) advocated. This is certainly not unique to this group of adult learners, and having research that looks at UDL apart from technological aspects may be an important way to focus attention on the issues of learner variability, accessibility, and design that are central to this learning framework. Furthermore, when conversations about teaching and learning through a UDL lens are not centered on technology integration, it may be easier for educators in schools with limited resources to find meaningful applications of UDL in these contexts.

One reason that many previous studies of UDL implementation may have focused on the use of technology to provide multiple means of representation, action/expression, and engagement in the classroom is that these components are easy to identify in practice. Using UDL guidelines as a checklist, an observer can note the use of multiple media, assistive technology, graphic organizers, or rubrics to clarify expectations and promote self-regulation; however, checklists and other frequency measures tell only a partial story, and in some cases can be misleading indicators of the effectiveness of implementation. UDL researchers and practitioners (Basham et al., 2014, March; Diedrich, Howery, & Ralabate, 2012, April; Edyburn, 2010; Katz, 2013; McGrath, 2014, March; Meyer et al., 2014; Nelson, 2014; Rappolt-Schlichtmann et al., 2012; Rose, 2014, March) have warned against watering down UDL to a checklist of strategies, while acknowledging the challenges of operationalizing UDL as an independent variable for the purposes of research and evaluation. The researcher's observations

in this study confirmed this, for "more UDL" (as summarized in Table 1) did not necessarily translate into improved student engagement. In the case of Ms. Turnage's class, the teacher used a variety of tools (e.g. Powerpoint with audio, a popular music parody, group activities, writing prompts), and yet students demonstrated low levels of engagement throughout the class. A study by King-Sears et al. (2014) similarly found that UDL treatment was not more effective compared with the comparison group, and authors noted a need for further refinements of the UDL condition. These examples corroborate the need for research across settings, subjects, and participant populations, as well as further development of instrument and guidelines that will make it more feasible to identify and measure UDL in practice.

Implications

Results from this study inform practice in the development of both learning opportunities for teachers and the supports they need to successfully implement UDL principles in their planning and teaching.

Implications for professional development. The findings confirm previous research on professional development, highlighting several key favorable components: extended interventions (Avalos, 2011; Hall & Hord, 2011; Kriek and Grayson, 2009; McLeskey & Waldron, 2004), online and face-to-face resources for learning and reflection (Jenkins et al., 2006; Owston et al., 2008; Smith & Tyler, 2011), teacher co-learning and feedback (Darling-Hammond & Bransford, 2005; Ross & Bruce, 2007; Shank, 2006; Skerrett, 2010), and applicability of content in context-specific ways (Desimone et al., 2002; Ganley & Ralabate, 2013; Guskey & Yoon, 2009; Helsing et al., 2008; Rose & Church, 1998). Despite what the literature has shown to be effective for the engagement of adult learners, numerous studies have indicated that most professional development opportunities do not succeed in giving teachers

what they need (Avalos, 2011; Guskey, & Yoon, 2009, Hall, & Hord, 2011; Hill, 2009; Rose & Church, 1998). Teachers have reported dissatisfaction with one-size-fits-all models that are generic and short-term, often consisting of a single lecture or workshop with little or no opportunity for teachers to apply what they learn or make connections between theories and practice. While the one-shot professional development programs may be cheaper and easier to create, if they do not engage teachers or have an effect on practices, they serve little purpose and are ultimately a waste of both time and money.

By using a hybrid model for professional development, teacher-educators and program designers may be able to provide customization of resources, access to outside expertise, and the flexibility of online learning (Dede et al., 2009;Smith & Tyler, 2011; Owston et al., 2008; Picciano & Seaman, 2010; Rose & Gravel, 2012) with guided, hands-on practice collaboration and peer problem-solving (Ganley & Ralabate, 2013; Hall & Hord, 2011; Sales et al., 2011). Web-based platforms can be used to share ideas and strategies across contexts, and for teachers in isolated areas or international settings where professional development opportunities are limited, this type of learning may open doors to furthering one's education and expanding one's knowledge base and practices. Findings from this study indicated, however, that online learning alone is often insufficient; teachers said they benefitted most from cooperative experiences that allowed them to try out practices and exchange feedback.

Assessing the needs of teachers is critical for developers of professional learning. This study illustrated that cultural sensitivity and contextual awareness are important factors to consider when choosing both platforms and content for teacher learning. Just as UDL researchers have highlighted the role that engagement plays in student learning, professional development literature has illustrated the importance of teachers overcoming their *immunities to change*

(Helsing et al., 2008; Kegan & Lahey, 2001) and being open to new ideas. Since teachers vary significantly in terms of learning needs and preferences, professional development needs to look at flexible designs that will allow learners to customize both the way they receive content and the content itself.

Implications for UDL practice. Related to the design of professional development and the benefits of feedback, teachers need long-term guidance and scaffolding as they implement UDL strategies. The UDL implementation process, based on the research of Fixsen et al. (2005), consists of five phases: (1) Explore, (2) Prepare, (3) Integrate, (4) Scale, and (5) Optimize; however, often teachers complete a professional development program and are then on their own when they return to the classroom. Participants in this study did have an extended timeframe in which to try out new strategies and resources in a gradual way, getting feedback throughout the process, but most expressed interest in continuing some form of collaboration and many said they needed additional instruction in UDL-related tools and resources. Research has shown that teachers need opportunities to practice, see results, reflect, and make necessary adjustments (e.g. Antoniou & Kyriakides, 2013; Clarke & Hollingsworth, 2002; Ganley & Ralabate, 2013; Hall & Hord, 2011; Helsing et al., 2008), and incorporating structures within individual schools or school systems to encourage this type of ongoing learning may improve implementation fidelity and impact on students.

