Journal of Montessori Research

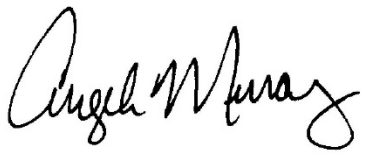
May 2017

From the editor:

This first issue of the *Journal of Montessori Research* for 2017 highlights the breadth of studies such a publication can disseminate. The Debs and Brown article is a critical review of the literature about students of color and public Montessori schools. The Jones article is a qualitative case study of teachers' beliefs and technology use in Montessori classrooms. Finally, the Setari and Bradley article is a psychometric validation of an instrument for a Student Evaluation of Teaching (SET) used in a Montessori high school.

As we achieve the milestone of our third volume, it seems a good time to express appreciation for the authors, reviewers, and copy editor, whose dedication and hard work make this publication possible. We are truly building something important for the Montessori community.

Sincerely,



Angela K. Murray, PhD
Editor
akmurray@ku.edu

Journal of Montessori Research
2017, Volume 3, Issue 1

Students of Color and Public Montessori Schools: A Review of the Literature

Mira C. Debs[1] and Katie E. Brown†[2]

[1]Yale University

[2]National Center for Montessori in the Public Sector

Acknowledgments

Thank you to Kellie Meyers, whose request for data inspired this article, and to the editor and anonymous reviewers of the *Journal of Montessori Research* for their comments. Please note the following author affiliations: Katie Brown oversees the Montessori Teacher Residency, and both Brown and Mira Debs are involved with Montessori for Social Justice.

Keywords*: minority, students of color, Montessori, urban education, school choice*

Abstract. Students of color comprise a majority in public Montessori school enrollments around the United States, and practitioners are often asked for evidence of the Montessori Method's benefits for these students. This article examines the relevant literature related to the experiences of students of color in public Montessori schools. Research finds Montessori education offers both opportunities and limitations for students of color in attending diverse schools, developing executive functions, achieving academically, accessing early childhood education and culturally responsive education, minimizing racially disproportionate discipline, and limiting overidentification for special education. Public Montessori education's efficacy with students of color may be limited by several factors: the lack of diversity of the teaching staff and culturally responsive teacher education, schools that struggle to maintain racially diverse enrollments, and the challenge of communicating Montessori's benefits to families with alternative views of education. The review concludes with directions for future research.

Students of Color and Public Montessori Schools: A Review of the Literature

One of the foremost priorities of American public education–reform efforts has been to eliminate the *opportunity gap* for students of color, particularly in urban schools. While the term *achievement gap* has long been used to describe the disparity in academic outcomes between White, middle-class students and low-income students of color, scholars like Gloria Ladson-Billings (2013) have argued that this phenomenon should be reframed as a disparity in opportunities to learn. Researchers have long debated the primary causes of this gap, including disproportionate poverty and childhood trauma for some students of color, underfunding of public education, continuation of segregated schools, shortage of quality teachers, racially biased tests, and other legacies of racism (Au, 2010; Anyon, 2014; Darling-Hammond, 2010; Ladson-Billings & Tate, 1995). One model for many urban charter schools has been to set up longer school days and school years alongside a strict system of rewards and punishments—in essence, a more concentrated dose of traditional school (Carter, 2000; Thernstrom & Thernstrom, 2004). These urban charter schools were initially hailed for their academic results, but today they face increasing scrutiny for

disciplinary practices that have resulted in higher levels of student suspensions and expulsions than found in neighboring district schools. In addition, while graduates of these high-performing charter schools have college persistence rates that are higher than the average rates for Black and Latino students, they are still far lower than White and Asian graduation rates, suggesting that these students are still not receiving critical skills for college readiness (Golann, 2015; Goodman, 2013). More broadly, scholars have repeatedly questioned whether the traditional *factory model* of education best serves students' needs, particularly those students of color (Hall, 2006; Hall & Murray, 2011; Kunjufu, 2005; Ladson-Billings, 1994; Noguera, 2003).

Montessori public schools offer a distinct contrast to methods used by traditional public schools, including these high-performing, strict-discipline charter schools. There, the teacher is the authority, children remain at their desks, and learning is highly regimented and standardized. In contrast, children in public Montessori schools work at their own pace on sequential lessons, and their learning is individually tailored. They collaborate with other students, moving freely around the classroom, and the curriculum emphasizes community building as students develop strong relationships with the same teacher over 3 years. In consideration of these significant differences, our study examines existing research to answer the question: How effectively do public Montessori schools serve students of color?

In the last 40 years, public Montessori schools have expanded exponentially to over 500 schools that serve approximately 125,000 students, forming the largest alternative pedagogy in the U.S. public school system (National Center for Montessori in the Public Sector [NCMPS], 2014). In a survey of 300 of these public Montessori schools in 2012–2013, 54% of students were students of color, comprising Black, Latino, Asian, Native American, Pacific Islander, and multiracial students (Debs, 2016b). Black students were enrolled in public Montessori schools at a rate that is 11% higher than the nationwide rate for public schools. Moreover, public Montessori school students, and Black and Latino students in particular, were more likely to attend a racially diverse school (between 25% and 75% students of color) compared to students nationwide (Debs, 2016b).

In light of this racial diversity, we evaluate existing research on the efficacy and limitations of public Montessori education for students of color and important gaps in the research. In particular, we update and expand research by Hall and Murray (2011) that examined Black students and the potential intersections of Montessori practice and culturally responsive pedagogy, an approach that promotes students' cultural strengths to support their well-being and achievement. We find that public Montessori education demonstrates strengths in racial diversity, mixed results in student outcomes, and promising potential in early childhood, special education, and cultural responsiveness. We recognize that Montessori schools are not a panacea to the broader set of social disadvantages that students of color face. Ultimately, though, we argue that further research into the experiences of students of color in Montessori schools will give educators and policymakers the tools to more effectively identify Montessori's strengths in these areas and to better identify areas of improvement. We conclude with next steps for both practitioners and policymakers.

Public Montessori Education and Racial Diversity

The Montessori Method has its roots in serving disadvantaged students. Montessori education began over a century ago by serving the poorest urban children in Rome, Italy. Similarly, in the United States, public Montessori schools have a 50-year history of creating racially and socioeconomically diverse schools. To support poor children, American public educators began to bring the Montessori Method to schools and classrooms to provide quality early childhood education via Head Start in the late 1960s. Subsequently, educators used Montessori education as a means to desegregate urban school districts including Cincinnati, Ohio; Kansas City, Missouri; and Milwaukee, Wisconsin. More recently, cities such as Cambridge, Massachusetts; Hartford, Connecticut; and Fort Wayne, Indiana, have successfully used Montessori education to retain families in urban district schools (NCMPS, 2014).

Today, in a landscape of increasing school segregation around the United States (Orfield, Kucsera, & Siegel-Hawley, 2012), public Montessori schools remain racially diverse (Debs, 2016b). This racial

diversity is important because research has consistently shown that students attending racially diverse schools have higher achievement in mathematics (Berends & Penaloza, 2010; Newton, 2010) and literacy (Benson & Borman, 2010) and build more expansive social networks (Braddock & Gonzalez, 2010; Goldsmith, 2010; Wells, Holme, Revilla, & Atanda, 2009). Of the roughly 500 public Montessori schools, 300 are schoolwide programs with available data on the racial, ethnic, and socioeconomic composition of their student body. Half of the 300 schoolwide, public Montessori programs enroll a racially diverse student body (between 25% and 75% students of color). In 23% of these schools, a majority (75%–100%) of enrolled students are students of color (Debs, 2016b). Half of these 300 schoolwide programs are located in urban areas (Debs, 2016b). We have less information about the 203 Montessori programs that are located within traditional schools, but some initial evidence (e.g., a study of student demographics in South Carolina's robust public Montessori sector) demonstrates that these partial school programs enroll a racially and economically diverse student population as well (Furman University, 2015). Thus, a clear and enduring strength of public Montessori programs has been their success in enrolling a racially diverse student body in schools around the country.

Although public Montessori schools are distinguished by their racial diversity, by other measures, many schools have Whiter or wealthier student enrollments than those in their surrounding districts. Over two thirds of schoolwide public Montessori schools enroll fewer students of color than their surrounding districts do (Debs, 2016b); this difference is even more pronounced in Montessori charter schools (Brown, 2016a). Roberts and Fleming (2016) found a similar enrollment pattern in South Carolina's public Montessori programs within schools. Enrolling a higher proportion of White students can be positive if the resulting Montessori school is racially diverse in an overwhelmingly monoracial district, but it may be a problem if the public Montessori enrollment is significantly different from that of the surrounding district. In several cases in Washington, California, Oregon, and Wisconsin, public Montessori charter applications have been denied, charter renewals have been given extra scrutiny, and programs have been closed because of concerns about disproportionately White enrollments ("EGUSD staff," 2016; McCord, 2012; Nyland, 2015; Swedien, 2013; Wong, 2014).

Maintaining student diversity in public Montessori schools requires constant vigilance from school administrators and policy makers, as structural and cultural factors can impede the enrollment of students of color. Most public Montessori schools are a component of choice programs, including choices within schools, selective magnets, and charters. To enroll their children, parents must research their choices, navigate complicated information systems, and sometimes provide transportation, all of which are significant burdens for the poorest families. One great strength of public Montessori education is that students often begin these programs at age 3 or 4, but limited public funding causes some schools to charge tuition for preschool programming, thereby restricting the diversity of students who can attend the school. Further, a number of public Montessori schools that began with missions to attract a racially diverse student body have found their enrollments becoming increasingly White (Makris & Brown, in press). Several charters, like Baltimore Montessori Charter in Maryland and City Garden Montessori School in St. Louis, Missouri, are now exploring the use of a weighted lottery to maintain racial balance at their schools (Bowie, 2016; Prothero, 2016). Research thus far shows that public Montessori schools are particularly strong in creating racially diverse student enrollments, but maintaining such diversity requires intentional efforts to reduce barriers and increase access.

Montessori Students of Color and Academic Achievement

While research has identified the diversity strengths of public Montessori education, research on outcomes for Montessori students of color has been inconclusive and limited in both size and scope. One complicating factor for the development of large studies across public Montessori schools is that Montessori implementation varies widely in the public sector (Murray & Peyton, 2008), and these variations have been shown to have an impact on student outcomes (Lillard, 2012). In recent years, policymakers and researchers have therefore been working to define high-quality Montessori to include, at minimum, the following elements: Montessori-trained teachers and administrators, a majority of Montessori materials, students

working in 3-hour cycles, and multiage classrooms that span three grade levels (NCMPS, 2016a).

Some initial findings suggest that public Montessori programs can benefit Black and Latino students. A recent study found that Black third graders in a public Montessori magnet school outperformed their traditional school counterparts in both reading and math. When compared to other magnet students in the same district, these Black Montessori students still performed better in reading and equally in math (Brown, 2016b). Dohrmann, Nishida, Gartner, Lipsky, and Grimm (2007) found that a racially diverse group of pre-K through fifth-grade students who attended a high-quality public Montessori program (i.e., one with Montessori-trained teachers; Montessori materials; multiage classrooms; and long, independent work blocks) had a pronounced advantage in high school math and science, even 7 years after leaving the Montessori program. These students had higher scores on standardized tests of math and science and higher subject-specific grade point averages in high school than their non-Montessori peers. In the largest cohort study to date, Ansari and Winsler (2014) examined 709 low-income Black and Latino 4-year-olds and found strong developmental gains for Latino students following only 1 year of Montessori pre-K in Miami-Dade County Public Schools, with more modest gains seen among Black students. Despite the sample size, two factors limited the Ansari and Winsler (2014) study: the public Montessori programs in Miami included only 4-year-olds (i.e., not children in multiage classrooms), and the study evaluated only 1 year of implementation. Another study of a bilingual Montessori preschool program (Rodriguez, Irby, Brown, Lara-Alecio, & Galloway, 2005) found that Latino Montessori students made greater gains in both English and Spanish language acquisition than did their peers in a traditional bilingual program. Not all findings have been positive, however. Using a majority–minority student sample, Lopata, Wallace, and Finn (2005) found no clear advantage on standardized math and language arts assessments for fourth- and eighth-grade Montessori students as compared to their peers in traditional and magnet schools.

While a number of studies have featured racially and socioeconomically diverse public Montessori student samples, researchers frequently have not disaggregated data by race, making it difficult to evaluate academic and noncognitive outcomes for students of color (Dohrmann et al., 2007; Duax, 1989; Ervin, Wash, & Mecca, 2010; Lillard & Else-Quest, 2006; Lopata et al., 2005; Mallett & Schroeder, 2015; Moody & Riga, 2011). Public Montessori leaders around the country have reported strong academic gains and high graduation rates for students of color in their programs (East Dallas Community Schools, 2010; Moody & Riga, 2011), but the widespread racial achievement gaps in American public education have also been found in public Montessori schools (Mallett, 2014). To better understand the performance of students of color in public Montessori schools, it is critical that future research projects disaggregate students by racial and ethnic background, as well as by income level and English-language learner and special education status.

Further, existing research on public Montessori education has been limited in studying students of color, in part because of the small sample sizes in the studies (Lillard & Else-Quest, 2006), the short duration of the research (Ansari & Winsler, 2014), and the difficulty of measuring whether families who choose Montessori are different from nonchoosers. Thus, two research gaps in public Montessori education are noted: (a) national studies that focus on the achievement of students of color and (b) longitudinal studies that compare families that choose Montessori education with families that do not.

Other Montessori studies have focused on gains in noncognitive skills related to academic achievement and professional success. Montessori has been shown to be particularly effective for all students in fostering the development of executive functions like self-discipline, critical reasoning, and problem-solving (Diamond & Lee, 2011; Ervin et al., 2010; Lillard, 2005, 2012; Lillard & Else-Quest, 2006; Rathunde & Csikszentmihalyi, 2005). These executive functions help students self-regulate as their learning becomes more independent in college and in the workplace (Mischel, Shoda, & Rodriguez, 1989; Mischel et al., 2011; Tough, 2012). Executive functions also help empower students to be agents of change in their communities. In particular, Lillard and Else-Quest (2006) found a strong sense of school community and a willingness to be proactive in resolving peer conflict among Milwaukee public Montessori middle school students. Further research is needed on the noncognitive effects of Montessori education on students of color.

Montessori and Early Childhood Education for Students of Color

Because Montessori programs ideally begin with children at age 3, they provide a significant opportunity to build strong foundations for academic achievement among students of color. The work of economist James Heckman suggests that public investments in early childhood education pay dividends for many years, especially for economically disadvantaged students (Heckman, 2012). This investment is particularly important for Black and Latino children, who attend preschool at lower rates than their White peers (U.S. Department of Education, 2015). As an early childhood program that promotes school readiness, academic development, and noncognitive skills, the Montessori Method meets Heckman's criteria for high-quality early learning. Moreover, by emphasizing *playful learning* (Lillard, 2013), Montessori education occupies the middle ground between entirely play-based and entirely academics-based preschool (Lillard et al., 2013). Montessori education also represents a model that can sustain students from early childhood through elementary school and beyond.

As Black preschoolers are in the racial group most likely to attend low-quality preschools (U.S. Department of Education, 2015), expanding access to public Montessori pre-K constitutes an opportunity to significantly improve early learning experiences for these students. More research is needed to demonstrate the advantages of these programs for students of color. The Ansari and Winsler study (2014) of Black and Latino 4-year-olds found strong improvement in Latino students in the areas of pre-academic and behavioral skills after 1 year of public Montessori preschool; gains for Black students were comparable to those seen in traditional preschool programs. Similar study designs in fully implemented Montessori programs would be useful to determine if these results were consistent at other sites and after the full 3-year primary cycle.

Racially Disproportionate Discipline

Just as Montessori preschool may provide a strong educational beginning for students of color, Montessori education may also help to reduce the overuse of exclusionary discipline (e.g., suspension and expulsion) for students of color (Skiba, Michael, Nardo, & Peterson, 2002). Students of color are two to three times more likely to be suspended or expelled from school than their White peers, even for the same offenses (Skiba et al., 2002). This racially disproportionate discipline is partially attributable to the spread of zero-tolerance policies and school cultures that emphasize uniformity and compliance, as well as to a shortage of culturally sensitive teachers (Irvine, 1990; Shedd, 2015). The Montessori approach, with its emphasis on positive behavioral interventions, personalized learning, and *following the child*, both combats overreaching disciplinary practices and encourages teachers to learn about the unique cultural heritage of each student. The Montessori curricula of Grace and Courtesy and Peace may also contribute to lower levels of disciplinary sanctions by fostering conflict resolution and teaching social interaction skills that build mutual respect. Montessori students enjoy the freedom to move around and work together, practices that align closely with students of color who may come from communal and collaborative home cultures (Hall, 2006).

Initial research into public Montessori education and discipline has yielded some important findings. Brown and Steele (2015) examined racial discipline disproportionality for Black students in Montessori schools and in comparable traditional public schools in a large, urban district in the Southeast. While Black students were still suspended at disproportionately higher rates compared to White students in public Montessori elementary schools, this disproportionality was far less severe than in the traditional schools. These findings are significant, albeit preliminary, and further empirical research is needed to examine how Montessori may disrupt racialized exclusionary discipline practices.

