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FROM THE EDITORS

Under the educational planning umbrella, four essential articles are selected for publication in this issue covering the school principal's role in support of professional learning communities, ways to involve students with disabilities in STEM, innovative financing for education, and data collection for college accreditation.

Thessin explored teachers' perceptions of the key supports principals provided that contributed to the development of high-functioning professional learning communities (PLCs). Findings revealed three specific supports provided by school leaders: (1) the communication of clear expectations for PLC work; (2) the provision of school-based professional learning; and (3) a school culture focused on learning and collaboration.

Klimaitis and Mullen's study addressed the knowledge gap on instructional practices that enable K–12 students with disabilities (SWD) to access STEM environments and develop 21st-century skills. Drawing upon school practitioner responses, it was found that seven practices across the school levels enabled SWD to access STEM lessons. The information gained should increase awareness of effective instructional practices for supporting SWD in STEM education and planning for inclusion.

In his article of innovative financing for education, Douse claimed that Information and Communication Technology (ICT) and Artificial Intelligence (AI) have had much potential in enabling education (secondary and above) to be learner-directed and as means of achieving universal participation, equity and enjoyment. He also added that this should not involve high (or developed world directed) expenditure.

Finally, Riegel developed a pragmatic method of collecting evidence to meet the accreditation requirements of higher education institutions. Satisfaction of the program participants and their current employers would serve as indications of program quality. This study provides a model for higher education practitioners for future research in preparation for program accreditation.

While traditional planning ideas are valuable, innovative planning concepts and practices as presented in this issue could be explored to find out if these concepts and practices make sense. We educational planners can broaden our horizon of educational planning by opening ourselves to new planning concepts and practices.

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April 2021

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THE PRINCIPAL'S ROLE IN PLANNING ESSENTIAL SUPPORTS FOR SCHOOL-BASED PROFESSIONAL LEARNING COMMUNITIES

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ABSTRACT

The purpose of this study was to explore teachers' perceptions of the key supports principals provided that contributed to the development of high-functioning professional learning communities (PLCs). This study used a qualitative case study approach to learn from three schools in one mid-city district. Findings revealed three specific supports provided by school leaders: (1) the communication of clear expectations for PLC work; (2) the provision of school-based professional learning; and (3) a school culture focused on learning and collaboration. Implications for practice at the district and school level, for policy, and for further research are considered.

OVERVIEW

As reform efforts in education have sought to increase teacher collaboration, the term "professional learning community," or PLC, has been applied to a variety of types of collaborative gatherings among leaders, teachers, and school staff in schools and districts. In some settings, a committee seeking to reduce the number of tardy students to school might be designated as a PLC. In other schools, teachers meeting in PLCs may analyze state test data and set goals to raise student performance. Yet, discussion of the instructional changes needed to meet these goals may be absent from their conversations. Despite varied understandings of what a PLC is and does, current research identifies a PLC as a group of professionals in a learning organization continuously collaborating to learn and reflect on their practice, achieve school improvement by making changes that improve teaching and learning, and work toward shared and common goals through the collection and analysis of data (Hipp & Huffman, 2003; Hord, 1997; Hord & Sommers, 2008; Jones & Thessin, 2017; Louis & Marks, 1998; McLaughlin & Talbert, 2006).

In our current era in which the need for schools to improve is paramount, research demonstrates PLCs may be a key element in the process of facilitating instructional improvement and improving student achievement (Goddard et al., 2007; Roy & Hord, 2006; Stoll & Louis, 2007). Specifically, PLCs foster a learning organization and build professional capacity for improving student achievement (Langer, 2000; Louis & Marks, 1998). Consequently, many school principals have modified schools' schedules to provide time to meet in PLCs.

Yet teachers have traditionally learned, taught, and succeeded or failed independently from the teacher in the classroom next door (Elmore, 2004; Goddard et al., 2007; Schechter, 2010). To prepare teachers to engage collaboratively, a provision of time is not all that is necessary for teachers to collectively affect the instructional core (City et al., 2009; Elmore, 2004; Thessin & Starr, 2013). Teachers need to first learn how to work together to utilize assessment data and student work to identify students' learning needs and meet them in the classroom (Thessin & Starr, 2011). Moreover, the degree of collaboration among teachers that is necessary to engage in the difficult

work of improving teaching practice requires school leaders to be actively involved in planning for, supporting, and modeling PLC work (Hord & Sommers, 2008; Huggins et al., 2011; Jones & Thessin, 2017; McLaughlin & Talbert, 2006; Thessin, 2015).

In a prior study I conducted, I examined the impact of specific research-based districtwide supports on the growth of PLC teams in one mid-city district (Thessin, 2015). Teachers in high-functioning PLC teams confirmed that the district-initiated supports, including the provision of professional learning on PLCs and the direction of an improvement process to guide PLC work, contributed to their PLC teams' development. Despite the provision of the supports to all schools, large disparities in PLC growth resulted among district schools at the end of two years of PLC work. Upon further analysis of the data, it became apparent that variation in PLC development was due largely to actions specifically planned and taken by the school leader to support PLCs at individual schools.

While research from the past two decades highlights principals' influence on teaching and learning, the call for principals to shift from roles as strong school managers to roles as instructional leaders who foster effective PLCs is challenging for districts to support and achieve at scale (Honig & Rainey, 2020). Standard 7 of the Professional Standards for Educational Leaders (National Policy Board for Educational Administration, 2015) specifically emphasizes this need in describing the principal's role in fostering a professional community of teachers and staff by designing and implementing collaborative professional learning opportunities. Yet, for districts to support principals' growth in this critical role, it is first necessary to understand the specific actions that principals take that support the establishment of high-functioning PLCs that contribute to improved student achievement.

PURPOSE AND RESEARCH QUESTIONS

The following research questions guided the current study:

(1) How do teachers describe the role of school-based leaders on their work in PLCs?

(2) What school-based supports do teachers identify as contributing to the development of high-functioning PLC teams?

The data and findings of this study are particularly relevant today as we strive to focus our collaborative efforts to improve teaching and learning practices and facilitate student achievement in light of a lengthy period of school closures due to COVID-19.

BACKGROUND LITERATURE

Research demonstrates that high-functioning professional learning communities contribute to improvements in classroom instruction (Goddard et al., 2007; McLaughlin, 1993; Roy & Hord, 2006; Stoll & Louis, 2007). McLaughlin (1993) identified strong professional communities as key to changing norms of practice, developing new practices, and altering one's own pedagogical conceptions—critical components of school improvement processes. Specifically, a professional community, also described as a community of practice, might consist of a cohesive group of teachers that engages in a process of working together to deepen teachers' expertise and to discuss common challenges, thereby exemplifying elements of the learning organization (Stoll & Louis, 2007;

Wenger et al., 2002). Stoll and Louis (2007), however, distinguished that professional learning communities have agreed-upon objectives of improvement and are formed specifically for the purpose of improving student learning (Roy & Hord, 2006).

A large body of literature now points to the principal's critical role in the process of improving student learning (Leithwood et al., 2004; Leithwood & Louis, 2011), with the school leader's role in the work of school-based professional learning communities being an important component of this role (National Policy Board for Educational Administration, 2015). These findings and current accountability policies have shifted the principal's role away from one of managerial and transactional responsibilities to one prioritizing the improvement of classroom teaching and learning (Grissom et al., 2013; Knapp et al., 2014) through a distributed and collaborative approach of leading school improvement (Hallinger & Heck, 2010; Harris, 2012; Spillane et al., 2001). While principal leadership practices largely contribute to improved student learning outcomes indirectly, leaders directly influence teachers' instructional practices and their fostering of collaboration and communication around instruction (Hallinger & Heck, 1998; Robinson et al., 2008; Supovitz et al., 2010; Waters et al., 2003), such as in PLC teams.

Existing research highlights the important role principals play in designing and leading professional learning for their staff and in fostering a collaborative and trusting learning environment (Hord & Sommers, 2008; Lin, 2012; Waldron, 2010). Lin (2012) found that one fourth of high school principals surveyed pointed to teacher professional learning as a key component of developing a healthy school environment. In her study of principals in Taiwan, principals enhanced teachers' professional learning by focusing teachers' learning on student learning while creating a respectful and caring learning environment (Lin, 2012). Research also suggests that principals have an important responsibility to establish relationships in schools that are built on collaboration, commitment, and trust, relationships that can then support individual change in classrooms (Cranston, 2011; Hallam & Mathews, 2008). Cranston (2011) found the principal has the responsibility of nurturing adult relationships that reinforce the practices required by professional learning communities. Hallam and Mathews' (2008) research showed a high-trust culture facilitated teachers' willingness to work together to improve the school.

Empirical research also confirms the importance of the school leader in establishing the conditions for PLC work (Harris & Jones, 2010; Huggins et al., 2011; Schechter, 2012; Schneider et al., 2012). Superintendents and teachers who participated in one study in Israel cited the principal's openness and willingness to engage others in the learning process and in decision-making as a key aspect of the creation of PLCs (Schechter, 2012). In the urban high school math PLC studied by Huggins, Scheurich, and Morgan (2011), the principal participated directly in the math professional learning community meetings to drive changes in teaching behaviors and thereby improve student learning. Additionally, Schneider, Huss-Lederman, and Sherlock (2012) highlighted the principal's role in identifying goals that are worth pursuing. Zepeda (2019) identified the need for a clear focus for improvement crafted from the needs of the organization and from individuals within the organization in order to sustain learning communities. Schechter (2012) pointed to the administrator's provision of time, space and resources. In another study of six French-language elementary schools, teachers similarly spoke about the importance of time, in addition to support, follow-up, and encouragement by the principal and the involvement of teachers in decision-making

(Leclerc et al., 2012). Yet, in these studies, specific actions taken by the principal, beyond broad identifications of time and structure, to provide support to facilitate growth in PLC teams across the school were lacking.

As the change agent in the school, the principal is responsible for designing professional learning to facilitate change and for providing support to those implementing the change (Hord & Sommers, 2008). Through the work of teacher teams in PLCs, principals can have exponentially greater influence on changing classroom instruction by supporting individual teachers through the provision of feedback, classroom-by-classroom. In this study, I examined sources of data to understand teachers' perspectives on how school leaders supported the development of high-functioning PLCS at three schools. The findings of the study will lay the groundwork for other principals planning to develop teacher PLCs.

CONCEPTUAL FRAMEWORK

Hall and Hord (2015) indicate that academically successful professional learning communities, described as high-functioning professional learning communities for the purpose of this study, are defined by six dimensions: shared values and vision, intentional collective learning and its application, supportive and shared leadership, supportive (structural) conditions, relational conditions, and shared practice. Two of these dimensions depend almost exclusively on school leadership for their establishment - supportive and shared leadership and supportive (structural) conditions – and therefore served as my conceptual framework for this study in examining the role of the school principal in developing high-functioning PLCs. Each dimension will be briefly discussed in the following paragraphs.

The first dimension, shared values and vision, is demonstrated by a focus on a high level of student learning for all and on supporting every child to achieve it (Carroll, 2010; Kruse et al., 1994; Stoll & Louis, 2007). The second dimension, intentional collective learning, highlights how engaging in an inquiry-based approach to learning in an ongoing manner allows teachers to identify student successes and address areas where students have not performed well, leading to exploration of new practices (Hall & Hord, 2015). The fifth dimension points to the need for trust among individuals and openness to feedback for PLCs to operate (Hall & Hord, 2015). The sixth dimension of shared practice is exemplified by the opportunity for peers to help peers to become competent in their professional practice (Roy & Hord, 2006).

The dimensions of supportive and shared leadership and supportive conditions are essential to PLC development and rely on the leadership of the school principal. Hord (2004) identifies supportive and shared leadership as necessary to foster PLCs (Hall & Hord, 2015; Schneider, et al., 2012). Supportive principals share leadership, power, and authority with teacher leaders and staff in decision-making processes (Hord, 2004). The principal creates an environment in which staff can learn continuously and bring ideas in from outside the school in order to focus on improvement. By supporting a culture of school inquiry, the school leader facilitates openness and trust in the school and empowers teachers to make decisions to meet student learning needs, while also applying "appropriate pressure to perform" (Carroll, 2010, p. 10). The resulting climate partly results from principals' willingness to be learners with teachers as they work together toward improvement (Hall & Hord, 2015).

The school leader also plays an essential role in establishing supportive structural and cultural conditions for PLC work. This is the fourth element of Hall & Hord's (2015) framework. Hollingworth (2012) broadly identified the administrative supports of "time to meet, money to support new curriculum, and training" (p. 377) as essential for the existence of professional learning communities in a study of one Midwestern high school. Other researchers highlighted the administrator's provision of time, space and resources, in addition to the provision of support and follow-up by the principal and the involvement of teachers in decision-making as factors that influenced the functioning of a school as a PLC (Leclerc et al., 2012; Schecter, 2012).

Yet, in my prior work, I found that the provision of time to meet, a PLC structure put in place by the principal at the school level, and professional learning provided by the district office were insufficient to foster the establishment of high-functioning PLCs (Thessin, 2015). Teachers in high-functioning PLC teams indicated that school-based conditions and supports provided by the school leader were the primary facilitators of their teams' development. The current study sought to examine teachers' perceptions of the role of school-based leaders in their PLC work and of the supports that facilitated development of high-functioning PLC teams.

METHODOLOGY

Employing a primarily qualitative data-gathering approach allowed me to gain a full understanding of both the lived experiences of teachers in professional learning communities and of the contextual supports and leadership roles that affected PLC success (Maxwell, 2013). In this study, a multiple-case study approach was utilized to identify themes that emerged from interviews with members of high-functioning PLCs in one school district at three school sites (Baxter & Jack, 2008). High-functioning teacher PLCs served as the unit of analysis for this study and teacher interviews served as the primary source of data (Yin, 2013).

Context

In the mid-city district in which this study took place, PLCs were initiated as part of an overall system redesign. In the district's first year of PLC work, school leaders were provided with professional learning on PLCs. Principals also identified time for teachers to collaborate in PLCs on a weekly basis, but no specific guidelines were provided to schools regarding expectations for PLCs. In initiating the second year of PLC work, the district's PLC Steering Committee of principals, teachers, and central office stakeholders developed a districtwide PLC plan. The plan provided a district-designed improvement process to guide PLC collaboration and asked all PLC teams to establish an instructional goal. The district also provided voluntary professional learning opportunities for teachers to help teachers understand what a PLC is and does and to support teachers in the implementation of the district's improvement process.

Site and Participant Selection

Results from a districtwide survey administered by this district's central office and observations of PLC teams were used to identify schools with high-functioning PLCs and to subsequently invite teachers in these PLCs to participate in this study. Data from the survey provided a complete picture of the work and characteristics of PLCs and of school leaders' roles in supporting

PLC work across all schools in this district (Maxwell, 2013; Yin, 2013). In completing the survey, teachers were asked to answer questions about their PLC teams' characteristics, implementation of the district's improvement process and engagement in instructional goal setting (as described in the district's PLC plan), and their establishment of group norms and use of protocols. Approximately 67% of the district's teaching staff, or 939 teachers, responded to the districtwide survey. The three schools selected for inclusion in this case study consistently scored at or above the district mean in the survey results. They included one middle school and two elementary schools based on the survey results. Profiles of the selected schools with their pseudonyms are provided in Table 1. Subsequently, observational data were collected from PLCs at each of the three school sites using a protocol framed on the dimensions of effective professional learning communities (Hall & Hord, 2015; Hord, 2004) as previously described. PLC teams that were identified as high functioning for the purpose of this study displayed five of Hord's (2004) original characteristics of effective PLCs.

Data Sources and Analysis

Purposeful sampling was utilized to choose nine teachers of differing grade levels and subject areas for interviews at the three identified school sites (Maxwell, 2013). Interview questions are focused on the content and characteristics of the teacher's PLC team work and on the ways in which the teacher learned how to engage in and lead a PLC team (see Appendix A for the protocol). These teachers were all members of high-functioning PLC teams. After each interview, I recorded observations and reflections and explored initial findings and potential themes in response to the research questions posed in analytic memos (Saldana, 2013). Interview responses were coded using Atlas.ti software, paying particular attention to themes that emerged and to instances in which codes overlapped. While I focused my analysis on Hall and Hord's (2015) PLC characteristics of supportive and shared leadership and supportive conditions, within these specific areas, I used pattern coding to identify emerging themes both within and across school contexts through inductive analysis. Additionally, I shared findings and interpretations of the data with colleagues in a research study group on a regular basis.

FINDINGS

In interviews, teachers repeatedly emphasized the influence that school leaders had on their work in PLCs, raising two of the five dimensions identified by Hord (2004) - supportive and shared leadership and supportive conditions -to levels of importance above others. Specifically, teachers in high-functioning PLCs described how their school leaders influenced their PLC work through: (1) their communication of clear expectations for PLC work; (2) the provision of school-based professional learning on PLCs; and (3) establishment of a school culture focused on learning and collaboration. In the following section, I respond to the two research questions that guided this study collectively, as each of these findings offer insight on the role of the school leader and teachers' identification of supports provided by school leaders:

- How do teachers describe the role of school-based leaders on their work in PLCs?
- What school-based supports do teachers identify as contributing to the development of high-functioning PLC teams?

The characteristics of schools in this study are included in Table 1 below:

Table 1. Characteristics of Schools

	Hillside Elementary School	Garden Elementary School	Fielding Middle School
Grade Levels	K-5	K-5	6-8
Student Enrollment	697	637	617
Characteristics of Student Body			
*White	42%	49%	41%
*Hispanic	28%	25%	30%
*African America	23%	16%	18%
*Asian	8%	10%	11%
*Qualifies for Free and Reduced Price Lunch	36%	32%	43%
*Not Fluent in English	18%	15%	8%
*With Disabilities	8%	7%	6%

School Profiles

Hillside Elementary School

Hillside Elementary School enrolled a diverse K-5 population of approximately 660 students. A new principal, who had previously been an assistant principal in this same district, assumed leadership of Hillside Elementary.