The Jamaican schools in this study faced numerous challenges related to resources: technology, physical space, classroom materials, and school personnel. While this participant group was quite small, research on education in numerous, international settings indicates that many schools and systems face similar obstacles (Epstein & Yuthas, 2012; Jules, 2008; Jules et al., 2000; Richmond & Manokore, 2010). Because schools in impoverished areas are often

characterized by barriers such as low test scores, high dropout rates, and inadequate staffing, it is important not only to provide training to help teachers increase student engagement and performance by implementing innovative, research-based methods, but also to design and provide low-tech, low-cost resources to facilitate classroom learning. Edyburn (2010) argued that "to suggest that the potential of UDL can be achieved without technology is simply another way to maintain the status quo" (p.38), but this type of thinking leaves many schools and students behind.

Finally, because of its emphasis on inclusion and learner variability, an understanding of UDL theory has potential to change attitudes about special education, accessibility, and program design. By definition, UDL is universal; it does not propose teaching "one way" and then offering remediation for those who fail to make progress. Instead, the focus is on designing curricula and lessons that are flexible and accessible to meet the needs of many kinds of learners. Several participants in this study remarked that the Virtual Classroom gave them the language and empirical backing to talk to other educators, policy-makers, and stakeholders about inclusion. In settings like the one in this study, where misconceptions and negative stereotypes often pose significant barriers to equal educational access for students with disabilities, these conversations, backed by research on learning and neuroscience, may pave the way for better educational opportunities.

Implications for policy. In Jamaica, new special education policies are still being put into place, and objectives include early identification, appropriate education placement and services in the least restrictive environment, promotion of public awareness of disabilities and educational equity, and professional development for teachers and other school personnel (ESTP, draft 2015). The findings in the Virtual Classroom study, particularly those related to program

impacts on teacher mindsets and practices, have implications for ways that the Ministry of Education may design outreach programs for stakeholders, including teachers, as it works to achieve these goals.

This case study indicated that even with high initial engagement of teachers, program impacts may be limited without ongoing feedback and contextual relevance. This study confirmed previous findings (e.g. Owston et al., 2008) about the benefits of hybrid learning, as well as findings (e.g. Antoniou & Kyriakides, 2013; Clarke & Hollingsworth, 2002; Ganley & Ralabate, 2013; Hall & Hord, 2011; Helsing et al., 2008) about the need for longer-term programs to give teachers opportunities to apply what they learn in their own classrooms. These insights suggest that policy-makers, not only in Jamaica but also internationally, should consider long-term impacts and invest in quality professional development programs, rather than funding short-term workshops that may not bring about substantive changes in teacher mindsets or practices.

This case study also illustrated some of the advantages of using web-based platforms to create opportunities for educators to build knowledge about instructional methods by sharing their knowledge, resources, and teaching experiences across different contexts. Online social learning communities can provide important platforms not only for learning, but also for international collaboration. The American Council on Education (ACE) has embraced new strategies for global engagement, noting, "As the first decade of the 21st century drew to a close, American higher education was inextricably part of a global milieu that was vastly more interconnected than ever before" (Pelletier, Winter 2012). The Virtual Classroom project, while small in scale, demonstrated some of the benefits of international collaboration; Jamaican educators had the opportunity to access expertise and resources that were not available within

their current system, and students and faculty from the United States were able to learn about education practices and cultural components that were different from their own. Through these interactions, new relationships and partnerships were forged, and in the increasingly globally-connected 21st century, these types of relationships may expand both opportunities and cross-cultural understandings. Findings from this case study support claims by ACE:

> Inherent in the global interconnectivity that is the reality of our era is abundant promise and opportunity, not just for colleges and universities in the United States but indeed for institutions of higher learning around the world... now is the right time for leaders in higher education, and the institutions they serve, to do all they can to capitalize on those opportunities (Pelletier, Winter 2012).

This case study also highlighted considerations that should be made by universities when establishing these types of opportunities. The Virtual Classroom combined international and local leadership, and this format offered advantages because local facilitators, familiar with government policies and participants' schools, were able to help bridge potential gaps that may not have been evident to program designers. Some of the identified program challenges, such as adapting UDL practices to meet the needs of Jamaican school settings, emphasized the need for cultural sensitivity and relevance when creating or sharing resources, and these considerations have implications not only in education, but also in any situation that occurs across international contexts.

Limitations

Despite extensive steps taken to ensure quality and rigor across study design, implementation, and interpretation of results, this research study has several limitations.

Interpretations of research findings are far from conclusive and raise numerous questions for future research (discussed below). Data collected through classroom observations, group meetings, and interviews were subject to time limitations because of the overseas location of the participant group. The researcher did not have the opportunity to spend multiple days in each participant's classroom and therefore had only a snapshot of classroom practices, rather than collecting observational data over long periods of time. LeCompte, Preissle, and Tesch (1993) claim that long-term data collection increases internal validity, so in order to address this possible limitation, the researcher closely examined the classroom context over the course of a several hours, compiled extensive field notes, and sought clarification and insight from participants during subsequent interviews and a follow-up focus group meeting. When possible, the researcher also gathered classroom data in the form of photos, copies of lesson plans, and examples of student-produced work.

Since blogs, group meetings, and interviews relied on participants' perceptions and self-reports, there may be limitations due to perceived social desirability or demand characteristics (Fowler, 2009; Merriam, 2009; Mitchell & Jolley, 2010). Evidence of "UDL success" in this study came primarily through anecdotes, and this evidence should not be used to make definitive statements about the impact the Virtual Classroom. Despite this limitation, there is considerable insight to be gained from teachers talking about the impact of UDL on them as educators, about their relationships with students, and the effects on student engagement. As noted by McGrath (2014, March) educational change is a social process, and substantive reform can be achieved through storytelling that allows people to see themselves in the narrative.

