Right Where They Are Right Now:

Formative Assessment in Montessori Lower Elementary Classrooms

Diana Smith Butler

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AUTHORIZATION

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PI: Ms. Diana Butler
        Graduate Student

CC: Carrie Tzou

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Lauren White
Human Subjects Review Coordinator
4333 Brooklyn Ave. NE, Box 359470 Seattle, WA 98195-9470

main 206.543.0098   fax 206.543.9218   hsdinfo@uw.edu   www.washington.edu/research/hsd

(206) 543-4798

lawhite@uw.edu

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ABSTRACT

Lack of knowledge about how formative assessment is routinely used in classrooms is a problem for schools and teachers who want to adopt these practices and for schools and teachers who struggle to explain to stakeholders how they use formative assessment to understand and advance their students' academic growth.

Formative assessment has a long history in Montessori education, where it is foundational to teachers' practice. This project examined the use of summative and formative assessment by Montessori lower elementary teachers in public and private schools. An online survey, classroom observations, and semi-structured interviews were used to collect qualitative and quantitative data on frequency of use for summative and formative assessment; types and frequency of formative assessment use; and meanings which teachers assigned to them. Results indicated that Montessori lower elementary teachers in both public and private schools used summative assessments, with public school teachers using them more than private school teachers, reflecting the requirements of public schools for data collection. Montessori teachers in both types of schools showed a high degree of frequency and unanimity of practice in their use of formative assessment, especially in use of observation and conversation as formative assessment. Findings could by used by schools and teachers who want to understand formative assessment practices as they are enacted in classrooms in order to begin to adopt some of these practices. Findings could be used by Montessori schools and teachers to develop understanding of how they know what their students know in the absence of summative assessment data. This study points to professional development opportunities for public and private schools.

Key Words: formative assessment, summative assessment, multi-age classrooms, Montessori, lower elementary, conversation, observation

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1. INTRODUCTION

In Ms. Shelton's second grade classroom, 24 lively second graders are learning to read complex texts, write personal narratives, subtract whole numbers, identify vertices of geometric solids, and describe the life cycle of a butterfly. Ms. Shelton has data on her students from various tests they have taken, but as she surveys her busy class she wishes she knew more about where they were having difficulties at the moment, and how to use formative assessment to guide their daily learning.

In Ms. Carter's Montessori classroom, 24 energetic first-, second- and third-graders are engaged in similar learning adventures. In the long Montessori tradition of relying primarily on formative assessment to guide students, she watches, makes notes on her clipboard, and engages in conversations with children, gauging what her students know, and directing them to what they need to learn next. She wishes she could translate this successful but almost stream-of-consciousness process into something she could talk about knowledgeably with her students' parents and with administrators who want to know how the students are progressing.

Teachers like Ms. Shelton find that relying on summative assessments leaves them with an incomplete understanding of their students' current knowledge, and of individual students' barriers to learning, but they don't know what routine implementation of formative assessment looks like. Montessori teachers like Ms. Carter know that they are closely monitoring and guiding their students, but they often lack the awareness of how they do these "in the moment" assessments, and the vocabulary to describe what is for many a routine and intuitive practice.

Summative tests are a relatively new phenomenon in human experience, with standardized multiple-choice tests in use for less than a hundred years. Formative assessment, on the other hand, is the way humans have helped one another to learn since time immemorial. In

teaching how to shape an arrowhead, or weave a blanket, in Socrates' use of questions to guide his students, teachers engaged in dialogue based on their knowledge of the goal, their observation of the learner's progress, and their best assessment of what the learner needed to do next. Sadler (1989) described this as a three-step process in which learners must understand what mastery looks like, be able to compare their attempts to the model, and work to close the gap.