Garden Elementary School

Garden Elementary, also a K-5 school, enrolled approximately 630 students. The principal at this school was well-established and respected for her leadership, particularly in the area of professional learning.

Fielding Middle School

Fielding Middle School served grades 6-8 with an instructional focus on math, science and technology. While the principal at this site was new, she was an experienced district administrator. She was asked to mentor two new assistant principals at Fielding during the year of the study.

Communication of Clear Expectations

At these three schools, school administrators communicated specific expectations for teachers' work in PLCs at staff meetings, in professional learning sessions, and in teachers' PLC meetings. At Hillside Elementary School, teachers identified the principal's role in communicating concrete improvement processes for learning and in developing a culture focused on instruction as contributing to PLC growth. Following guidelines from central office, Hillside's principal communicated her expectation for each grade level PLC to establish an instructional goal influenced by the school context.

Following the principal's direction, Mary, a teacher leader, described how her PLC established an instructional goal of improving student writing in Reading Response journals. This goal aligned with the school's overall focus on improving literacy through an examination of Guided Reading instruction and use of Reading Response journals. Subsequently, two members of Mary's grade level PLC piloted the practice of using Reading Response journals and shared their learning with their colleagues. Mary explained that the objective of her team's work together was clear: "PLCs, for us, are a more structured way to look at student learning, or a way for us to improve our instruction to gain more success for the student."

Another teacher leader at Hillside, Michelle, explained that the focus on instructional improvement communicated by her principal gave new meaning to teachers' time in PLCs. Michelle indicated that the principal started to bring teachers' attention to the different styles and methods with which they taught. Describing Hillside's new school leader, she articulated, "Some of her background knowledge has changed our instructional practices just with her being in our building for a year."

At Garden Elementary School, teachers in PLCs also cited their use of a districtwide improvement process and the practice of setting goals to guide PLC teams as influential on their work. In similarity to Hillside, Garden teachers explained that they learned about PLC guidelines and expectations through communication from their school administrators. One lower-grade teacher, Jill, said her team followed an inquiry-based improvement process that she described as a "a circle of steps for PLCs." This process was also displayed in the teachers' workroom on a large poster hanging prominently on the wall. Additionally, Jill indicated that her team's engagement in goal setting contributed to improved productivity in their second year of PLC work:

> The first year was really just meeting and talking; it wasn't very formal at all, but we did have goals, somewhat. Nothing formal. . . And then last year, I think we did it more formally. We were told to set goals, and we followed the format that we were given to set goals and used data to come up with our goals.

Jill also reported that her PLC team saw improvements in students' understanding of the state learning strand designated as Making Connections in their second year of PLC work, following her team's focus on this goal. Further, at Garden, teachers explained how school administrators continued to communicate their expectations of PLCs throughout the school year during their attendance at individual teacher PLC meetings.

At Fielding Middle School, a school with a strong existing culture of collaborative work and teacher leadership, teacher interviews revealed that the principal provided few expectations and directions for teachers' work in PLCs. However, a focus on instructional improvement was evident. As one example, science and math teachers organized time to work together across PLCs, initiating this collaboration to collectively determine how best to meet their goals. Kristin, the PLC facilitator, articulated how the meeting was initiated:

> The two eighth grade math teachers and the math coach, we asked if we could sit down and try to figure out what skills the students needed when they left sixth grade in measurement, [and when they] left seventh grade and left eighth grade. So we are making sure that we hit

all the skills, but we wanted to do it through math to make sure that it was being supported by the curriculum.

At Fielding, the principal included teachers from each subject area as members on the school's improvement planning (SIP) team. Through their active participation, teachers on the team saw the link between the school's improvement plan and the work they were being asked to do to meet their school improvement goals in PLCs over the course of the year. As a result, goals, learning, and progress discussed at the school's SIP meeting could be easily shared with PLC teams, distributing a focus on instructional improvement across the school. Eddy, a new teacher at Fielding, quickly understood and recognized this focus on instruction. He articulated, "Here PLCs don't always follow the official district format, but whatever it is we're doing, it's always geared around how do we teach better, how do we help our students more?"

As reported by teachers, the principal and assistant principals at this school also demonstrated their support and expectations for teachers' work in teams by frequently participating in PLC meetings, as teachers had reported at Garden Elementary as well. The principal's affirmation of the work of PLCs was recognized by other administrators and by teachers at the school, contributing to teachers' own dedication to the PLC process.

School-Based Professional Learning on PLC Work

In addition to the PLC training sessions that were offered by this district's central office, school leaders at Hillside, Garden and Fielding provided teachers at their school sites with continuing school-based opportunities for professional learning on PLC work that supported their teams' successes. Michelle, a PLC teacher leader at Hillside, confirmed the important role that Hillside's new principal played in preparing teachers for PLC work. While she indicated that staff members received only "vague outlines" from school leaders of what teachers should do in PLCs in their first year of implementation, at the beginning of the second year of PLC work, Michelle said the new principal dedicated a full day to preparing teachers for PLCs and then continued this work during staff development sessions throughout the year. Michelle explained:

> She gave us some strategies that we can use in our PLCs . . . We practiced the world café protocol at our staff meeting. We practiced a couple of different components of it. It wasn't every meeting, but it was definitely some of our staff meetings and/or half-day or full-day staff development.

Hillside's principal not only communicated expectations for PLC work to her staff, but also modeled protocols which teachers could use in their PLCs.

Furthermore, at Hillside, to supplement the districtwide PLC training in which 26% of this school's teachers had participated, the principal provided numerous teachers at her school with the opportunity to attend a training on Data Teams offered by the state. Even though this school was not eligible to enroll teachers directly in the training under state guidelines (since the school was not a recipient of Title I funds), the principal specifically arranged for teachers to participate in the training at another school site so that they might learn new data analysis tools to use in PLC work.

At Garden Elementary, the school administrators shared their learning from the district's administrative professional learning sessions by organizing and facilitating school-based learning

sessions on PLCs. Teachers Jill and James credited school leaders as the primary source of their knowledge of PLCs. They explained that their administrators were the reason why PLCs "work" at the school. James recalled participating in an astounding eight to ten school-based learning sessions on PLC work during the school year. When asked how she learned about PLCs, Jill responded, "Really through our administration. I think they went to workshops, and they came back and told us about them." Jill also credited the structure of PLC work communicated to teachers by administrators as an important factor in her team's ability to engage productively in PLC practices. Further, through their regular attendance at teachers' PLC meetings, Garden's administrators modified future professional learning sessions to meet teachers' needs for improving PLC work. Both the number and depth of professional learning sessions at Garden demonstrated the capacity of this school's administrative team to lead the development of PLCs.

At Fielding Middle School, the amount of time dedicated to collaborative work demonstrated the emphasis that school leaders placed on PLC work. Fielding fostered continued professional learning on PLCs by scheduling teachers to work with more than one PLC team. While central office required that every teacher in the district has the opportunity to participate in a PLC weekly, at Fielding Middle School, school administrators established a schedule that would allow teachers to meet with teachers in their discipline *and* with teachers on grade level teams. Following the old adage "practice makes perfect," teachers at this school had the opportunity to engage in and learn PLC practices with multiple groups of teachers on a weekly, if not daily, basis, fostering an opportunity for continued PLC learning.

At all three school sites, administrators followed the recommendations of Hord (2004) by engaging teachers in learning how to learn together in an ongoing, continuous manner. By engaging teachers in site-based professional learning on PLC work and subsequently participating in and observing PLC meetings themselves, administrators provided needed support and follow-up to teachers. At Hillside and Garden, the administrators took an active role in teaching teachers the elements of PLC work; in contrast, at Fielding, administrators provided the opportunity for teacher leaders who were already members of multiple PLCs to share their learning and expertise schoolwide.

School Culture Focused on Collaboration

At these three school sites, the school principals also established an environment of collaboration and trust. At Hillside, a school in which a practice of collaboration among teachers and administrators was not already established, the new principal worked to shift the culture. One teacher articulated how an important balance between providing direction, without dictating the work, was established:

> School administrators had explained to us that in the PLCs, for our grade level, here's what I would like you to focus on. It's all going to be you guys deciding on the goals and how to attain these, but we needed to focus on these directions, directions without top down. It's [based on] what you need. It was guidance, direction or guidance that we didn't get [the year prior].

One PLC team at Hillside dedicated specific time to the ongoing learning of its own members. The teachers committed to read an article about a practice they were studying prior to

each PLC meeting, and then all team members participated in the discussion. By engaging in the practice of inquiry together, team members acquired new knowledge as a collective whole and to contribute to one another's ongoing learning. This practice signaled this PLC was beginning to make the transition from individual learning to team learning, thereby building organizational capacity (Gherardi, 2006).

In contrast, at Garden, teachers were accustomed to working together to achieve common goals using protocols and practices they had learned through the school's use of the Responsive Classroom model. James indicated there was a certain culture at the school that allowed PLC work to happen. James described this interest in sharing instructional practice as a good "esprit de corps" that was directly enhanced by work in PLCs. He also suggested that this culture contributed to the lack of turnover among teachers at Garden Elementary, saying, "There's a reason why nobody wants to leave this building, unless they retire."

Furthermore, in describing the role of the school leader on PLC work, teachers at Garden Elementary were the first to describe the importance of trust. James indicated that this trust in PLC work was initially conveyed by administrators during school-based learning sessions:

> It's very collaborative in the way the training happens. The principal sets the agenda, and then, "Here's what we're going to do. Here's what we need to do." And then we coalesce into the teams that we work in, ordinarily, and you, as a group, find your way to get there…I think that trust thing is a big part of this. I think I would say it is initiated by the principal, but the goal is achieved cooperatively.

James further articulated that school administrators not only gave teams this freedom in collaboratively planning professional learning at the school, but also in planning the agendas for their weekly PLCs. Jill agreed that the trust that administrators placed in teachers at Garden Elementary influenced their work, explaining:

> Administrators influence us with letting us know that the expectation is that you have a literacy goal, you have a math goal, that type of thing, and enforcing that. . . But I know that I do my best, and that the principal knows that I do my best, and there's a give and take."

The administrative attitude perceived by teachers at Garden Elementary influenced the administrator-teacher relationship. In this case, administrators at Garden Elementary established a balance between trusting the work of teachers in PLCs and providing structure for these learning teams. Kruse et al. (1994) state, "human resources – such as openness to improvement, trust and respect, teachers having knowledge and skills, supportive leadership and socialization – are more critical to the development of professional community than structural conditions" (p. 4). It is possible that Garden was able to progress more quickly in its second year of PLC work than other school sites because of the existing trusting and collaborative culture.

The established practice of talking about instruction at Garden was also present at Fielding. Teachers at Fielding referred to the existing schoolwide practice of leaving classroom doors open as evidence of teachers' willingness to share materials and instructional ideas. Kristin acknowledged that engaging in PLC work was part of the school's culture, as further displayed by the amount of PLC collaboration in which teachers engaged on a regular basis by meeting in two types of PLCs

each week. Kristin and Eddy classified both their grade level team meetings and their discipline-based team meetings as PLCs.

Eddy added that the PLC teams of which he was a member actually met more often than required by the district: "Most of the year we did both [meetings], but the school didn't tell us to do it, which I guess they can't, but we did it on our own. . . That was better use of my time than sitting on my own lesson planning, was to be touching base and sharing stuff, so no complaints about doing that." The schoolwide culture of working together to improve practice across all three school sites contributed to teams' abilities to work effectively as PLCs.

DISCUSSION

Evidence from three school sites gathered in this mid-city district at the end of its second year of PLC development demonstrates that school leaders have a critical impact on teachers' work in PLCs teams. Teachers in effective PLCs pointed to their principals' supportive and shared leadership practices and their establishment of supportive structural and cultural conditions (Hall & Hord, 2015). While findings from this study confirmed the importance of these two dimensions of the framework, they also highlight specific administrative actions that facilitate the development and implementation of high-functioning PLCs: (1) communicating expectations for PLC work; (2) providing school-based professional learning; and (3) establishing a school culture focused on learning and collaboration.

Within these findings, some differences in the administrators' actions at the elementary and middle school levels are also apparent. Across all three school sites, clear evidence was found for an established culture focused on learning and collaboration, which facilitated trust between administrators and teachers. However, at the elementary level, school leaders at Hillside and Garden assumed responsibility for communicating clear expectations for PLC work and for organizing PLC professional learning sessions in which all staff participated. At Fielding Middle School, in contrast, the principal relied on a model of shared leadership with the school's improvement team to communicate expectations for PLC work. School leaders at Fielding provided consistent support through their attendance at PLCs, and structured time to engage in PLCs, but the support provided by the school principal was not directive, as at the elementary level. Recent research by Leithwood, Harris and Hopkins (2020) reaffirm the importance of distributed leadership in stating, "School leaders have an especially positive influence on school and student outcomes when it is distributed" (p. 13).

It is also possible that the principals' backgrounds and experiences could have influenced the supports they provided for teachers' work in PLCs. The level of schooling may have influenced the findings across these three school sites as well (elementary vs. middle school). Based on this variation in findings, it seems that multiple models of supportive and shared leadership have the potential to facilitate the development and implementation of high-functioning PLCs.

IMPLICATIONS

Implications for Practice

At the three school sites in this study, school leaders demonstrated engagement in supportive and shared leadership practices (Hall & Hord, 2015) to facilitate high-functioning PLCs. School leaders at Hillside and Garden both communicated clear expectations for goal setting and for teachers' use of the districtwide improvement process to guide PLCs. Then they supported teachers in meeting these expectations by organizing and facilitating many professional learning sessions on PLCs, in addition to providing ongoing learning and support opportunities through their own attendance at PLC meetings. While the school leader at Fielding was less specific in her expectations, this principal played a key role in creating and sustaining a school community in which teachers were valued and given the opportunity to learn over time, confirming similar findings by Wynn et al. (2007) in their study of beginning teachers' experiences in learning communities. At this school site, the principal's provision of time for teacher engagement in multiple PLCs, her demonstrated support of and attendance at PLCs, and the deliberate connections between teachers' work in PLCs and the school's goals for improvement provided sufficient direction to teachers to lead PLC work.

Moreover, at all three of these school sites, the school leader specifically connected the school's improvement plan "up" to the district goals and "down" to teachers' goals in PLCs, with a clear expectation that goals for improvement focus on instruction. Leithwood et al. (2004) describe the importance of agreement between district and school leaders on a reform's purposes and the needed supports for the reform to impact practice, and thus, student learning. In order for principals to make these connections for teachers, though, Wynn et al. (2007) state, "School districts may need to focus first on gaining information related to principals' abilities to support teachers and then explore ways to assist principals as they work to support teachers" (p. 224). In the current study, district central office provided support to school-level leadership so that leaders could, in turn, support and provide direction for teachers' work. Districts need to consider how best to prepare, support and communicate expectations to principals in advance of expecting them to develop effective learning communities at their own schools.

Implications for Policy

Across the nation in 2020, K-12 schools moved to a fully virtual or hybrid model of instruction. In many instances, teachers' work in PLCs has been pushed aside in the virtual environment. In other schools and districts, leaders have prioritized teachers' time in PLCs, dedicating full or half days weekly for teachers' engagement in collaborative work; these schools have accurately recognized that teacher teams have greater capabilities to design virtual instruction to meet individual students' learning needs than individual teachers might do on their own. At a time of such significant change in K-12 schooling, it is of utmost importance that districts not just allocate the time for PLCs, but that they also prepare school leaders to communicate expectations for PLCs, facilitate professional learning on PLC work, and establish a virtual collaborative culture. By establishing and aligning federal, state and local policies that award districts for effectively growing the capacity of school leaders and teachers to lead ongoing improvement efforts and for assessing these learning strategies with evidence, districts and schools will be more likely to take the time needed to implement educational reforms that will contribute to long-term improvement.

Implications for Future Research

While school context emphasized how the principals in this study approached the process of PLC implementation, administrators at all three school sites prioritized their roles as instructional leaders. In recent years, our understanding of the role of the principal as an instructional leader has shifted (Thessin & Louis, 2019). As instructional leaders, principals serve as coaches and modelers, as individuals who stimulate innovative teaching behaviors, and as supporters and facilitators of teachers' professional learning (Grissom et al., 2013; Leithwood & Louis, 2011).

As teachers need time to learn to collaborate for the purpose of improving instruction, principals also must be taught the skills needed to establish supportive and shared leadership and structural and cultural conditions for PLC work (Hall & Hord, 2015). Principals, like the teachers they supervise, benefit from ongoing, intensive, school-based, professional learning to improve their own leadership practices (DiPaola & Hoy, 2013; Zepeda, 2019). This preparation must begin in programs focused on developing and certifying school leaders. In order for universities and independent leadership preparation programs to adequately prepare aspiring leaders with the skills they need, additional research is needed to both define the aspects of instructional leadership that are most critical to include in aspiring leadership programs and to prepare aspiring principals to build effective teacher teams.

CONCLUSION

Although supportive and shared leadership and supportive conditions have been clearly identified as essential characteristics for successful PLC work, results from this study suggest that these conditions must be planned for and established by educational leaders before PLC work can develop at all. Teachers in high-functioning PLCs at three school sites indicated that their school leaders established an essential balance between trust and support and direction and accountability. In light of research indicating that teachers' collaborative work in PLCs facilitates improved instruction and student achievement, and particularly as we strive to recover from the significant achievement gaps that will result from extended COVID-19 school closures, the need for district and school leaders to work together to plan to provide supports and direction to teachers in PLCs cannot be overlooked. In a learning environment that is no longer contained by the school building walls, clear direction and support from administrators for teachers may be even more important than previously. Research gathered over time continues to point to the critical role of the principal on teachers' work in teams. Findings from this study further this literature by identifying the specific actions that three school leaders took to develop and implement high-functioning PLC teams in their schools.

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APPENDIX A

INTERVIEW PROTOCOL

Background Questions

1. Please tell me about your background.
   - What subjects and grade levels do you teach?
   - How long have you been at your current school?
   - What positions did you have before moving into your current role?
2. Describe the composition of your PLC.
   - How were the members of your PLC selected?
   - What do the members of your PLC have in common?
3. How often, and when, does your PLC meet?
4. How long have you been a member of this particular PLC?
   - Has the composition of the PLC changed over the last one-two years?