Because classroom observations were scheduled in advance, there exists the possibility that lessons were designed with that in mind, rather than representing typical daily practices. To

address these issues, the researcher informed participants that the purpose of this research was to gain insight into the effectiveness of the UDL Virtual Classroom in order to identify obstacles to UDL implementation and make improvements in future teacher-learning projects. Furthermore, participants were informed that data collected in interviews and classroom observations would be kept confidentially and reported in aggregate form to encourage honest responses.

Since participation in this case study research was voluntary, there was a possibility that some participants from the initial pilot study would not agree to be interviewed. This, however, was not the case. The researcher was able to reach only six of the participants because one was no longer on the island, and contact information was not available. The other participant not included in this study had dropped out of the program after the first session, and the researcher was not able to make contact with him. Having his input would have been a beneficial component of this study, since it is not known why he did not remain in the program. Because not all participants were available for interviews and observations, findings may not represent the full range of experiences, and some meaningful data and interpretation may be lost. However, blog posts and responses to Survey 1 were available for the participant who was out of the country at the time of the researcher's visits, and these data sources were included in analysis.

The researcher was involved in the execution of the original Virtual Classroom study and assumes the value of UDL implementation; therefore, there is some risk of researcher bias as a limitation of this study. Evaluating the extent to which teachers in the Virtual Classroom found the course's content valuable is indeed challenging, since participants were aware of the researcher's affiliation with the program and may have given responses that were somewhat biased. While the researcher played a role in the initial evaluation of the program, she was not a program designer, and the present study seeks not only to identify learning components of the

UDL Classroom, but also to look beyond initial participant engagement and learn more about the ways that school contexts influence implementation of learned practices. For the field of teacher education, related to UDL or other frameworks, there is much to be learned from both positive and negative outcomes, and as a practicing classroom teacher the researcher was sensitive to the challenges of translating theory to practice in real-world contexts. Addressing possible limitations related to bias, the researcher clarified her assumptions and perspective (Maxwell, 2005), offering candid examples of her own experiences with professional development and teaching in several secondary school settings. The researcher also employed a second coder, one familiar with UDL but not associated with the *UDL Virtual Classroom* project, during qualitative data analysis to help control for researcher bias by supporting the reliability of coding.

This study strove to gain understanding about the impact of this professional development project on teachers' learning experiences, attitudes, and practices, and this understanding is part of the researcher's long-term goal of identifying components of teacher training that will improve accessibility and engagement for students in a variety of contexts. Because the researcher also works as a classroom teacher, she is aware of the challenges that educators face when applying educational principles and learned practices in the context of the classroom, and this insight served to provide some balance to any bias she may have had as a researcher.

Recommendations for Research

This qualitative study has added to the limited body of literature addressing UDL professional development by describing factors that facilitated or hindered teacher learning and classroom implementation within a bounded system. Because subjects in the Virtual Classroom project were practicing educators, and data collection took place at various points over the course

of 1-2 years, this research expanded on previous studies, which have focused on UDL training in postsecondary settings, and has addressed the gap in the literature between short-term impacts in contexts with high levels of support and built-in motivation and the real-world context of diverse classrooms and schools. Furthermore, by examining the experiences of teachers as learners and highlighting the components that impacted their learning, this study added to the body of literature on professional development, hybrid learning designs, and collaborative learning and feedback. Nevertheless, there are questions that remain and areas for future research.

Small-scale studies. Hill (2009) called for "small-scale but rigorous studies that measure the effectiveness of local and regional professional development programs and suppliers" (p.474). Small studies allow researchers to focus on meaning and understanding rather than measuring cause and effect, and because teachers and educational contexts vary significantly, it is important to capture details and perspectives about content relevance and the types of feedback that best support learning and may be unique to each learner or participant group. Further research is needed to learn about the ways that online and collaborative learning models may be combined to form effective hybrid models that work in diverse contexts. Qualitative research allows researchers to explore professional development programs in depth and may lead to customizable, flexible platforms for teacher learning that may then be applied on a larger scale.

Replication research should examine future Virtual Classroom cohorts with diverse participant groups, settings, and leadership in order to build on the findings of this study. By modifying existing components to include increased opportunities for customization and technical support, future research may be able to build on program strengths and fill gaps identified by participants. These replication studies should also look at the issue of teacher incentives by incorporating a certificate or course credit program to document program

completion and/or content mastery. As researchers learn more about what worked and what didn't, adjustments may be made to improve the quality and applicability of the Virtual Classroom and similar formats for teacher learning.

International and high-needs contexts. Because participants in this study identified numerous obstacles to UDL implementation, future studies should investigate ways that UDL principles can be applied in schools where technology, classroom resources, physical space, and adequate personnel are lacking. Currently, there is no research examining the application of UDL in large-class settings or schools without access to computers or internet. One participant's remark speaks to the need for research in schools where context is indeed a challenge: "How do we make UDL work in chaos?"

Since educational equity is a global issue, research on teacher training in UDL should also be conducted in diverse international settings. In addition to assessing varying needs in terms of resources, studies should look at factors such as cultural relevance and sensitivity that impact the ways that teachers (and students) learn.