Special Education

Another area in which Montessori research could demonstrate particular benefits for students of color is in their overrepresentation in special education (Lewis, Chambers, & Butler, 2012). While students with learning differences in traditional public education must qualify for an individualized education plan,

all Montessori students enjoy a curriculum designed for their own needs and pace, allowing for differentiated instruction in the classroom. Because classrooms are multiage, students are less likely to feel the stigma of their learning differences in relation to their peers. Curriculum individualization can also reduce special education referrals, which may indirectly remedy this overrepresentation (García & Ortiz, 2006; Green, 2005). Cossentino (2010) noted the natural overlap between the Montessori Method and the inclusion model of education for students with learning disabilities. For the many Black and Latino students who are eligible for special education, an inclusion model may mitigate the "racial isolation resulting from segregation based on disability" (Connor & Ferri, 2007, p. 69). Research on Montessori and special education is in the early stages, but Danner (2015) found Montessori-specific practices like peer support and multiage classrooms particularly conducive to full inclusion of special education students. But while Montessori teachers were enthusiastic about inclusion of special needs students, they received less training in inclusion than did their traditional school counterparts (Danner & Fowler, 2015). Additional research in this area may help determine the educational impact of a Montessori classroom on students with special needs.

Montessori and Cultural Responsiveness

Montessori teachers also pay close attention to children's cultural context, and a growing body of qualitative research focuses on Montessori as a *culturally responsive teaching* approach. Culturally responsive teaching acknowledges that teachers should incorporate students' home cultures into their lessons (Ladson-Billings, 1995). Many researchers argue that cultural responsiveness can improve educational outcomes for students of color by affirming, rather than marginalizing, key aspects of children's identities (Gay, 2010; Ladson-Billings, 1995).

Similarly, Montessori education allows children to bring into the classroom their own cultural *funds of knowledge*—the cultural skills and knowledge students bring with them from their families and communities (Moll, Amanti, Neff, & Gonzalez, 1992). Dr. Montessori's son Mario Montessori, who developed much of the Montessori elementary curriculum, described schools as a "cultural environment" where students should "become familiar with basic aspects of their own culture … [and] enlarge their cultural horizon" (Montessori, 1976, p. 42). This description suggests that a focus on a child's unique cultural background is, or should be, an inherent element of the Montessori Method.

A number of schools serving indigenous students in the United States employ the Montessori Method as a vehicle to pass on linguistic and cultural traditions. Schonleber (2011) documented the integration of the Montessori approach in Hawaiian language and culture-based immersion programs. A number of Native American Montessori programs align with cultural preservation efforts on reservations around the country (Ayer, 2016a; "Fort Peck combines language," 1998; "Head Start turns 50," 2015; Hixon, 2002; Johnson, 2005; Johnston, 2016). A small but significant cohort of Montessori teachers of color work in public and private Montessori schools, often combining the Montessori Method with cultural pride and social-justice teaching (Alston, 2008; Trondson, 2016).

Others have argued that celebrating a student's cultural background is not enough. *Culturally sustaining pedagogy* describes the practice of not only incorporating cultural pluralism but also teaching students how to be advocates for equality (Paris & Alim, 2014; Paris & Winn, 2013). Another related practice is *antibias, antiracist* (ABAR) education. Some early research is examining efforts to implement ABAR practices in public Montessori schools (Banks & Maixner, 2016). Where culturally responsive practices support the unique cultural background of each child, ABAR education helps teachers develop awareness of their own implicit biases and the social structures that grant privilege to some individuals, and ABAR education encourages teachers to create change in their classrooms and schools (Pollock, 2008). Further research could document ABAR practices in public Montessori schools and examine their effects on students, families, and teachers.

Bilingual Montessori programs can also support English-language learners and affirm students' home cultures (Rodriguez et al., 2005). The multiage structure of Montessori classrooms means that

children typically stay with the same teacher for 3 years, which helps teachers develop a deep knowledge of their students and may lead to strong working relationships with their families. Studies of *looping*—the practice in which teachers stay with their students for multiple, consecutive years—support this conclusion (Thompson, Franz, & Miller, 2009). Several case studies have documented promising applications of the Montessori Method as a culturally sustaining practice; additional research is needed to explore the benefits of this work.

While the Montessori Method lends itself to cultural responsiveness, a perceived lack of such may dissuade families of color from enrolling in public Montessori programs. Montessori's focus on the individual child may encourage teachers to be *colorblind* (Lewis, 2001), overlooking the critical roles of class, race, and culture in students' identities. Some practices and assumptions must be presented to families of color with context and care to avoid further alienating them; examples may include focusing on abstract ideas of education instead of concrete learning outcomes or advising parents to bring Montessori into the home (Debs, 2016a). Montessori schools and teachers can strengthen their work with diverse student populations through continued conversations about race and other forms of bias and through training and professional development in culturally responsive education models (Banks & Maixner, 2016).

Additional limitations to practicing culturally responsive Montessori education are the marginal nature of this topic within Montessori teacher preparation and the shortage of Montessori teachers of color. While the standards for Montessori teacher preparation programs established by the Montessori Accreditation Council for Teacher Education ([MACTE], 2016) include criteria for culturally responsive education, it is unclear how effectively or consistently Montessori teacher preparation programs incorporate them.

Similar to the nationwide public school teacher pool, which is over three quarters White and over 80% female (U.S. Department of Education, 2013), public Montessori teachers are also disproportionately White and female. None of the three Montessori organizations that oversee the majority of American Montessori teacher preparation centers (i.e., Association Montessori Internationale, American Montessori Society, and MACTE) collect data on the racial or ethnic diversity of their teacher trainees or their broader membership (B. Beste, personal communication, December 9, 2015; C. Hofland, personal communication, December 7, 2015; R. Pelton, personal communication, March 26, 2016). A 2016 NCMPS initial survey of 311 teacher trainees found that 69% of respondents were White and 90% were female (NCMPS, 2016b), likely a more diverse enrollment than in previous years but still predominantly White and female.

This clear majority of White teachers is significant because education researchers argue that White teachers may have lower expectations for their students of color than teachers of color do (Gershenson, Holt, & Papageorge, 2016). Like their traditional public school counterparts, public Montessori teachers may also exhibit cultural biases when working with students of color (Stansbury, 2012; Yezbick, 2007). Some Montessori teachers of color also reported feeling isolated and marginalized in the profession, with few opportunities for honest conversations about race (Trondson, 2016). The Montessori teacher pool can become more diverse through efforts like outreach and increased funding for Montessori training for teachers of color. Future research may help develop best practices for culturally responsive education in Montessori classrooms and recruiting Montessori teachers of color.

In addition, Montessori teacher preparation programs have traditionally focused on preparing teachers for private schools that still dominate the American Montessori landscape (Whitescarver & Cossentino, 2008). The concern with Montessori fidelity sometimes makes Montessori teachers reluctant to incorporate new approaches that support struggling students. Moreover, public Montessori teachers need ongoing support and training to integrate the demands of the Montessori curriculum with state and national standards like the Common Core (Van Acker, 2013). Given the sustained growth of Montessori in the public sector, Montessori teacher preparation programs and public school districts should consider collaborating to design training for teachers who will work with racially and socioeconomically diverse students. The DC Montessori Teacher Residency program, currently in the pilot phase in Washington, DC ("DC Montessori Residency," n.d.), is one example of such a program. The Residency augments high-quality Montessori teacher preparation with professional development and training to prepare teachers for service in high-need

public schools. Residents receive supplemental instruction in cultural competency, family engagement, and support for English-language learners. This program is one example of a model that combines Montessori preparation with additional training for a public school context.

The Montessori Method is already deployed as a culturally responsive model in a number of schools serving indigenous students. Teacher preparation in this area and research into best practices may help Montessori teachers develop culturally responsive and ABAR practices in their classrooms. Moreover, evidence of the importance of teachers of color and of racial bias in Montessori classrooms indicates the significance of sustained efforts to recruit a more diverse Montessori teaching force, particularly in public Montessori schools.

Conclusion and Future Directions

Research indicates that the Montessori Method in public schools offers both opportunities and limitations for students of color. In this section, we summarize our findings and make policy recommendations for educators. Public Montessori schools attract a majority of students of color, and Black and Latino public Montessori students are more likely to attend racially diverse schools than are their traditional public school counterparts. Central to Montessori education are individual autonomy, respect—including respect for students' cultural backgrounds—and positive discipline. Students with special needs may integrate particularly well in multiage classrooms, where all students have individualized learning programs.

At the same time, research suggests that students of color face obstacles in enrolling in public and private Montessori schools. While tuition is the greatest obstacle to private Montessori schools, parents also face enrollment challenges in public Montessori schools, including informational and logistical barriers related to school choice. The results of these challenges are evident in charter schools, whose enrollments feature a lower percentage of students of color in comparison to both Montessori magnets and the charters' surrounding districts (Debs, 2016a). Public Montessori schools should work to eliminate enrollment barriers through district lotteries, strategic recruitment in low-income communities and communities of color, free transportation and lunch, before- and after-school care, and sliding scales for preschool tuition.[1] Private Montessori schools also can prioritize a racially and economically diverse enrollment as part of their school mission and can raise funds to do so. A small but growing number of "intentionally diverse" (Wohlstetter, 2016) private Montessori schools offer sliding-scale tuitions. Some of these schools have a goal of an enrollment comprising 50% low-income students, becoming a public–private hybrid of "tuition-based, access-oriented" schools (Ayer, 2016b, para. 3).

Debs (2016b) cautioned Montessori educators against using terms like *good fit* or *bad fit* to influence parents' school choices. Families' racial, ethnic, and social backgrounds influence their educational experiences and the questions they may have about Montessori education. Parents of color may be reluctant to choose Montessori schools due to perceptions that they do not deliver an academically rigorous and culturally responsive education. Therefore, Montessori educators should speak explicitly about academic achievement, rather than downplay it, so parents know that Montessori is a college-preparatory curriculum.

Once Montessori schools increase the enrollment of students of color, they need to demonstrate that students of color succeed in their schools. The Montessori research community should explicitly examine both academic and nonacademic outcomes for students of color and then share their findings, both positive and negative, with the broader education community via peer-reviewed journals. This research requires an explicit disaggregation of data and a commitment to focus on the particular experiences of students of color, in contrast to previous research that has avoided discussions of race entirely. Just as the charter sector as a whole is subject to rigorous national study, public Montessori schools would benefit from

[1] For a complete list of equitable enrollment strategies and measures to include cultural responsiveness in the Montessori classroom, see Debs (2016a.)

national-level studies that examine student outcomes and additional qualitative research that identifies best practices. The Furman University study in South Carolina is an important step toward this goal, but more research on the outcomes for students of color is urgently needed. It is also important that educators honestly reflect on Montessori practices to determine which practices are successful and which should be supplemented to effectively serve all students; this reflection also will guide the development of school strategies that ensure inclusive academic success. Making progress in this area is the Montessori for Equity Collaborative, a coalition of public school leaders who share best practices for academic equity via monthly conference calls (Fabel, 2016).

To support the needs of students and families of color, Montessori educators should become leaders in developing culturally responsive and ABAR practices. Private and public schools—like Chicago's private Near North Montessori School and City Garden Montessori School, a public charter school in St. Louis—have implemented schoolwide diversity and antiracism training for their staff. Important, early efforts toward this goal include ABAR training at the Montessori for Social Justice 2016 conference, the AMI/USA 2017 Refresher Course, and public and private Montessori schools around the country. These actions are vital in developing both a common antiracism language and strategies for Montessori teachers to address the broader social problems that influence their classrooms and help break cycles of racism and bias.

Finally, it is incumbent upon Montessori training centers to make a concerted effort to diversify their teaching corps. To raise the national profile of Montessori teacher preparation, NCMPS created *Teach Montessori*, a web portal that connects candidates to relevant training centers (Teach Montessori, 2017). As of 2016, *Teach Montessori* staff members were actively recruiting Montessori trainees at college job fairs around the Northeastern United States, instead of using traditionally passive, word-of-mouth enrollment practices. The DC Montessori Teacher Residency also aims to add more Montessori teachers of color by targeting classroom assistants (who are more likely to be people of color) for teacher preparation (DC Montessori Residency, n.d.). These are important first steps in recruiting a more diverse pool of public Montessori teachers, but additional action is needed to attract teachers of color, including targeted recruitment and scholarship funds designated for trainees of color. Further, Montessori trainees and educators need to supplement their Montessori training with training specifically for teaching diverse learners in public Montessori schools. Embedded teacher preparation programs, like the DC Montessori Residency, equip Montessori trainees to work in urban public Montessori schools.

In his keynote address to 4,000 Montessori educators at the American Montessori Society 2016 Annual Conference, noted civil rights attorney Bryan Stevenson stated that "our commitment to education has to be judged not by how we teach the rich but how we teach the poorest members of our society," and he exhorted the Montessori community to "get proximate to families in poverty…. They ought to be getting a Montessori education…. Too many of us are too far away" (2016). The most urgent issue in American public education is to ensure that students living in poverty, many of whom are students of color, receive an outstanding education. Existing research suggests that the Montessori Method has the potential to contribute through schools that respect the developmental needs and cultural backgrounds of all children. Montessori educators can strengthen their work with students of color by limiting enrollment obstacles at their schools and addressing issues of race, culture, and privilege in their classrooms and their communities. Montessori researchers can support teachers' work by disaggregating Montessori student achievement by race and socioeconomic background and informing the Montessori community about what works well and where the community needs to improve.

AUTHOR INFORMATION

†Corresponding Author

Mira C. Debs is a postdoctoral researcher in Education Studies and Political Science at Yale University.

Katie E. Brown† is the DC Regional Coordinator for the National Center for Montessori in the Public Sector and can be reached at katie.brown@public-montessori.org.

References

Alston, L. (2008). *Why we teach: Learning, laughter, love, and the power to transform lives.* New York, NY: Scholastic.

Ansari, A., & Winsler, A. (2014). Montessori public school pre-K programs and the school readiness of low-income Black and Latino children. *Journal of Educational Psychology, 106,* 1066–1079. http://dx.doi.org/10.1037/a0036799

Anyon, J. (2014). *Radical possibilities: Public policy, urban education, and a new social movement.* New York, NY: Routledge.

Au, W. (2009). *Unequal by design: High-stakes testing and the standardization of inequality*. New York, NY: Routledge.

Ayer, D. (2016a, May 16). Native Montessori project revived. *Montessori Public.* Retrieved from http://www.montessoripublic.org/2016/05/native-montessori-project

Ayer, D. (2016b, October 12). Public, private, or something in between? A new model for Montessori schools. *Montessori Public.* Retrieved from http://www.montessoripublic.org/2016/10/3414/

Banks, K., & Maixner, R. A. (2016). Social justice education in an urban charter Montessori school. *Journal of Montessori Research, 2*(1), 1–14. https://doi.org/10.17161/jomr.v2i2.5066

Benson, J., & Borman, G. (2010). Family, neighborhood, and school settings across seasons: When do socioeconomic context and racial composition matter for the reading achievement growth of young children? *Teachers College Record,112,* 1338–1390.

Berends, M., & Penaloza, R. V. (2010). Increasing racial isolation and test score gaps in mathematics: A 30-year perspective. *Teachers College Record, 112,* 978–1007.

Bowie, L. (2016, February 22). City school board to decide if charter should welcome students who live nearby. *Baltimore Sun.* Retrieved from http://www.baltimoresun.com/news/maryland/bs-md-montessori-vote-20160222-story.html

Braddock, J. H., II, & Gonzalez, A. D. C. (2010). Social isolation and social cohesion: The effects of K-12 neighborhood and school segregation on intergroup orientations. *Teachers College Record, 112,* 1631–1653.

Brown, K. (2016a, April). *Racial diversity in Montessori charter schools.* Paper presented at the annual meeting of the American Educational Research Association [AERA], Washington, DC. Available from AERA: http://www.aera.net/Publications/Online-Paper-Repository/AERA-Online-Paper-Repository/Owner/952029

Brown, K. (2016b, March). *Reading and math achievement for third grade African American students in public Montessori schools*. Poster presented at the annual conference of the American Montessori Society [AMS], Chicago, IL. Available from AMS: http://amshq.org/Publications-and-Research/Research-Library/Conference-Handouts

Brown, K. E., & Steele, A. S. (2015). Racial discipline disproportionality in Montessori and traditional public schools: A comparative study using the relative rate index. *Journal of Montessori Research, 1*(1), 14–27. https://doi.org/10.17161/jomr.v1i1.4941

Carter, S. C. (2000). *No excuses: Lessons from 21 high-performing, high-poverty schools*. Washington, DC: Heritage Foundation.

Connor, D. J., & Ferri, B. A. (2007). The conflict within: Resistance to inclusion and other paradoxes in special education. *Disability & Society, 22*(1), 63–77. doi:10.1080/09687590601056717

Cossentino, J. (2010). Following all the children: Early intervention and Montessori. *Montessori Life, 22*(4), 38–45.

Danner, N. (2015). *Early childhood inclusion in a public Montessori school: Access, participation, and supports* (Doctoral dissertation). Available from AMS: https://amshq.org/Publications-and-Research/Research-Library/Dissertations-and-Theses

Danner, N., & Fowler, S. (2015). Montessori and non-Montessori early childhood teachers' attitudes towards inclusion and access. *Journal of Montessori Research, 1*(1), 28–41. https://doi.org/10.17161/jomr.v1i1.4944

Darling-Hammond, L. (2010). *The flat world and education: How America's commitment to equity will determine our future.* New York, NY: Teachers College Press.