PLC Characteristics

5. How would you describe the characteristics of your PLC?
6. Do members of your PLC share roles and responsibilities for your work? If so, please provide some examples.
7. Do you believe that _____, and if so, how?
   - the work of your PLC is ongoing, focusing on continual improvement and growth
   - the work of your PLC is connected to your own instruction and school context
   - the goals of your PLC are closely aligned to the goals of your school and of the district
   - members of your PLC work collaboratively to analyze and improve classroom practice
   - your PLC focuses on the achievement of a high level of learning for all students
   - your PLC studies evidence of student learning and progress throughout the year
   - your work in PLCs is encouraged and supported by school leadership
   - structures exist in your school to promote a collaborative culture
   - you are encouraged to be creative and innovative in your PLC

Engagement in the District PLC Cycle

8. How familiar are you with the district's PLC Plan?
9. Do you think that this plan, which was developed by the PLC Steering Committee, has influenced the work of your PLC this year?
10. Did your PLC set an instructional goal to guide your work?
    - What is your PLC's instructional goal?
    - How did your PLC select an instructional goal?
    - To what extent has the establishment of an instructional goal guided the work of your PLC this year?
    - How has your PLC instructional goal affected your own instruction in the classroom?
11. Did your PLC establish an action plan to facilitate the achievement of your goal this year?
    - If so, to what extent has this action plan guided the work of your PLC this year?

12. How often has your PLC engaged in each step of the PLC Cycle this year? For each step of the cycle in which you have engaged, please provide an example of your work.
    - Inquiry
    - Analyze Data
    - Look at Student Work
    - Examine Instruction
    - Assess Student Progress
    - Reflect

Use of Data

13. Can you elaborate a bit more on what types of data, which might include standardized test data or student work, your PLC has examined this year?
    - How has this data been used by your PLC?
    - How often has your PLC examined or referred to student data in your PLC meetings?
14. How might your PLC use data more effectively?
15. Does your PLC's examination of student data affect your own instruction in the classroom?
    - If so, how?
    - What barriers do you face in using data to improve classroom instruction?

Impact of PLC Work on Classroom Instruction

16. To what degree has the work of your PLC affected your instruction in the classroom? Please provide some examples.
17. Do you think that the work of your PLC has affected the practice of all teachers in your PLC similarly?
18. What constraints would you identify as preventing PLC work from impacting classroom instruction in your school?
    - How might the work of PLCs have a larger and more direct impact on improved classroom instruction?

Reflection

19. Has the work in which your PLC has engaged been very different in the 2008-2009 school year than it was in the 2007-2008 school year?
    - If so, how?
    - To what would you attribute this change?
20. Do you think that your PLC has been successful this year?
    - If so, how has it been successful?
    - If not, why hasn't it been successful?
21. What do you think you have learned this year about PLCs?
22. Is there anything you would like to add about which I have not directly asked?

INCLUDING K–12 STUDENTS WITH DISABILITIES IN STEM EDUCATION AND PLANNING FOR INCLUSION

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ABSTRACT

This study addresses the knowledge gap on instructional practices that enable K–12 students with disabilities (SWD) to access STEM environments and develop 21st-century skills. A related purpose is to examine teachers' planning for inclusion in elementary, middle, and high schools. STEM curriculum integrates two or more of the disciplines for approaching real-world problems. STEM lessons facilitate opportunities for students with special needs to develop their competencies and prepare for college and careers in a global economy. The primary question guiding this qualitative study was, What are teachers' perceptions of instructional practices for STEM lessons for SWD in a suburban Virginia school division? Interviewees were 13 teachers from 12 US public schools. Drawing upon school practitioner responses, key instructional practices involving STEM lessons for SWD are reported. Access and barriers to STEM learning for SWD are also described, in addition to the PD considered desirable by participating teachers and opportunities for collaborating on STEM lessons. It was found that seven practices across the school levels enabled SWD to access STEM lessons. Three barriers for SWD's participation in STEM projects were also identified. The need for PD targeting teacher collaboration and student disability knowledge was another outcome. The information gained should increase awareness of effective instructional practices for supporting SWD in STEM education and planning for inclusion.

This study addresses the knowledge gap on instructional practices that enable K–12 students with disabilities (SWD) to access STEM environments and develop 21st-century skills. A related purpose is to examine teachers' planning for inclusion in elementary, middle, and high schools. Instructional practices involving students with special needs in STEM projects may not be widely known. Barriers to inclusion within STEM educational settings still exist. Teachers' perceptions and experiences of instruction that involves SWD in STEM classrooms are central to this discussion. The most important contributors to STEM learning are educators' content knowledge and pedagogical practices (Nite et al., 2017). Because teachers are influential, we sought to find out what they think and do.

Access and barriers to STEM education, also of interest to the current study, are reflected in the global workforce; notably, SWD remain underrepresented in STEM fields (Lee, 2011). Educators need to know what best practices in STEM enable SWD to develop 21st-century skills and, conversely, what prevents their participation and development. Education leaders may influence all these dynamics, including targeted professional development (PD) and continuing education. Utilizing teachers' thoughts and recommendations, we offer insight into inclusion in STEM contexts, extending to targeted PD.

The question guiding this qualitative study was: What are teachers' perceptions of instructional practices for STEM lessons for SWD in a suburban Virginia school division? Secondary questions were: What do teachers think helps SWD gain access to STEM lessons? What do teachers think are barriers for SWD participating in STEM lessons? What kind of PD is needed to improve inclusivity of SWD in STEM lessons?

STEM is increasingly popular in K–12 public schools, with calls for integrative approaches to teaching the four disciplines (Estapa & Tank, 2017). Education systems worldwide are being expected to infuse STEM within various subjects (e.g., English/language arts) (Bybee, 2013; Hallinen, 2019; Klimaitis & Zakierski, 2019). STEM lessons should promote skills and content in the disciplines and be integrated into designs or projects, often with real-life application (Carmichael, 2017; Lesseig et al., 2017). STEM challenges can be as simple as building a marshmallow tower or as complicated as developing a prosthetic limb.

As a collaborating principal and professor, our mutual interest in K–12 STEM education, inclusion, and 21st-century learning inspired this study. We review literature on STEM education that merges with inclusion in classrooms and workforces. Then we move to the teacher interviews and address our methods, findings, and recommendations.

LITERATURE REVIEWED ON STEM AND INCLUSION

This section addresses what STEM and inclusion studies report about access and barriers to STEM education for K–12 SWD. It adds to the limited body of knowledge on instructional practices that involve SWD in STEM lessons and 21st-century learning.

STEM Definitions and Educational Concepts

STEM curriculum integrates two or more of the disciplines for approaching real-world problems (Hallinen, 2019). STEM lessons facilitate opportunities for students to develop 21st-century skills (e.g., citizenship, collaboration, communication, creativity, and critical thinking) in preparation for college and careers in a global economy (Mullen & Klimaitis, 2019).

No "single definition or conceptualization of what STEM integration is or should look like at the elementary level" exists (Estapa & Tank, 2017, p. 2). By *STEM*, we refer to STEM in education befitting "an interdisciplinary approach to learning where rigorous academic concepts are coupled with real-world lessons as students apply [STEM] in contexts that [connect] school, community, work, and the global enterprise" (Hallinen, 2019, p. 6). Gerlach (2012) expounded, "Everyone knows what [STEM] means within their field," yet meanings of STEM "all have one thing in common: It is about moving forward, solving problems, learning, and pushing innovation to the next level" (p. 3). We extend these definitions to fully include K–12 students with special needs so they too can reap the benefits of STEM education.

Viewpoints vary as to what STEM education should accentuate. As examples, Evans et al. (2014) highlighted engineering design and tackling global challenges, whereas Zollman (2012) set sights on STEM literacy for satisfying "societal, economic, and personal needs" (p. 1). STEM curriculum incorporates knowledge from diverse disciplines to propel authentic problem- and project-based learning experiences (Klimaitis & Mullen, 2020). Instruction in STEM content embeds 21st-century skills and may feature the scientific method and design processes (Basham et al., 2010).

Access to STEM ensures that widely divergent vulnerable groups (SWD and females) are

"included in meaningful STEM education and develop expertise in STEM areas as well as 21st-century skills associated with STEM learning" (Basham et al., 2010, p. 9). In contrast, *barriers* to STEM lessons manifest as a lack of support, role modeling or mentoring, appropriate accommodations, advocacy, and assistive technologies (Sukhai & Mohler, 2016). *Disability* regarding children with special needs means they have at least one of the 13 conditions (e.g., specific learning disability) identified in the Individuals with Disabilities Educational Act (IDEA, n.d.). To benefit from public education, they require special education and related services.

Law and Policy Drivers of STEM Education

Regarding US education law, the Every Student Succeeds Act of 2015 (ESSA) helps fund STEM education and SWD (US Department of Education [USDOE], n.d.). This Student Support and Academic Achievement Enrichment Program has financially supported districts in increasing underrepresented students' access to, and engagement in, STEM.

Policy can determine what is taught in the K–12 classroom and what is measured for school accountability. Accordingly, Judson (2012) compared state testing results for the 2009 National Assessment for Educational Progress and concluded that adding science as an accountability measure did not negatively impact grades 4 and 8 reading and math scores. Also, fourth-grade students scored higher in states that added science. All US states test math and science, but only a few use science for accountability purposes.

STEM education is regulated by state and local policies, initiatives, and goals (Bybee, 2013). A review of STEM definitions and materials for each of the 50 US states indicated that 58% have STEM-related postings and 82% have defined STEM in policy documents; 42% have bills, executive orders, or statutes (Carmichael, 2017).

In a US school district where elementary teachers must teach 10 STEM lessons annually, Mullen and Klimaitis (2019) studied 124 STEM lessons from 14 schools and 53 grade 5 classrooms. These lessons were examined for deeper learning and 21st-century skills in various subjects (e.g., English). SWD were included in lessons for which 91% incorporated problem solving, 90% fused critical thinking and creativity, and 54% integrated communication and 50% collaboration. STEM learning enabled SWD to develop targeted competencies.

Job Market and K–12 Education

Within a decade, STEM jobs grew at three times the rate of non-STEM jobs (US Department of Commerce, 2017). Before COVID-19, STEM jobs were expected to increase by 17%, compared with 9.8% for other occupations, with 1.9 STEM jobs for every person compared with 3.6 people for one job in another field. Besides the increased demand for STEM jobs, pay was predicted to be 26% higher than non-STEM jobs. In 2014, it was also reported that STEM wages were nearly twice that of other occupations; the 26 million STEM jobs in the US comprise 20% of all jobs (Jones, 2014). Given that the US job market influences K–12 STEM education (Bybee, 2013), instructional practices relative to equity are worth examining.

Skills and dispositions—creativity, innovation, and entrepreneurship—are expected to retain value in an uncertain future (Klimaitis & Zakierski, 2019). The preparedness of students for global economies is an investment in their future and society: "Investing to ensure a pipeline of workers skilled in STEM competencies" necessitates that these skills [are fostered] in young children" (Chesloff, 2013, p. 1). Science, technology, engineering, and math can be worked into projects that foster creativity and entrepreneurship. Student-centered approaches to instruction

allow for choices in the curriculum and ownership of learning (Brown et al., 2017). While ensuring the inclusion of SWD and females, STEM activities can propel engagement and inspire creativity, meaning-making, collaboration, connections, and global outlooks (Evans et al., 2014; Klimaitis & Mullen, 2020). Curriculum and schedules should allow for student immersion in STEM so creative capacities develop in anticipation of fulfilling careers and lives.

Children embody the fundamentals of STEM as curious beings, yet natural learning is excluded from formal education. Couros (2015) remarked, "Kids walk into schools full of wonder and questions, yet we often ask them to hold their questions for later, so we can *get through* the curriculum" (p. 4), adding that when students leave schools less curious, public education has failed them. Natural curiosity, independent thinking, and keen interests drive the success of STEM activities (Evans et al., 2014).

STEM Education and Student Engagement

Determining if students are immersed in a STEM activity depends on context and is somewhat subjective. However, indicators of engagement are evident (Evans et al., 2014). *Engagement* ensures student participation is beneficial, and that teachers thoughtfully prepare and plan. Engagement necessitates attention, curiosity, interest, and confidence that students demonstrate in the environment in response to "interest-driven learning" (Evans et al., 2014, p. 630). This is evidenced when students who are motivated to learn and progress seize the "opportunity to self-direct learning," relating the "situation or problem at hand [to] their interests and experiences" (p. 630). Participation in STEM activities often involves peer interaction and tutoring and is expected to foster deep learning (Evans et al., 2014; Klimaitis & Zakierski, 2019). Engaged learning enables students to improve and experience success upon which to build (Parsons et al., 2014). In fact, engagement is "a robust predictor of student learning, grades, achievement, test scores, retention, and graduation" (Skinner & Pitzer, 2012, p. 21).

With so much emphasis on student engagement, it makes sense to prioritize learners' interests and strengths, interaction with peers, and attraction to curricular formats with STEM-designed features (e.g., digital technologies). Based on STEM activity with middle schoolers, these focus participation, stimulate interest, and advance STEM literacy (Evans et al., 2014). Experimenting pedagogically, investing in best practices, incorporating design features, advancing creative learning, taking calculated risks, building on success, assessing progress, and learning from failure are all attributes of STEM environments (Klimaitis & Zakierski, 2019).

By monitoring their influence on participation, teachers can create dynamic STEM classrooms. Checking for student engagement, they can ask themselves if their environment is interest driven, conducive to engaging in activities, and conveys the value of effort. Such questions are especially applicable to STEM lessons, as many feature group projects. For increased engagement, learning involves student choice and is authentic, collaborative, and challenging (Parsons et al., 2014).

STEM Education and Inclusion of SWD

Three out of four SWD in K–12 public schools are instructed in the general education program. In the 2018–2019 school year, 7.1 million (14%) public school SWD ages 3 to 21 in the USA received special education services under the Individuals with Disabilities Education Act (IDEA) (National Center for Education Statistics [NCES], 2020).

The need for STEM inclusion of SWD is twofold. First, SWD are "significantly more likely to enroll in STEM majors," and low-income SWD gravitate toward STEM majors to increase their job prospects (Lee, 2011, p. 76). Despite being in STEM majors, they are less likely to secure STEM careers. Second, SWD spend 80% of their day in the general education classroom (NCES, 2020), so teachers must ensure accessibility to STEM lessons.

Instructional practices used for including SWD in the general education classroom have been studied (Basham et al., 2010; Israel et al.,2015). The Council for Exceptional Children (CEC, 2017) identified 22 high-leverage practices for use with K–12 SWD organized around "assessment," "instruction," "practice collaboration," and "social/emotional/behavioral practices." However, research on the inclusion of SWD in STEM lessons and instructional strategies based on teachers' feedback is limited and not all STEM disciplines (e.g., science) are included (Brown et al., 2017; Israel et al.,2013; Moorehead & Grillo, 2013). Moreover, the elementary grades are infrequently addressed.

SWD can lack exposure to the sciences, starting in elementary grades, which contributes to underrepresentation in STEM fields (Sukhai & Mohler, 2016). Although enrollment of SWD in science and engineering majors has increased, persons with disabilities remain underrepresented in the workforce.

In 2017, a new public education standard for inclusion was mandated by the US Supreme Court. *Endrew F. v. Douglas County School District* requires that an Individualized Education Plan (IEP) "enable(s) a child to make appropriate progress" (Yell & Bateman, 2017, p. 11). This calls for STEM educators to amend academic approaches to increase SWD's participation in their lessons. Significant workload differences among staff can be a problem (Ernst & Williams, 2014). Beyond individual educators' efforts, barriers for SWD can be reduced with accommodations and modifications guided by educational values (e.g., equity) (Sukhai & Mohler, 2016).

STEM Approaches for SWD

Supports specific to STEM for learners with special needs benefit most student populations. These include "regular movement, shorter class times, smaller classes, respectful, understanding environments, and flexible teaching styles," the latter of which respond to problems and projects for driving inquiry (Fiore, 2014; Klimaitis & Zakierski, 2019). SWD may learn in different ways and contribute differently when working with peers on a STEM lesson or project.

Instructional strategies have been evaluated in STEM programming for middle schoolers with learning disabilities (Menzemer, 2008). Access to STEM for learners with special needs must be met with effective curriculum organized around big ideas (e.g., energy sustainability) (Basham & Marino, 2013).

Collaborative groups and station teaching for SWD are recognized in studies. STEM classes cotaught by general education and special education teachers can meet both IEP goals and learning needs (Moorehead & Grillo, 2013). Coteaching enables teacher collaboration on a big idea spanning two or more STEM disciplines (Basham et al., 2010). Heterogeneous groups for science support students with a learning disability. Small-group station rotations allow time for instruction to be differentiated and IEP gains to be measured. Accommodations and modifications can be made for small groups; working in a team allows for better communication, focused attention, and increased interaction for SWD (Basham & Marino, 2013).

Embedded STEM Supports for SWD

The Universal Design for Learning, a planning framework, helps teachers proactively embed supports for effective instruction (Israel et al., 2015). Special education teachers may need to support "students' reading comprehension as part of active engagement in STEM literacy" (Israel et al., 2013, p. 5). Assistive technology that reads text aloud assist SWD whose reading is not at grade level (Sukhai & Mohler, 2016). Supporting multiple levels of reading ability is essential for STEM access for SWD (Basham et al., 2010). Digital models, simulations, and software assist in the comprehension of abstract concepts like space travel (Israel et al., 2015).

Barriers to Inclusive Education for SWD

At least seven barriers to inclusive education for SWD exist: (1) school personnel inadvertently thinking and acting in isolated ways rather than working together; (2) teachers and principals lacking vital knowledge and skills; (3) resistance to trying new ways to serve SWD; (4) lack of PD and training targeting inclusive STEM education practices; (5) lack of meaningful instructional, environmental, and testing accommodations; (6) low expectations for SWD; and (7) lack of mentors (Klimaitis & Mullen, 2020; Sukhai & Mohler, 2016).