Long term studies. One way to improve the rigor of professional development research is to conduct regular observations over longer periods of time. Because it takes time for teachers to practice and apply what they learn (Fixen et. al., 2005), short-term studies do not adequately measure the impact of professional development on teachers' practices or student outcomes. Extended research studies have the potential to assess both the ways that teachers incorporate new ideas and practices and the impacts of these changes on student outcomes. However, in order to accurately evaluate UDL in practice, additional measures will be needed. Self-reports and checklists offer some data but are not sufficient to "assess teachers' knowledge or compare teachers' practices to a standard or to goals for improvement or to other characteristics that a

researcher might wish to observe" (Dede et al., 2009). Furthermore, frequency measures alone fail to capture important data about appropriateness and fidelity of implementation (James & McCormick, 2009; NRC, 2000; Rose & Church, 1998), and this study supported assertions (Basham et al., 2014, March; McGrath, 2014, March) that *more UDL* is not only difficult to measure, it does not necessarily translate into better student outcomes. As measurement tools, based on the critical elements of implementation fidelity and flexibility, are developed (Basham et al., 2014), researchers will be able to better evaluate the impact of UDL professional development on teaching practices.

Further research is also needed to understand both the academic impact of UDL and its feasibility across multiple contexts. Rao et al. (2014) called for explicit descriptions of interventions that are linked to specific UDL principles and complete demographic reports of participants, and these are research components that will add validity to studies that attempt to link strategies, aligned to UDL, with data related to student engagement and performance. Using multiple measures to assess outcomes over a period of time (Dede et al., 2009; Edyburn, 2010) will also be important to capture impacts at various stages of implementation.

Conclusions

Using qualitative multiple-case study, this research offered insight into ways that the UDL Virtual Classroom project met the needs of adult learners and impacted teacher mindsets, teaching methods, and student performance. While narrow in scope, this study contributes to understanding what works to engage teachers in professional development and what supports and obstacles may impact implementation of learned practices. This study also helps to fill a gap in UDL training literature by examining program impacts in real-world contexts instead of postsecondary settings.

This study reaffirmed what previous professional development research has shown. First, engagement is essential to program success, and programs need to consider the learning needs and preferences of teachers, in addition to providing content that is relevant and applicable to their teaching contexts. Participants in the UDL Virtual Classroom demonstrated that despite built-in engagement due to voluntary involvement, dynamic leadership and alignment of content with existing goals were important factors in keeping them involved. Teachers expressed a desire for professional development opportunities with tangible benefits, including formal documentation of successful course completion and specific tools and strategies that they could use in their classrooms. Some differences between American and Jamaican schools posed challenges for translating research into practice, and this has notable implications for international and high-needs settings, where resources may be limited, and cultural or political differences may result in a perceived incongruity between program content and school context. Professional development programs need to be flexible enough to incorporate setting-specific materials, and integrating methods for assessing the needs of participants is likely to enhance engagement. It takes time and effort to learn about the educational communities where professional learning will take place, but this initial investment may lead to improved outcomes and substantive change.

Next, there are advantages to hybrid models of professional development that offer outside expertise, resources, and the flexibility of online platforms, but also incorporate peer learning and feedback. This feedback is most effective when it is sustained over a period of time, and the findings of this study confirm assertions than one-time, one-size-fits-all professional development is insufficient. Teachers identified the flexibility, self-pacing, and access to materials as benefits of online learning, but they consistently noted that group meetings and face-

to-face feedback and collaboration were paramount. One advantage of this particular program was that it introduced Jamaican educators to research and resources developed in the United States, but it also involved on-site facilitators who met regularly via Skype with program developers and helped "translate" research and materials in context-specific ways. This model for professional development is one of ongoing needs-assessment; rather than creating a finished product to be administered to teacher-learners, program designers modeled the sort of feedback loops (Fixen et al., 2005) that inform practice rather than evaluating it after the fact. Some obstacles did not present themselves until after participants had completed the learning modules, and this is likely to occur in any situation where there are multiple factors (i.e. technology needs and preferences, learning needs, cultural gaps, content-related questions) at play. The implication here for professional developments across contexts is that program design should be an ongoing process that includes communication among stakeholders (i.e. designers, leaders, participants) so that content, delivery methods, and supports can be tailored according to expressed needs.

With regard to UDL-specific findings, this study showed that even after completing online modules, participants often failed to make distinctions between UDL and other learning frameworks that advocate multi-sensory approaches, technology integration, or support for struggling learners. This implies that advocates and researchers need to better operationalize UDL in teacher training, which is consistent with what has been demonstrated thus far in the literature (Diedrich, Howery, & Ralabate, 2012, April; Edyburn, 2010; Katz, 2013; McGrath, 2014, March; Nelson, 2014; Rappolt-Schlichtmann, Daley, & Rose, 2012). It may be important, then, to show not only what UDL is and does, but also to make distinctions between UDL and similar learning frameworks. Nevertheless, participants found that the principles and research-backing of UDL gave them the language to engage in meaningful discussions about learner

variability and accessibility with peers and other stakeholders. This finding illustrated a common goal among participants, which also aligns with one of the key objectives of UDL: to give all individuals the opportunity to learn, despite differences in skills, interests, and needs (National Center on UDL, 2012c). Participants in this study also described incorporating new strategies to engage students and improve outcomes for low-performers, and while evidence was anecdotal and cannot support definitive conclusions about program impacts, teachers' insights about factors that support or obstruct implementation are important first steps to gain insight about how educators can be taught UDL, and how they can be supported as they translate what they have learned into meaningful practice.

Central to this case study was the issue of context, both for teacher learning and for UDL implementation. HPL theory situates all learning components within the domain of community (see Figure 1), and UDL is "universal" only if it is applicable in varied settings. The scope of this particular case was certainly limited, but it did highlight potential obstacles for UDL professional development in international, high-needs, or low-tech contexts. These findings point to the need for additional research to examine ways to address these learning and implementation gaps so that UDL may reach its goal of improving and optimizing teaching and learning for all people (National Center on UDL, 2012c), identifying and removing barriers "until learning has no limits" (CAST, n.d.).