DC Montessori Residency. (n.d.). *Surround: 15 job-embedded modules packaged into three courses.* Retrieved from https://www.dc-montessori-residency.org/ - surround

Debs, M. (2016a, April). *Minority parents, Montessori schools: Perceiving cultural fit in theme-based public schools.* Paper presented at the annual meeting of the American Educational Research Association, Washington, DC. Available from AERA: http://www.aera.net/Publications/Online-Paper-Repository/AERA-Online-Paper- Repository/Owner/961581

Debs, M. (2016b). Racial and economic diversity in U.S. public Montessori schools. *Journal of Montessori Research, 2*(2), 15–34. https://doi.org/10.17161/jomr.v2i2.5848

Diamond, A., & Lee, K. (2011). Interventions shown to aid executive function development in children 4–12 years old. *Science, 333,* 959–964.

Dohrmann, K. R., Nishida, T. K., Gartner, A., Lipsky, D. K., & Grimm, K. J. (2007). High school outcomes for students in a public Montessori program. *Journal of Research in Childhood Education, 22,* 205–217. doi:10.1080/02568540709594622

Duax, T. (1989). Preliminary report on the educational effectiveness of a Montessori school in the public sector. *The NAMTA Journal, 14*(2), 55–62.

East Dallas Community Schools. (2010). *Summer newsletter 2010* [Newsletter]. Retrieved from the National Center for Montessori in the Public Sector: http://public-montessori.org/wp-content/uploads/2017/03/2010-EDCS-Outcomes-Charts-and-Graphs.pdf

EGUSD staff wants diversity in local charter schools. (2016, March 8). *Elk Grove Citizen.* Retrieved from http://www.egcitizen.com/articles/2016/03/08/news/doc56df70b6df8db588124584.txt

Ervin, B., Wash, P. D., & Mecca, M. E. (2010). A 3-year study of self-regulation in Montessori and non-Montessori classrooms. *Montessori Life, 22*(2), 22–31.

Fabel, L. (2016, October 16). How a Montessori movement is reinventing public schools. *One Day Magazine.* Retrieved from Teach for America: https://www.teachforamerica.org/one-day-magazine/how-montessori-movement-reinventing-public-schools

Fort Peck combines language immersion with Montessori methods. (1998). *Tribal College Journal, 9*(4), 15.

Furman University, Riley Institute. (2015). *South Carolina public Montessori study: Montessori student demographics.* Retrieved from https://riley.furman.edu/sites/default/files/docs/MontStudentData12-13.1.20.15.pdf

García, S. B., & Ortiz, A. A. (2006). Preventing disproportionate representation: Culturally and linguistically responsive prereferral interventions. *Teaching Exceptional Children, 38*(4), 64–68.

Gay, G. (2010). *Culturally responsive teaching: Theory, research, and practice*. New York, NY: Teachers College Press.

Gershenson, S., Holt, S. B., & Papageorge, N. W. (2016). Who believes in me? The effect of student-teacher demographic match on teacher expectations. *Economics of Education Review, 52,* 209–224. http://dx.doi.org/10.1016/j.econedurev.2016.03.002

Golann, J. W. (2015). The paradox of success at a no-excuses school. *Sociology of Education, 88,* 103–119. doi:10.1177/0038040714567866

Goldsmith, P. R. (2010). Learning apart, living apart: How the racial and ethnic segregation of schools and colleges perpetuates residential segregation. *Teachers College Record, 112,* 1602–1630.

Goodman, J. F. (2013). Charter management organizations and the regulated environment: Is it worth the price? *Educational Researcher, 42,* 89–96. doi:10.3102/0013189X12470856

Green, T. D. (2005). Promising prevention and early intervention strategies to reduce overrepresentation of African American students in special education. *Preventing School Failure, 49*(3), 33–41.

Hall, H. R. (2006). *Mentoring young men of color: Meeting the needs of African American and Latino students.* Lanham, MD: Rowman & Littlefield Education.

Hall, H. R., & Murray, A. K. (2011). *Intersections between Montessori practices and culturally-based curriculum for African-American students* [White paper]. Retrieved from AMS: https://amshq.org/~/media/Files/Publications-and-Research/Research-Library/Position-and-White-Papers/White-Papers/Research/Montessori-and-Needs-of-African-American-Students.ashx?la=en

Head Start turns 50. (2015, September 28). *The Durango Herald*. Retrieved from http://www.durangoherald.com/article/20150928/NEWS01/150929624/SUCAP%E2%80%99s-Head-Start-turns-50

Heckman, J. J. (2012). *Invest in early childhood development: Reduce deficits, strengthen the economy.* Retrieved from The Heckman Equation: http://heckmanequation.org/content/resource/invest-early-childhood-development-reduce-deficits-strengthen-economy

Hixon, S. (2002). Blending Head Start and Montessori: The best of both worlds. *Montessori Life, 14*(4), 37–38.

Irvine, J. J. (1991). *Black students and school failure: Policies, practices, and prescriptions*. New York, NY: Praeger.

Johnson, J. K. (2005, March 9). Preschool utilizes cultural relevancy. *Indian Country News*. Retrieved from http://indiancountrytodaymedianetwork.com/2005/03/09/preschool-utilizes-cultural-relevancy-94582

Johnston, L. J. (2016, October 12). Education self-determination superstars: Cochiti Pueblo takes on language-learning. *Indian Country Media Network.* Retrieved from https://indiancountrymedianetwork.com/education/native-education/education-self-determination-superstars-cochiti-pueblo-takes-on-language-learning/

Kunjufu, J. (2005). *Keeping Black boys out of special education.* Chicago, IL: African American Images.

Ladson-Billings, G. (1994). *The dreamkeepers: Successful teachers of African American children.* San Francisco, CA: Jossey Bass.

Ladson-Billings, G. (1995). Toward a theory of culturally relevant pedagogy. *American Educational Research Journal, 32,* 465–491.

Ladson-Billings, G. (2013). Lack of achievement or loss of opportunity? In P. L. Carter & K. G. Weiner (Eds.), *Closing the opportunity gap: What America must do to give every child an even chance* (pp. 11–23). New York, NY: Oxford University Press.

Ladson-Billings, G., & Tate, W. F., IV (1995). Toward a critical race theory of education. *Teachers College Record, 97,* 47–68.

Lewis, A. E. (2001). There is no "race" in the schoolyard: Color-blind ideology in an (almost) all-white school. *American Education Research Journal, 38,* 781–811.

Lewis, C. W., Chambers, T. V., & Butler, B. R. (2012). Urban education in the 21st century: An overview of selected issues that impact African American student outcomes. In J. L. Moore III & C. W. Lewis (Eds.), *African American students in urban schools: Critical issues and solutions for achievement* (pp. 11–30). New York, NY: Peter Lang.

Lillard, A. S. (2005). *Montessori: The science behind the genius.* New York, NY: Oxford University Press.

Lillard, A. S. (2012). Preschool children's development in classic Montessori, supplemented Montessori, and conventional programs. *Journal of School Psychology, 50,* 379–401. http://dx.doi.org/10.1016/j.jsp.2012.01.001

Lillard, A. S. (2013). Playful learning and Montessori education. *American Journal of Play, 5,* 157–186.

Lillard, A. S., Lerner, M. D., Hopkins, E. J., Dore, R. A., Smith, E. D., & Palmquist, C. M. (2013). The impact of pretend play on children's development: A review of the evidence. *Psychological Bulletin, 139,* 1–34. doi:10.1037/a0029321

Lillard, A., & Else-Quest, N. (2006). Evaluating Montessori education. *Science, 313,* 1893–1894. doi:10.1126/science.1132362

Lopata, C., Wallace, N. V., & Finn, K. V. (2005). Comparison of academic achievement between Montessori and traditional education programs. *Journal of Research in Childhood Education, 20,* 5–13. http://dx.doi.org/10.1080/02568540509594546

Makris, M., & Brown, E. (in press). A different type of charter school: In prestige charters, a rise in cachet equals a decline in access. *Journal of Education Policy*.

Mallett, J. D. (2014). *Longitudinal academic achievement outcomes: Modeling the growth trajectories of Montessori elementary public school students* (Doctoral dissertation). Retrieved from UMI. (2620830)

Mallett, J. D., & Schroeder, J. L. (2015). Academic achievement outcomes: A comparison of Montessori and non-Montessori public elementary school students. *Journal of Elementary Education, 25*(1), 39–53. Available from the University of the Punjab: http://pu.edu.pk/images/journal/JEE/PDF-Files/3_v25_no1_15.pdf

McCord, S. (2012, September 19). Santa Cruz City Schools takes public Montessori plan off the table. *Santa Cruz Sentinel*. Retrieved from http://www.santacruzsentinel.com/general-news/20120919/santa-cruz-city-schools-takes-public-montessori-plan-off-the-table

Mischel, W., Ayduk, O., Berman, M. G., Casey, B., Gotlib, I. H., Jonides, J. … Zayas, V. (2011). "Willpower" over the life span: Decomposing self-regulation. *Social Cognitive and Affective Neuroscience, 6,* 252–256. https://doi.org/10.1093/scan/nsq081

Mischel, W., Shoda, Y., & Rodriguez, M. I. (1989). Delay of gratification in children. *Science, 244,* 933–938. doi:10.1126/science.2658056

Moll, L. C., Amanti, C., Neff, D., & Gonzalez, N. (1992). Funds of knowledge for teaching: Using a qualitative approach to connect homes and classrooms. *Theory Into Practice, 31*(2), 132–141. Retrieved from http://www.jstor.org/stable/1476399

Montessori Accreditation Council for Teacher Education. (2016). *Guide to accreditation: April 2016 revision*. Retrieved from http://www.macte.org/wp-content/uploads/2016/05/2016-MACTE-Guide-to-Accreditation.pdf

Montessori, M. (1976). *Education for human development: Understanding Montessori*. New York, NY: Schocken.

Moody, M. J., & Riga, G. (2011). Montessori: Education for life. In L. Howell, C. W. Lewis, & N. Carter (Eds.), *Yes we can! Improving urban schools through innovative education reform* (pp. 127–143). Charlotte, NC: Information Age Publishing.

Murray, A., & Peyton, V. (2008). Public Montessori schools: A delicate balance. *Montessori Life, 20*(4), 26–30.

National Center for Montessori in the Public Sector. (2014). *Growth of public Montessori in the United States: 1975-2014* Retrieved from http://www.public-montessori.org/white-papers/growth-of-public-montessori-in-the-united-states-1975-2014/

National Center for Montessori in the Public Sector. (2016a). *NCMPS rubric of essential elements of Montessori practice in the public sector*. Retrieved from http://www.public-montessori.org/wp-content/uploads/2016/10/NCMPS-Essential-Elements-4.0.pdf

National Center for Montessori in the Public Sector. (2016b). *2016 Teach Montessori current trainee survey: Summary report*. Washington, DC: Author.

Newton, X. A. (2010). End-of-high-school mathematics attainment: How did students get there? *Teachers College Record, 112,* 1064–1095.

Noguera, P. A. (2003). Schools, prisons, and social implications of punishment: Rethinking disciplinary practices. *Theory Into Practice, 42*, 341–350. Retrieved from http://futurescholars.rutgers.edu/FutureScholars/Images/Schools%20Prisons%20&%20Social%20Implications%20of%20Punishment.pdf

Nyland, L. (2015). Amendment to the new student assignment plan regarding Leschi Elementary blended model for the 2015–16 school year. *School Board Briefing/Proposed Action Report.* Seattle, WA: Seattle Public Schools.

Orfield, G., Kucsera, J., & Siegel-Hawley, G. (2012). *E Pluribus… separation: Deepening double segregation for more students.* Civil Rights Project/Proyecto Derechos Civiles. Retrieved from https://civilrightsproject.ucla.edu/research/k-12-education/integration-and-diversity/mlk-national/e-pluribus...separation-deepening-double-segregation-for-more-students

Paris, D., & Alim, H. S. (2014). What are we seeking to sustain through culturally sustaining pedagogy? A loving critique forward. *Harvard Educational Review, 84*, 85–100. http://dx.doi.org/10.17763/haer.84.1.982l873k2ht16m77

Paris, D., & Winn, M. T. (2014). *Humanizing research: Decolonizing qualitative inquiry with youth and communities*. Thousand Oaks, CA: SAGE.

Pollock, M. (2008). *Everyday antiracism: Getting real about race in school.* New York, NY: The New Press.

Prothero, A. (2016, March 8). In charters, using weighted lotteries for diversity hits barriers. *Education Week.* Retrieved from http://www.edweek.org/ew/articles/2016/03/09/in-charters-using-weighted-lotteries-for-diversity.html

Rathunde, K., & Csikszentmihalyi, M. (2005). The social context of middle school: Teachers, friends, and activities in Montessori and traditional school environments. *The Elementary School Journal, 106*(1), 59–79. doi:10.1086/496907

Roberts, J. C., & Fleming, D. J. (2016, January). *Mapping the landscape of public Montessori in South Carolina.* Paper presented at the annual meeting of the Southern Political Science Association, San Juan, Puerto Rico.

Rodriguez, L., Irby, B. J., Brown, G., Lara-Alecio, R., & Galloway, M. M. (2005). An analysis of second grade reading achievement related to pre-kindergarten Montessori and transitional bilingual education. National Association of Bilingual Education. In V. González & J. Tinajero (Eds.), *NABE Review of Research and Practice* (Vol. 3, pp. 45–65). Mahwah, NJ: Lawrence Erlbaum Associates.

Schonleber, N. (2011). Hawaiian culture-based education and the Montessori approach: Overlapping teaching practices, values, and worldview. *Journal of American Indian Education, 50*(3), 5–25. http://www.jstor.org/stable/43608610

Shedd, C. (2015). *Unequal city: Race, schools, and perceptions of injustice*. New York, NY: Russell Sage Foundation.

Skiba, R. J., Michael, R. S., Nardo, A. C., & Peterson, R. L. (2002). The color of discipline: Sources of racial and gender disproportionality in school punishment. *The Urban Review, 34*, 317–342. doi:10.1023/A:1021320817372

Stansbury, J. (2012). *Dealing with diversity: Administrator, teacher and parent perceptions of the responsiveness of Montessori schools to racial and ethnic diversity* (Unpublished master's thesis). DePaul University, Chicago, IL. Retrieved from AMS https://amshq.org/Publications-and-Research/Research-Library/~/media/9E1F8E5CC6E2496E8FE8E183D3BE98BE.ashx

Stevenson, B. (2016, March 12). *American injustice: Mercy, humanity, and making a difference.* Dr. Nancy McCormick Rambusch Lecture at the annual meeting of the American Montessori Society, Chicago, IL.

Swedien, J. (2013, June 4). Montessori charter school supporters fight back. *Leader-Telegram*. Retrieved from http://www.leadertelegram.com/News/Front-Page/2013/06/04/Montessori-Charter-School-supporters-fight-back.html

Teach Montessori. (2017). *Teach Montessori.* Retrieved from http://www.teach-montessori.org/

Thernstrom, A., & Thernstrom, S. (2004). *No excuses: Closing the racial gap in learning*. New York, NY: Simon & Schuster.

Thompson, N. L., Franz, D. P., & Miller, N. C. (2009). *Looping: Research summary.* Retrieved from https://www.amle.org/BrowsebyTopic/WhatsNew/WNDet/TabId/270/ArtMID/888/ArticleID/311/Looping.aspx

Tough, P. (2012). *How children succeed: Grit, curiosity, and the hidden power of character.* New York, NY: Houghton Mifflin Harcourt.

Trondson, E. (2016). *Montessori education and social justice: Overlap, potential and areas for growth* (Unpublished master's thesis). University of Wisconsin, Madison. Retrieved from https://amshq.org/Publications-and-Research/Research-Library/Dissertations-and-Theses

U.S. Department of Education, National Center for Education Statistics (2013). Table 209.10. *Number and percentage distribution of teachers in public and private elementary and secondary schools, by selected teacher characteristics: Selected years, 1987–88 through 2011–12* [Table]. Retrieved from https://nces.ed.gov/programs/digest/d13/tables/dt13_209.10.asp

U.S. Department of Education (2015). *A matter of equity: Preschool in America*. Retrieved from https://www2.ed.gov/documents/early-learning/matter-equity-preschool-america.pdf

Van Acker, T. (2013). *From boutique to big box: A case study concerning teacher change transitioning to a public Montessori school* (Doctoral dissertation). Retrieved from ProQuest. (3609604)

Wells, A. S., Holme, J. J., Revilla, A. T., & Atanda, A. K. (2009). *Both sides now: The story of school desegregation's graduates*. Berkeley: University of California Press.

Whitescarver, K., & Cossentino, J. (2008). Montessori and the mainstream: A century of reform on the margins. *Teachers College Record, 110,* 2571–2600.

Wohlstetter, P. (2016, April). *Intentionally diverse charters: Inside schools*. Paper presented at the annual meeting of the American Educational Research Association, Washington, DC.

Wong, Q. (2014, June 19). State approval of Montessori school in Salem stalls. *Statesman Journal*. Retrieved from http://www.statesmanjournal.com/story/news/education/2014/06/19/state-approval-montessori-school-salem-stalls/11004775/

Yezbick, M. (2007). *How Montessori educators in the U.S. address culturally responsive teaching* (Unpublished master's thesis). San Francisco State University, San Francisco, CA. Available from AMS: https://amshq.org/Publications-and-Research/Research-Library/Dissertations-and-Theses

Journal of Montessori Research
2017, Volume 3, Issue 1

Technology in the Montessori Classroom: Teachers' Beliefs and Technology Use

Sara J. Jones

University of Houston

Keywords*: Montessori, technology, elementary, teacher beliefs*

Abstract: As technology becomes ubiquitous in society, there is increasing momentum to incorporate it into education. Montessori education is not immune to this push for technology integration. This qualitative study investigates four Upper Elementary Montessori teachers' attitudes toward technology and technology integration in a public school setting. Interviews and observations were used to understand the teachers' thoughts and actions regarding technology in the classroom. Both the school context and teacher background played important roles in teachers' beliefs and actions. Teachers in this study expressed positive views of technology in general, exhibiting high technology efficacy and valuing the development of technology skills in their students. However, all four teachers struggled to include instructional technology in ways that are consistent with a Montessori paradigm. Although individual student use of adaptive tutoring software was the most common use of technology, the teachers varied greatly in both the amount of student time spent on computers and the roles that technology played in their classrooms.