The difference between the information provided by formative and summative assessments has been compared to the difference between a video stream and a snapshot (Heritage, 2007). Formative assessments such as teacher comments on rough drafts, class and one-on-one discussions, small group work, and students' self-reflection, yield specific information about what students know in order to help them learn more effectively (Black & Wiliam, 1998). This feedback has been shown to foster student achievement, and positive attitudes toward learning and school (Black & Wiliam, 1998; Graue & Johnson, 2011). Summative assessments, such as yearly tests, spelling tests and end-of-unit tests, sum up the learning that has occurred—or not—but do not call for student involvement in using the outcomes (Sadler, 1989). Since they are not designed to provide timely, targeted information about students' achievements, struggles, and possible remedies during the learning period, they don't function well in that capacity (Leahy, Lyon, Thompson & Wiliam, 2005; Stiggins, 2006).

Surprisingly, given the evidence of formative assessment's effectiveness in meeting student need, this approach is not being adopted as widely as one might expect (Clark, 2012; Frey & Schmitt, 2010). This gap is a problem for all stakeholders in education, but most of all the students—especially those at risk—who are potentially being short-changed in their academics and in their development of life-long learning skills and attitudes. The slow adoption of formative assessment is due in part to teachers themselves not understanding what routine

implementation of formative assessment looks like (Volante, Drake & Beckett, 2010) and a lack of examples that teachers could identify with (Black & Wiliam, 2004). Two methodologies that have been suggested to help teachers with this problem are research in classrooms where formative assessment strategies are being used (Clark, 2012b; Shephard, 2000), and sharing stories of successful implementation (Volante, Drake & Beckett, 2010). One set of authors described the dilemma teachers are in by saying, "knowing about [formative assessment] is one thing; figuring out how to make [it] work in your own classroom is something else" (Leahy, Lyon, Thompson & Wiliam, 2005).

Could investigating the formative assessment practices of Montessori elementary teachers help traditional teachers like Ms. Shelton begin to adopt this research-based approach by seeing what routine implementation looks like? Could this investigation give Montessori teachers like Ms. Carter a structure for understanding their practice, and a vocabulary for communicating with stakeholders?

By investigating the formative assessment practices of Montessori lower elementary teachers in public and private schools through an online survey, classrooms observations, and semi-structured interviews, this study attempted to provide a picture of teachers' routine use of formative assessment in lower elementary classrooms, and to clarify and to articulate the beliefs and experiences of some Montessori teachers around formative assessment which could lead to development of a framework for understanding and describing the practices to stakeholders.

2. LITERATURE REVIEW

This literature review will look at some results of formative and summative assessment research in elementary schools, the gap between research and classroom implementation, and some objections to formative assessment. Then it will consider the work of Helen Parkhurst, a

Montessorian, whose work has been cited in the literature as foundational to the development of

formative assessment. It will look at the theoretical basis of formative assessment in Dr.

Montessori's philosophy. Finally it will examine research in Montessori classrooms.

Formative and Summative Assessment

Formative and summative assessments occur at differing points during the learning

process, and have different purposes and processes.

The definition of formative assessment used in this project was proposed by Black and

Wiliam (2009):

> Practice in a classroom is formative to the extent that evidence
>
> about student achievement is elicited, interpreted, and used by teachers,
>
> learners, or their peers, to make decisions about the next steps in
>
> instruction that are likely to be better, or better founded, than the
>
> decisions they would have taken in the absence of the evidence
>
> that was elicited. (p. 9)

Formative assessment occurs throughout the learning process via a variety of practices including

teachers' observation of their students, discussions, and review of students' written work (Black

and Wiliam, 1998). They also include students' reflective processes during small group work and

guided self-reflection (Sadler, 1989). The common denominator of these practices is careful

observation by teachers and by students, followed by decisions on next steps to take in the

learning process, thus informing the learning process rather than summing it up. The impetus for

development of formative assessment stemmed from the realization that a "one size fits all"

system of education created a large pool of disadvantaged learners, learners who could quite

possibly be successful with a different kind of teaching (Bloom, 1984; Wiliam, 2011)

The definition of summative assessment used in this project was proposed by Stiggins and Chappius (2005):

Summative assessment [refers] to tests administered after learning is supposed to have occurred to determine whether it did. (p. 17)

Summative assessments range from high-stakes yearly tests, drivers license tests, and college entrance exams to end-of-unit tests and spelling tests. Summative assessments, whether mandated by governments, included in commercially produced curriculum, or designed by classroom teachers, occur at the end of a period of learning and are designed to provide a picture of learning that has already occurred. They compare and rank students by achievement (Cauley & McMillan, 2010) and demonstrate what Shepard (2000) called "walking around knowledge", that is knowledge and skills that are presumed to have been committed to long-term memory and are available for use in other contexts.