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Appendix A

Email Solicitations to Participants

Dear _____,

My name is Katie Best, and I am a doctoral candidate at Virginia Commonwealth University in Richmond, Virginia. I have worked with Dr. Evelyn Reed and Dr. Fran Smith on the UDL Virtual Classroom pilot project, and I am contacting you with the hope that you are willing to give a small amount of time to a research project I am engaged in. The goal of my research is to gain information and insight about your experiences in the UDL Virtual Classroom in order to identify the ways the project impacted both engagement in the project itself and classroom practices following participation. I also hope to identify obstacles and areas of concern in order to inform future professional development.

Your perspectives about your experience in the UDL Virtual Classroom are not only valuable to me but also to the larger academic community. In order to prepare teachers to fulfill the national shared vision of Jamaica's Ministry of Education (Every Child Can Learn…Every Child Must Learn), it is crucial for professional development to provide not only the knowledge and theoretical frameworks to make this happen, but also to give teachers tools and experiences that are relevant and practical to their classrooms.

If you would be willing to help me by participating in an interview about your experiences in the UDL Virtual Classroom project, **please respond to this email**. If I have not heard from you within two weeks, I will send a follow up email inquiring about your willingness to participate.

I greatly appreciate your time in considering this opportunity to help develop effective learning opportunities for educators in Jamaica and abroad. Attached to this email is a form containing details about the study and your involvement.

Please feel free to contact me directly by replying to this email or by calling 804-402-6578 with any questions.

Sincerely,

Kathryn (Katie) Best

Doctoral Candidate

Virginia Commonwealth University

Richmond, Virginia

RESEARCH SUBJECT INFORMATION AND CONSENT FORM

TITLE: Understanding the Impact of a Global Universal Design for Learning (UDL) Virtual Classroom on Jamaican Educators Through The Lens of How People Learn (HPL)
VCU IRB NO.: HM20006096

PURPOSE OF THE STUDY
By examining the UDL Virtual Classroom project, this study aims to better understand the impact of the project on teacher engagement and classroom practices. Analyzing the project's components and outcomes is critical to understanding how the UDL framework can be implemented effectively.
Data gathered through this study will contribute to research about what works in UDL professional development, while identifying obstacles and areas for improvement so that future teacher learning opportunities can be created in ways that are effective and relevant.

You are being asked to participate in this study because you were a participant or facilitator in the UDL Virtual Classroom project. I am interested in learning more about how the design of this program worked for you and impacted your planning and teaching.

DESCRIPTION OF THE STUDY AND YOUR INVOLVEMENT

In this study you will be asked to complete a brief survey and participate in an interview that will take approximately 30 minutes and can be scheduled at time that best suits your schedule. The interviews will be tape recorded so that what you have to say is accurately captured, but no names will be recorded on the tape. I will use these audio recordings to transcribe our conversation so that later I can go back and look for key ideas and themes across participants' answers to my questions. When I have completed the transcripts, I will permanently destroy the audio recording. I would also like to request the opportunity to visit your school and spend part of a day observing in your classroom. You will have the opportunity to review my thematic analysis of observation notes.

RISKS AND DISCOMFORTS
There are minimal, if any, risks associated with participation in this study; however, if at any time you wish to refrain from answering a question or withdraw from the study, you are free to do so.

BENEFITS TO YOU AND OTHERS
You may not get any direct benefit from this study, but the information we learn from people in this study may help us design better programs for educating teachers.

COSTS
There are no costs for participating in this study other than the time you will spend in the interview and filling out the questionnaire.

CONFIDENTIALITY
Potentially identifiable information about you will consist of surveys, interview notes and recordings, and observation notes. Data is being collected only for research purposes.

Your data will be identified by a pseudonym and stored in a password-protected electronic system. All personal identifying information will be kept in password-protected files, and these files will be deleted after 3 years. Other records [audiotaped interviews] will be kept in a password-protected electronic file until written transcripts have been approved by you. No names will be recorded. At that time, they will be destroyed. Access to all data will be limited to study personnel. A data and safety-monitoring plan is established.

We will not tell anyone the answers you give us; however, information from the study and the consent form signed by you may be looked at or copied for research or legal purposes by Virginia Commonwealth University.

What we find from this study may be presented at meetings or published in papers, but your name will not ever be used in these presentations or papers.

VOLUNTARY PARTICIPATION AND WITHDRAWAL
You do not have to participate in this study. If you choose to participate, you may stop at any time without any penalty. You may also choose not to answer particular questions that are asked in the study. By completing this survey, you are agreeing to partake in this study.

QUESTIONS
If you have any questions, complaints, or concerns about your participation in this research, contact:

Kathryn Best: kwbest@vcu.edu
(804) 402-6578

The researcher/study staff named above is the best person to call for questions about your participation in this study.

If you have any general questions about your rights as a participant in this or any other research, you may contact:

Office of Research
Virginia Commonwealth University
800 East Leigh Street, Suite 3000
P.O. Box 980568
Richmond, VA 23298
Telephone: (804) 827-2157

Contact this number to ask general questions, to obtain information or offer input, and to express concerns or complaints about research. You may also call this number if you cannot reach the research team or if you wish to talk with someone else. General information about participation in research studies can also be found at http://www.research.vcu.edu/irb/volunteers.htm.

Appendix B

Follow Up Email Reminder

Dear _____,

A couple of weeks ago I contacted you about participating in a survey and interview as part of my research related to the UDL Virtual Classroom. Please consider taking a few minutes of your time to respond to this email about your willingness to participate. Your perspectives are very valuable to my research and to the field of teacher education and UDL.

Again, I greatly appreciate your time in considering this opportunity to help advance our profession. As a reminder, for your participation in this survey your responses will not be tied to you or your school in the way I discuss and report the results of my research. I will give each participant a pseudonym, and I will not identify any school by name.

Please feel free to contact me directly by replying to this email or by calling 804-402-6578 with any questions.