Introduction

Recently, there has been a call for technology integration in schools that focuses on student use of technological tools in constructivist and socioconstructivist ways (ISTE, 2016; Partnership for 21st Century Learning, 2009; U.S. Department of Education, 2017). This technology use is being pushed not only in traditional public schools, but also in Montessori classrooms. In line with this movement, this research defines effective technology integration as teacher and student use of computer technology in constructivist and socioconstructivist ways to support the learning of core subject-area content (Read, Jones, Hughes, & Gonzales-Dholakia, 2011).

Technology in Schools

In 2009, a U.S. national survey found that 97% of teachers had at least one computer in their classrooms, and 54% were able to bring additional computers into their classrooms for technology-focused lessons (Gray, Thomas, Lewis, & Tice, 2009). Despite this access to computers, only 40% of these teachers reported that their students often used technology during instructional time (Gray et al., 2009). Researchers have begun to view student use as a better measure for technology integration rather than simply counting computers in a classroom (Gray et al., 2009; Russell, Bebell, O'Dwyer, & O'Connor, 2003). Eteokleous (2008) found two categories of student use of technology: traditional and transformative. The traditional view of technology integration is characterized as "learning about computers" and "learning from computers" (Eteokleous, 2008, p. 673). *Learning about computers* includes activities directed at increasing

Published online May 2017

students' computer skills, while *learning from computers* refers to computer-assisted learning and drill and practice programs designed to teach students core subject matter. Transformative technology integration is a shift to "learning with computers" (Eteokleous, 2008, p. 673). In this approach, students use technology to create new meaning in constructivist or socioconstructivist ways. The creation of YouTube presentations is one example of this socioconstructivist approach because the students use technology to articulate their own understanding of a topic and present it to others.

Ferdig (2006) cautioned that research should include both the context and purpose of the innovation when judging technology integration. From this perspective, teachers' knowledge, views of technology, and teaching objectives are key to understanding if and when technology integration is appropriate. Ferdig (2006) proposed technological pedagogical content knowledge as a way to assess a teacher's decision-making regarding technology integration.

Technological Pedagogical Content Knowledge

Mishra and Koehler (2006) developed the concept of *technological pedagogical content knowledge* (TPACK) to emphasize the importance of teachers having an integrated understanding of how technology, content, and pedagogical methods work together to increase learning within their particular content discipline (Figure 1). The TPACK framework is structured after Shulman's (1986) idea of pedagogical content knowledge which asserts that, to be effective, teachers must have more than simply a knowledge of their content area and a separate understanding of pedagogy; they must also be aware of how to use pedagogy to support the teaching and learning of specific content knowledge. In the same way, TPACK represents the intersections among the three major knowledge domains of technology, pedagogy, and content, creating seven knowledge domains: content knowledge (CK), pedagogical knowledge (PK), technological knowledge (TK), pedagogical content knowledge (PCK), technological content knowledge (TCK), technological pedagogical knowledge (TPK), and TPACK (Mishra & Koehler, 2006). TPACK forms the core of the framework, and knowledge in this domain involves recognizing how technological tools, subject matter, and pedagogical techniques can work to augment or hinder one another. According to the model, teachers use technology most effectively when they are able to simultaneously consider the content, pedagogy, and functions and uses of various technologies (Niess, 2005).

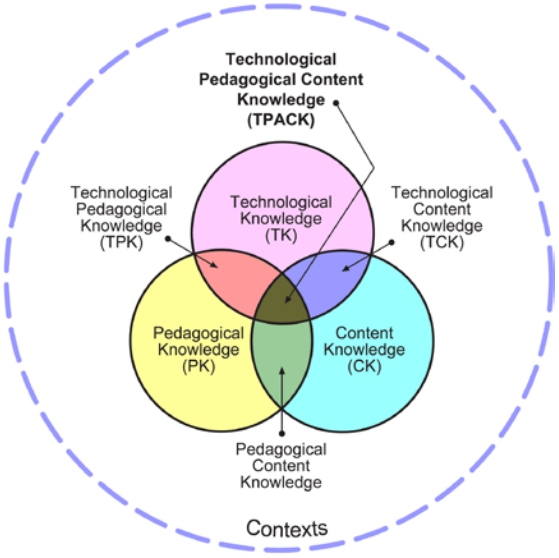


Figure 1. Technological pedagogical content knowledge. Reproduced by permission of the publisher, © 2012 by tpack.org

The TPACK framework is typically measured and described as a knowledge framework (Archambault & Crippen, 2009; Mishra & Koehler, 2006; Schmidt et al., 2009). However, because knowledge and beliefs are very intertwined (Kagan, 1992), it is difficult to understand teachers' TPACK without considering their beliefs about pedagogy, technology, and the subject matter they teach. Hervey (2011) found that teachers' attitudes about technology as an instructional tool greatly influenced the ways they used technology in their classes. Experienced teachers who had a well-developed PCK had difficulty integrating technology that conflicted with those beliefs and preferences. Ertmer (2005) proposed that, since teachers' initial experiences both with teaching and with technology shape their future actions, their "personal theories and beliefs are rarely sufficiently revised and, thus over time, become deeply personal, highly engrained, and resistant to change" (p. 30). Because PK and beliefs influence teachers' technology

adoption (Ertmer, 2005; Teo & Zhou, 2016), teachers who hold strong Montessori beliefs will most likely integrate technology in ways that align with the Montessori paradigm, and novice Montessori teachers may need more support than experienced teachers to include technology in constructivist and socioconstructivist ways.

Montessori Education

Maria Montessori considered children to be whole beings, capable of learning without much interference from adults (Montessori, 1912). Under the Montessori paradigm, learning is guided by the child rather than the teacher.

> Education is a natural process spontaneously carried out by the human individual, and is acquired not by listening to words but by experiences upon the environment. The task of the teacher becomes that of preparing a series of motives of cultural activity, spread over a specially prepared environment, and then refraining from obtrusive interference. (Montessori, as cited in Faryardi, 2007, p. 3)

Although Dr. Montessori did not explicitly instruct teachers to take a constructivist approach to learning, Montessori techniques and materials do provide opportunities for students to interact with and construct meaning from their environment in a way that is consistent with this theoretical paradigm (Elkind, 2003; Ültanir, 2012).

Dr. Montessori also felt that "the child should love everything he learns, for his mental and emotional growths are linked" (1989, p. 17). For this to occur, she suggested that students be allowed to direct the activities they wish to complete at any given time (Faryardi, 2007). Although autonomy is supported, a sense of personal and social responsibility for learning is also instilled in children in a Montessori classroom (Faryardi, 2007). In this way, Montessori curriculum overlaps with socioconstructivism in emphasizing social support in multiage classrooms. These classes are frequently referred to *houses* and, as evident in family-style meals and peer learning, function as an interdependent learning community.

In the traditional Montessori school, the only materials available to students were those created by Dr. Montessori herself (Lillard, 2008). These hands-on learning activities and puzzles were the basis for the entire curriculum. However, it can be difficult for American public schools to align completely with an authentic Montessori paradigm, and many schools adapt and augment the materials created by Dr. Montessori (Lillard, 2008; Monson, 2006). Although some members of the Montessori community feel that these changes may hurt the integrity of the paradigm (Lillard, 2008), others argue that new materials and new technologies are needed because the original materials may not authentically reflect contemporary society (Hubbell, 2006). Because technology is now integrated into our daily lives, some researchers and educators are pushing for the integration of technology in Montessori classes as a way to provide more authentic and meaningful learning experiences (Hubbell, 2006; Love & Sikorski, 2000). Despite this push, little research has studied the actual integration of technology in the Montessori classroom.

Methods

Statement of Problem

This study seeks to qualitatively assess Montessori teachers' belief about and uses of technology through two research questions. (a) What are Montessori teachers' beliefs about the use of technology in the classroom? and (b) Is TPACK demonstrated in the technology Montessori teachers choose to use in Lower Elementary school classrooms?

Site of Study

Openwood[1] Elementary School is one of 170 elementary schools in a large urban school district in the southwestern United States. Openwood serves about 600 children from pre-kindergarten through sixth grade. During the year of this study, 2011–2012, the student population was 65% Hispanic, 24% White, 7% Black, and 1% Asian or Pacific Islander. Another 4% of students reported multiple ethnicities, and 56% of students qualified for free or reduced lunch. Thirty-seven teachers, with an average of 13 years of experience, worked at Openwood in 2011–2012. Teachers at the school taught in one of two programs: a traditional public school or a Montessori charter. Under the traditional system, the teachers follow the district curriculum for one or two grade levels. All Montessori classes are self-contained, multilevel classes. In the past, the school had consistently met its annual yearly progress, but in 2010–2011, the school did not meet the district's annual yearly progress standards.

Montessori charter. Openwood's Montessori charter program serves students from across the school district, beginning at age 3. Priority is given to students in the neighborhood school zone, and a lottery is used to fill the remaining seats. Pre-kindergarten children are charged a fee to attend but can apply for financial aid from community partners.

The school received a grant to expand the Montessori program to a whole-campus charter over 3 years. At the end of the 2009–2010 school year, all teachers were given the opportunity to begin Montessori training. The school district paid for the Montessori training fees for teachers who committed to teach in the district for 3 years. In 2011–2012, the school had 20 Montessori classrooms and only nine traditional curriculum classrooms. Openwood's Montessori program is an Americanized Montessori program, meaning that the teachers can be flexible with the Montessori curriculum to better prepare students for state and national grade-level testing. This flexibility includes incorporating materials that may not be found in traditional Montessori classrooms.

Technology resources. Openwood Elementary School has one computer lab with 27 computers. In the 2011–2012 academic year, a technology specialist was hired to teach ancillary classes in the computer lab. Each classroom also contained three to five computers and a document camera.

During the 2010–2011 school year, the principal began a 2-year technology-integration leadership-training program. Through an evaluation in conjunction with that training program, Openwood earned a novice-level rating in technology integration. Beyond the principal's emphasis on technology, the Parent–Teacher Organization dedicated its 2011–2012 fundraising efforts to the purchase of more technology resources.

Participants

All kindergarten through sixth-grade teachers were invited to participate in technology-focused professional development with their planning teams. The planning teams were determined according to the members' scheduled planning periods and consisted of three to five teachers teaching similar grade levels. This study focuses on one team, composed of four Lower Elementary Montessori teachers.

Analysis

I used case studies (Corbin & Strauss, 2008; Yin, 2009) to understand the teachers' beliefs and uses of technology in the Montessori classroom. For the purpose of triangulation, I used multiple data sources throughout the semester. Data sources and their analyses are discussed below.

[1] All school and teacher names are pseudonyms.

Data Sources

Interview transcripts. All of the teachers were interviewed at least once during the semester. Two of the teachers agreed to interviews at both the beginning and the end of the semester, totaling six interview transcripts. All interviews were transcribed and coded using a combination of open coding and pre-established TPACK codes (Hughes, Guion, Bruce, Horton, & Prescott, 2011). A peer reviewer coded samples of the transcripts to verify the a priori and emerging themes and to discuss problem areas in the coding.

Lesson plans. Lesson plans for the entire semester were requested from the teachers, but only one teacher submitted a sample of lesson plans. Lesson plans that included technology were reviewed using the TPACK rubric (Harris et al., 2010).

Class observations. Ten classroom observations were conducted. Field notes were coded using the TPACK rubric (Harris et al., 2010).

Group meeting transcripts and field notes. I recorded and observed all eight teacher meetings, writing field notes about the number of attendees, the tone of the meeting, and the topics discussed.

Teacher cases. A teacher case was constructed for each consenting teacher. This profile included a summary analysis from their interviews and lesson plans. Other group members' perceptions of the teacher were also included in the teacher profiles when applicable.

Results

Montessori Lower Elementary Team

The Montessori Lower Elementary team (see Table 1) consisted of four classroom teachers: Kenneth, Lance, Marianne, and Nathan[2]. The following section describes each teacher's philosophies of teaching and of technology use in the Montessori classroom.

Teacher Cases

Marianne. Marianne had 14 years of teaching experience, two in a high school computer lab and 12 in a Montessori classroom. Because she had the most experience and had been at Openwood the longest, Marianne was the team leader. In her teaching, Marianne focused on her students and their individual learning. She said that it was her job to

> give them what they need and then teach them what they need to know in order to grow up to be whatever they want to be in life. They need this foundation. This is very important, even though it's only an elementary school. If you don't do well now, it builds up, and I feel it's very important for me as a teacher to be aware of that and to have that in mind all the time. (Interview 1)

Marianne used a combination of individual, small-group, and whole-class lessons to facilitate her students' learning. Students were also expected to take responsibility for their learning and spent significant time working on individual Montessori materials.

Marianne majored in computer science and had worked in the computer software business. She stated that she was very comfortable teaching technology skills in the high school computer lab, but she did not have time to teach those skills in the elementary class. Marianne knew that technology skills were crucial for her students: "Technology is actually very important because nowadays everything is based on technology, and we as adults are asked to do it [use technology] in order to be competitive" (Interview 1).

[2] All names are pseudonyms.

Table 1

Participants and Technology Used in Classrooms

Teacher	Teaching experience (years)	Classroom computers (*n*)	Technology used in classroom							
			Pro	ESW	EW	R	Word	PP	B	A
Marianne	14	3		×		×	×	×	×	
Kenneth	8	6	×							
Lance	2	*		×		×				
Nathan	15	4		×	×					×

Note. * = unknown; Pro = Projector or Elmo; ESW = educational software; EW = educational website; R = computer used for research; Word = Microsoft Word; PP = Microsoft PowerPoint; B = blogs; A = assessment software; × = in use.

She wanted her students to learn basic computer skills like Microsoft Word and PowerPoint. On the other hand, she remarked that the "true Montessori" curriculum did not include technology. She felt that the principal was trying to incorporate technology at Openwood only because it was a public school and the district was emphasizing technology.

Marianne had only one teacher computer and two student computers in her classroom, fewer than most teachers in the school had. She had been offered more computers but did not have space for them in her classroom. Students mostly used educational software programs that tracked individual student progress in math and reading. Some of her students also had started to use blogs to publish their research projects; this blog use was initiated by a student, not by Marianne. The student had asked to use the blogging tool that she used at home. Marianne liked the idea and said that other students wanted to learn as well. Marianne allowed the student to teach her classmates how to create a blog (Interview 2).

Because Marianne had 12 years of teaching experience in a Lower Elementary Montessori classroom, other teachers often called her the *expert* and asked her for help and suggestions during team meetings. However, Marianne did not offer more suggestions than other teachers did.

Kenneth. Kenneth had taught for 8 years in a Montessori classroom, but he also emphasized life experiences other than teaching and working with children. He felt that

> teaching to me is more of an avocation, not a vocation. It's a hobby. If I had millions of dollars, I'd do this for free. I would be a teacher just because it's so pleasurable. It's so wonderful to see the light go on. (Interview 1)

Kenneth's previous teaching experience had been in an Early Childhood Montessori classroom (pre-K through kindergarten), and the study year was his first as a Lower Elementary Montessori teacher (first through third grades).

In terms of teaching, Kenneth was adamant that Dr. Montessori was brilliant and that her curriculum was the most beneficial for student learning. In his pre-interview he stated, "Public education is the illness; Montessori is the cure" and explained why.

> A lot of really dedicated people have tried to discover a way to make… educating children work, and Montessori just already does that. So the joy of being a Montessori teacher is

> so profound. You get to have the children for three years. You have a learning society. (Interview 1)

From his perspective, public education had developed during the industrial revolution to train people using one set method for every student, much like a factory, and did not effectively address individual differences. He felt that addressing these differences was a strength of Montessori education. In his interviews, he also discussed recent research on learning and brain functioning to emphasize how many of Dr. Montessori's theories were being confirmed by brain studies today.

Kenneth did not see technology in opposition to a Montessori curriculum, but rather as an important complement to his curriculum. He speculated that if Dr. Montessori were living today, she would have invented a technology-rich robotic classroom. He saw technology as a way to differentiate and individualize instruction for his students. Kenneth shared ideas about the ways that face recognition, temperature sensors, and tracking software could be used to create a classroom where data collection was ongoing, and computers with artificial intelligence provided immediate information to help teachers target student misconceptions. He felt that educational technologies were neglected.

> I cannot tell you how frustrated I am that there is software to sell people things, there is software to track stock markets, and you can sign on and get on a website and have all this software and all this hardware at work on you. I mean there's more technology in a cell phone … it knows where the nearest place is to get an ice cream soda or it'd give you a choice of three. And it's just phenomenal that the education of our future generations is not worthy of that kind of investment. (Interview 1)

In his classroom, Kenneth used computer software that tracked individual student progress, but his technology use was limited by school resources. In regard to technology in his class, he remarked, "I love it. Give me more. Give me a million-dollar grant. You'll see some action here" (Interview 1). In addition to the software programs provided by the school, Kenneth used Microsoft PowerPoint to make electronic flashcards for his students to learn vocabulary words. The computers in his classroom served as a workstation. Students could use computer programs for their math or reading lessons but were not required to use the computers. This element of choice resulted in some students spending lots of time on the computers, while others rarely chose to use technology.