They are not designed to provide the kind of guidance teachers need to shape their instruction, and learners need to refine their learning efforts at the time when such guidance is needed, and hence do not function well in that role (Leahy, Lyon, Thompson & Wiliam, 2005; Stiggins 2006). The consequences of this are worst for the most vulnerable students (Graue & Johnson, 2011; Yeh, 2010), creating an equity issue for minorities and low-achieving students. High-stakes summative tests in particular have been linked to higher drop-out rates for minorities (Au, 2007), and to a widening achievement gap (Graue & Johnson, 2011). Summative tests are useful for purposes of accountability, ranking, demonstrating learning and competence, and communicating these things in a short bit of information to stakeholders (Chappius & Stiggins, 2009). The use of summative assessments to produce high-achieving, independent, self-

motivated learners and reduce the achievement gap has proved to be futile (Stiggins & Chappius, 2005).

Academic Impacts of Formative Assessment

Numerous studies have pointed to the academic benefits of formative assessment. In their seminal article, "Inside the Black Box," Black and Wiliam (1998) reviewed more than 20 studies of students from kindergarten through college and concluded that all the studies demonstrated sizeable improvement in academic achievement as a result of formative assessment. Achievement test scores of students receiving formative assessment rose above those of students not receiving formative assessment on teacher-made tests (Bakula, 2010); curriculum-embedded tests (Baccillieri, 2009; White & Frederiksen, 1998); and standardized tests (Meisels, Atkins-Burnett, Xue Bickel, & Son, 2003; Rodriguez, 2004). Formative assessments are narrow in scope, happening in a "minute-by-minute assessment"; they provide details about how to proceed that are tailored to individual students' needs (Perie, Marion, & Gong, 2009, p. 6). This can greatly narrow the gap between high and low achieving students by providing specific, corrective feedback when the student needs it (Bloom, 1984; Fuchs & Fuchs, 1986; White & Friederiksen 1998).

Formative assessment has been shown to positively impact academic achievement in a variety of subject areas. A meta-analysis of formative assessment during the writing process found that both written and verbal feedback from teachers positively impacted the improvement of writing skills (Graham, Harris & Hebert, 2011). Formative assessment has been linked to academic growth in science (Bakula, 2010; Yin et al., 2008), math (Barnett, 2011; Phelan, Choi, Vendlinski, Baker, & Herman, 2011), and literacy (Applebee, Langer, Nystrand, & Gamoran, 2003; Baccillieri, 2009). While these studies differ in size, they share a common quality of

demonstrating that formative assessment can have a beneficial effect on academic outcomes in a variety of disciplines.

Characteristics and Types of Formative Assessment

Formative assessment is not a more sophisticated means of testing, but a process for acquiring the skills necessary to learn throughout life, a process which occurs in a social context (Clark, 2012b). Formative assessment can occur in a variety of ways: between teacher and learner; between learners in pairs or in group work; and within learners themselves. It always involves the learner's development of understanding of the target goal, and opportunities to practice the enhanced understanding (Clark, 2012a). Class discussions or one-on-one conversations are difficult to study due to the complexity of the interactions, but the research that has been done points to positive impacts on student learning (Ruiz-Primo, 2011). Questioning during instruction provides teachers and students the opportunity to probe for understanding, verbalize learning, and gives teachers an opportunity to assess students' knowledge. (Heritage, 2007; Volante & Beckett, 2011). Performance-based assessments such as group projects, presentations, and science labs can serve formative purposes (Bakula, 2010). Portfolios of exemplary work provide evidence of learning and opportunities for students' self-reflection during conversations with teachers and families in student-led conferences (Stiggins, 2009).