Sincerely,

Kathryn (Katie) Best

Doctoral Candidate

Virginia Commonwealth University

Richmond, Virginia

Appendix C

Blog Prompts

The following prompts were embedded in Virtual Classroom modules, and responses were downloaded onto an Excel spreadsheet for analysis:

Prompt 1: Please share a short bio about yourself, what you do in your work, your interests, etc.

Prompt 2: How do you use technology to learn or communicate with others?

Prompt 3: What is most important to you to explore about UDL?

Prompt 4: As you've thought about UDL, how could this be important in your setting?

Prompt 5: What did you learn about engagement during the first module? What questions do you have about engagement?

Prompt 6: How does this apply to your students?

Prompt 7: What engagement strategies would you like to try in your classroom over the next few weeks?

Prompt 8: What did you try in your classroom? How did that engage your students? Are there other engagement strategies that you would like to explore further?

Prompt 9: How does this apply to your students?

Prompt 10: How would multiple forms of representation benefit your classroom?

Prompt 11: What did you try? How did you represent information to your students? Were there other representation strategies that you would like to explore further?

Prompt 12: How does this apply to your students/learners?

Prompt 13: How would offering students multiple means for action and expression benefit your learners?

Appendix D

Survey 1 (Participants)

1. What is your experience with online learning? (Check all that apply.)

Participation in the UDL Virtual Classroom
Participation in a webinar
Participation in an online course
Participation in an online professional learning community
Participation in an online degree program
Other

2. Please choose the response that best describes your response to the following statements.

	Strongly Disagree	Disagree	Neither Disagree Nor Agree	Agree	Strongly Agree
The virtual classroom provides resources that are accessible to everyone, including participants with disabilities.					
The design of the UDL virtual classroom webpage (layout, fonts, images) is clear.					
I can easily navigate the virtual classroom webpage to find what I need.					
The virtual classroom format fosters collaboration and communication among participants.					

	Strongly Disagree	Disagree	Neither Disagree Nor Agree	Agree	Strongly Agree
Links on the virtual classroom to additional information about a term or topic are useful and effective.					
The virtual classroom offers various ways to access information.					
The virtual classroom offers various ways to demonstrate my understanding.					
The virtual classroom offers various ways to engage my interests and participation.					
The virtual classroom offers opportunities for self-assessment and reflection.					

3. What are the strengths or advantages of the virtual classroom format?

4. What are the weaknesses or areas for improvement?

5. What additional UDL learning opportunities would you like to see?

6. What additional UDL resources would you like to have added to the virtual classroom?

Appendix E

Survey 1 (Facilitators)

1. What was effective during this process for supporting your participation as a facilitator?

2. What has worked well for you and participants during the implementation of the Global UDL Virtual Classroom?

3. How effective were the facilitator meetings for you? What worked?

4. What would you change about the facilitator meetings?

5. What components of the Global UDL Virtual Classroom helped the participants learn the material?

6. What were the challenges of the Global UDL Virtual Classroom learning approach?

7. What are your suggestions for improvement and/or next steps?

Appendix F

Survey 2

By examining the UDL Virtual Classroom project, this study aims to better understand the impact of this project on teacher engagement and classroom practices. Analyzing the project's components and outcomes is critical to understanding how the UDL framework can be implemented effectively.

Data gathered through this study will contribute to research about what works in UDL professional development, while identifying obstacles and areas for improvement so that future teacher learning opportunities can be created in ways that are effective and relevant. This survey should take approximately 5-10 minutes to complete. You will be asked to provide basic demographic data and general information about your school and student population. Your responses will not be tied to you or your school in the way I discuss and report the results of my research. I will give each participant a pseudonym, and I will not identify any school by name. Completing this survey is voluntary. You may skip items or exit the survey at any time. If you have questions or concerns about the survey, or if you prefer to address these questions using an alternative method (i.e. electronic copy or verbal responses), please feel free to inform me now or contact me at any time: Katie Best at kwbest@vcu.edu or 804-402-6578.

1. How many years of work experience do you have in the field of education?
   - o 0-5
   - o 6-10
   - o 11-15
   - o 16-20
   - o 21+
2. Degrees held (Check all that apply)
   - o High School/Secondary
   - o Vocational
   - o Associate degree
   - o Bachelor's degree
   - o Master's degree
   - o Professional degree
   - o Doctorate degree
3. Identify the grade(s) you currently teach.
   - o Early Childhood Level (ages 3-5)
   - o Primary Level (grades 1-6)
   - o Secondary Level (grades 7-9)
   - o Secondary Level (grades 10-13)
4. Identify the grade(s) served by your school.
   - o Early Childhood Level (ages 3-5)
   - o Primary Level (grades 1-6)
   - o Secondary Level (grades 7-9)
   - o Secondary Level (grades 10-13)

5. Describe your current educational role(s).
    - o General Educator
    - o Special Educator
    - o Learning Specialist (reading or mathematics)
    - o School Administrator
    - o Other
6. Which best describes your school setting?
    - o Urban
    - o Rural
    - o Neither urban nor rural
7. How would you describe the typical class size at your school.
    - o Fewer than 10 students
    - o 11-20 students
    - o 21-30 students
    - o 31-40 students
    - o 41-50 students
    - o 51-60 students
    - o more than 60 students
8. Does your school have internet access?
    - o Yes
    - o No
9. What percentage of your students do you estimate have access to the internet at home?
    - o 0-20%
    - o 21-40%
    - o 41-60%
    - o 61-80%
    - o 81-100%
10. Do you have computers (including laptops or tablets) in your classroom?
    - o No
    - o Yes. If yes, how many? _____
11. Does your school have a computer lab available for classes to use?
    - o No
    - o Yes. If yes, how many? _____
12. Please describe how you were recruited to participate in the UDL Virtual Classroom Project.
13. Prior to participation in the project, how would you describe your knowledge of UDL?
    No prior knowledge of UDL
    Limited prior knowledge of UDL
    Moderate prior knowledge of UDL
    Ample prior knowledge of UDL

Completing this survey is voluntary. You may skip items or exit the survey at any time. If you have questions or concerns about the survey, or if you prefer to address these questions using an alternative method (i.e. face-to-face, Skype, telephone interview), please feel free to contact Katie Best at kwbest@vcu.edu or 804-402-6578.