Kenneth also had a projector in his classroom but struggled with how to use it effectively. In his interview, he described wanting to use his projector in a more student-focused way.

> I would do more with my projector, but the priority is the individualized learning of every child and the projector is a kind of a whole-group event. So I've yet to bridge the gap between small-group and individualized learning with the technology I have available. Once the projector is on, everybody's brain just shuts off and they all stare at whatever I'm doing. But I'm planning on using [the digital projector] with a new terrarium …. I want to have that camera focused on it, and it will be running full time. Students will be able to do their observation and zoom in and out. (Interview 1)

The terrarium and projector were not set up during the time I completed my observations.

Kenneth discussed how difficult it was to get the technology resources that he wanted in his classroom. During the observations, he had six computers, but he mentioned that he had begged for these computers. With his computers, he was planning to have the students improve their writing and spelling by teaching them to type journals using Microsoft Word and make informed decisions about grammar and spelling using the spell-check function.

Kenneth also felt the pressure to improve his students' scores on the mandated state and district standardized tests. Kenneth did not feel prepared for the new district and state testing and was having a difficult time learning to merge the Lower Elementary curriculum with the standardized assessments. He found this especially difficult because he was new to teaching first through third grades and was still struggling to learn the curriculum and expectations for those students. He explained that there was some

contention among the Montessori teachers about which textbooks and software, if any, were appropriate in the Montessori classroom. He said that he had tried to enlist other Montessori teachers to help create test-preparation materials that aligned with the Montessori curriculum, but no one was willing to take the extra time to do so. His response was to use school-provided materials to supplement his Montessori materials. Despite his strong beliefs in the Montessori curriculum, Kenneth had a practical outlook on testing and its importance for his class. Kenneth felt that if Montessori students did not perform well on standardized tests, the program would be cut. He wanted the "Montessori experts," (i.e., teachers with the most Montessori experience) to get together with the newer Montessori teachers to create materials that would bridge the gap between the standardized tests and the Montessori curriculum.

Lance. Lance consented to only one interview and the recording of his involvement in the weekly group meetings, so no observations were collected. He was in only his second year of teaching and his first year in a Montessori classroom. He did have some previous experience as an aide in a Montessori classroom but was having a difficult time managing the new curriculum, a multiage class, and the standardized tests. His interview took place toward the end of the semester. Several times during the interview, he mentioned being "overwhelmed."

He may have felt overwhelmed by the pressure he put on himself as a teacher. He viewed his role as a teacher broadly: Lance felt responsible not only for his students' content-area learning, but also for their emotional well-being. While other teachers tended to describe themselves as facilitators, Lance classified himself as a "classroom manager, psychologist, and life coach" (Interview). He set up routines and procedures "to motivate the students to do their best" with the goal of "[helping] these young children to feel okay about themselves" (Interview). This need to be everything for his students, paired with his inexperience, caused him more stress than it did other teachers at the school.

Further, Lance had to be absent from the classroom for several days for required professional development. Lance also described the professional development as "overwhelming" and was not sure how to implement the information or find the time to do so.

> I don't have a lot of time outside of the classroom, and that's really what, to do this successfully, that's really what you have to do. You really have to spend a lot of time planning out all these little details. There's a lot of detail, a lot of details in this job. (Interview)

Teaching was Lance's second career. He had switched to teaching from technology, as a way to slow down, but was not finding teaching to be what he had expected.

Another source of Lance's stress was balancing the Montessori curriculum in a public-school setting with other demands, which was especially hard for him as a first-year Montessori teacher.

> To have three different grade levels in here and to have all this focus on this new big [state-standardized] test for my third graders and all these other programs going on, it's—and then for me, and like several other people here going through their internship year in Montessori, where you're really trying to follow exactly what we just came out of and trained, but kind of having these different camps pulling and pushing with what's important and what are we doing. (Interview)

The growth of Openwood's Montessori program meant that the school's test scores and ratings were more affected by the Montessori students' scores than in previous years. Unfortunately, the Montessori students did not perform well on benchmark testing. Both the principal and her district supervisor were concerned and placed additional pressure on the Montessori teachers to raise student test scores.

Coming from a technology background, Lance was comfortable using technology and stated that it was important for his students to be able to use technology. However, he did not think that much of the educational software provided by the school was consistent with Montessori education. His students were able to use computers during their Montessori work time only as a tool for research or for one reading

intervention program. Students were allowed to use other educational software only after they had completed all of their daily Montessori work.

Lance thought the school was moving in the right direction regarding technology use but felt the implementation was still lacking in some areas. While most teachers were asking for more computers in their classrooms, Lance saw a greater need for human support for technology implementation on campus.

> We just really need somebody who can really drive all that, and so to have a technology person who's also spending 90% of their time teaching ancillary classes, it's going to be very challenging for the teachers to spend the time and figure out what to do to get certain pieces of software up and running, and set up systems, and solve problems, and we have issues, and then you have to take time to call the help desk, and so to coordinate all that for teachers is very challenging. (Interview)

Beyond hardware and human support, school technology policies also determined the programs Lance used in his class. He, like other teachers at the school, used programs that were licensed by the school or district.

Email was another way Lance used technology. He complained that he received too much email and again described it as "overwhelming."

> I could spend every [weekly team] meeting sitting at my computer going through all the emails I get, and trying to process which ones I have to deal with, which ones can wait. I mean, I could have a to-do list like this, and it's just kind of gotten to a point now where if somebody's not barking up my tree, I'm just not worrying about it. That's kind of unfortunate that it gets to that point, but it's just too much. There's no filtering … so, we're just spread too thin. (Interview)

Like professional development, email was another form of information overload for Lance.

Nathan. Nathan had 15 years of experience in education. He had taught at both the elementary and high school levels. He also had served 2 years as a high school assistant principal and 2 years as head principal. To get out of the high school environment, Nathan took an assistant principal position at Openwood. During the summer of 2010, the assistant principal position was eliminated, and Nathan decided to go back into the classroom as a Montessori teacher. Openwood was his first experience with a Montessori curriculum, and he liked that the curriculum encouraged critical thinking. His class was one of two bilingual Lower Elementary Montessori classes in the school and the only bilingual class in this team. Nathan consented to the interviews, class observations, and participation in weekly team meetings. His classroom was observed, and team meetings were recorded. However, scheduling conflicts limited him to only one interview, near the end of the semester.

Nathan's high school experiences influenced how he viewed his role as a teacher. He believed that his students needed to enter middle school "two grade levels ahead in content mastery," and it was his goal to push them in that direction. He felt that if students were ahead of the curriculum when they entered middle school, they were less likely to drop out in high school. He wanted his students to be critical thinkers and did not agree with a top-down approach to education. "I want to make a vision for the child so he can think outside the box down the road, and that's what I want" (Interview). While Nathan saw critical thinking as a strength of the Montessori Method, he also mentioned deficits in the system. He had observed teachers—in his school and in other schools—using reading materials that were inappropriate or too easy. He supplemented the traditional Montessori curriculum with more guided-reading lessons and writing workshops, techniques he had learned during his master's program.

As a bilingual teacher, he also stressed English language skills. He asserted that his third-grade students were capable of taking the standardized tests in English and wished they were allowed to do so. He felt that practicing for the test in Spanish—when they would test in English the following year—was counterproductive.

Nathan enjoyed working with students whom others found difficult. He used positive encouragement and high expectations to push struggling students to succeed. He was strict with these students but always respectful. He also said that he "never gave up" on these students.

> I never yell at them. I never say they're stupid. Nothing. I just keep working with them and keep working with them. Sometimes I have to calm them so they won't hurt anybody…. I'm firm with them. They understand that. They can't get out. I keep them there for five minutes and I'm like, "Okay. Are you ready to learn now?" (Interview)

Because these troubled students were so difficult for other teachers, Nathan found it rewarding to be able to help them succeed.

Regarding technology, Nathan stated that he "tried to use it as much as [he could]" and that he used it "quite a bit." Nathan viewed technology as a "resource" but said that it was "never going to replace the instructor" (Interview). He thought a teacher was needed to guide students and to assess their learning. The teacher could then use technology to help students improve specific skills.

> I use it as a resource, but I teach to listen, do hands-on, do questions hands-on, and then I'll put them on the computer for them to practice. And then they have to write, what have you, and then they get it. Then they test it. (Interview)

Nathan used online resources to supplement other classroom activities. However, he was not satisfied with the programs purchased by the school and district. He used several free, online programs and even personally paid for the licensing fees for one program. After benchmark test scores proved low, Nathan decided to use the district's test-bank software to create common assessments for his team, appearing comfortable using that program. After producing the first test, he wanted to teach other members of his team how to make them so they could all share that responsibility. He believed other teachers would be more likely to use the tests if they were involved in the design. He said, "You can give them information all day long, and they're not going to use it. They won't use it unless they're involved in the planning, like they're planning three weeks ahead and all that with you" (Interview). Nathan reiterated that you cannot force information on teachers—they must either ask for the information or be repeatedly included in the planning in some way. He also demonstrated this belief in his interactions with his team.

Technology Beliefs, Knowledge, and Integration

Several patterns emerged in how Openwood Montessori teachers approached technology, which can be grouped into two main themes: positive attitudes toward technology and TPACK-based decisions and technology use.

Attitudes toward technology. All teachers exhibited generally positive attitudes toward technology. They said that technology skills were important in today's society and felt that technology could be used to supplement other forms of instruction, despite some debate about the fidelity of technology integration in the Montessori curriculum. Most agreed that additional technology resources (e.g., computers) were needed.

Negative attitudes about technology focused on the difficulty of maintaining a balance between human interaction and computer time. Teachers were not opposed to technology use but felt it was important to not let it replace all human interaction between teachers and students. They also debated the types of technology and programs that align with, rather than compete with, Montessori philosophy. All teachers dealt with this struggle in their own way.

TPACK and technology use. The teachers at Openwood had technology experience and knowledge but did not use technology in transformative ways. Both Marianne and Lance had computer backgrounds, and all other teachers said they were at least moderately comfortable with technology. Students also were observed using individual drill-and-practice software. A few teachers mentioned using

technology in more student-directed ways, such as blogs and student-created PowerPoint presentations, but these uses were not observed.

While the teachers were not using much transformative technology, they demonstrated some TPACK reasoning when describing why they chose to use various technologies. Teachers demonstrated much technological pedagogical knowledge, often citing the ability to differentiate instruction and motivate student learning by integrating technology into their teaching. The teachers used individualized and adaptive software because it allowed them to track student progress and differentiate instruction for their students. Some of these programs were aligned with district and state content standards and the mandated tests, showing technological content knowledge. The school held licenses for several educational programs, but the teachers did not use all of these programs. Each of the teachers had preferences for certain programs over others, and they were able to articulate clearly which software they liked or disliked and why. These reasons included ease of use, but focused mainly on the rigor of the activities or alignment with the teachers' beliefs about student learning.

Finally, most of the teachers were capable of generating transformative ways to use technology (e.g., creating blogs and class websites), but they chose not to do so because of time constraints, lack of resources, or a low perceived value of these activities in a Montessori classroom.

Conclusion

Regardless of teaching experience, all teachers at Openwood Elementary School reported feeling confident with technology. Previous research had found that novice teachers reported feeling more confident in their general technology use when compared to their technology use in the classroom (Russell et al., 2003). This dissonance could be due to a lack of content or pedagogical knowledge, although most teachers used some TPACK in their technology choices. While they indicated that software that allowed for self-pacing and differentiation was appropriate to a Montessori paradigm—clearly acknowledging the technology affordances, the subject matter content, and the type of pedagogy that they wanted to use—these decisions did not lead to transformative technology use. It is possible that the teachers were unable to use technology in transformative ways, not because of a lack of technology knowledge, but rather a lack of constructivist or socioconstructivist pedagogical knowledge or access to or knowledge about technology tools that are more interactive. All teachers focused on technology's capacity for individualized pacing, but they rarely capitalized on the affordances of creating and sharing information.

Previous research found that teachers' beliefs about teaching influence how they use technology in the classroom (Ertmer, 2005; Hervey, 2011; Niess, 2005; Ravitz, Becker, & Wong, 2000; Sang, Valcke, van Braak, & Tondeur, 2010). The Montessori teachers in this study generally described their lessons in a constructivist manner, establishing an environment that encouraged individual student exploration and learning. They also spoke frequently of building critical thinking skills in their students and using computers for student-driven research. However, the technology use, while self-paced, was often still didactic.

Even teachers with socioconstructivist teaching beliefs and practices may need outside expertise to be able to use technology in transformative ways. Hughes et al. (2011) proposed a framework for action (FFA) that involves outside experts who are familiar with how teachers learn and change their practices, as well as with TPACK. In the FFA, these experts intervene at various critical decision points during implementation of new technology. This intervention addresses Lance's concern that teachers could not be successful in integrating technology in sociocontructivist ways without additional personnel resources to focus on the technology.

Some teachers cited a lack of computers as the main reason for their limited technology use, which is consistent with previous research in the field (Gray et al., 2009). The teachers used computers mainly as a station at which a limited number of students could take turns working independently. Software decisions were generally influenced more by availability than by the quality or pedagogical relevance of the software to classroom content. Only Nathan used his supply budget to purchase licenses for a software program not readily available at the school.

Limitations

This qualitative study is an initial look at how technology fits into a Montessori curriculum. The limited sample of teachers is not representative of the whole population of Montessori teachers. The sample was 75 percent male, which is an anomaly in the field of education. Moreover, all of the teachers claimed a high degree of comfort with technology, but many had a low degree of comfort with the Montessori paradigm, as they were in their first year teaching in that system.

Further, the definition of technology integration has shifted over the years. This study defines technology integration as the use of technology in constructivist and socioconstructivist ways to support learning in content areas (Read et al., 2011). The TPACK framework (Mishra & Koehler, 2006) was used to investigate individual teachers' knowledge, beliefs, and reasoning as they integrated technology in their classrooms. Even within this framework, capturing and measuring an individual's thought processes can be complex. The teachers' reasoning and intentions were usually not obvious during observations, and teachers do not always act in accordance with their stated beliefs (Calderhead, 1996). Triangulation of several class observations, interview data, and group meetings was used to gather the fullest possible picture of these teachers' technology knowledge, beliefs, and use. An added challenge with measuring teachers' TPACK lies in the ambiguity of the framework itself. Graham (2011) argued that the overlapping TPACK categories lack parsimony and are therefore difficult to distinguish.

Suggestions for Future Research and Practice

If school and district administrators want teachers to use more transformative technology, they need to re-evaluate the hardware and software they provide to teachers. Although most schools have some computers and Internet access, the quality of those resources varies greatly. Teachers in this study still report lack of appropriate technology as a barrier to technology integration. The school in this study had a classroom set of laptops, but due to issues with Wi-Fi connectivity, they were used in a laboratory setting rather than used flexibly by classroom teachers. Without consistent Internet access, many of the affordances that allow for transformational learning with computers cannot be realized. Hughes et al. (2011) called for the use of more Web 2.0 tools (e.g., presentation software, blogs, YouTube) in schools. They proposed that "openness and social interaction inherent in Web 2.0 support learners in generating and refining their understandings, as they read, reflect, and create new content to share with others" (Hughes et al., 2011, p. 54). Much of this technology is limited or restricted in U.S. public schools due to legitimate privacy concerns, but these barriers need to be re-evaluated if we hope to move toward a more transformative use of technology in our schools, where students are not simply learning from technology but rather using technology to build, understand, and create new meaning and content. The latest National Education Technology Plan update also recommends that "states, districts, and postsecondary institutions should develop and implement learning resources that embody the flexibility and power of technology to create equitable and accessible learning ecosystems that make learning possible everywhere and all the time for all students" (U.S. Department of Education, 2017, p. 25). As more schools adopt 1-to-1 laptop or tablet policies and Bring Your Own Device programs, teachers and students can begin to capitalize on the new capabilities technology can offer. Teachers should use this ubiquitous access to technology to facilitate deeper learning using real-life applications (Johnson, Adams Becker, Estrada, & Freeman, 2015).

Future research should also examine across multiple settings how Montessori teachers view technology. There was no strong consensus in this study about the degree and type of technology that should be included in a technology classroom. The Montessori community as a whole has not reached a consensus on this issue, and much work remains to understand if and when technology use can support Montessori ideals. The teachers in this study focused on individualized, adaptive tutoring programs rather than more constructivist technologies. The question still remains: Can technology integration truly exhibit the spirit of a Montessori classroom, or will it simply become the obtrusive interference? For the Montessori

community to address this issue in an informed way, rigorous qualitative and quantitative research is needed to better understand the impact of technology on students' motivation, learning, and development.

AUTHOR INFORMATION

Sara J. Jones is an assistant professor in Psychological, Health and Learning Sciences at the University of Houston and can be reached at sjjones3@uh.edu.

References

Archambault, L., & Crippen, K. (2009). Examining TPACK among K-12 online distance educators in the United States. *Contemporary Issues in Technology & Teacher Education, 9*(1). Retrieved from http://www.citejournal.org/volume-9/issue-1-09/general/examining-tpack-among-k-12-online-distance-educators-in-the-united-states/

Calderhead, J. (1996). Teachers: Beliefs and knowledge. In D. Berliner & R. Calfee (Eds.), *Handbook of Educational Psychology* (pp. 709–725). New York: Macmillan Library Reference.