Students themselves use formative assessment when they help each other make decisions about the next steps to take in their learning. Sadler (1989) emphasized the importance of students' being able to participate together in the process of developing expertise independently of the teacher, saying that teacher evaluations alone could not produce high quality learning. Working in small groups settings, peers were shown to provide scaffolding for one another primarily by asking questions, giving feedback, and by direct teaching (Gnadinger, 2008).

Teachers express concern over the reliability of peer-to-peer feedback, but it has been shown to

be at least equal in reliability to teacher assessment (Topping, 2009). A meta-analysis of

research on the impact of peer-to-peer feedback in developing students' writing skills showed it

had a significant positive effect (Graham et al. 2010). Peer assessment serves as scaffolding for

development of students' abilities to self-assess by providing a bridge from teacher assessment to

the internal assessment processes which students must learn to use if they are to be successful in

learning (Black & Wiliam, 2004).

Ultimately learning occurs within the student alone, and formative assessment serves to

develop an internal evaluative process for the learner in which self-reflection promotes academic

and personal growth (Sadler, 1989). Several kinds of formative assessment by students have

been studied. Student-involved record keeping let students see their own growth over time

(Stiggins & Chappius, 2005). Students' self-assessment of their writing using rubrics for specific

qualities improved student writing (Graham et al., 2011) and promoted taking responsibility for

their own learning by encouraging a metacognitive stance (Volante & Beckett, 2011). Formative

assessment helped students develop some of the skills necessary to succeed with academic work

by involving them in assessing and recording their own learning, reflecting on their work, setting

goals for improvement and working toward those goals (Heritage, 2007; Stiggins & Chappius,

2006). By including students' self-evaluative work in the definition of formative assessment,

learning is framed as an active, not a passive, process for the student (Heritage, 2007), and one

which involves development of this critical metacognitive life skill (Sadler, 1989).

Observation as Foundation of Formative Assessment

The key to formative assessment, whether done by teachers or by students, is observation

of students' learning. By looking at what is happening, and listening to what is said, insights and

judgments can occur, and informed decisions can be made on how to advance individual

students' progress. Observation, along with discussions and reading of students' work were cited

by Black and Wiliam (1998) as ways in which teachers can understand what their pupils know.

Observation was a key feature of the Dalton Plan, cited by Wiliam (2011) in the history of

individualized instruction leading to current formative assessment research and practice. Helen

Parkhurst developed the Dalton Plan following her own experiments, her work with Frederic

Burk at San Francisco Normal State School, and her work with Dr. Maria Montessori in Europe

and in the United States. Observation allowed her teachers to guide their individual students'

learning and create the community of the school (Parkhurst, 1922).

In his search for the most effect ways to advance the learning of all students, Benjamin

Bloom and his graduate students compared student learning under conventional teaching,

mastery learning, and tutoring (Bloom, 1984). They found the fastest and highest student

learning gains occurred in one-to-one tutoring because the feedback loop between tutor and tutee

was short, targeted to exactly what the student needed, and not incidentally, accompanied by a

positive emotional atmosphere. Sadler (1989) noted that students' observations of their peers'

work along with the feedback of teachers helped to develop their sense of what constituted

exemplary products, although this was easier in classes where products were tangible (as in

theater and shop classes), than in academic classes where work was less visible.

Implementation Gap

Research pointing to the usefulness of formative assessment in promoting positive

outcomes for students, especially for low-achieving students, has been amassing for several

decades (e.g., Black & Wiliam, 1998; Bloom, 1984; Fuchs & Fuchs, 1984; Graue & Johnson,

2011; Spaulding, 1970) and yet there is a gap between academic research on the successes of

formative assessment and its translation into routine classroom practice (Clark, 2012; Heritage, 2007; Frey & Schmidt, 2010; Volante & Beckett, 2011). One study found formative assessment occurring in only 12% of classes studied (Frey & Schmitt, 2010). There is also a lack of research in classrooms where formative assessment is being used to show exactly which practices are employed, the frequency of use, and the expertise with which teachers use them. Such research is necessary for teachers to understand what enacted formative assessment looks like (Black & Wiliam, 1998; Clark, 2012b).