Appendix G

Participant Interview Protocol

Learner-Centered

- Describe your experience as a learner in the UDL Virtual Classroom project.
    - How were you recruited to participate? Are there particular strengths or interests that you have that may have been relevant to your selection?
    - How often did your group meet as a whole? What were these meetings like? Did they impact your experience in the UDL classroom? If so, how?

Knowledge-Centered

- What did you know about UDL before you started?
- What did you learn as a participant?
- Do you feel like the information is relevant in your school or classroom? Why or why not?
- Did you share information about UDL with other teachers or administrators at your school? If so, how did you do this, and how was it received?
- Have you implemented UDL in your lessons? If so, would you provide some examples?
- Are there things you did before this program that you would now consider to be UDL?
    - Has this changed the way you think about the variability across your students?

Assessment-Centered

- What kind of feedback did you get while participating in the project?
- Are you still getting feedback? If so, from whom (i.e. program facilitators, peers, administrators, students)? If not, when did this stop?

Community-Centered

- What aspects of your teaching (school, leadership, classroom) context affect your implementation of UDL?
- What are your best resources for implementing UDL?
- What are your biggest obstacles for implementing UDL?

Appendix H

Script for Interview

Hi, _____. I am Katie Best, and I will be asking you some questions about your participation in the UDL Virtual Classroom Project. Thank you so much for agreeing to participate in my research. It is very important to me to capture the perspectives of educators who have completed the program in order to learn more about how this type of professional development impacts real-world classrooms and experiences.

If it is okay with you, I would like to audio record our conversation so that I know I am accurately capturing what you have to say. I will use these audio recordings to transcribe our conversation so that later I can go back and look for key ideas and themes across participants' answers to my questions. When I have completed the transcripts, I will permanently destroy the audio recording. Do I have your permission to audio record our conversation?

Thank you. Please feel free to stop and ask questions at any time during the interview. Also, you may choose not to answer any of my questions or end the interview at any time. I am interested in capturing your perspectives, not looking for any particular answers. I hope you will feel comfortable being direct and candid throughout the interview. Your responses will not be tied to you or your school in the way I discuss and report the results of my research. I will give each participant a pseudonym so that any direct quotes I report will stay anonymous. Is this okay to you?

Thank you. Do you have any questions before we begin?
I will now start the recording.
[Interview will follow the semi-structured interview protocol.]

I will now stop the recording. Once I have transcribed our conversation, I will email a copy to you so you can review it to make sure what I have written accurately reflects your perspectives. You will be able to withdraw or make changes to any of your responses.

Thank you so much for your time and help with my research; I really appreciate this opportunity to talk with you.

Appendix I
Observation Template

Teacher: School:
Class/Subject: Grade:
Date of Observation:
Number of students in class:

	Classroom
Desk arrangement	
Technology resources	
Technology utilized in lesson	
Lesson overview (content, methods)	
Description of UDL Components	
Multiple Means of Representation	Options for Perception
	Options for Language, Mathematical Expressions, and Symbols
	Options for Comprehension
Multiple Means for Action and Expression	Options for physical action
	Options for expression and communication
	Options for executive functions
Multiple Means of Engagement	Options for recruiting interest
	Options for sustaining effort and persistence
	Options for self-regulation

Appendix J

Codebook

Research Question 1: How did the Virtual Classroom address the needs of participants as adult learners?	**Learner-Centered**	Learning that is *learner-centered* considers the "knowledge, skills, and attitudes" of learners and also focuses on engagement by monitoring progress and providing appropriate supports and challenges along the way (Darling-Hammond & Bransford, 2005; NRC, 2000).
	Getting and Keeping Teachers Involved	Definition: Recruitment to Virtual Classroom and maintenance of engagement. Inclusion Criteria: Include statements about how participants were recruited to participate, attrition, relevant characteristics of participants perceived to have an impact on program involvement, relevant information about program leaders/facilitators with perceived impact on participation recruitment and/or retention. Exclusion Criteria: Exclude demographic details (unless specifically related to recruitment) such as teaching experience, prior knowledge of UDL, school role.
	Providing Teachers with Tangible Benefits of Participation	Definition: Participants' recommendations about tangible benefits that would increase participation and commitment to future professional development programs in UDL. Inclusion Criteria: Include statements about the need for course credit, certificates, and other tangible evidence of participation in professional development. Exclusion Criteria: Exclude tangible benefits related to tools and strategies to use in the classroom.
	Benefits/Challenges of Technology and Resources	Definition: Participants' descriptions of the technology and resource benefits and challenges they experienced while participating the UDL Global Classroom program. Inclusion Criteria: Include statements demonstrating ease/difficulty of accessing modules or online resources, finding or utilizing tools during participation, and resources that either facilitated or impeded individuals' participation. Exclusion Criteria: Exclude statements that demonstrate challenges of technology and resources related more specifically to classroom implementation of UDL strategies after the program's completion.