Corbin, J., & Strauss, A. (2008). *Basics of qualitative research: Techniques and procedures for developing grounded theory* (3rd ed.). Thousand Oaks, CA: SAGE. https://doi.org/10.4135/9781452230153

Johnson, L., Adams Becker, S., Estrada, V., and Freeman, A. (2015). *NMC Horizon report: 2015 K-12 edition.* Austin, TX: The New Media Consortium. Retrieved from http://cdn.nmc.org/media/2015-nmc-horizon-report-k12-EN.pdf

Elkind, D. (2003). Montessori and constructivism. *Montessori Life, 15*(1), 26–29.

Ertmer, P. A. (2005). Teacher pedagogical beliefs: The final frontier in our quest for technology integration? *Educational Technology Research and Development, 53*(4), 25–39. doi:10.1007/BF02504683

Eteokleous, N. (2008). Evaluating computer technology integration in a centralized school system. *Computers in Education Journal, 51,* 669–686. https://doi.org/10.1016/j.compedu.2007.07.004

Faryardi, Q. (2007). *The Montessori paradigm of learning: So what?* Available from https://eric.ed.gov/?id=ED496081

Ferdig, R. E. (2006). Assessing technologies for teaching and learning: Understanding the importance of technological pedagogical content knowledge. *British Journal of Educational Technology, 37,* 749–760. https://doi.org/10.1111/j.1467-8535.2006.00559.x

Graham, C. R. (2011). Theoretical considerations for undertaking technological pedagogical content knowledge (TPACK). *Computers & Education, 57,* 1953–1960. https://doi.org/10.1016/j.compedu.2011.04.010

Gray, L., Thomas, N., Lewis, L., & Tice, P. (2009). *Teachers' use of educational technology in U. S. public schools: 2009 first look.* (NCES 2010-040). Washington, DC: National Center for Educational Statistics, Institute of Educational Sciences, U. S. Department of Education. Retrieved from https://nces.ed.gov/pubs2010/2010040.pdf

Harris, J. B., Hofer, M. J., Schmidt, D. A., Blanchard, M. R., Young, C. Y., Grandgenett, N. F., & van Olphen, M. (2010). "Grounded" technology integration: Instructional planning using curriculum-based activity type taxonomies. *Journal of Technology and Teacher Education, 18,* 573–605. Available from http://www.editlib.org/p/30418

Hervey, L. G. (2011). *Between the notion and the act: Veteran teachers' TPACK and practice in 1:1 settings* [Doctoral dissertation]. Available from ProQuest. (UMI No. 3463705).

Hubbell, E. R. (2006). Authenticity and technology in Montessori education. *Montessori Life, 18*(2), 16–20. Available from EBSCO Host http://connection.ebscohost.com/c/articles/20982979/authenticity-technology-montessori-education

Hughes, J. E., Guion, J. M., Bruce, K. A., Horton, L. R., & Prescott, A. (2011). A framework for action: Intervening to increase adoption of transformative web 2.0 learning resources. *Educational Technology, 51*(2), 53–61.

ISTE. (2016). *National educational technology standards for students (NETS-S)*. Retrieved from https://www.iste.org/standards/standards/for-students-2016#startstandards

Kagan, D. M. (1992). Implications of research on teacher belief. *Educational Psychologist, 27*(1), 65–90. https://doi.org/10.1207/s15326985ep2701_6

Lillard, A. (2008). How important are the Montessori materials? *Montessori Life, 20*(4), 20–25.

Love, A. & Sikorski, P. (2000). *Integrating technology in a Montessori classroom.* Report No. ED441600. Retrieved from ERIC http://files.eric.ed.gov/fulltext/ED441600.pdf

Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record, 108,* 1017–1054. https://doi.org/10.1111/j.1467-9620.2006.00684.x

Montessori, M. (1989). *To educate the human potential*. Oxford, England: Clio Press.

Montessori, M. (1912). *The Montessori Method*. New York, NY: Frederick Stokes Co.

Monson, M. (2006). Reconstructing Montessori: On being an authentic Montessori school. *Montessori Life, 18*(2), 36–43.

Niess, M. L. (2005). Preparing teachers to teach science and mathematics with technology: Developing a technology pedagogical content knowledge. *Teachers and Teacher Education, 21,* 509–523. https://doi.org/10.1016/j.tate.2005.03.006

Partnership for 21st Century Learning. (2009). *P21 framework definitions*. Retrieved from http://www.p21.org/storage/documents/P21_Framework_Definitions.pdf

Ravitz, J. L., Becker, H. J, & Wong, Y. T. (2000). Constructivist-compatible beliefs and practices among U.S. teachers. Teaching, learning, and computing: 1998 National Survey (Report #4). Center for Research on Information Technology and Organizations, University of California, Irvine and University of Minnesota. Retrieved from ERIC http://files.eric.ed.gov/fulltext/ED445657.pdf

Read, M. F., Jones, S. J., Hughes, J. E., & Gonzales-Dholakia, G. (2011, April). *An ecological case study of two middle schools' technology integration.* Paper presented at the annual meeting of the American Educational Research Association, New Orleans, LA.

Russell, M., Bebell, D., O'Dwyer, L., & O'Connor, K. (2003). Examining teacher technology use: Implications for preservice and inservice teacher preparation. *Journal of Teacher Education, 54,* 297–310. https://doi.org/10.1177/0022487103255985

Sang, G., Valcke, M., van Braak, J., & Tondeur, J. (2010). Student teachers' thinking processes and ICT integration: Predictors of prospective teaching behaviors with educational technology. *Computers & Education, 54,* 103–112. https://doi.org/10.1016/j.compedu.2009.07.010

Schmidt, D. A., Baran, E., Thompson, A. D., Mishra, P., Koehler, M. J., & Shin, T. S. (2009). Technological pedagogical content knowledge (TPACK): The development and validation of an assessment instrument for preservice teachers. *Journal of Research on Technology in Education, 42*(2), 123–149. https://doi.org/10.1080/15391523.2009.10782544

Shulman, S. S. (1986). Those who understand: Knowledge growth in teaching. *Educational Researcher, 15*(2), 4–14. https://doi.org/10.3102/0013189x015002004

Teo, T., & Zhou, M. (2016). The influence of teachers' conceptions of teaching and learning on their technology acceptance. *Interactive Learning Environments.* http://dx.doi.org/10.1080/10494820.2016.1143844

Ültanir, E. (2012). An epistemological glance at the constructivist approach: Constructivist learning in Dewey, Piaget, and Montessori. *International Journal of Instruction, 5,* 195–212. Retrieved from ERIC http://files.eric.ed.gov/fulltext/ED533786.pdf

U.S. Department of Education, Office of Educational Technology. (2017). *Reimagining the role of technology in education: 2017 National Education Technology Plan update.* Retrieved from https://tech.ed.gov/files/2017/01/NETP17.pdf

Yin, R. K. (2009). *Case study research: Design and methods* (4th ed.). Thousand Oaks, CA: SAGE Publications, Inc.

Journal of Montessori Research
2017, Volume 3, Issue 1

Determining the Measurement Quality of a Montessori High School Teacher Evaluation Survey

Anthony Philip Setari and Kelly D. Bradley

University of Kentucky

***Keywords**: evaluation, survey, Erdkinder, high school*

Abstract. The purpose of this study was to conduct a psychometric validation of a course evaluation instrument, known as a student evaluation of teaching (SET), implemented in a Montessori high school. The authors demonstrate to the Montessori community how to rigorously examine the measurement and assessment quality of instruments used within Montessori schools. The Montessori high school community needs an SET that has been rigorously examined for measurement issues. The examined SET was developed by a Montessori high school, and the sample data were collected from Montessori high school students. Using a Rasch partial credit model, the results of the analysis identified several measurement issues, including multidimensionality, misfit items, and inappropriate item difficulty levels. A revised version of the SET underwent the same analysis procedure, and the results indicated that measurement issues persisted. The authors suggest several ways to improve the overall measurement quality of the instrument while keeping the Montessori foundation. Additional validation studies with a revised version of the SET will be needed before the instrument can be endorsed for full implementation in a Montessori setting.

The number of Montessori high schools has increased across the United States and is now approximately 121 (National Center for Montessori in the Public Sector, 2017). Building on the popularity of Montessori education experiences in the early grades, Montessori high schools offer students with Montessori backgrounds an opportunity to continue their experience at the high school level. Students new to Montessori education also have the opportunity for a nontraditional high school experience. Underlying much of the Montessori high school philosophy is the principle that students have multifaceted cognitive, social, emotional, and moral experiences. These experiences provide the enrichment that facilitates the Montessori valorization process, explained well as "the process of becoming a strong and worthy person" (Donahoe, Cichuki, Coad-Bernard, Coe, & Scholtz, 2013, p. 18; Mayes & Williams, 2013), which is the primary intent of a Montessori adolescent education (R. Miller, 1990; J. P. Miller, 2010).

The role of the Montessori high school teacher in the valorization process is critical although poorly defined (Barker, 2011; Montessori, 1973). Unlike the depth of detail that Maria Montessori provided for education at the Early Childhood and Elementary levels, specifics on the Montessori high school experience are comparatively lacking (Barker, 2011). Further complicating the issue is that unique programs on Montessori adolescent pedagogy are offered by a range of institutions; some of the most recognizable include the Cincinnati Montessori Secondary Teacher Education Program, the Hershey Montessori School, the Houston Montessori Center, and the Montessori High School at University Circle in Cleveland. This ambiguity, along with the variety of Montessori adolescent education methods, has led to much uncertainty

Published online May 2017

about how to establish a true Montessori adolescent experience, as Dr. Montessori would have envisioned it, and to the development of highly variant Montessori high schools (Barker, 2011; Kahn, 2011; Kahn & Pendleton, 2007).

Currently, Montessori high schools do not have a widely used means of measuring the quality of their teachers. In an attempt to evaluate the performance of their teachers, the administrators at the Montessori high school in this study developed a teacher evaluation form, also known as a student evaluation of teaching (SET), to implement in their school. Basing their ideas on principles promoted by the North American Montessori Teacher Association ([NAMTA], 2015), the administrators developed a teacher evaluation instrument composed of 19 items. Partnering with the study's authors, the administrators sought to determine the quality of the instrument and identify ways to improve it.

The purpose of this study was to conduct a validation analysis on a Montessori high school SET, thereby demonstrating how the Montessori community can begin to rigorously examine the quality of measurement and assessment instruments implemented in their schools. To address the primary purpose of this study, we developed three research questions about the quality of the SET measurement instrument: (a) How well did the SET measure teacher effectiveness? (b) How well did the individual SET items measure teacher effectiveness? and (c) How well did the ability to endorse items on the SET align with an established model of teacher effectiveness?

Background

Montessori High Schools

The core of Montessori secondary educational philosophy is taken from Dr. Montessori's (1973) work, *From Childhood to Adolescence: Including Erdkinder and the Function of the University*, in which she proposed that adolescents be educated through an *Erdkinder* system. Meaning "children of the earth," Erdkinder was to be a largely unstructured environment in which adolescents worked and lived together in a farm setting (Barker, 2011). In addition to cognitive outcomes, the goal of Erdkinder is to develop students' social, emotional, and moral characteristics by cultivating social skills, emotional self-awareness, and introspective reflection (Mayes & Williams, 2013; Montessori, 1973; R. Miller, 1990; J. P. Miller, 2010). The development of these characteristics is believed to prepare students to be independent and successful in their postsecondary lives.

Although Dr. Montessori's (1973) foundational text indicated that teachers play a unique and critical role in Erdkinder, the specific expectations for teachers' actions were vague. For example, Dr. Montessori (1973) wrote, "teachers must be young, of open minds, ready to take an active part in the life of the school and to contribute personally" (pp. 124–125), although the specific details of how teachers were to achieve these ends were not detailed. Dr. Montessori (1973) further explained that teachers should facilitate students' learning, work to cultivate an appreciation of content knowledge in students, and be caring individuals. However, beyond encouraging students to learn content material through their farm work, Dr. Montessori provided scant details on how teachers were to reach these goals. In one of the few others instances where she directly addressed the issue of adolescent education, Dr. Montessori (2011) argued that a true Erdkinder teacher "has a real personality, a feeling heart, and takes keen interest in her pupils; one in whom children recognize a source of inspiration and upon whom they can rely" (p. 55), again failing to provide details of how to realize these goals in the school setting. Dr. Montessori's silence on how to transfer these teacher traits into a school environment has allowed for a great deal of variation in the instructional behaviors of Montessori secondary teachers (Kahn, 2011).

Without consistency in the expectations for Montessori high school teachers, standardized teacher evaluation across the Montessori community has lagged, as Montessori high school administrators cannot refer to a key set of practices to determine if their teachers are demonstrating Montessori best practices. Across the Montessori secondary education spectrum, the large American Montessori organizations, such as the American Montessori Society (AMS) or NAMTA, do not indicate a standardized Montessori SET

for use in Montessori high schools throughout the United States. An endorsement of an SET from an organization such as AMS or NAMTA, along with summary statistics on rates of usage in schools and results, would strongly indicate that such an instrument had been developed and widely implemented in the Montessori secondary community; however, no such endorsements or statistics are provided by these two leading organizations.[1]

Without a set of psychometrically sound standardized evaluation instruments to implement across Montessori secondary schools, the Montessori secondary community is unable to evaluate its teachers and schools for consistency and quality. Although the Montessori secondary community struggles with evaluation issues, these issues are also pervasive at the earlier Montessori grade levels. The extent to which the overall Montessori community faces challenges with evaluation issues indicates great potential for psychometric instrument development and validation to address these issues.

Student Evaluations of Teaching

SETs are commonly used to evaluate schools (Kulik, 2001; Wright & Jenkins-Guarnieri, 2012). Historically, SETs have had several purposes: to capture student perspectives on their experiences with teachers and administrators for improvement purposes, to aid other students interested in a course or a specific instructor, and to gain information for academic research (Marsh & Dunkin, 1992). In order for SETs to be effective, an understanding of which factors make for a high-quality instructor must be established. Feldman proposed such factors in his work, *The Superior College Teacher from the Students' View* (1976). Although the model was intended for postsecondary schools, the factors also apply to other levels of education, including secondary schools. In Feldman's model, the three factors that produced a quality teacher were *presentation*, *facilitation*, and *regulation*. Presentation referred primarily to a teacher's course material delivery and was the easiest issue for teachers to address. Facilitation referred to the work teachers completed with students within the context of their interactions, which was largely influenced by the instructor's personality. Regulation referred to the administrative processes of a course, such as implementing a fair grading policy, and was the most challenging factor for teachers to influence. Although Feldman's model did not address all the factors of being a teacher, it provided a foundation for examining teacher performance in the classroom.

The Rasch Model

The Rasch model is a psychometric technique commonly used to conduct validation analyses on tests and surveys and is closely compared to a one-parameter item response theory model (Bond & Fox, 2007; de Ayala, 2009). Key features of the Rasch model include assigning difficulty levels to items and ability levels to respondents (Bond & Fox, 2007). In assigning these levels, researchers and policy makers better understand the degree of difficulty of a measurement instrument (e.g., a survey or assessment) and the ability of respondents to endorse the items. For example, an instrument featuring many items with low difficulty levels is expected to result in many respondents demonstrating high ability levels; in contrast, an instrument with a large amount of high difficulty level items would result in many respondents showing low ability levels (Bond & Fox, 2007). To extend this example to an SET, higher ability students would rate their teachers more positively, and lower ability students would rate their teachers more negatively. The presence of too many easy-to-endorse items promotes artificially positive endorsements of a teacher, and the presence of too many hard-to-endorse items promotes artificially negative endorsements. Developing an instrument with a range of item difficulty levels helps assure that the constructed instrument can assess

[1] NAMTA (2015) does provide examples of evaluation procedures and instruments; however, it does not indicate that these materials have been psychometrically validated for measurement quality. The organization also does not provide information regarding the usage of these resources by Montessori high schools.

or evaluate fairly and as intended, as it simultaneously takes into account respondents' varying ability levels.

When an instrument uses rating scales or Likert-type data, such as in survey research, polytomous forms of the Rasch model are used (Bond & Fox, 2007). If there is a reason to believe that respondents interpreted the response categories differently (e.g., if response categories changed midway through a survey and there were concerns that respondents did not notice this change in categories), then the Rasch partial credit model (PCM) is recommended over other polytomous models (Bond & Fox, 2007). The formula for the Rasch PCM model (Wright & Masters, 1982) is

$$\frac{\exp(\beta_n - \delta_{ik})}{\phi_{nik} = 1 + \exp(\beta_n - \delta_{ik})},$$

where ϕ_{nik} is the probability that person *n* will respond to item *i* with response *k*. $\beta_n - \delta_{ik}$ is the ability (β) of person *n* subtracted from the difficulty (δ) of moving to the *k* rating of item *i*. When interpreting the item difficulty levels in the Rasch PCM, item difficulty levels demonstrate the point on the item threshold at which endorsing a category above the point is equal to endorsing a category below the point.[2] Both person ability and item difficulty estimates are reported on a logit scale, which allows for comparisons of interval level growth, with reported logit scales commonly running from -3.0 to 3.0 (de Ayala, 2009; Toland 2014; Wright, 1993). In practical terms, difficulty level in response to a survey item is connected to a respondent's ability to endorse, or positively rate, that item. Thus, item difficulty levels with negative logit items are easier to endorse than are positive logit items. For person ability levels, respondents with negative logit scores are less able to endorse items than are respondents with positive logit scores.[3] Examining and interpreting these logits are important components of determining the quality of a measurement instrument in a Rasch validation approach.