Classroom implementation of formative assessment requires understanding on the part of administrators, teachers and parents. In a program to foster formative assessment use by elementary teachers in the UK, it was found that successful implementation required not only learning new practices, but also a philosophical shift and a change in classroom culture (Webb & Jones, 2009). A three-year study of formative assessment in Canada found that the required cultural shift extended to parents and students (Volante, Drake & Beckett, 2010). And, while teachers voice their belief in the efficacy of formative assessment practices, they need support from school boards and administrators and effective professional development to translate those beliefs into successful classroom practice (Brookhart, 2011; Stiggins & Chappius, 2005; Volante, Drake & Beckett, 2010).

School boards, governmental and university departments of education, parents and others have an impact on adoption of new policies (Nolen, 2011; Volante & Beckett, 2011), but teachers' beliefs about the nature of education and their role in it also play a large part in educational change (Shepard, 2000; Volante & Beckett, 2011; Webb & Jones, 2009).

Adding to the barriers, as the term "formative assessment" has become more familiar, it has been used widely and in varying ways, describing practices outside the classroom, and even

being used to describe accountability testing rather than classroom interactions in support of

student growth, further muddying the discussion of a demonstrably effective practice (Johnson &

Burdett, 2010).

Objections to Formative Assessment

Despite the evidence showing positive benefits of formative assessment for students, not

all researchers hold a sanguine view of the practice. Objections have been raised about the lack

of theoretical foundations, lack of agreement on definitions of key terms, over-stated effect sizes

and claims for generalizability of results, methodological deficiencies, and inadequate numbers

of studies.

Dunn & Mulvenon (2009) commented on the lack of consistent definition of terms. They

argued that most of the research on formative assessment which Black and Wiliam (1998) cited

to prove its benefits was flawed for various reasons. These included studies which were not large

enough, investigated teachers with different amounts of teaching experiences, claimed

generalizability not justified by the study, or did not describe the research in sufficient detail.

They concluded that while the research does provide some support for formative assessment,

better research is called for. Kingston and Nash (2011) raised similar objections saying that

claims of effect size are overstated given the flawed designs of most of the 300 studies they

reviewed. They also called for more high-quality research. Taras (2010) called Black and

Wiliam's theoretical framework into question, as well as their ambiguous definitions. While

acknowledging that Black and Wiliam's work had highlighted the importance of feedback to

students, Taras noted that lack of clarity about the processes of summative and formative

assessments resulted in inadequate and confused implementation by teachers.

These objections point to directions for further research, refinement of theory and definitions of terms, but they do not seem to contradict the general trend of the research showing positive correlations in student academic and personal growth as a result of teachers' use of formative assessment.

Helen Parkhurst, the Dalton Plan, and Formative Assessment

The work of Helen Parkhurst, a colleague of Dr. Maria Montessori, has been cited as foundational to contemporary work on formative assessment (Wiliam, 2011). In 1914, after conducting experiments in her lab school method in the United States, Parkhurst enrolled in Dr. Montessori's Second International Training Course in Rome and soon became a translator and trusted collaborator (Lager, 1983). After several years of work in Montessori preschool education, she moved on to study older students' experience of school as society (Parkhurst, 1922). Parkhurst devoted her energies to developing what became known as the Dalton Plan, a method of education for students from upper elementary through high school which developed practices and concepts foundational to formative assessment. She believed the ideal preparation for the Dalton Plan was Montessori education, which in the early twentieth century was confined to preschool education (Lager, 1983).