Results from a schools and staffing survey found little training on the part of general education teachers in content areas outside their subject specialization that are needed for STEM projects, and special education teachers lacked specialized content knowledge (e.g., science) necessary for STEM lessons. Also, general education teachers did not have a full understanding of SWD (Williams et al., 2018). Teachers of science, technology, and math on the frontlines of STEM instruction have been known to attend fewer hours of PD than others (Li et al., 2015). PD should remedy all such deficits.

Minimal research has investigated the influence of STEM mentoring on SWD, but the need for mentors is a known obstacle (Sukhai & Mohler, 2016). Powers and colleagues (2015) examined intentional STEM mentoring for urban high school students, parents, and mentors. Some of the mentors had disabilities; coaching involved interaction with mentees and "STEM postsecondary and career exploration" (p. 27). Students and mentors participated in STEM activities. Peer mentoring sparked "STEM career development"; the SWD's learning gains from the "successful mentoring included relationship development" and the SWD–student mentor matches reflected "personality and overall interest compatibility" (p. 30).

METHODS

Research Setting and Participants

A suburban school division in southwest Virginia, USA, was the setting, and 12 public schools served as the research sites. The division was chosen owing to its emphasis on STEM teaching from kindergarten through grade 12 and 21st-century skills. Its strategic plan required that these skills be addressed in instruction and that elementary teachers implement 10 skills-directed STEM lessons per year.

Experienced general and special education teachers were purposefully selected to share perceptions of STEM-oriented instructional practices for SWD. Eligible teachers (N = 13—5 at the elementary level, 4 middle, and 4 high school; 8 females, 5 males) had at least 3 years of teaching experience; also, they had taught STEM lessons inclusive of SWD. The five elementary teachers were from five schools; the four middle school teachers were from four schools (one teacher taught

at two schools); and the four high school teachers were from three schools (two of them were from the same school). Prospective participants were based on principals' contacts.

Data Collection and Analysis

Demographic data from the 13 teachers were collected followed by their self-reports (interview data). The demographics survey (not included) was designed by the researchers. Open-ended questions on an original interview protocol (Table 1) elicited views of instructional practices that support the inclusion of SWD in STEM lessons. Interviewees were asked what they were doing to improve access and/or reduce barriers to STEM curriculum for SWD.

From May to June 2020, 45-minute interviews occurred virtually one-to-one. WebEx was used to accommodate pandemic-induced health concerns. Conversations were private, and participants and their schools remained anonymous. The audio recorded sessions were stored on a password-protected laptop and transcribed by an online service. Interview transcriptions were emailed to the participants for member checks; all verified their statements. Following qualitative procedures (Yin, 2018), deductive and inductive coding ensued. Based on the literature review and research questions, *access* and *barrier* were meta codes. Frequency counts of codes were tracked and in vivo coding was also applied; participants' actual words and surrounding phrase(s) were coded as an aid for examining nuanced expressions namely of instructional practices.

Access was linked to specific codes: *accommodation*, *aide*, *assistive technology*, *audio book*, *big idea*, *breaks*, *differentiation*, *digital calendar*, *group norms*, *flexible scheduling*, *frontloading information*, *graphic organizer*, *headphones*, *IEP*, *leadership*, *math ability*, *orthopedic impairment*, *paraprofessional*, *PD*, *peer helper/mentor planning*, *reading ability*, *retelling directions*, *scaffolding*, *small group(s)*, *student input*, *training*, and *visuals*.

For *barriers*, associative codes included *advocacy*, *below-grade-level reading ability*, *collaboration time for staff*, *environmental trigger*, *executive functioning skill*, *lack of accommodation*, *lack of teaching knowledge/training*, *lack of support staff*, *low student expectation*, *math dyscalculia*, *physical disability*, and *planning time*.

Transcriptions, read multiple times, were coded; notes became memos. Codes were generated for each transcription, and within and across the levels (elementary, middle, and high school). In a spreadsheet, codes from the interview protocol were listed on the *x* axis, and codes from the transcriptions on the *y* axis. Eleven data summary forms were developed, one for each interview question. Three qualitative researchers each coded 20 pages of raw data. The coding was compared; searching for commonalities, we arrived at themes and intercoder reliability.

Research Design and Validation

K-12 principals carefully selected teachers based on the eligibility criteria, after we contacted 26 of them in the division. This approach is in keeping with qualitative research and open-ended (interview) questions said to work best in studies with small populations (Yin, 2018).

Our Teacher Interview Protocol (Table 1) was inspired by Hagerty's (2019) instrument that probed teacher perceptions about STEM education and Kumar's (2019) survey that explored teacher attitudes toward inclusive education in STEM classrooms. However, we did not use their questions. Besides validating the protocol, three initial interviews (with one teacher at each level) established that no procedural adjustments were needed.

Table 1

Teacher Interview Protocol
1. What process do you go through to become familiar with accommodations and modifications in a student's IEP?
2. How do you prepare your STEM lesson or unit with differentiation in mind for your SWD?
3. Do your SWD have input on their areas of interest on the STEM lessons you plan for them?
4. How might your STEM lessons offer opportunities for SWD to be leaders?
5. What strategies might you be using to help a student with a math or reading disability?
6. What strategies might you be using to help a student with a physical disability?
7. What general strategies or initiatives might you be using to help SWD access STEM lessons?
8. Based on your experiences, what are some barriers to STEM lessons for SWD?
9. In your opinion, what PD/training is needed to promote the inclusion of SWD in STEM lessons?
10. If you have the assistance of support staff like special education teachers, paraprofessionals, and student mentors during inclusive STEM lessons, how do you make use of them to support SWD?
11. Is there anything else you would like to add?

DISCUSSION

Demographics were collected and nine thematic findings resulted from the teacher interviews. Seven of these are key instructional practices for including SWD in STEM lessons.

Demographically, eight females and five males, all White (one did not identify race), were distributed across the three grade levels. This sample of experienced teachers had taught anywhere from 6 to over 26 years. While some were teaching one content area only, most were handling multiple STEM and non-STEM subjects. Almost half had a master's degree. Teachers' license/certification areas ranged from general education to special education, to learning disabilities, and they were certified in grade levels (e.g., PK–12) and content areas (e.g., math).

Also, nine of the teachers had completed one or more special education courses in college and all but two had attended PD/training on inclusion specific to SWD. The job classification was general education for 10 of the teachers, and special education for 3. STEM was not identified as a content area or source of expertise by any participant. Engineering, notably, was missing at the elementary and middle school levels, with representation held by two high school teachers. English/language arts representation was mainly at the elementary level, where there were four such specialists, and one at the middle and high school levels. Math expertise was also mostly reflected in the lower grades, with three elementary math teachers and one in the middle and high school. Science, too, was more evident in the elementary grades, with three teaching science; two of the high school teachers taught science (with no representation at the middle school level). Technology expertise stood out at the middle school level, with three teachers of technology—one each in the middle and high schools.

Seven instructional practices (thematic findings) across the teachers and school levels enabled SWD to access STEM lessons. These best practices in inclusive STEM are elaborated

(points 1 through 7 below). Point 8 identifies barriers to SWD's participation in STEM lessons and point 9 captures participants' recommendations for remedying obstacles to STEM inclusion.

1. *IEP review*: Initial knowledge of SWD was achieved by these teachers through IEP document review and communication with staff members.
2. *Students' interest*: Knowledge of a student's disability and interests guided differentiation of instruction.
3. *Relationship building*: Teachers' relationships with SWD and teacher knowledge helped SWD gain access to STEM lessons.
4. *Support staff*: Assistance of support staff was considered essential for managing the classroom and implementing IEP accommodations.
5. *Hands-on learning*: Learning by doing helps SWD access STEM lessons and perform roles, jobs, and tasks.
6. *Intentional grouping*: Being grouped by design supports SWD during STEM lessons and facilitates their roles, contributions, and leadership opportunities.
7. *Classroom accommodation*: Accommodations in, and modifications to, the environment and support from others enable SWD to access STEM curriculum.
8. *Participation barriers*: Student ability, lack of adult support, and time limitations with lessons were the main barriers for STEM lessons.
9. *PD recommended*. More training was called on to support teacher collaboration and extend disability knowledge.

IEP Review (Finding 1)

All 13 teachers shared the procedures they follow to get to know SWDs and find out what they need to succeed in school. Participants found it helpful to develop spreadsheets for quick reference. They also spoke with case managers and former teachers to gain insight into individuals' needs and interests. One participant noted how after she reads the IEPs, she adapts her teaching style to SWD's needs. All such actions qualify as best practices for inclusive classrooms: "Effective multi-tiered instruction that is personalized to students' needs and interests depends on high-quality, comprehensive information about individual students" (p. 51); as recommended, teachers used a variety of sources to assess student strengths and needs and collaborated with stakeholders on quality programming (CEC & CEEDAR Center, 2017).

Students' Interest (Finding 2)

Every teacher underscored the importance of understanding a student's disability and interests to plan and adapt STEM lessons that meet their needs, which corresponds with expectations stated in research: "The success of SWD who participate in general education STEM classes is directly linked to teachers' abilities to understand students' unique learning needs and problem-solving abilities" (Basham & Marino, 2013, p. 9). Being informed about students' disabilities helps teachers balance what kind of support they provide and how much. Providing STEM learning opportunities where students can "feel the struggle" while not becoming defeated was Teacher F's insight. Many STEM lessons are designed to be open ended, interviewees explained, so students can choose their own designs. Knowing SWD's interests is a high-leverage practice for inclusive classrooms (CEC & CEEDAR Center, 2017). All teachers said they use knowledge of a disability and interests to allow SWD choice in demonstrating mastery. They also reported that SWD have

some of the most creative ideas in their classrooms and that they seem to like learning through STEM. Teacher C shared, "Our SWD really do enjoy STEM projects because they can be creative in an area they don't feel frustrated in or feel like they have to perform to a certain level. There's a bit of freedom in a STEM project."

These teachers' planning involving SWD accounted for the individual learner, disability type, and STEM lesson. Teacher A considered whether SWD could interpret the abstract ideas associated with STEM projects and did not hold different expectations of performance for them. An inspiring response came from Teacher G, who years earlier had a student struggling with a photography project in the STEM environment: "I quickly realized he wasn't going to be able to manipulate the chemicals in the darkroom. So, I found things he could do well [which made him] the expert at those things." This teacher continued to plan for alternative scenarios, making last-minute changes to benefit SWD's learning: "I build enough flexibility into my lessons so I can make adjustments to meet the needs of a certain student or group." Teacher L's planning differed because her students were twice exceptional (gifted but with learning or developmental challenges), requiring extra time or added explanations. Based on IEP requirements, the teachers planned for accommodations in STEM classrooms. Some enlisted staff in planning STEM lessons and utilized aides in circumstances involving severe disabilities. The five instructional practices used to plan and differentiate STEM lessons for SWD were stipulated as disability/ability, intentional grouping, STEM dependent, plans for accommodations, and plans for support staff.

Relationship Building (Finding 3)

Becoming familiar with their SWD and building relationships with them were considered important. Teachers also reported that knowing everyone in their classes facilitates a broader support system for SWD and teacher decisions about group configuration and peer assistance. Teacher B stated, "You have to know your kids. If you know their personality and heart, you'll know which ones are going to build up SWD and help them in a loving way." Awareness of socioemotional needs was crucial to them; SWD were helped with developing coping skills for doing STEM projects and collaborating. Positive student–teacher relationships strengthen SWD's sense of belonging in school (Crouch et al., 2014).

Numerous instructional practices were shared for learning SWD's interests. Teachers allowed for choice and options within the parameters of STEM challenges. With group STEM projects, students often chose the roles, parts, jobs, or things of interest. Teachers B, F, and M described how they facilitate SWD's problem solving, while teachers C, H, and E talked about how they encourage creativity. Participant J had students work together to mirror workforce expectations. Frequent practices used for eliciting student input on STEM activities were student interest, student design choice, group role choices, teacher facilitation, and relevance to student.

Support Staff (Finding 4)

Participants all reported utilizing support staff (when available) to help with classroom management; eight also tapped personnel to assist with implementing IEP accommodations. For STEM lessons involving a large group of students, safety was a concern, so having additional adults in the room was needed. Communication with staff was essential for being clear about what kinds of support and how much to provide for individual SWD. All adults concerned had to work together to ensure the quality and integrity of IEP accommodations (e.g., specialized instruction and services and supports like monitoring SWD's progress). For SWD needing intensive support during STEM

projects, their lessons occurred when support staff were present. As Kumar (2019) echoed, teachers' attitude toward inclusive STEM tends to be positive when staff and resources are available.

Hands-on Learning (Finding 5)

Hands-on learning was described as an instructional practice that engages SWD in STEM lessons and increases their achievement (as confirmed by Parsons et al., 2014). At a high school, Teacher J thought that concepts make more sense for SWD when the learning is practical and project oriented. Across the high schools, many STEM lessons involved machines (e.g., laser engravers). A middle school teacher described an interactive STEM project with real-life application that had students (in a general education classroom and mainstreamed SWD) mentor SWD from a self-contained classroom. Student pairs designed storage crates for a senior citizen center. Elementary teachers' classes are presented with an open-ended STEM challenge (e.g., build a structure satisfying specifications and function requirements) for which supplies are provided.

Intentional Grouping (Finding 6)

All but one teacher indicated that intentional grouping was a key instructional practice for ensuring that SWD will thrive. Eleven teachers agreed that the mixed ability grouping of students with and without disabilities for STEM lessons affords benefits for SWD. The implication was that mixed grouping balances a student's learning challenge and compensates for disability deficits while enhancing individual strengths. These teachers also explained that they use a variety of grouping formats (mainly mixed ability grouping and cross-ability peer tutoring) to serve the needs of their SWD. These teachers used information they knew about SWD and other students to decide who would collaborate well and in what kind of format. They saw intentional grouping as a mechanism for balancing strengths and weaknesses for SWD, as well as managing behavior by avoiding personality clashes. Some of these educators rotate leadership within a group and choose the leaders, whereas others identify SWD's strengths conducive to naturally leading others. Leadership roles assumed by SWD in these classrooms include presenting on behalf of the group, making design choices, performing as a data collector, tracking of project tasks and deadlines, collecting tools/media, and overseeing equipment. Even when SWD were not group leaders, they benefitted from leadership being a norm in STEM contexts dependent on students sharing ideas, using their talents, and thinking for themselves. SWD benefit from collaborating and communicating with peers (Basham at al., 2010; Israel et al., 2015). Creating opportunities for peer leadership enables SWD to develop leadership abilities aimed at achieving a common goal and preparing for life. This process helps SWD transition from having interest in STEM to studying STEM in college and being employed in STEM careers.

Classroom Accommodation (Finding 7)

Eleven teachers asserted that room modifications gave SWD physical access to STEM lessons, and 10 reported that support from others was an access factor. They described spaces that were handicap accessible and modified for individual needs, ranging from adjusting lab tables for wheelchairs to managing constructive group collaborations. Support staff and classmates helped with SWD's access to STEM lessons, whether physical, cognitive, or socioemotional. Such modifications were in keeping with Virginia's requirement that facilities are appropriate for SWD with specialized services; sound inclusive practices extend to peer mentoring support. The teachers enlisted students as mentors of SWD on projects (e.g., brainstorming) and helpers with components of STEM projects (e.g., using manipulatives). Participant C stated, "When you find that really good

peer mentor, it can just mean the world of difference to a SWD [who]sometimes prefer the help to come from other students."

Participation Barriers (Finding 8)

Three barriers that SWD face when trying to access STEM lessons were named: student ability (8); lack of adult support (7); and time limitation (6). Although most SWD like STEM projects, some lack confidence and may be reluctant to participate. Some SWD may have difficulty generating ideas or might need brainstorming or processing assistance to take an idea to the next level. Lack of adult support was attributed to educators and guidance counselors who do not promote SWD's engagement in STEM tasks. Unsupportive staff, interviewees said, lacked confidence in SWD's ability to contribute to STEM lessons or felt their time would be better spent in another subject or (math) remediation. As Sukhai and Mohler (2016) revealed, negative teacher bias is thought to be an artifact of socialization: "[SWD are] actively excluded from STEM when they are deliberately coached in a direction away from the sciences" (p. 36). This statement reinforces the concern that some staff do not support SWD's participation in STEM. Although extended time is often an accommodation written into IEPs, interviewees viewed time as a participation barrier for SWD owing to such pressures as instructional pacing guides for curriculum that align with state standards.

PD Recommended (Finding 9)

Targeted PD is needed to improve SWD's access to STEM curriculum. Eleven teachers asserted that PD should foster teacher collaboration and sharing of STEM pedagogical and content expertise in service of STEM learning for SWD; seven stated the need for more education around disability knowledge specific to students. Teacher collaboration, it was suggested, could be encouraged in PD sessions and within schools. A desire was expressed to work with other teachers on STEM lessons that incorporate learning strategies for SWD and observe how colleagues implement STEM curriculum and engage SWD in various subjects. Participants wanted training on each disability's characteristics to readily modify a STEM lesson. Supportive of these statements, Williams et al. (2018) identified a need for cross-credentialing among teachers, and Nite et al. (2017) found that teacher content knowledge impacted student outcomes. Several interviewees considered their workforce knowledge to be a useful resource in the classroom but sharing it outside their program was not broached.

Conclusions and Recommendations

We have fulfilled our two purposes: to address the knowledge gap on instructional practices that enable K–12 SWD to access STEM lessons and develop contemporary competencies, and to examine teachers' planning for inclusion in elementary, middle, and high schools. Besides reviewing studies of STEM and inclusion, we drew upon the reports of 13 teachers from 12 schools who imparted how they engage SWD in STEM activity and barriers for participating in STEM, extending to what PD could help ensure meaningful inclusivity.