In addition to item difficulty levels and person ability levels, item and person reliability estimates are reported in a Rasch PCM analysis. Item reliability is a means of determining whether the analysis contained a sufficient sample size to develop item difficulty estimates that accurately reflect the item's difficulty level (Linacre, 2015). Person reliability is a means of determining if the instrument included a sufficient number of items to accurately identify the person ability levels of respondents in the sample. An estimate of .80 is considered sufficient for both item reliability and person reliability (Linacre, 2015).

An additional set of item level estimates are developed, known as infit and outfit estimates, which provide insight into the quality of individual items in an instrument (Bond & Fox, 2007). Item infit and outfit *z* scores, reported as *t* statistics, are expected to fall within the range of -2.0 to 2.0, indicating that an item functions appropriately, thus suggesting that lower ability level respondents were less likely to endorse the item than were higher ability level respondents (Bond & Fox, 2007). In contrast, inappropriately functioning items function inconsistently, where lower ability level respondents may be more likely to endorse the item than may higher ability level respondents. These infit and outfit estimates are a means to identify issues with individual items.

Beyond the item level and person level estimates, the Rasch PCM includes estimates that help determine the *dimensionality* of the instrument (Bond & Fox, 2007; de Ayala, 2009). Dimensionality refers to the instrument's measurement of a latent trait, so unidimensionality indicates that the instrument measures a single latent trait (e.g., evaluating only teacher performance instead of both teacher performance and school climate). Determining unidimensionality requires examining the results of the reported principal

[2] More advanced validation techniques examine threshold functioning, which is beyond the scope of this article. Threshold examination is of particular interest when a rating scale has a large number of response categories (Bond & Fox, 2007).

[3] In the context of surveys for evaluation purposes, ability level refers to a respondent providing a high or low endorsement of the subject (Linacre, 2015; Nardi, 2006).

components analysis (PCA) of Rasch residuals (Linacre, 2015). A PCA of Rasch residuals returning a first contrast with an eigenvalue below 2.0 indicates the instrument is unidimensional. However, a first contrast with an eigenvalue at or above 2.0 means that it must be determined whether the mapping of these residuals showed items of the same facet type. This clustering of items with the same facet would suggest the presence of a second latent trait, likely one matching the facet of the clustering item and thus indicating multidimensionality. Although instruments can still function when they are multidimensional, a unidimensional instrument provides users with results that intentionally measure a single concept.

Methodology

The study methodology was designed to examine how the SET instrument functioned both at the item level and as a complete instrument through a survey validation framework. Two analyses were conducted. The first analysis was a Rasch PCM analysis that examined the Montessori high school SET in its original form. Appendix A includes the original SET, and each item is labeled with a facet that corresponds to one of Feldman's SET facets (1976). Montessori high school administrators collected data for the first analysis in the fall semester of 2014; data included responses from the 27 students who attended the study school. Students completed an SET for multiple teachers in the school, increasing the overall number of responses included in the analysis. After the first analysis, the authors reviewed the results with the SET creators and suggested possible revisions.

The second analysis examined the revised form of the Montessori high school SET using a Rasch PCM analysis. The revised form of the SET can be found in Appendix B. Similar to the original SET, each item is labeled with a facet that corresponds to one of Feldman's (1976) SET facets. School administrators collected data for the second analysis in the spring semester of 2015; data included responses from the same sample of students who provided data in the fall semester of 2014 and who were used in the initial analysis.

The survey validation framework used in this study guided the estimates examined as a result of each Rasch PCM analysis. The validation framework for this study was similar to that used by Royal and Elahi (2011) and Bradley, Sampson, and Royal (2006). These frameworks included examining estimates of instrument unidimensionality, item reliability, person reliability, item fit, and the spread of item difficulty levels. The analysis began by determining whether the item and person reliability estimates were at or above the suggested .80 level, which would indicate that the estimates developed by the Rasch PCM analysis can be confidently interpreted for the purposes of determining the quality of the measurement instrument (Bond & Fox, 2007). Determining reliability was followed by determining dimensionality, which required examining the PCA of the Rasch residual results for unidimensionality as determined by contrast estimates and factor loadings (Linacre, 2015). This was followed by examining item fit, which included determining if the infit and outfit *t* statistics were between -2.0 and 2.0. The analysis concluded by examining the spread of item difficulty levels and determining how this ordering compared to the theoretical item ordering of Feldman's (1976) model. To support that the instrument is measuring the proposed latent trait, the Presentation facet items should be the easiest to endorse, followed by the Facilitation facet items, and finally the Regulation facet items. If the item difficulty levels matched Feldman's (1976) model, then it would indicate that the instrument's items were at appropriate levels for the SET.

For this study, all analyses were conducted using Winsteps (Version 3.92.1; Linacre 2016). The first analysis included data from 106 student ratings, and the second Rasch PCM analysis included data from 105 student ratings. To protect the anonymity of participants, no demographic variables or student identifiers were included in the dataset, so these elements were excluded from both analyses.

Results

We begin with describing the outcomes of the analysis conducted on the initial SET. The first analysis results are followed by a detailed description of how the authors shared the results with the SET developers. We conclude with details of the analysis results from the revised SET.

First Analysis

Results of the Rasch PCM analysis indicated several measurement issues with the initial SET. Framing the interpretability of these results, both the item reliability estimate (.84) and the person reliability estimate (.86) were satisfactory, indicating the analysis included both a sample size and number of items sufficient to confidently interpret the generated estimates (Linacre, 2015). Next, the researchers examined the instrument's dimensionality results. Initial results indicated the instrument was not unidimensional; the results of the PCA of the Rasch residuals estimated the eigenvalue of the first contrast to be 3.0, above the 1.9 recommendation of Linacre (2015) and indicating that item loadings needed to be examined. The item loadings of the first contrast are reported in Table 1. The first contrast had a large representation of items from the Presentation facet with positive loadings (seven out of eight items). Unidimensionality could not be assumed, given the clustering of Presentation items with positive loadings in the first contrast, which indicated the instrument had issues with appropriate measurement. The instrument likely measured Presentation as a full dimension, rather than as a facet of the intended teacher-quality dimension.

Table 1

Item Level Estimates for Initial SET

Item	First contrast loading	Measure	*SE*	Infit mean-square	Outfit mean-square	Infit *t*	Outfit *t*
p1_i	.22	.14	.13	.90	.73	-.6	-1.4
p2_i	.40	-.05	.13	.80	.91	-1.3	-.3
p3_i	-.37	-.90	.17	1.40	1.23	1.8	.8
p4_i	-.22	-.26	.14	.87	1.06	-.7	.4
p5_i	.12	.60	.12	.94	.99	-.4	.0
p6_i	.37	.58	.12	1.85	1.95	4.7	4.3
p7_i	.03	-.15	.13	.72	.66	-1.8	-1.6
p8_i	.60	.04	.13	1.31	1.17	1.8	.8
p9_i	.31	.30	.12	.94	.84	-.4	-.8
p10_i	-.03	.09	.13	1.66	1.42	3.6	1.9
p11_i	-.52	-.30	.14	1.07	.76	.5	-1.0
f1_i	-.01	.31	.12	.56	.63	-3.4	-2.2
f2_i	-.27	.14	.13	.79	.82	-1.4	-.9
r1_i	.68	.32	.12	1.31	1.44	1.9	2.1
r2_i	-.04	-.27	.14	.95	.86	-.2	-.5
r3_i	-.47	-.17	.13	.81	.70	-1.1	-1.4
r4_i	-.58	.09	.13	.77	.82	-1.5	-.9
r5_i	-.54	-.04	.13	.92	.89	-.5	-.5
r6_i	-.61	-.46	.15	.74	.57	-1.5	-1.9

Note. Items in the Presentation facet begin with the prefix "p"; Facilitation items begin with the prefix "f"; Regulation items begin with the prefix "r."

The results at the item level were mixed. The *t*-statistic estimates, reported in Table 1, indicated that four items—p6_i, p10_i, f1_i, and r1_i—demonstrated an issue with misfit (Bond & Fox, 2007; Linacre, 2015). These estimates indicated that students with varying views of their teachers were likely endorsing teachers in a similar manner, and thus the misfit items misrepresented students' perspectives. Item difficulty levels were then examined to determine the presence of a range of item difficulty levels and to evaluate the ordering of item difficulty levels as compared to the model proposed by Feldman (1976).

The Wright map[4] in Figure 1 demonstrates the logit hierarchy of the item difficulty estimates. As Figure 1 shows, item difficulty levels overlapped greatly, suggesting a redundancy in item measurements. This result indicated that students were not asked to endorse items from a range of difficulty levels. Therefore, it is likely that all teachers, regardless of quality, were given similar ratings that prevented administrators from identifying high- and low-performing teachers. The difficulty levels also did not extend below -1.0 logit or above 1.0 logit, indicating that the instrument did not effectively measure respondents at the highest and lowest ability levels. This result also demonstrated that students were prevented from expressing highly positive or highly negative views of teachers, as there were no items that reflected these views. These initial item difficulty results indicate that the SET lacked an appropriate range of items with varying difficulty levels.

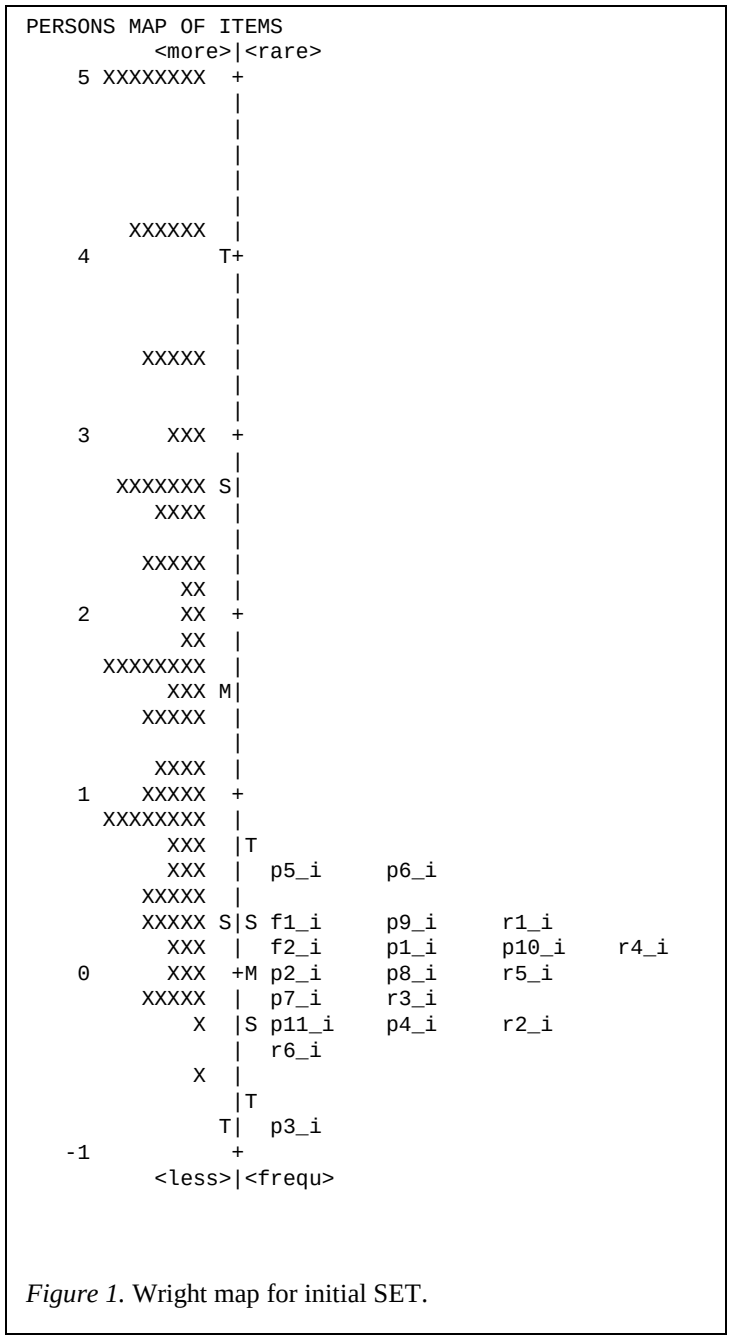


Figure 1. Wright map for initial SET.

When comparing the item ordering to Feldman's (1976) model, additional issues with item difficulty levels became apparent. As Figure 1 demonstrates, there was no clear indication of an item difficulty ordering based on facet. Although Presentation items should be the easiest to endorse, with item difficulty levels ideally at the low end of the negative range, Presentation items appeared throughout the item difficulty range. After the Presentation facet, the Facilitation items should be the next-most difficult items to endorse, according to Feldman's (1976) model. The two Facilitation items fell into appropriate item difficulty levels, with both at the moderately-difficult-to-endorse level, .14 (item f2_i) and .31 (item f1_i). However, the Facilitation items were at similar levels as several items from other facets, indicating the SET did not contain the appropriate items at the moderately-difficult-to-endorse level; according to Feldman's (1976) model, the non-Facilitation facet items should not be at this level. According to Feldman's model, Regulation items should have been among the most challenging items to endorse. However, only two of the Regulation items had item difficulty levels above the 0.0 logit (i.e., more difficult to endorse; Bond & Fox, 2007). The comparison of item difficulty estimates

[4] Wright maps are a means of reporting Rasch model results (Bond & Fox, 2007). The left side of the map indicates person ability levels, and the right side of the map indicates item difficulty levels. The numbers in the middle of the map are the logit scale for the person ability and item difficulty estimates.

to Feldman's model further indicated issues with the initial SET. Overall, the results demonstrated that several measurement issues in the initial SET needed to be addressed.

Revision Process

After conducting the first analysis, the researchers discussed the results with the Montessori high school administrators who developed the initial SET. The discussion included a detailed explanation of how well the overall instrument functioned in its ability to evaluate teachers, as well as an explanation of how well individual items functioned. Based on these results, the researchers suggested several ways to improve the instrument, including revising or dropping the misfit items (i.e., items p6_i, p10_i, f1_i and r1_i) and revising current items to be much easier to endorse or much harder to endorse.

The researchers also recommended how to enhance the instrument to assure measurement quality. These recommendations included revising items (a) that were double-barreled, (b) that may have used terms unfamiliar to respondents, and (c) that included clauses that could be interpreted differently by respondents (Nardi, 2006). For example, a double-barreled item, such as item p4_i "Lesson topics are clear and concise," uses a conjunction that may cause a respondent to answer both parts of the question or only one part of the question. Using unfamiliar terms, such as "differentiation of instruction" in item f1_I, could confuse respondents who were unfamiliar with the term. The problem with the use of descriptive clauses in items, such as in item p11_i "Has a good rapport with students, based on mutual respect," is that a student's response may change because of the wording of the clause. In this example, a teacher may have a good rapport with students, but it may not be based on mutual respect, possibly leading to inconsistent measurement. The researchers recommended revising items that included any of the three identified measurement issues.

The researchers also suggested revising the SET scale. The initial SET scale used estimated percentages of time as the response categories for students. The researchers identified two measurement issues with this scale: (a) the ability of students to assign temporal percentages to a teacher's efforts, and (b) the practical impossibility for teachers to simultaneously engage in all behaviors all of the time, as an increase of any one behavior would likely lead to a decrease of other behaviors. There also was an issue with percentages overlapping on the scale, allowing students to endorse the same percentage on two different parts of the scale. Therefore, researchers suggested that the scale be revised to ask about infrequency and frequency or disagreement and agreement.

During this meeting, the administrators asked many questions about the findings and the researchers' recommendations. Administrators also discussed their concerns about the revision or removal of items, which the researchers noted. Based on the results and administrator feedback, the researchers revised the SET. Finally, the administrators incorporated their own revisions to the instrument and implemented the revised instrument with their students in a scheduled evaluation.

Second Analysis

Results of the Rasch PCM analysis on the revised SET (SET-R) indicated the instrument still had measurement issues, despite the revisions. The reliability estimates were above the preferred level of .80, with person reliability at .87 and item reliability at .86 (Linacre, 2015). These reliability estimates indicated that the Rasch estimate results could be confidently used by the researchers to answer the research questions. Dimensionality of the SET-R was then examined. The results of the PCA of Rasch residual estimates showed that the first contrast had an eigenvalue of 2.2, indicating that the instrument was likely not unidimensional; however, the item loadings, found in Table 2, did not indicate the presence of an additional factor (Linacre, 2015). The facets of the positive and negative item loadings were mixed and did not cluster on a single facet for either loading; clustering would have indicated the presence of a second dimension. Although the first contrast eigenvalue was above 1.9, the lack of item loadings by facet indicated the instrument could be considered unidimensional.