	Knowledge-Centered	*Knowledge-centered* learning considers carefully "what is taught (information, subject matter), why it is taught (understanding), and what competence or mastery looks like" (NRC, 2000, p. 24).
	Providing Research-Based Evidence for Best Practices	Definition: The extent to which UDL theory confirms or builds on practices that teachers already had in place. Inclusion Criteria: Include statements demonstrating successful teaching practices prior to program that may fall under "UDL umbrella," statements about language used to describe best practices, and language/theories/research that supports inclusion and variability. Exclusion Criteria: Exclude statements about changes in practices or mindsets that have occurred as a result of program participation.
	Exposure To and Practice With Resources	Definition: The ways in which the UDL classroom project provided tools and links that were new to participants. Inclusion Criteria: Include descriptions of online tools, websites, and other teaching resources introduced in the UDL classroom. Include participants' statements about how they tried out new tools as part of the program. Exclusion Criteria: Exclude statements about collaboration and feedback, as well as challenges of technology related to online access during the program.
	Assessment-Centered	Learning that is *assessment-centered* incorporates formative assessment and feedback during the process of instruction; assessment contributes to learning rather than just evaluating whether learning has taken place (Darling-Hammond & Bransford, 2005; NRC, 2000).
	Feedback from Facilitators and Other Participants	Definition: The feedback and reflection that took place throughout the UDL Classroom project Inclusion Criteria: Include descriptions of the ways that teachers tried new ideas and received input from program facilitators and peers. Also include statements related to self-reflection. Exclusion Criteria: Despite obvious overlap here between feedback shared resources and expertise (community-centered), exclude statements that do not explicitly describe evaluative measures (formal or informal).

	Community-Centered	Learning that is *community-centered* considers physical, cultural, and social factors by "providing supportive, enriched, and flexible settings where people can learn from one another" (Darling-Hammond & Bransford, 2005, p.33).
	Shared Resources and Expertise	Definition: The benefits of working in a collaborative, diverse group when individuals bring different strengths and share with each other. Inclusion Criteria: Include descriptions about collaborative learning within the participant group, shared resources and knowledge from participants and facilitators, and group problem-solving. Exclusion Criteria: Exclude statements related to online resources, self-reflection, implementation.
	Relevance to Jamaican Context	Definition: Adapting UDL practices meet demands of Jamaican educational settings. Inclusion Criteria: Include comparisons of US and Jamaican educational systems; trends, beliefs, and practices that are (or are perceived to be) unique to Jamaican schools. Include relevance to Jamaican curriculum and standardized testing. Exclusion Criteria: Exclude statements specific to an individual school or classroom. While resource needs are a challenge across Jamaican public schools, exclude statements related to implementation challenges due to limited resources within an individual classroom.

Research Question 2: What obstacles to implementation of UDL existed for teachers following their participation in the Virtual Classroom project?	**Implementation Challenges**	

	Physical Space	Definition: The degree to which physical space and other environmental factors impact UDL implementation. Inclusion Criteria: Include layout/design of schools and classrooms, class size, multi-age classrooms, shift system, class furniture, space-related issues. Exclusion Criteria: Exclude statements specific to technology and other resources available in the classroom.
	Technology	Definition: Computers and other multi-media tools available in classrooms and schools. Inclusion Criteria: Include technology available in classrooms and schools, technology wants and/or deficits, costs related to technology acquisition and maintenance, access to internet. Exclusion Criteria: Exclude statements related to physical space/environmental factors, non-technology resources.
	Classroom Resources	Definition: Non-technology tools used for teaching and learning. Inclusion Criteria: Include teacher-made and teacher-acquired resources (i.e. handouts, manipulatives), student-provided resources (i.e. composition books and writing utensils), and resources provided by the Ministry of Education or other outside sources. Exclusion Criteria: Exclude statements related to physical space and environmental factors, technology resources.

Research Question 3: How have teachers applied UDL principles in their planning and teaching?	**Program Impacts**	
	Educator Mindsets	Definition: Changes in the way educators think about learner variability, instruction, and inclusion. Inclusion Criteria: Include statements about understanding needs of different learners, approach to teaching and learning, professional learning and growth. Exclusion Criteria: Exclude statements related

		specifically to implementation or outcomes.
	Teaching Methods	Definition: Newly-adopted or revised methods perceived to result from participation in the UDL classroom project, especially those that incorporate multiple means of engagement, representation, and action/expression. Inclusion Criteria: Include statements about incorporating new practices, introduction of new tools or strategies, and revision/modification/enhancement of previous practices. Exclusion Criteria: Exclude statements related to educator mindsets and student engagement or performance.
	Student Engagement	Definition: Impact of teaching methods (defined as or perceived as UDL-related) on student engagement, interest, and on-task behavior. Inclusion Criteria: Include statements related to student engagement and interest (positive and negative), observations about student engagement from classroom observations. Exclusion Criteria: Exclude statements specifically related to performance outcomes, and double-code when statements link practices or mindsets to engagement.
	Student Performance	Definition: Changes in student performance outcomes related (or perceived to be related) to UDL teaching methods. Inclusion Criteria: Include statements related to skill acquisition, scores on national assessments or other measures. Exclusion Criteria: Exclude statements specifically related to student engagement, and double-code when statements link practices or mindsets to engagement.

VITA

Kathryn Whitaker Best was born on December 24, 1969, in Bronxville, New York, and is an American citizen. She graduated from Shaker High School, Latham, New York in 1988. She received her Bachelor of Arts in English and Secondary Education from Westhampton College at the University of Richmond, Richmond, Virginia in 1992. She received her Master of Arts in Literature from Virginia Commonwealth University, Richmond, Virginia in 2000. She taught English in Richmond Public Schools from 1992-1996 and at Trinity Episcopal School in Richmond, Virginia from 1996-2007. She has served as the Director of the Academic Resource Center at Trinity Episcopal School since 2007. She also served as adjunct faculty at Virginia Commonwealth University in Summer 2014, Summer 2015, and Spring 2016.