Teachers and leaders play an essential role in creating cultures that favor accessibility through inclusive STEM learning for SWD. The insights conveyed could support these stakeholders with mindfully preparing for inclusion and adapting STEM curriculum. Crucial instructional practices that include SWD in STEM lessons were reported as follows:

1. Conducting an IEP document review and communicating with staff and getting to know SWD's needs and interests.
2. Gaining knowledge of a student's disability and interests guides differentiated instruction.
3. Building relationships with SWD positions teachers to help SWD with STEM learning.
4. Utilizing staff is essential for managing classrooms and implementing accommodations.
5. Intentional grouping during STEM activity supports SWD's progress and belonging.
6. Hands-on learning makes STEM accessible and the engagement can lead to achievement.
7. Modifications to settings and support help SWD access STEM projects and excel.

These findings could also help SWD in subject areas outside STEM (e.g., language arts).

A major study limitation is that the teacher data were extracted from one suburban school division, although urban and rural schools were included in the literature review. Different divisions within Virginia and other states may not have the same STEM initiatives and requirements as the context studied. Also, while we did not extend our reach to include female underrepresentation in STEM education and careers, we have investigated this area of marginalization (Klimaitis & Zakierski, 2019). Additional research could examine teacher perceptions of access to STEM for K–12 SWD to gain a broader sense of the issues at play. While participants' responses referenced a range of disabilities, emerging studies could narrow the focus by disability category (IDEA [n.d.] provides the classifications). Alternatively, follow-up research could investigate student perceptions of access to STEM or how STEM lessons address skills development and outcomes for SWD. Further, new research could examine integrative STEM activities for SWD and PD for K–12 educators. It could also focus on grades or the college level, or hybrid and virtual contexts.

Practitioners and policymakers concerned about equal opportunity and equity with respect to inclusion can benefit from four recommendations for engaging SWD in STEM lessons.

1. *Implement effective instructional practices that facilitate SWD's access to STEM curriculum.* Getting to know SWD and building relationships with them is important. Support staff play a vital role in aiding SWD's involvement in STEM and can be included in advance planning (e.g., scheduling). Pedagogically, engagement in STEM lessons is strategically leveraged by design—intentionally planned groups facilitate SWD's immersion, collaboration, group roles, and success. The accessibility of STEM lessons (including online) is a planning consideration, as is the formation of peer mentorships.
2. *Find solutions to barriers that prevent SWD from engaging in STEM lessons.* PD is advisable on disability characteristics, in effect giving teachers a firmer foundation upon which to support SWD's involvement in STEM work. Deliberate personnel planning would ensure SWD's participation in STEM learning through such means as the scheduling of paraprofessionals and/or special education teachers during STEM lessons to support SWD; establishing a common planning time between general education and special education teachers for STEM lessons; and facilitating planned collaboration and co-teaching that builds capacity for teachers and students alike.
3. *Support teacher PD to increase knowledge of disabilities, teacher and student collaboration, and STEM learning for SWD.* PD is needed to educate about issues of disability and how to make STEM accessible, inclusive, and educative. Collaboration among teachers, including teaching observations, could usefully reveal how STEM lessons are implemented in various content areas. Budgeting time for teachers' learning and actions is a crucial step toward inclusivity.

4. *Promote equitable access to STEM lessons by creating policies or operationalizing existing ones.* Education policy expectations should support STEM literacy and readiness for 21st-century jobs. Funding should align with priorities.

The unrelenting marginalization of SWD in the workforce has been called out as "occupational injustice" (Sukhai & Mohler, 2016, p. 28). Schools are expected to disrupt inequities like the lack of opportunity for SWD in STEM fields. Thus, access to STEM lessons and effective instructional practice are paramount for cultivating SWD's 21st-century skills. The participants had some experience with supporting SWD during STEM activity and identified approaches for this purpose. However, the obstacles SWD encounter extend beyond environmental conditions. Some SWD may lack the confidence or ability to participate in STEM projects, and some adults may think are incapable. Targeted PD can address these issues and ways to help SWD cope.

Should this research sparks ideas for better serving SWD in STEM and 21st-century education, the instructional practices described offer timely information about inclusion. A desired outcome is that the teachers who made PD recommendations will positively impact school cultures. Presently, all unfolding changes are pitted against the pandemic. With the suspension of normal school operations in 2020, US public schools were challenged to reimagine how best to virtually educate students. Despite the chaos, accessibility to, and engagement within, STEM lessons that rely on hands-on learning warrant vigilance. Teachers are on the frontlines educating SWD and they need more supports. Educating SWD in the present is an investment in the future.

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INNOVATIVE FINANCING OF OUTMODED EDUCATIONAL PRACTICES THROUGH DUBIOUS PECUNIARY MACHINATIONS

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ABSTRACT

Innovative Financing for Education (IFE) is examined in the light of public and private practices and responsibilities, of the dangerous irrelevance of economics to education, of the essentially unmeasurable nature of learning outcomes, of the challenges created and the responses made possible by contemporary technology, of the forthcoming and fundamental transformation of 'the school', and of the nature and rituals of bi- and multi-lateral donors and development banks. Evidence of significant and sustainable benefits attributable to IFE was far less in evidence than were its negative social as well as educational risks and consequences, in respect of which governments may neither delegate nor evade their responsibilities. Given the largely non-material objectives of education, rate-of-return and similar analyses were seen as, at best, misleading. Clearly, Information and Communication Technology (ICT) and Artificial Intelligence (AI) have much potential in enabling (secondary and above) education to be learner-directed and as means of achieving universal participation, equity and enjoyment – yet this should not involve high (or developed world directed) expenditure. Wealthy countries and individuals, taking full account of the provenances of their riches, should, it is concluded, cede the definition and direction of international support to the beneficiary nations. This might be regarded as a provisional arrangement pending the replacement of conditional grants and loans by enabling, through substantial transfers of wealth and knowledge, those recipient countries to emerge soon from education sector aid-dependence, thereby going some way towards righting colossal age-old wrongs.

Commencing with a consideration of Innovative Financing for Education (IFE), this paper proceeds to explore whether the dismal science of economics may usefully be applied to the joyful art of education. It addresses the extent to which, if at all, educational outcomes may be measured, leading on to a discussion of the transformed nature of education made necessary and possible through contemporary technology, and perhaps given impetus by the consequences of Covid-19. Attention is then afforded to the cost and other implications of universal digital age education, and to how development partners and banks now do – and soon should – operate in that scenario, leading to some reflections upon the underlying donor/beneficiary relationship. Finally, arising from the discussion, some general conclusions are offered as bases for hopefully heated discussion.

INNOVATIVE FINANCING: THE STATE OF THE ARTIFICE

Delivering education along with health and other social provision is costly and, consequently, many countries, from the wealthiest to the poorest, have sought fresh ways of mobilising resources to supplement and partially replace direct government funding. In that education is widely seen as linked with economic growth – the better-qualified the workforce, some assert, the higher the productivity – expenditure in the sector is frequently perceived as investment in national development. How best to obtain more funding for education, including new ways of sharing costs

and responsibilities between public and private actors, tends to be discussed more seriously by international donors and development banks as well as by national education ministries than does exploring the reasons for that lack of sufficient funds in the first place.

A recent set of working papers, case studies and video animations (NORRAG, 2020) describes and illustrates a range of Innovative Financing for Education (IFE) mechanisms including income contingent loans, income-share agreements, microfinance, advance market commitment, impact investment, debt swaps, education bonds, remittances, and parametric disaster insurance. This valuable IFE compilation includes a systematic literature review of emerging trends (Avelar et al, 2020) which "revolve around identifying new sources, engaging new actors, and sharing costs and risks with these new stakeholders" involving, as those authors explain, "a reform of the state according to market practices" (p. 20).

While many IFE proponents assert that it is not about privatisation, as Marina Avelar and her colleagues recognise "…the overall narrative does indeed indicate greater private actor involvement and new relationships between the public and the private realms" (ibid, p. 20). What is offered to those private stakeholders (along with prestige, good public relations and pride in communal contribution) is the undoubted opportunity to profit materially from underfunded social and educational initiatives. In practice, while the private sector quite properly shoulders the financial risks, it is the education community – extending to the learners and their families – who bear the social risks such as impairing fairness and exacerbating inequality. In effect, this is a political choice in the context of neoliberal and austere policies with, as Avelar sums up, "advocates adopting a managerial perspective of improving effectiveness and efficiency (and) critics stressing topics related to social and fiscal justice" (ibid, p. 20).

The systematic literature review concludes that fundamental tensions, including "…the lack of empirical research, the large challenges of implementation, the risk IFE poses to education and the often hard-to-implement solutions… can result in no additional funding or could even further weaken the structures that are in place and replace them with feeble ones that rely on market preferences" (ibid, p. 21). IFE may, the review concludes, lead to "curriculum narrowing, student selection in schools and the consequent exclusion of the most in need, increase inequality between and within schools diminish public investment and damage the right to education (Avelar et al, 2020). And, let it be emphasised, irrespective of private sector involvement, not to mention non-government organisation and civil society benevolence, the public mandate of government responsibility for education, especially but not only that which is compulsory, may not be abrogated.

This present author, having searched diligently through the literature, has been unable to unearth any objective evidence (other than reports prepared by the perpetrators) of significant and sustainable benefits to either learners or to society from IFE or from the market's engagement in educational provision more generally. Kenneth Saltman talked of the 'swindle' of innovative educational finance and offered an interesting social theory to explain why privatisation policies and programs such as charter school expansion, vouchers and scholarship tax credit programmes win favour despite being unsupported by empirical evidence. He detailed how, "under the guise of innovation, cost savings, and corporate social responsibility, new and massive neoliberal educational privatization schemes have been widely adopted in the United States" (Saltman, 2012, p. 9) and ultimately connects such schemes to that country's current crisis of truth and offers advice

for resistance. Many objective researchers and readers may, eight years on, feel compelled to heed his call.

EDUCATIONAL ECONOMICS AS OXYMORON

The discipline that addresses issues such as the returns to human capital, the relationship between the higher productivity of well-educated workers, various production functions and enhanced gross domestic product (GDP), along with externalities such as educated workers bringing in new technologies and teaching others, together with long-term benefits such as cultural capital, tends to make its own assumptions as to what education is for. Schooling has, over the centuries, been misused in the service of particular religious, military, ideological, empire-governing, social justice and, most recently, sustainable development objectives. The late 20th century myth of educational input being justified by economic returns is exploded with the realisation that, when asked to identify 'education's true objectives' a very large portion of the aims and aspirations described by learners and teachers, by parents, politicians and philosophers, and by 'normal' people excluding economists, are essentially non-material. (See Unicef advertisements, early chapters of biographies and a whole range of feature films[1] for further evidence.)

Józef Dziechciarz (2015) is one of many authors to underline the exclusion of education's non-monetary benefits in standard rates of returns (RoR) analyses, including "positive relationships between education and health, the health of family members, the schooling of one's children, life choices made, fertility choices and infant mortality… the environment… crime reduction". Looking specifically at higher education, he identifies the 'triple helix concept' of providing "trained people for the needs of contemporary society… research/ knowledge generation… (and) society" (p. 8). Dziechciarz goes on to suggest that the "answer of the European Commission to the challenge of university modernisation is their policy promoting three main reforms… radical curricular reform… governance reform towards the new, entrepreneurial concept of the university… (and) funding reform (which) is designed to enable change from input oriented towards output-oriented budgeting (ibid, p. 11). As discussed below, disentangling these kinds of consequences from inputs other than funding levels involves grappling with the indefinable along with the intangible.

Given that digital age labour market requirements are largely unknown, the false yet dangerously prevalent notion that education is predominantly preparation for the world of work may at long last be overturned. School outcomes may now be understood in terms of non-competitive learner fulfilment such as 'Did they all enjoy learning what they were interested in?'. According to this present author, 'education' and 'training' are as distinct as chalkboards and cheeseboards and the workplace's colonization of the schoolroom should be stoutly resisted (Douse, 2013, p. 7). Digitisation offers an escape from education as indoctrination and enables the empowering of students as genuine partners in their own learning, effectively becoming fellow-teachers (just as all teachers are learners). It is noteworthy that Marx and Engels understood education as essential to developing free individuals and creating many-sided human beings and thus, for them, education should become "a more essential part of the life of people unlike capitalist society which is organised mainly around work and the production of commodities" (Kellner, 2010, p. 43).

The world's very lifeblood is money, both beyond education and, unless this is wholeheartedly resisted, within that sector itself. On a personal level, in many advanced nations, young adult learners face student debt and perilously easy credit, exorbitant rents and hidden charges, sneaky loan traps, shimmeringly deceptive mortgage deals, elaborately convincing scams and the general headache of tax management in a gig and short-contract economy. Beyond their own lives, they witness a society infected by an obsession with literal worth, reading splash stories about instant bitcoin fortunes, viral YouTube mini-millionaire influences and teenage video-game tycoons. It is in this context that some decision-makers seem determined to penalise those who seek higher education, almost as if to exact revenge upon the youth just for being young, irrespective of the costs and the ill-will that is inevitably involved in pursuing such expedients.

For some four decades, many governments of developed countries have determined that more and more of the costs of university education should be funded directly by its beneficiaries, through one or other, or a combination of up-front fees and deferred fees repayable as loans or through the tax system. As Tim Curtin pointed out (1996), "the basis for this view is the belief that university education generates substantial personal benefits for its recipients, and that they should therefore be required to fund their studies, either as students, or subsequently through repayment of student loans or special taxes on graduates' income" (p. 17). International donors and loaners (led by the World Bank) have acted on the same set of beliefs by requiring their client countries in the developing world to adopt the 'user pays' policy, although, as Curtin recognised, this has also been the part of its broader aims both to reduce total public spending and to have its clients switch public funding of education from the tertiary level to primary schools" (ibid, p. 21). This misplaced focus upon so-called basic education resulted for many years in resentful half-educated youngsters stalking the unsafe streets of third world cities, insufficiently qualified to proceed into the limited number of secondary or vocational schools but now too numerate/literate to settle back into their villages. Similarly, the contradictory concept of technical and vocational education has diverted attention from what might have been high-status training to third-rate routes for formal schooling dropouts.

As Curtin concluded, "the negative effects of fees in higher education are an unnecessary burden on society, because of the automatic recovery of the costs of higher education through the extra taxes paid by graduates on their higher earnings vis-a-vis non-graduates" (ibid, p. 19). Indeed, as this present author has long argued (Douse, 1992), every tax is a graduate tax. Provided there is a progressive and efficient taxation regime, any financial benefits arising from (the state's involvement in supporting) any individual's higher education will be reflected in the higher income, corporation, property and consumptive taxes paid by that individual over their lifetime. Strangely, the bulk of publications by educational economists, as evidenced by an inspection of articles in relevant and reputable journals this century, seems to ignore that straightforward conclusion in favour of erudite models involving fees and loans. Perhaps advertisements aimed at recruiting future generations of economics students should stipulate that post-secondary mathematical expertise will be regarded as a disadvantage.

MEASURING THE IMMEASURABLE, QUANTIFYING THE INDETERMINATE

IFE applications are linked with a focus on measurable outcomes, large-scale assessments and high-stakes testing, associated also with disingenuous league tables of school or university

performance (focusing but not always restricted to examination results, tending to take no account of variable intakes) and dangerous distractions such as the Organisation for Economic Co-operation and Development (OECD)'s Programme for International Student Assessment (PISA). There is a recognition that sensible assessments would need to go beyond purely educational outcomes "but also consider the broader social and financial dynamics and effects related to innovative financing for education – in other words, monitor the impact on equity and financial additionality leveraged by the IFE" (Avelar et al, 2020, p. 4), extending to an ethical dimension.

Indeed, one of the conclusions reached by Dziechciarz (2015) as stated above is that any kind of useful RoR analyses in relation to higher education would call for adequate measurement systems covering the production of skilled graduates, research and community contribution, including feasible result indicators in each of his three identified activity fields. But, even here, there can seldom be certainty as to what an educational institution or system is really meant to achieve, whether it be a pre-primary school or a postgraduate college. The only thing that evaluating the outcomes of a year's 'learning through fun' of two dozen 5-year olds has in common with assessing the consequences of enabling six honours graduates to obtain their doctorates is that neither task is possible. Indeed, some may say that the limitations of defining and monitoring quantitative educational indicators inevitably outweigh the advantages; that the assumptions are so vast and the ambiguities so huge that it is better that the exercise not to be embarked upon at all.

Based upon this present author's analyses of programme and project objectives, very few, if any, donor-funded education sector programmes and projects are directed at, or even take seriously on board, anything beyond material progress. The notion that children should enjoy their education gets very few mentions. International aid, despite being guided or misguided towards all kinds of donor goals, and even when some heed of beneficiary nations' priorities is taken, has seldom achieved, let alone exceeded, its specified higher objectives. But, to some degree due to, and to a larger extent despite of, such international munificence, there are educated people the world over, the best educated being who have risen above their own educational systems.

Many donor-supported educational and social sector interventions achieve their purpose-level indicators but when, as is frequently the case, overall objectives claim that a contribution will be made to, for example, 'reduced unemployment' or 'enhanced productivity', let alone 'diminished reliance on imported goods' or 'increased GDP', these targets tend to be unverifiable in reality and, indeed, ignored by evaluators. A programme may well upgrade primary retention or even improve science and mathematics performance – but to imagine that its outcomes may be linked explicitly and measurably to economic indicators is over-ambitious and disingenuous. The externalities overshadow even the mightiest of specific interventions.

Some planning tools, while perhaps of utility in, say, the construction of transport links or telecommunication systems, are less practicable in social development where, as we have discussed, the desired end-product is less tangible. The logical framework or 'logframe' was the proud centrepiece of much educational planning and investment for the three or four decades from the 1970s onwards – recently, it has become less popular. Angkeara Bong (2013) noted that this project tool "…is sometimes used only because external funders demand it… sometimes invented after a project has been designed… encourages a simplification of the real world… limitation and risks such as vague planning, absence of a time dimension, and improper use and static nature

(of the logframe) moves from planning to evaluation and makes the tool ineffective for project management, particularly evaluation purposes" (p. 5).