Table 2

Item Level Estimates for Revised SET

Item	First contrast loading	Measure	*SE*	Infit mean-square	Outfit mean-square	Infit *t*	Outfit *t*
p1_r	.08	-.66	.19	.79	.81	-1.5	-1.1
p2_r	.73	-.52	.18	1.00	1.03	.0	.2
p3_r	-.24	-.93	.20	1.29	1.13	1.8	.7
p4_r	.37	.19	.17	.71	.77	-2.0	-1.5
p5_r	-.31	.12	.17	.98	.97	-.1	-.1
p6_r	-.43	.26	.17	1.22	1.24	1.4	1.5
p7_r	-.41	.41	.17	.83	.81	-1.2	-1.2
f1_r	.62	-.23	.18	1.26	1.21	1.6	1.2
f2_r	-.02	-.70	.19	.67	.81	-2.4	-1.0
f3_r	.30	.57	.17	1.51	1.65	3.0	3.5
f4_r	-.41	-.38	.18	.86	.82	-.9	-1.1
f5_r	.40	.17	.17	.70	.79	-2.1	-1.4
f6_r	-.14	.12	.18	.89	.84	-.7	-1.0
f7_r	-.30	-.13	.18	1.29	1.48	1.8	2.5
f8_r	.02	-.13	.18	.72	.70	-2.0	-2.0
r1_r	.06	.03	.17	.88	.94	-.8	-.3
r2_r	-.21	1.20	.16	1.61	1.63	3.6	3.4
r3_r	-.18	.52	.17	.69	.78	-2.2	-1.4
r4_r	.18	.09	.18	.89	.88	-.7	-.7

Note. Items in the Presentation facet begin with the prefix "p"; Facilitation items begin with the prefix "f"; Regulation items begin with the prefix "r."

The item level estimates, reported in Table 2, indicated issues with the measurement of specific items on the SET-R. Of the 19 items, six indicated a misfit issue, according to their infit or outfit *t*-statistic estimates (i.e., items f2_s, f3_s, f5_s, f7_s, r2_s, and r3_s; Bond & Fox, 2007). These outcomes showed that students with both more and less favorable perceptions of their teacher were likely similarly endorsing the misfit items. The item difficulty levels further indicated an issue with the instrument, as the spread of difficulty levels was not wide, and thus the instrument could not distinguish well between students with more favorable and students with less favorable perceptions of their teachers. As is evident in the Wright map in Figure 2, the item difficulty levels clustered in the moderate range, between -.93 and 1.20. Additional items at the easier-to-endorse and more-challenging-to-endorse levels would need to be added to increase the instrument's ability to measure the full range of student perceptions.

The last component of the analysis examined the order of the SET-R items with their difficulty levels to determine if they were aligning by facet with Feldman's (1976) model. As Figure 2 shows, the item difficulty levels did not order by facet in this way because the Presentation and Facilitation items were at similar difficulty levels; that is, the Facilitation items were not consistently more challenging to endorse than the Presentation items. The Regulation facet items were among the more difficult items to endorse, although the items overall fell within the moderately difficult logit range (Bond & Fox, 2007). Additionally, students completing the SET-R were able to endorse Regulation items at a similar level as Presentation items, although Regulation items should be more challenging to endorse. These results indicated that the SET-R did not contain items with appropriate difficulty levels according to Feldman's (1976) model and needed additional revision.

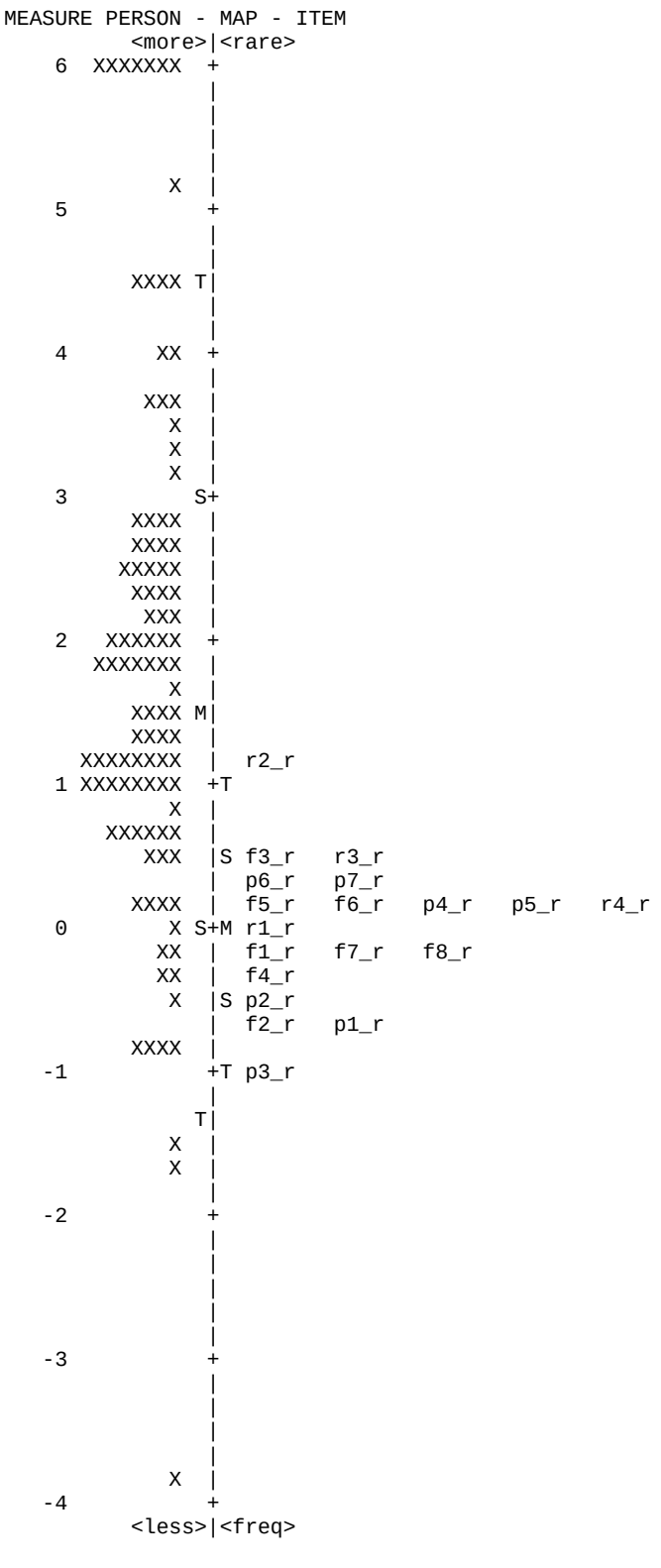


Figure 2. Wright map for revised SET.

Discussion

The primary purpose of this study was to examine an SET in use in a Montessori high school and, in doing so, show the Montessori community how to rigorously examine the quality of measurement and assessment instruments used in their schools. The results indicated that the SET-R needed additional reworking before it could be confidently used for evaluation purposes. We answered the first research question (i.e., "How well did the SET measure teacher effectiveness?") by examining the dimensionality of the instrument and determining if there was a spread of item difficulty levels for students to endorse. According to the results, the SET-R can be interpreted as unidimensional, suggesting the instrument is measuring the concept of teacher effectiveness. However, the lack of item spread showed that the instrument was incapable of measuring the wide range of person ability levels. Additional revision is needed before the instrument can provide effective measurement of students' perceptions. We answered the second research question (i.e., "How well did the individual SET items measure teacher effectiveness?") by examining the items for misfit issues. As the results showed, the SET-R included six misfit items. These misfit items indicated that, although most items were capable of measuring teacher effectiveness, additional item revision is needed to assure all items provide effective measurement. To answer the third research question (i.e., "How well did the ability to endorse items on the SET align with an established model of teacher effectiveness?"), we examined the facets of the items in relation to their item difficulty levels. Comparing the item difficulty levels and their facets to Feldman's (1976) model demonstrated that the Presentation and Facilitation facet items did not have the expected item difficulty levels. The Regulation items were among the more

difficult items to endorse, although their overall difficulty levels were not at the highest levels that Feldman's (1976) model proposed (Bond & Fox, 2007). The answers to these research questions demonstrated that, to assure the instrument is of high quality, additional work on the SET-R is needed.

Conclusion

The authors conclude that the SET-R needs additional revisions. Possible revisions include dropping or revising the misfit items, as well as assuring that items at low and high difficulty levels are included on the instrument. After these initial revisions are made, the instrument will begin to better measure the views of students with both higher and lower perceptions of their teacher. Altering the misfit items will also aid in assuring the instrument is measuring a unidimensional trait, as these misfit items are likely interfering with the clarity of the instrument's overall measurement (Bond & Fox, 2007). An additional possible revision includes removing items in the same facet at similar difficulty levels, as these items with similar difficulty levels are providing duplicative measurements of the same concept. For example, items p6_r and p7_r have similar difficulty levels, .26 and .41 respectively, and both measure elements of presentation. Removing either p6_r or p7_r would reduce the number of questions a student has to answer but still capture the student's perception of a teacher's presentation quality.

Additional revisions of the SET-R and continued validation studies will ultimately yield a high-quality instrument that can be widely implemented in Montessori high schools. The results from this instrument could collect data that would allow Montessori stakeholders and administrators to determine the quality of their teachers and make informed decisions about the future, thus ensuring the best educational experiences for students. Furthermore, the development of this high-quality instrument would demonstrate to the Montessori community that its schools and teachers can be evaluated in a quantitative manner that aligns with its values. We hope the validation process described here has shown the Montessori community how to rigorously examine current measurement instruments and the value of such examination.

Limitations

This study had two primary limitations. First, the Rasch analyses would have benefitted from a larger student sample, which would have permitted the development of more accurate estimates (Bond & Fox, 2007; Linacre, 2015). Second, because the development of the SET items was not based on a set of general principles that is accepted by the Montessori high school community—which arguably does not exist—it may not be accepted by the wider Montessori audience (Barker, 2011; Kahn, 2011). The extent to which the SET items reflect Montessori views on desirable Erdkinder teacher traits is unclear, as the items were developed from outcomes pertaining to a certain Montessori secondary-school philosophy and then modified for inclusion on an evaluation instrument (Barker, 2011). Without an extensive and well-developed model for Erdkinder teacher effectiveness, the items can only be compared to non-Montessori–specific models of teacher effectiveness, and thus their reflectiveness of Montessori values cannot be confirmed. Additional work in the area of Erdkinder standards would enhance these schools' ability to develop evaluation instruments and systems that clearly reflect a unified Montessori vision of Erdkinder education, as instruments such as the SET in this study could be compared to those agreed-upon standards. The limitations of this study can be addressed by collecting data from a wider sample of students and by confirming the appropriateness of the instrument's items with members of the Montessori community.

AUTHOR INFORMATION

†Corresponding Author

Anthony Philip Setari† is a recent doctoral student graduate of the University of Kentucky and can be reached at anthony.setari@uky.edu.

Kelly D. Bradley is a professor in the College of Education at the University of Kentucky.

References

American Montessori Society. (2015). *Montessori schools*. Retrieved from http://amshq.org/Montessori-Education/Introduction-to-Montessori/Montessori-Schools

Barker, D. (2011). A historical look at Montessori's Erdkinder. *Communications, 1-2,* 96–112.

Bond, T. G., & Fox, C. M. (2007). *Applying the Rasch model: Fundamental measurement in the human sciences* (2nd ed.). New York, NY: Lawrence Erlbaum Associates.

Bradley, K. D., Sampson, S. O., & Royal, K. D. (2006). Applying the Rasch rating scale model to gain insights into students' conceptualisation of quality mathematics instruction. *Mathematics Education Research Journal, 18,* 11–26. doi:10.1007/BF03217433

de Ayala, R. J. (2009). *The theory and practice of item response theory*. New York, NY: The Guilford Press.

Donahoe, M., Cichucki, P., Coad-Bernard, S., Coe, B., & Scholtz, B. (2013). Best practices in Montessori secondary programs. *Montessori Life, 25*(2), 16–23.

Feldman, K. A. (1976). The superior college teacher from the students' view. *Research in Higher Education, 5,* 243–288.

Kahn, D., & Pendleton, D. R. (2007). *The whole-school Montessori handbook for teachers and administrators*. Burton, OH: North American Montessori Teachers' Association.

Kahn, D. (2011). Eight pictures at an exhibition: A Montessori retrospective on the discovery of the adolescent. *Communications, 1-2,* 15–41.

Kulik, J. A. (2001). Student ratings: Validity, utility, and controversy. *New Directions for Institutional Research, 109,* 9–25. doi:10.1002/ir.1

Linacre, J. M. (2015). *A user guide to Winsteps Ministeps Rasch-model computer programs: Program manual 3.90.0.* Available from Winsteps http://www.winsteps.com/manuals.htm

Linacre, J. M. (2016). Winsteps [Computer software]. Available from Winsteps http://www.winsteps.com

Marsh, H. W., & Dunkin, M. J. (1992). Students' evaluations of university teaching: A multidimensional perspective. In J. C. Smart (Ed.), *Higher education: Handbook of theory and research* (Vol. 8, pp. 143–233). New York, NY: Agathon Press.

Mayes, C., & Williams, E. (2013). *Nurturing the whole student: Five dimensions of teaching and learning.* Lanham, MD: Rowman & Littlefield Education.

Miller, J. P. (2010). *Whole child education*. Canada: University of Toronto Press.

Miller, R. (1990). *What are schools for? Holistic education in American culture*. Brandon, VT: Holistic Education Press.

Montessori, M. (1973). *From childhood to adolescence: Including Erdkinder and the function of the university.* New York, NY: Schocken Books.

Montessori, M. (2011). Principles and practice in education. *Communications, 1-2,* 50–60. (Reprinted from First Lecture, Institute of Medical Psychology, London, November 10, 1936.)

Nardi, P. M. (2006). *Doing survey research: A guide to quantitative methods*. Boston, MA: Pearson Education.

National Center for Montessori in the Public Sector. (2014). *USA Montessori census*. Available from http://www.montessoricensus.org

North American Montessori Teachers' Association. (2015). *Curriculum downloads*. Available from http://www.montessori-namta.org/Curriculum-Downloads

Royal, K. D., & Elahi, F. (2011). Psychometric properties of the Death Anxiety Scale (DAS) among terminally ill cancer patients. *Journal of Psychosocial Oncology, 29,* 359–371. http://www.tandfonline.com/doi/abs/10.1080/07347332.2011.582639

Toland, M. D. (2014). Practical guide to conducting an item response theory analysis. *The Journal of Early Adolescence, 34,* 120–151. doi:10.1177/0272431613511332

Wright, B. D., & Masters, G. N. (1982). *Rating scale analysis*. Chicago, IL: MESA Press.

Wright, B. D. (1993). "Logits"? *Rasch Measurement Transactions, 7,* 228. Retrieved from https://www.rasch.org/rmt/rmt72e.htm

Wright, S. L., & Jenkins-Guarnieri, M. A. (2012). Student evaluations of teaching: Combining the meta-analyses and demonstrating further evidence for effective use. *Assessment & Evaluation in Higher Education, 37,* 683–699. http://dx.doi.org/10.1080/02602938.2011.563279

Appendix A

Initial Version—Student Evaluation of Teaching Questions by Category

Presentation
p1_i. Balances student-centered and teacher-centered instruction (i.e., direct instruction to large group, but also small group lessons and coaching of small groups and individuals).
p2_i. Actively teaches and coaches during class time but gives ample time for independent work (shelf work/project work).
p3_i. Has a thorough knowledge of course content.
p4_i. Lesson topics are clear and concise.
p5_i. Provides a variety of teaching methods on a regular basis.
p6_i. Provides several work/project options for students to choose for lessons.
p7_i. Facilitates smooth transitions between activities.
p8_i. Manages lessons so that they begin and end in a timely manner, leaving enough time for independent work.
p9_i. Lessons are engaging; using hands-on materials, real-life experiences, and encouraging discussion as much as possible.
p10_i. Encourages discussion in seminars and/or lectures.
p11_i. Has a good rapport with students, based on mutual respect.

Facilitation
f1_i. Understands how to use differentiation of instruction so that all students are challenged and supported.
f2_i. Asks questions that employ higher order thinking skills during lessons/discussions to promote thinking "outside the box."

Regulation
r1_i. Provides the opportunity for large blocks of work time.
r2_i. Provides access to curriculum and course objectives.
r3_i. Understands how to set up the necessary infrastructure for students to follow guidelines that create student success and a pleasant classroom environment.
r4_i. Employs and teaches students creative resolution techniques to resolve conflict in the classroom.
r5_i. Knows when to intervene to guide students who exhibit inappropriate behavior.
r6_i. Fosters a learning environment that encourages concentration, self-discipline, respect, and independence.

Rating Scale[5]
1 = 60% or less of the time
2 = 60%–70% of the time
3 = 70%–80% of the time
4 = 80%–90% of the time
5 = 90%–100% of the time

[5]An important concern about this instrument is that the rating scale overlaps in percentages across different rating levels (e.g., 60% is present in both a rating of 1 and a rating of 2).

Appendix B

Revised Version—Student Evaluation of Teaching Questions by Category

Stem
My Montessori teacher:

Presentation
p1_r. Explains course objectives.
p2_r. Allows time for independent work.
p3_r. Has a thorough knowledge of course content.
p4_r. Clearly explains the topic of lessons.
p5_r. Challenges students at all levels of learning.
p6_r. Uses a variety of teaching methods.
p7_r. Teaches engaging lessons.

Facilitation
f1_r. Provides large blocks of work time.
f2_r Provides individual attention to students.
f3_r. Provides options for students to choose their work.
f4_r. Ask questions that challenge students.
f5_r. Manages classroom time well.
f6_r. Encourages class discussions.
f7_r. Has a good relationship with students.
f8_r. Fosters a learning environment that promotes independence.

Regulation
r1_r. Sets clear classroom guidelines.
r2_r. Resolves classroom conflict with creative techniques.
r3_r. Corrects students who exhibit inappropriate behavior.
r4_r. Facilitates smooth transitions between activities.

Response Scale
1 = Strongly disagree
2 = Disagree
3 = Agree
4 = Strongly agree