Her general conclusion that "it only works well for those who understands its use and place in the development context and have the necessary skills to use it in that context" (ibid. p. 10) is undeniable although her claim that "as a tool, the logframe has not been evaluated". Based on an assessment of some 120 programmes and projects of which about 80 per cent were logframe-based to a large or a limited extent between 1986 and 1994, this present author had reached the same overall conclusions that Bong and others came to several years later, namely that "Logframe can be of significant benefit when understood by all decision-makers, planners and stakeholders and when conducted in open participation – when applied half-heartedly or without beneficiary involvement, the consequences tend to be worse than having no Logframe at all" (Douse, 1995, p. 11). Not for nothing was the paper based upon that research entitled 'Logical Framework – Pedalling through the Project Cycle Backwards'.

EDUCATION IN THE (POST-PANDEMIC) TIME OF DIGITISATION

Having examined several hundred ICT applications, Uys and this present author reached the clear conclusion that piecemeal technological 'add-ons' have become dysfunctional distractions and that isolated ICT is not the answer, while insular AI is incongruously inappropriate (Douse & Uys, 2020). Let the system be reconstructed first, we recommended, and then integrate the best of contemporary applications to rebuild the house before putting in the furniture. We further detailed how digital age education might evolve, seeing the pre-primary and primary phases as times of individual awakening – a few enjoyable and stimulating years of enabling each child to become ready for self-directed learning. Some children will, we suggested, be ready, academically and emotionally, to escape from external educational direction at the chronological age of 10 years (or even earlier); others may not be ready until well into their teens.

When a particular pupil shrugs off the well-intentioned mentorship straight jacket and declares 'I am now ready to take responsibility for my own learning!' it is then, we argued, that self-directed education may and must begin. From that (by definition 'secondary' but also encompassing 'lifelong') phase onwards, we maintained that it is necessary to recognise the school not as a physical location but as a dispersed (and ever more global) community of learners – a process of individually-driven teacher-buttressed self-fulfilment as opposed to a physically-located exercise in regimented enforcement. The learners then 'own' the curriculum, self-directed learning from secondary onwards is the defining characteristic and the pedagogy is learning-supportive, seamlessly incorporating digital and traditional methodologies.

Far from schooling being a preparation for the world of work, we insisted that the only reason for working hard, for getting a well-paid job and for accumulating wealth is to be able to devote oneself to obtaining the best possible lifelong education. What young people – all people – should be helped to acquire, we argued, is the facility of deciding what they want to learn, and to enjoy learning, in the present-day (and sometime, perhaps, post-pandemic), evolving context of life encompassing but not defined by work. Schools, as we have known them, are a relatively recent industrial age phenomenon (with ecclesiastical antecedents). In this contemporary world, characterised by connectivity, exemplified by immediacy and defined by self-determined information

access, they are as outdated as are quill pens, buttoned boots and facsimile machines. It is time, we resolved, to discard our rosy-coloured spectacles and see the School as the dysfunctional relic that it really recently was.

Educationally, the past is another country which we may not re-visit. Let it be recognised also that this current (September 2020) determination to re-open the schools as the pandemic is (hopefully) receding, is often for economic rather than educational motives, as if schooling were but a combination of child-minding, completing an imposed curriculum on schedule, and exam-based life chance labelling. But education in its pre-pandemic form was inconvenient, discriminatory and dysfunctional anyway. Despite the educare enlightenment slogans, schooling systems across the world tended to remain geared to providing compliant labour to increase the wealth of a few, tailoring people to the workplace, and engendering the false notion of education as human resource investment. Covid-19, for all its ghastly consequences, offers an opportunity to move fairly speedily towards inclusive and equitable, enjoyable and self-fulfilling quality education for all. Let that opportunity be seized – we urged – intelligently, openly, determinedly and creatively.

The manner in which the transmission of information (and the terrifyingly glorious vastness of readily-available data out of which, skilfully, such information may be derived) and the sharing of ideas and the stimulation of creativity may be achieved, manifest a fresh socio-economic as well as educational era – a transition as epoch-shattering as that from feudalism to capitalism. An entire overhaul is called for, moving above AI and beyond ICT, embodying and synergistically integrating contemporary technology in its connectivity, organisation, curriculum content and research, and in innovation, learning methods and management. This is by no means the end of history, or more, at least educationally, the overcoming of geography. Above all, let us recognise that, just as nothing will ever be the same economically and socially, in the post-Covid-19 time, so also will nothing educationally ever be the same again in the post-digitisation period.

THE INEXPENSIVE REVOLUTION

But let it not be assumed that education in the digital age involves either vast expenditure on hard- and soft-ware or being based upon every teacher becoming a swift-fingered whizz-kind. Just as video-based learning was the fad of the 1950s, and much as programmed learning machines were optimistically and expensively delivered to some schools in the 1960s, and in the same way that language laboratories were installed in the 1980s, dedicated 'computer rooms' replete with many exorbitant desktops have been established more recently. The massive multinationals are entirely aware of yet more rich pickings awaiting them should the educational decision-makers still be captivated by high-cost so-called solutions.

Most products, services, models, expertise and research related to ICT (and now, even more so, to AI) use in education have usually come from high-income contexts and environments and, consequently, 'solutions' enabled by technology have been imported and 'made to fit' in settings that are often much more challenging. Here again, we encounter the difficulty (to the margin of impossibility) of assessing cost and benefits, rates of return and quantifiable consequences. Du Toit (2015) points to the challenges faced by most countries "in measuring the impact of investments in infrastructure, massive roll-outs of teacher training initiatives, and ICT usage in the classroom" (p. 9), going on to consider "different types of learning (i.e. basic education approach, knowledge

acquisition approach, knowledge deepening approach and knowledge creation approach)…" concluding that teacher training and ICT applications "need to be viewed within a larger system where the teacher is central to several conceptual domains including ICT in education policy, curriculum development through the provision of digital content, ICT-enabled pedagogy, ICT infrastructure, and organisation and administration at schools" (Du Toit, 2015, p. 19). The corollary of this corresponds with our earlier and general contention that it is the overall system that must be transformed prior to incorporating the best of contemporary technology in an integrated manner.

While Uys and this present author recognised the centrality of the learner, along with the teacher's vital supporting role, Du Toit's general point regarding the impact of technological infrastructure is well-made, but this was not our recommended route. Enabling individual connectivity through inexpensive handheld devices is the advocated way forward: with the creative application of such ubiquitous and relatively inexpensive devices connected to the "cloud" or with pre-loaded content and systems, a long-overdue move away from high investment solutions may and must eventuate. Mobile computing with a strong set of cloud-based software tools and content may, in the appropriate setting, support higher order knowledge deepening, knowledge creation and problem solving and will provide learners with a positive and virtually (in both senses) unlimited learning potential along with the resources to develop 21st century skills.

Digitisation is essentially cost-effective in enabling the equitable access of students as self-directed consumers and an equitable provision of learner-demanded content. That realisation will inevitably have profound consequences for educational planners and development partners seeking to support national educational policies and plans. No longer should any well-meaning donor, still entrapped in the 1990s, offer to provide desktops for all. The over-priced, imported response is now redundant and the machinery antediluvian. Similarly, and let there be rejoicing in staff rooms worldwide and the educational technology is coming back to the user. Even the most vehement 'computer illiterate and proud of it' pedagogue will soon find applying the most effective devices and systems as easy as switching on the classroom lights or, in extreme circumstances, bleeding the laboratory radiators – and, if not, their 5-year old pupils will explain it to them.

However, around half of the world's people are still offline and cannot participate in the digital culture or economy in any meaningful way. Overcoming that disparity is a sensible starting point on the road to equity. Development partners should consider diverting funding from national-level interventions to supporting effective education throughout the developing world in such areas as free Bring Your Own Device (BYOD) connectivity, online learning resources, reference sources, teacher consciousness-raising, inclusiveness, and special needs, and for international recognition that celebrates distinctiveness yet builds upon our similarities. Whether the interventions are philanthropic or otherwise, enabling everyone, worldwide, to participate on an equal footing is extremely challenging and undoubtedly worthy. The kind of development most likely to promote its intended beneficiaries is that which they are allowed the opportunities to devise, essentially learner-driven, universally participative and affordably accessible, necessitating a fresh approach to international cooperation and development support.

THE RELATIVE WEALTH OF NATIONS

The international 'development aid for education' industry, whether offering technical expertise, grants or loans, has its own frequently economist-devised and often numbingly complicated procedures for the awarding, application, monitoring, reporting and evaluation of support. A major player is the Global Partnership for Education (many such donor organisations imply 'companionship' in their titles) whose 'Key Performance Indicators' include such undoubtedly worthy outcome targets as 'Proportion of students able to read and understand at national curriculum level at end of primary or basic education', all disaggregated by gender. GPE also requires education sector assessments and plans, each to be of acceptable content and quality, 'reasonable' domestic finance for education, aid effectiveness and "the further disaggregation of all the outcome indicators by income or wealth quintile, disability, and subnational levels of government" (GPE, 2015, pp.5/8).

The support of GPE, and that of numerous bi- or multi-lateral development partners before them, has undoubtedly contributed to vast numbers of children worldwide receiving education, from upgraded teachers and in refurbished facilities, from pre-school to university. Development banks expect their loans to be repaid, often with low rates of interest over long periods. Bilateral donors continue to embody their national interests in their educational support strategies sometimes requiring, for instance, primary schools to be constructed within sight of main roads to ensure donor visibility, or for French to be taught (in Anglophone or Lusophone countries) as a key curriculum component, to children having difficulty in learning in the official national language (which differs from their mother tongue). The fact that the aid agencies' concern over classroom practices became explicit soon after the fall of the Berlin Wall is in itself significant. However, the ascendancy of neo-liberalism as a development paradigm in the 1980s and 1990s elevated political democratisation as a prerequisite for economic development. Education then assumed a central role in the democratisation project and learner-centred pedagogy was a natural choice for the development of democratic social relations in the schools of aid-receiving countries.

At its best, educational aid is genuinely focussed on sympathetic perceptions of developing countries' requirements. For instance, one widely read European Union declaration (EU, 2017) portrays education as a driver of inclusive growth and poverty reduction, and vital to the achievement of broader development goals. It adds that education is a human right, as recognised in the 1948 Universal Declaration of Human Rights and by many conventions and international declarations ever since. The tension between education as a factor in economic development and as a human right is seldom scrutinised. Impacts of education on other sectors – health, nutrition, employment, environment, peace building and governance – are widely claimed. The Paris Declaration on Aid Effectiveness (OECD, 2006) backed a process of collaboration between the donor nations and those impoverished countries receiving educational aid. That Declaration articulated goals for an "improved approach that would make it more effective than the inadequate and flawed educational models inherited from colonial times, which continued to be entrenched across the globe" (ibid, p. 2). However, there are still many instances of more than one such organisation's teams simultaneously developing distinctive (and often incompatible) plans at the recipient nation, each regardless of the efforts of the others. Moreover, each development partner demands that beneficiaries make applications and submit reports embodying its own customised, frequently byzantine, documentation.

Studies of international trends in primary education depict a wide range of developments related to such (overlapping) themes as citizenship, life skills, personal welfare, social relationships, health education, family life, moral education, character development, leadership, orientation on mankind and the world, international understanding, environmental studies, communication/new media and/or literacy, technological literacy, working with others, improving one's own learning and performance, independent learning, problem-solving and thinking skills, cultural and multicultural education, the spiritual dimension, physical/ motor skills, education for peace, consumer education, mental health, values that underpin society (honesty; reliability; respect for others; respect for the law; tolerance; fairness; caring or compassion; and non-sexism and non-racism) and many others. These foci are, so extensive to the point of invariable, determined and imposed by the donor, albeit sometimes involving consultation with the recipient partner.

In this context, it is worth reminding ourselves of the origins of the current international donor-partner reality and of the historical factors that underlie all of this much-vaunted philanthropy, not to mention those high-minded aspirations set out in the previous paragraph. Benevolent nations and warm-hearted billionaires did not acquire their wealth solely through exploiting developing world mineral or agricultural resources, nor through cheap or indeed slave human labour, nor through financial subterfuges and aggressive tax avoidance – just the bulk of it. Those now positioned to donate or to loan often impose strict, complex and often demeaning conditions upon their partners. They are not so placed through their own exceptional talent, hard toil in the heat of the day, or moral superiority. Their fortune is very largely a matter of fortune.

To take this further, appeals by the chair of the International Commission on Financing Global Education Opportunity (and former UK Prime minister) for all countries to agree to call time on fifty years of neoliberal economics are echoed. They should, he argued, break with "the pursuit of deregulation, liberalisation and privatisation at the expense of fairness, employment and sustainability… give priority to fair trade, not just free trade… robustly address monopolistic behaviour from rent-seeking digital platforms… provide generous support for science and innovation – with all that wrapped in a commitment to action on climate change and action on unacceptable levels of inequality." (Brown, 2020, p. 1) Abandoning IFE might well be added to that list. So far, the responses to Covid-19 have been essentially 'My Nation First', despite the pandemic being an on-going universal threat. The world leaders – the people's genuine representatives globally – need to work together in overcoming specific emergencies and developing a shared resilience to all forms of future challenges, and, at the same time, agreeing upon an immediate and synchronised stimulus. Much of the work of sustainable significance would be achieved.

Or is it opportune to think of going still further? Massive transfers of treasure and technology, sufficient to enable all developing countries to emerge soon from education sector aid-dependence altogether, would, in addition to being of vast ultimate benefit to the givers as well as the receivers, go some way to righting colossal age-old wrongs. While some may regard this proposal as just within the parameters of a paper focussed upon innovative financing, others may see it as abusing the hospitality of these pages or, more convincingly, touching upon a major issue that deserves especial focussing upon elsewhere. Accordingly, for present purposes, let it be agreed that the ultimate sources of wealth that enables some to give (or to lend) while others need to receive (or to borrow) are, in the main, such that, at the very least, the responsibility for this support (maybe we

should call it 'reparations' rather than 'aid') should no longer be with the possessors of that wealth but, somehow, be handled forthwith by those from whom, historically and culpably, the bulk of it was derived.

IMPLICATIONS FOR EDUCATIONAL PLANNERS

Taking account of the above considerations, and on the analyses conducted, the following tentative conclusions are put forward as bases for further discussion amongst those of us who practice the arts of educational planning and decision-making and, hopefully (for let us not shirk well-informed criticism), impassioned argument between us:

a. Based upon available evidence, there seems to be little merit and much danger in the application of any form of Innovative Financing for Education.

b. Economists, as such, have nothing positive – and much that is potentially negative – to bring to the investment in education debate.

c. The essence of education is beyond quantification and, accordingly, all attempts to measure its outcomes or to compare school or national performance, are dysfunctional and vain.

d. Education is about to undergo a fundamental transformation worldwide; Covid-19 is advancing the realisation of that reality.

e. A key characteristic of that forthcoming universal transformation is that, from the secondary phase onwards, learning will be self-directed, with teachers and systems supporting rather than leading those learners.

f. Contemporary technology both necessitates and make possible this transformation – rather than necessitating any kind of high-investment solution, this may be regarded as the inexpensive revolution.

g. The responsibility for the awarding, management and evaluation of all education sector grants and loans should be transferred from the donor (country, region or philanthropist) to the recipient (e.g. the Global Partnership for Education should be run from, by and for the least developed 'partners').

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EXAMINING COMPLETER AND EMPLOYER SATISFACTION IN ADVANCED-LEVEL PROGRAMS

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ABSTRACT

Advanced-level education programs are held to rigorous accreditation standards that often require evidence of satisfaction from both program completers and their employers. The purpose of this study was to develop a pragmatic method of collecting this evidence for smaller liberal arts institutions. A convergent parallel mixed methods data collection approach was designed to simultaneously gather qualitative and quantitative data. This data collection method was piloted with eight alumni from an advanced-level literacy program at a small private liberal arts university in the American Northeast. Evidence of program completer satisfaction included analysis of self-reported data regarding perceptions of preparation relevant to current job responsibilities and program goals. Evidence of employer satisfaction included analysis of employment milestones and employer evaluations and/or observations. This study provides a model for future research intended on identifying practical ways of collecting evidence toward demonstrating overall satisfaction of program completers and/or their employers for smaller liberal arts institutions.

OVERVIEW

Advanced-level programs are defined as "educator preparation programs at the post-baccalaureate or graduate levels leading to licensure, certification, or endorsement" (Council for the Accreditation of Educator Preparation [CAEP], 2015a, para. 1). These programs are designed to develop P-12 teachers who have already completed an initial preparation program for employment in P-12 schools/districts. With increasing accountability in the field of education, it follows that advanced-level programs are held to high standards through rigorous accreditation procedures (Cochran-Smith et al., 2017). The Council for the Accreditation of Educator Preparation (CAEP) (2016b) standard A.4 states that providers of advanced-level programs must document the satisfaction of its completers and their employers with the relevance and effectiveness of their preparation. Additionally, the Association for Advancing Quality in Educator Preparation (AAQEP) (2020) requires programs to provide multiple measures of evidence of completer performance, including perspectives from program completers and employers. This leads to the question of how providers of advanced-level programs can collect valid and reliable data pertaining to the satisfaction of both its graduates and the schools that employ them. The purpose of this study was to develop a pragmatic method of collecting evidence that would provide a holistic interpretation of program completers and employers satisfaction with advanced-level programs.

LITERATURE REVIEW

Advanced-level programs in the field of education must align themselves with standards related to a specific discipline. For example, a graduate program leading to special education certification may align with the Council for Exceptional Children (CEC) standards (Council for Exceptional Children [CEC], 2015) while a graduate program leading to literacy specialist

certification may align with the International Literacy Association (ILA) standards (International Literacy Association [ILA], 2017). Given that standards are frequently updated to reflect changes in the field and societal expectations, it is necessary that programs continuously assess whether the preparation provided by the program meets the aligned standards *and* that these standards have practical application in the field. This demonstrates programs are not simply producing "standard" teachers, or those taught only to meet standards, but producing educators who can apply coursework in a practical manner in the field (Bourke, Ryan, & Lloyd, 2016). It follows that accreditation bodies, which can grant a level of credibility to a program, would need to gauge if advanced-level programs are developing competent and caring educators who can both meet standards and operate effectively in the field. When it comes to receiving accreditation of education programs in the United States, this is done by demonstrating the satisfaction of both program completers and their employers (Association for Advancing Quality in Educator Preparation [AAQEP], 2020; Council for the Accreditation of Educator Preparation [CAEP], 2016b).

Accreditation

Historically, teacher preparation in the United States morphed from normal schools into four-year colleges, eventually seeking and winning the title "university" (Coble, Edelfelt, & Kettlewell, 2004; Labaree, 2008, p. 295; Ogren, 2005). As universities grew, so did specific licensure requirements known as accreditation. In 1954, the National Council for Accreditation of Teacher Education (NCATE) was founded as a non-profit, non-governmental accrediting body for teacher preparation programs (CAEP, 2015b). NCATE worked to "establish rigorous standards for teacher education programs, hold accredited institutions accountable for meeting these standards, and encourage unaccredited schools to demonstrate the quality of their programs by working for and achieving professional accreditation" (National Council for Accreditation of Teacher Education [NCATE], 2014, para. 1). From the inception of NCATE, there have been several accreditation bodies for teacher preparation programs, including the Teacher Education Accreditation Council (TEAC), Council for the Accreditation of Educator Preparation (CAEP), and the Association for Advancing Quality in Educator Preparation (AAQEP) (Teacher Education Accreditation Council [TEAC], 2014; CAEP, 2015b; AAQEP, 2020). With CAEP currently being the largest accrediting body for teacher preparation programs, it follows that this study was designed to provide evidence towards meeting two specific subcomponents of CAEP (2016b) standard A.4:

- Satisfaction of Employers – Standard A.4.1: The provider demonstrates, using measures that result in valid and reliable data and including employment milestones such as promotion and retention, that employers are satisfied with the completers' preparation for their assigned responsibilities in working with P-12 students.
- Satisfaction of Completers – Standard A.4.2: The provider demonstrates, using measures that result in valid and reliable data, that program completers perceive their preparation as relevant to the responsibilities they confront on the job, and that the preparation was effective.

Stakeholder Satisfaction

Although CAEP outlines a guide for collecting evidence for towards meeting standards, the system for the analysis, evaluation, interpretation of data, and conclusions supported by data are left to the program provider to establish (Council for the Accreditation of Educator Preparation [CAEP], 2016a). Given this ambiguity and the lack of specifics outlined for data collection, it follows that

there is a gap in pragmatic methods of collecting evidence through the development of evaluative measures by which advanced-level programs can measure the program impact through examining program completer and employer satisfaction. As the CAEP Chair, Karen Symms Gallagher, points out, this leaves room for inconsistency in ways to accurately assess a program's impact (Goodson, 2018). Additionally, it is often not possible for smaller liberal arts institutions to use limited resources and funding to collect the large amounts of data needed to run statistical analysis or generate enough participation form a smaller student body. Thus, smaller institutions may be innately limited in the methods that can be used (e.g., value-added measures, student-growth percentiles, case studies, etc.) to provide evidence towards meeting accreditation standards (Alkathiri, 2020).

Now that accreditation requires programs to show direct evidence of consumer satisfaction (Cochran-Smith et al., 2016), it is suggested by Heafner, McIntyre, and Spooner (2014) that a combination of input measures for data collection should be used to determine satisfaction of both program completers and their employers. The Steinhardt School of Culture, Education and Human Development at New York University (NYU) outlined how they were "creative in [their] approach to measuring the satisfaction of employers" by developing an annual survey of school building leaders to be administered annually across all the schools that were known to hire graduates (Lyons et al., 2018, p. 11). When it came to measuring the satisfaction of completers, NYU outlined how they designed the student teacher End-of-Term Feedback Questionnaire (ETFQ) as an integral component of the evidence base for student's perception of preparation of the field (Lyons et al., 2018). Case studies have also been used by institutions seeking to examine satisfaction of employers and completers for accreditation purposes in states like Texas (Morgan et al., 2020). However, "there never seems to be enough time, money or personnel power to make the best case scenario a reality" (Peacock, 2015, p. 39).

Other institutions have utilized quantitative data (e.g., survey data) and/or qualitative data (e.g., case studies) to collect valid and reliable data pertaining to the satisfaction of both its graduates and the schools that employ them (Hougland, 2008; Kansas State University, 2019; Princeton University, 2019; University of Florida, 2017; University of North Alabama, 2016; Webster University, 2019). However, small liberal arts and science institutions looking to receive or maintain accreditation must "get creative" in their approaches to increase the response rate of an increasingly busy population of educators and administrators and utilize pre-existing data that may speak to the variables being addressed.

METHODS

This study used a convergent parallel mixed methods approach (Creswell, 2014) to simultaneously gather qualitative and quantitative data. This approach was designed to provide a holistic interpretation of program completer's and their employer's satisfaction with the relevance and effectiveness of their preparation from an advanced-level program in literacy instruction at a small private liberal arts university in the American Northeast. With priority to subcomponents A.4.1 (Satisfaction of Employers) and A.4.2 (Satisfaction of Completers), the following research questions were addressed:

1. In what ways do employers demonstrate satisfaction with recent graduates?
2. In what ways, if any, have recent graduates reached employment milestones?

3. How do recent graduates perceive their preparation as relevant to their current job responsibilities?
4. How do recent graduates perceive their preparation as effective relative to the goals of the program?

As demonstrated in Table 1, information from pre-existing documents was gathered to address the first research question. This included teacher evaluations containing quantitative Annual Professional Performance Review (APPR) scores and field observations containing qualitative comments from supervisors. Information from an Alumni Survey was gathered to address the second, third, and fourth research questions. This included quantitative and qualitative responses regarding completer's employment milestones and completer's preparation relevant to their current job, as well as quantitative responses regarding completer's preparation relative to the goals of the program (i.e., 2017 ILA Standards).

Table 1.

CAEP Standard, Research Questions, and Associated Data Collection

CAEP Standard	Research Question	Data Collection
Satisfaction of Employers: Standard A.4.1	(1) In what ways do employers demonstrate satisfaction with recent graduates?	• Teacher Evaluation Forms • Field Observations
Satisfaction of Employers: Standard A.4.1	(2) In what ways, if any, have recent graduates reached employment milestones?	• Alumni Survey
Satisfaction of Completers: Standard A.4.2	(3) How do recent graduates perceive their preparation as relevant to their current job responsibilities?	• Alumni Survey
Satisfaction of Completers: Standard A.4.2	(4) How do recent graduates perceive their preparation as effective relative to the goals of the program?	• Alumni Survey

Participants

The data collection method designed in this study was piloted with eight alumni from an advanced-level literacy program at a small private liberal arts university in the American Northeast. Purposive sampling was used to identify 55 alumni who graduated within the last three years (2016, 2017, and 2018). Graduates from the past three years were selected in an effort to keep results relevant. To identify potential participants, a data base of program alumni from the past three years was obtained containing school email addresses as well as some personal email addresses. To secure more updated contact information, the university also provided a list of updated email addresses student's supplied upon graduation. An internet search was also utilized in an attempt to acquire current employment email addresses by searching for alumni by name.

Purposive sampling was also used to further identify alumni who were currently employed in a New York State public, private, or charter school to ensure the necessary teacher evaluation data was available for analysis. Given that not all alumni who pursue a degree in the field of education end up working in the field of education, and individuals may be hired as part time or substitute teachers, it follows that not all of the alumni would qualify to participate due to lack of the necessary teaching evaluations and/or observations. Since graduates of the same program often have peers updated contact information, snowball sampling was also used. Alumni were asked to provide current contact information for other recent alumni. Of the 55 recent alumni, eight qualified for participation, completed the Alumni Survey, and forwarded a copy of their most recent teaching evaluation and/or observation.

All participants graduated from the same advanced-level program in literacy instruction in 2016 (37.50%), 2017 (25%), or 2018 (37.50%). The sample of participants included primarily White (87.50%) females (100%). All participants were between the ages of 20 and 30 and received both a Bachelor's and Master's degree. All participants indicated they were currently employed in a New York State public, private, or charter school. Participants reported working in grades K-2 (25%), grades 6-8 (37.50%) or mixture/subset of these settings (e.g., K-5, grades 5-6, etc.) (37.50%). Participants reported working in primarily suburban (75%) public (75%) settings. All but one participant (87.50%) had been a teacher of record for at least one year at the time of the study. Participants held a variety of positions within their schools, including literacy specialist/coach (25%), classroom teacher (37.50%), special area teacher (PE, music, art, technology, etc.) (12.50%) and long-term substitute teacher (25%). Most participants reported earning between $40,000 and $40,999 (75%) while some reported making less than $30,000 (25%) at the time of the study (i.e., within three years of receiving their Master's degree).

Procedure

Prior to beginning the study, approval from the institutions Institutional Review Board (IRB) was received. The approval included permission to analyze data obtained from pre-existing documents and conduct research on human subjects (i.e., alumni). The approval included the authorization of the consent form, disclaimer about volunteering, security of data, confidentiality, survey items, and sampling procedures for the participants.

An email was sent to all potential participants (to all available email addresses) in the middle of February 2018. Over the course of two months, additional emails were sent reminding alumni a) of the chance to participate, b) to complete the survey they started, or c) to forward a copy of their most recent teaching evaluation and/or observation. In an effort to reach individuals for whom updated contact information was not available, a link to the survey was posted via the University's social media accounts (i.e., Twitter, Instagram, and Facebook) to solicit a greater response. Incomplete surveys were disregarded for the purposes of the data analyses. Additionally, individuals who completed the survey but did not forward the necessary teaching evaluation and/or observation forms were disregarded for the purposes of the data analyses.

Upon agreeing to participate, alumni completed a survey involving multiple sections. The first three sections included personal demographics, current employment information, and information regarding employment milestones. The fourth section validated participants had the necessary teaching evaluation and/or observation forms. The fifth section had participants rate their agreement through a Likert scale, *one* (extremely prepared) to *five* (not prepared at all), to a series of questions phrased to determine their preparation relative to the goals of the program (i.e., 2017

ILA standards). The sixth section involved information regarding the ways, if any, in which the program prepared participants for their current job responsibilities. The last section was optional and collected updated contact information for other potential participants.

Qualified participants who completed the survey were provided the researcher's email address and instructions to forward their most recent teaching evaluation and/or observation. The researcher communicated directly with participants via email to answer questions regarding materials and to ensure that documents were provided in an acceptable format. Upon completion of the survey and receipt of the necessary documents, individuals who completed the study received a $25 electronic Amazon gift card via email that was mentioned during study participation solicitation.

Data Analysis

Anonymity could not be offered since the researcher had access to participants' names and contact information to remain in contact through the duration of the study. However, each participant received a numerical identifier (e.g., Participant 1) to maintain confidentiality. This identifier was also used to label all corresponding documents received from participants.

Research question 1 addressed the way in which employers demonstrate satisfaction with recent program completers. Document analysis, a form of qualitative research in which documents are interpreted, was used to address this question (Bowen, 2009). Provided documents (i.e., teacher observations and/or evaluations) were used to determine themes of employer satisfaction with participant performance in the field. Documents were coded using evaluation coding to establish specific areas of observation and/or evaluation (i.e., teaching domains) (Saldaña, 2013). Employer domain ratings were determined for each participant by looking at the domain mode (i.e., most frequent rating assigned). Documents were also used holistically to determine an overall measure of employer satisfaction using the percentage of ratings provided by employers in each category (i.e., ineffective, developing, effective, and highly effective). This overall measure was then compared to educator evaluation data collected by New York State (New York State Education Department, 2016). Additionally, qualitative comments provided by employers were analyzed using in vivo coding, involving the use of short phrases or words from the employer's own language as codes (Saldaña, 2013).

Research question 2 addressed the ways that recent program completers reached employment milestones. The percentage of participants that held a position of literacy specialist since graduation was represented with a bar chart to demonstrate a pattern of receiving a position in a field related to one's degree (employment milestone). Additionally, the number of years participants were a teacher of record was represented with a bar chart to determine the amount of teaching experience prior to participation in the study as well as demonstrate a pattern of retention (continued employment). Qualitative responses regarding specific position(s) held and length of each position were synthesized and analyzed using in vivo coding for trends in retention (continued employment) and promotion (position rank) (Saldaña, 2013).

Research question 3 addressed how recent program completers perceive their preparation as relevant to their current job responsibilities. To address this question, the percentage of participants who recorded being extremely prepared, prepared, somewhat prepared, not very prepared, or not prepared at all for their current job responsibilities was represented with a bar chart. Additionally, qualitative responses indicating specific responsibilities participants felt most/least prepared for were analyzed using in vivo coding (Saldaña, 2013). In vivo coding was also used to analyze qualitative responses provided by participants regarding the preparation provided by their practicum, including

observation and ongoing feedback by supervisors (Saldaña, 2013). A bar chart was used to outline specific fieldwork experiences that participants indicated (from a provided list) prepared them for their current job responsibilities, while in vivo coding was used to analyze qualitative responses regarding specific ways field work experiences prepared them or experiences that would have been more helpful (Saldaña, 2013).

Research question 4 addressed how recent program completers perceive their preparation as effective relative to the goals of the program. Participants rated their agreement to questions phrased to determine their preparation to meet various aspects of the 2017 ILA standards based on the preparation they received through a Likert scale, one (not prepared at all) to five (extremely prepared). Analysis included calculating the average extent of preparation participants recorded to determine the center of the data, along with the standard deviations to determine the variation of the data from the mean.

FINDINGS

Employer Satisfaction

Document analysis was used to interpret provided documents related to employer satisfaction. Table 2 outlines the type of document(s) received by participants. The documents received were of various forms (i.e., OBS*e*RVE, Edivate Observe, Unannounced Observation Rubric, Summative Performance Report, and Private School Form) making *direct* associations between documents unattainable. Some observations provided by participants included an overall rating while others did not. Given the inconsistencies, including ratings on some or all of the four teaching domains and their subscales, proportions were used to indicate the percentage of ratings provided by employers on the observation forms in each coded category (i.e., ineffective, developing, effective, and highly effective). In addition to forwarded APPR score report information, these comprehensive percentages were used to determine each participant's overall rating. Again, omitted ratings (i.e., not observed, does not apply, N/A, not yet rated, not evident, left blank) were not included in analysis.

Table 2

Pilot Example for Overall Employer Ratings

	Type of Document(s)	Percentage of Ratings			
		(1) Ineffective	(2) Developing	(3) Effective	(4) Highly Effective
Participant 1	Teacher Observation	0	0	66.66	33.33
Participant 2	Teacher Observation	0	0	0	100
Participant 3	Teacher Observation	0	0	25	75
Participant 4	Teacher Observation	0	14.29	71.42	14.29
Participant 5	Teacher Observation	0	0	62.50	37.50
Participant 6	Teacher Observation	0	0	41.86	58.14
Participant 7	Teacher Observation & APPR Score Report	0	0	50	50*
Participant 8	Teacher Observation	0	--	100	--

**indicates APPR rating*

Comparing participants overall ratings to the most recent New York State Educator Evaluation Data outlined in Figure 1 (New York State Education Department, 2016) allows a program to gather whether employers who hired program completers were satisfied to a similar extent if not more than that of a larger sample.

Figure 1: Educator Evaluation Data for Educators in New York State: APPR Overall Composite Ratings (New York State Education Department, 2016)

Specific analysis of each observation form revealed participants were evaluated on some or all of four common domains of teaching, which aligned to the Danielson Framework for Teaching (The Danielson Group, 2013): (1) planning and preparation, (2) classroom environment, (3) instructional practices and (4) professional responsibilities. Table 3 outlines the employer domain ratings for each participant in some or all of the four teaching domains addressed within the observation provided. All but one participant was rated by employers on a four-point scale, allowing for associations to be made across evaluation/observation forms. Terms used in the various four-point rating scales (e.g., unacceptable, insufficient, emergent, needs improvement, proficient, accomplished, etc.), were coded into four categories. The four rating categories of (1) ineffective, (2) developing, (3) effective, and (4) highly effective were selected for this study since this scale was used on several of the observations forms and represents the APPR ratings used by New York State (New York State Education Department, 2016). The terms used in the two-point rating scale on Participant 8's observation form (i.e., evident or missed opportunity), were coded as (1) ineffective or (3) effective. Omitted ratings (i.e., not observed, does not apply, N/A, not yet rated, not evident, left blank) were not included in analysis. Employer domain ratings were determined by looking at the domain mode (i.e., most frequent rating assigned).

Table 3

Pilot Example for Employer Domain Ratings

	Domain Ratings			
	Planning and Preparation N = 6	Classroom Environment N = 7	Instructional Practices N = 5	Professional Responsibilities N = 6
Participant 1	Effective	Effective	Highly Effective	Effective
Participant 2	Highly Effective	Highly Effective	Highly Effective	Highly Effective
Participant 3	Highly Effective	Highly Effective	Highly Effective	Effective
Participant 4	Highly Effective	Developing	Effective	Effective
Participant 5	--	Effective	Effective	--

Participant 6	Effective	--	--	Effective
Participant 7	--	Highly Effective	--	--
Participant 8	Effective	Effective	--	Effective

Qualitative comments included by employers on each of the observation forms provided were also coded, specifically into two categories (i.e., strengths and improvements). Themes that emerge from strength comments suggest what employers are satisfied with regarding the ability of program completers while themes that emerge from improvement comments suggest areas for program improvement. Template comments not directly selected or provided by the employer, but rather automatically generated from the rating selected, were not included in analysis.

Employment Milestones

The percentage of participants that held a position of literacy specialist since graduation was gathered through qualitative responses gathered through a survey. Figure 2 provides an example of how a bar chart can be used to demonstrate a pattern of receiving a position in a field related to one's degree since graduation (e.g., literacy specialists for students in an advanced literacy program), which is an employment milestone. It should be noted that even if participants do not indicate they hold a *specific* position, they may indicate they are still employed in the field of education, which is still an employment milestone. Figure 3 provides an example of how a bar chart can be used to demonstrate a pattern of retention/continued employment as a teacher of record for program completers. Qualitative responses regarding specific position(s) held and length of each position were synthesized and analyzed using in vivo coding for trends in retention (continued employment) and promotion (position rank) (Saldaña, 2013).

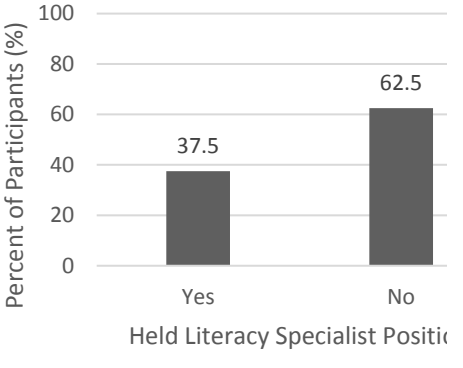

Figure 2. Pilot Example for Literacy Specialist Since Graduation

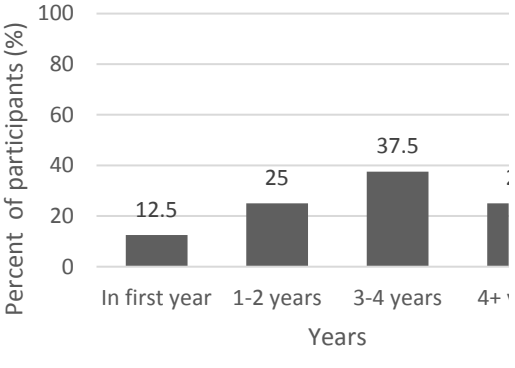

Figure 3. Pilot Example for Years as Teacher of Record

Table 4 outlines responses from participants regarding specific position(s) held in education and length of each position. Comments were coded into two categories, including position(s) and length of position(s) demonstrating a pattern of retention/continued employment. Multiple positions held by participants may demonstrate a pattern of promotion awarded (increased responsibility) while the increased rank of each subsequent position (e.g., substitute teacher to long-term substitute teacher to full time teacher) may also demonstrate a pattern of promotion. If a participant indicates

that they held only one position in education, but that this was a full-time teaching position, this further demonstrates a pattern of reaching employment milestones like receiving a *full-time* position in the field after graduation.

Table 4

Pilot Example for Employment Retention and Promotion

	Position(s) Held (chronological order)	Length of Position
Participant 1	First Grade Teacher	3-4 years
Participant 2	6th Grade Classroom Teacher	3-4 years
Participant 3	Teaching Assistant	Less than 1 year
	4th Grade Long Term Teacher	Less than 1 year
	Literacy Specialist	1-2 years
Participant 4	Secondary Teacher	3-4 years
Participant 5	Building-Based Substitute Teacher	1-2 years
	Long-Term Substitute Teacher	Less than 1 year
Participant 6	Art Teacher (tenure track)	1-2 years
Participant 7	Long Term Substitute Teacher	1-2 years
	.4 Special Education Teacher/.6 Teaching Assistant	Less than 1 year
Participant 8	Fourth Grade Teacher	Less than 1 year
	Literacy Specialist	1-2 years

Perceived Preparation: Current Job

The percentage of participants who recorded being extremely prepared, prepared, somewhat prepared, not very prepared, or not prepared at all for their current job responsibilities was gathered through responses gathered through a survey. Figure 4 provides an example of how a bar chart can be used to demonstrate a pattern of preparation. It should be noted that this preparation may be to work specifically towards something related to the advanced-level program (e.g., literacy specialist) or in the field of education in general pending how the survey questions are structured.

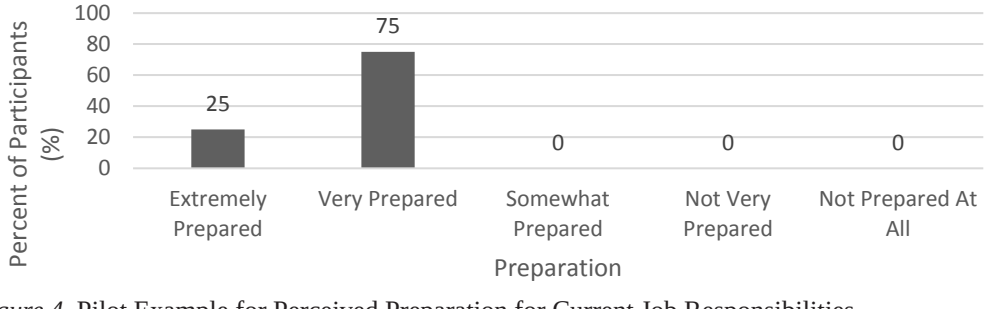

Figure 4. Pilot Example for Perceived Preparation for Current Job Responsibilities

Qualitative responses from participants regarding preparation for their current job responsibilities were coded into three categories, including aspects of their current job responsibilities in which they were most prepared and least prepared, as well as aspects they felt they were prepared for by practicum experiences. The themes the emerged can provide program with information pertaining to what completers were most and least prepared for upon entering the field, as well as feedback regarding if and how required practicum experiences contributed to completers overall preparation. Furthermore, Figure 5 outlines provides an example of how a bar chart can be used to outlined how fieldwork experiences related to *specific* advanced-level programs prepared them for their current job responsibilities. This can help programs determine if the skills acquired through these experiences may have the most practical application after graduation.

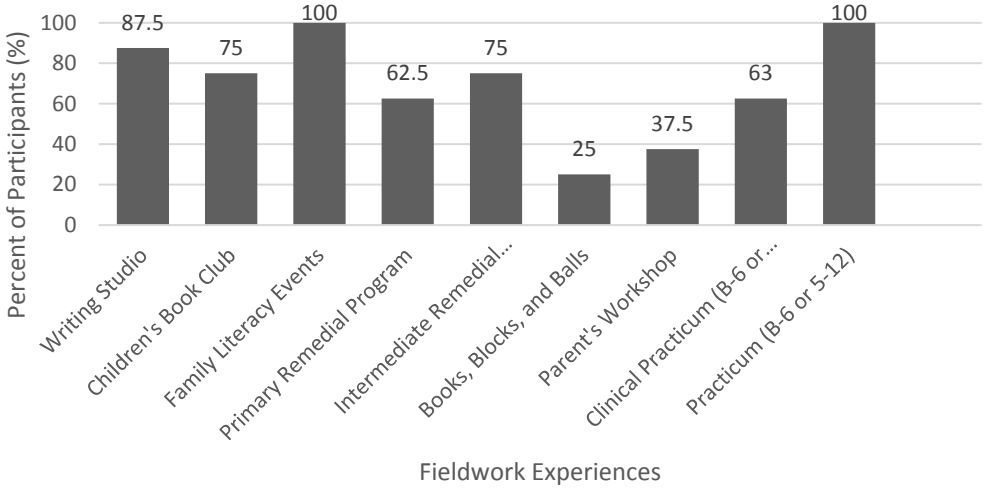

Figure 5. Pilot Example for Preparation from Specific Fieldwork Experiences

Qualitative responses from participants regarding ways that fieldwork experiences prepared them for their current job responsibilities were coded into two categories (i.e., strengths and improvements). Themes that emerge from strength comments suggest specific ways field work experiences prepared them for their current job responsibilities while themes that emerge from improvement comments suggest areas for program improvement related to field experiences and how to provide opportunities to connect learning with practice as well as prepare students for day-to-day responsibilities.

Perceived Preparation: 2017 ILA Standards

Measures of central tendency were used to analyze survey data pertaining to how recent program completers perceived their preparation as effective relative to the goals of the program. Table 5 outlines an overall perception of preparation regarding the 2017 ILA standards (specific to advanced literacy programs). By looking at the average perceived preparation in the range of very prepared (4) to extremely prepared (5) and standard deviations below one, programs can determine if data clustered around these high means, suggesting the program prepared graduates to a high extent to meet the standards. By looking at the average perceived preparation in the range of not prepared at all (0) to not very prepared (1) and standard deviations below one, programs can determine if

data clustered around these low means, suggesting the program did not prepare graduates to a high extent to meet the standards. Identifying standards with a standard deviation above one, indicating a wider spread of data from the mean, may also be helpful identifying area within standards that can be used for program improvement. For example, standard 3.3 and standard 6.3 in Table 5 are the only two standards with an average perceived preparation in the range of somewhat prepared (3) to very prepared (4) and a standard deviation above one, and both standards address the same area of leadership.

Table 5

Pilot Example for Perceived Preparation Relative to Goals of Program (2017 ILA Standards)

	Mean	Standard Deviation		Mean	Standard Deviation
ILA Standard			ILA Standard		
Standard 1.1	4.25	.46	Standard 4.2	4.25	.71
Standard 1.2	4.25	.71	Standard 4.3	4.75	.46
Standard 1.3	4.38	.52	Standard 4.4	4.13	.64
Standard 1.4	4.00	.76	Standard 5.1	4.50	.76
Standard 2.1	4.63	.52	Standard 5.2	4.25	.71
Standard 2.2	4.50	.76	Standard 5.3	4.13	.83
Standard 2.3	4.50	.76	Standard 5.4	4.50	.53
Standard 2.4	4.00	.93	Standard 6.1	4.75	.71
Standard 3.1	4.13	.64	Standard 6.2	4.38	.74
Standard 3.2	4.38	.74	Standard 6.3	3.75	1.67
Standard 3.3	3.75	1.75	Standard 6.4	4.13	.64
Standard 3.4	4.25	.89	Standard 7.1	4.50	.76
Standard 4.1	4.13	.64	Standard 7.2	4.50	.76
			Standard 7.3 & 7.4	4.13	.83

CONCLUSION

It is necessary for providers of advanced-level programs to collect valid and reliable data pertaining to the satisfaction of both its graduates and the schools that employ them in an effort to demonstrate adherence to everchanging standards in the field (e.g., 2017 ILA standards) as well as maintain program accreditation. This study fills a gap in pragmatic methods of collecting evidence through the development of evaluative measures by which advanced-level programs can measure their program's impact through examining program completer and employer satisfaction.

This study provides a model for future research intended on measuring the satisfaction of program completers. By collecting self-report data from alumni working in the field through a survey, institutions can gauge in-service teacher's perceptions of satisfaction relevant to both their

current job responsibilities as well as the preparation program's goals. Given that goals of specific programs will vary across institutions, modifications to the survey used in this study would need to be made to reflect specific program standards. Additionally, self-report data regarding employment milestones collected from alumni working in the field can be used by institutions to demonstrate continued employer satisfaction through patterns of promotion and retention. Finally, employer evaluation data collected from the evaluations and/or observations of alumni working in the field can be used by institutions to demonstrate overall employer satisfaction thorough employer's performance ratings as well as remarks on performance.

Limitations and Recommendations

This study's insights into methods used to measure the satisfaction of program completers and their employers are rooted in the CAEP (2016b) standards for advanced programs which may restrict the generalizability of the results. The model this study outlines may be less effective in measuring a different set of program accreditation standards. Although a large sample size would be necessary for more meaningful and robust results regarding completer and employer satisfaction, smaller populations resulting from restrictions set in place to keep results relevant, along with outdated contact information often gathered by smaller institutions, may limit the ability to gather a larger sample size. A strategic plan set in place by institutions outlining methods of collecting and maintaining a database of current contact information for alumni could potentially increase the size of future samples. Additionally, solicitation of participation *prior* to graduation may increase the sample size and overall validity of the study by encouraging participation from both effective and developing educators. Finally, providing alumni with practical forms of compensation, including free professional development opportunities for areas of improvement identified by the study (e.g., leadership) may work to increase the sample size for smaller liberal arts and science institutions.

Finally, the variation of observation and/or evaluation forms provided by participants made document analysis challenging. Although it would be ideal to limit the type of evaluation rubrics accepted or give preference to participants with select New York State approved teacher rubrics (i.e., Danielson, Marzano, or NYSUT), this would considerably limit the sample size given the percentage of alumni working in schools utilizing other forms of teacher evaluation. Additionally, although it would be ideal to limit participants to those who have and are willing to share their APPR scores, this would further limit the sample size.

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APPENDIX

PROGRAM COMPLETERS' PERCEPTION OF THEIR PROGRAM PREPARATION

Part A. Quantitative Questions

Please respond to the following survey questions of your perception of the teacher program preparation by using a 5-point Likert scale:

Extremely prepared *[Code = 5]*
Very prepared *[Code = 4]*

Somewhat prepared *[Code = 3]*
Not very prepared *[Code = 2]*
Not prepared at all *[Code = 1]*

Based on the preparation you received through your program, how prepared did you feel in the following areas?

_____ Q1. Demonstrating knowledge of the major theoretical, conceptual, historical, and evidence-based components of reading (e.g., concepts of print, phonological awareness, phonics, word recognition, fluency, vocabulary and comprehension) development throughout the grades.

_____Q2. Demonstrating knowledge of the major theoretical, conceptual, historical, and evidence-based components of writing (e.g., handwriting, spelling, sentence construction, typing, word processing, conventions) development and the writing process throughout the grades.

_____Q3. Demonstrating knowledge of theoretical, historical, and evidence-based components of communication (e.g., structure of language, conventions of standard English, vocabulary acquisition and use, speaking, listening, and viewing) throughout the grades.

_____Q4. Demonstrating knowledge of the historical and evidence-based foundations related to the role of the reading/literacy specialist.

_____Q5. Using foundational knowledge to design, select, critique, adapt and evaluate evidence-based literacy curricula that meets the needs of all learners.

_____Q6. Planning, adapting, teaching, and evaluating a range of evidence-based instructional approaches and practices to meet the literacy needs of whole class and groups of students in learning to read, write and communicate and in the service of content learning.

_____Q7. Planning, adapting, teaching, and evaluating a range of instructional approaches and practices for individual students, especially those who experience difficulty with literacy.

_____Q8. Collaborating with and coaching school-based educators in developing, implementing, and evaluating literacy instructional practices and curriculum.

_____Q9. Understanding the purposes, attributes, formats, strengths/limitations, and influences of various types of tools in a comprehensive literacy and language assessment system (including validity, reliability, inherent language, dialect and/or cultural bias) and applying that knowledge to using assessment tools.

_____Q10. Collaborating with colleagues to administer, interpret, and use data for decision making about student assessment, instruction, intervention, and evaluation for individual students.

_____Q11. Participating in and lead professional learning experiences to assist teachers in selecting, administrating, analyzing, interpreting, and using results data for instructional decision making for classrooms and schools.

_____Q12. Explaining assessment results and advocating for appropriate literacy and language practices to a variety of stakeholders, including students, administrators, teachers, other educators, parents/guardians, and students using both written and oral communication

_____Q13. Demonstrating knowledge of foundational theories about diverse learners, equity, and culturally responsive instruction

_____Q14. Demonstrating understanding of yourself and others as cultural beings through your pedagogy and interactions with individuals within and outside of the school community

_____Q15. Creating and advocating for inclusive and affirming classroom and school environments

_____Q16. Advocating for equity at school, district, and community levels

_____Q17. In consultation with families and colleagues, meeting the developmental needs of learners, taking into consideration their physical, social, emotional, cultural, and intellectual factors

_____Q18. Collaborating with school personnel to implement a variety of digital and print materials to engage and motivate all learners

_____Q19. Integrating digital technologies in appropriate, safe, and effective ways and assisting colleagues in these efforts

_____Q20. Participating in and leading schoolwide efforts to foster a positive climate with families and colleagues that support a literacy-rich learning environment

_____Q21. Becoming a reflective, self-aware, lifelong learner

_____Q22. Engaging in collaborative decision making with colleagues to design, align, and assess instructional practices and interventions within and across classrooms

_____Q23. Developing, refining, and demonstrating leadership skills through effective interpersonal and written communication

_____Q24. Consulting with and advocating on behalf of teachers, students, families, and communities for effective literacy practices and policies

_____Q25. Working with individual and small groups of students at various grade levels to assess students' literacy strengths and needs, develop literacy intervention plans, implement instructional plans, and assess impact on student learning

_____Q26. Developing, reflecting on, and studying your own teaching practices through ongoing and cyclical collaborative and novice coaching experiences with peers and experienced colleagues

_____Q27. Completing your authentic, school-based practicum experiences

_____Q28. Based on the preparation you received through your program, how prepared were you for your current job responsibilities?

Part B. Open-ended Questions.

OQ1. What responsibilities in your current job, if any, were you prepared for the *most*?

_____

_____

OQ2. What responsibilities in your current job, if any, were you prepared for the *least*?

_____

_____

OQ3. In what ways, if any, did your practicum supervision, including observation and ongoing feedback by supervisors, prepare you for your current position?

_____

_____

OQ4. What specific fieldwork experiences did you participate in while a student (check all that apply)?

Writing Studio	*[Code = 1]*
Children's Book Club	*[Code = 2]*
Family Literacy Events	*[Code = 3]*
Primary Remedial Program	*[Code = 4]*
Intermediate Remedial Program	*[Code = 5]*
Books, Blocks, and Balls	*[Code = 6]*
Parent's Workshop	*[Code = 7]*
Clinical Practicum P-6	*[Code = 8]*
Clinical Practicum 5-12	*[Code = 9]*
Practicum (school based) B-6	*[Code = 10]*
Practicum (school based) 5-12	*[Code = 11]*

OQ5. In what ways did these fieldwork experiences prepare you for your current job?

_____

_____

OQ6. If not, what would have been more helpful?

_____

_____

OQ7. Do you know any other individuals graduated from the program within the past three years that would be willing to complete this survey?

_____

_____

OQ8. Would you be willing to discuss and elaborate on some of your survey responses if determined necessary by the researcher?

_____

_____

End of Survey

Note: The actual survey includes questions on program completers' demographic information, and quantitative and qualitative questions. Because of word limitation and format of journal publication, the survey has been modified to include only the quantitative and the qualitative questions.

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