The Dalton Plan relied almost exclusively on formative assessment and made small use of summative assessments, confining them to monthly or even yearly exams (Lee, 2000). Formative assessments occurred as teachers conducted careful observations of their students while they worked, and used checklists to keep track of work accomplished. Teachers conversed with students informally and during individual conferences with students to assess progress and determine next steps in lessons (Lager, 1983). Teachers also laid out clear goals and expectations for work (Parkhurst 1922). Peer-to-peer help, tutoring and cooperation were encouraged (Czaja,

2006). Student self-assessments occurred as they decided how to proceed in fulfilling academic expectations, developed time management skills, and followed individual interests in social studies (Parkhurst, 1922).

Montessori Theory and Formative Assessment

Dr. Maria Montessori originally called her method, "Scientific Pedagogy" and its goal was the full and optimal development of human beings. Rigorous scientific observation of children was at its core. Holding doctoral degrees in both medicine and anthropology, Dr. Montessori believed in the practice and importance of close observation of living beings, including measurement and record-keeping of observations of human beings (Kramer, 1977). As a result of learning to closely observe living beings, Dr. Montessori held the freedom of the child to be the foundation of her theory of Scientific Pedagogy, since only freely acting children could show their true nature and thus provide accurate insight into human development unhindered by harmful adult prejudices and practices (Montessori, 1964). Observation thus became the foundation of Dr. Montessori's theory of Scientific Pedagogy.

During her training courses Dr. Montessori emphasized the centrality of observation to her method of education. "One might say that she [the Montessori teacher] works within a framework where she is always observing the children while she directs them" (Parkhurst's lecture notes quoted by Lager, p. 89). Dr. Montessori wrote that the capacity of the teacher to observe was fundamental to being a teacher in her method, that it required training, practice and patience, and that the teacher's observations should be of the child's work as well as of psychological development (Montessori, 1965).

Montessori teacher training programs devote many hours to teaching students how to observe children (Lillard, 2005). Observation continues to be fundamental to Montessori

teachers' practice today, guiding understanding of academic development and readiness for new lessons as well as guiding understanding of psychological development and classroom interactions (Cossentino, 2009).

Dr. Montessori regarded developing the ability to make good choices, and to concentrate, as essential to the development of the person (Montessori, 1995). These goals are reached through work. In Dr. Montessori's theory of education, "work" is not the opposite of "play." It is an activity, freely chosen through which the child's whole personality develops by fully concentrating for as long as the child is interested (Montessori, 1995). Rathunde & Csikszentmihalyi (2005) liken this to the state of flow, described by optimal experience theory, in which affect and intellect are both engaged, the mind is clear and happy, and time falls away. Montessori teachers use formative assessment to guide students to develop these traits.

Research on Montessori Education

Only a small amount of research has been conducted on Montessori education, especially at the elementary level (Cossentino 2005; Lillard, 2012). What research there is has tended to look at the academic achievement of Montessori students rather than at social benefits of the method. Results have pointed to some benefits of early childhood Montessori education, with positive effects extending into the elementary and high school years for students in both public and private Montessori programs (Lillard & Else-Quest, 2006; Mallett & Schroeder, 2013; Peng, 2009). A study conducted with 200 Milwaukee public high school students who had attended a public Montessori program from ages 3 to 11, and a similar comparison group, found that the Montessori students' math and science scores were significantly higher in high school, but no difference was found social studies or English scores or in grade point averages (Dorhman, Nishida, Gartner, Lipsky & Grimm, 2007). In a comparison study of five Montessori middle

schools and six traditional middle schools, intrinsic motivation was shown to be higher among the Montessori middle school students, with Montessori students spending more time engaged in academic work, and having more positive perceptions of school than did the traditional students (Rathunde & Csikszentmihalyi, 2005).

The main method that Montessori teachers use to guide their students is formative assessment. Dr. Montessori strongly advocated for routine observation of students for clues not only to academic development, but social, emotional, spiritual and physical development as well. A study of 44 early childhood Montessori teachers investigated how they collected information through observation of their students (Hennigan, 2009). It concluded that while this was done, it was mostly an informal process. How teachers used the information was unclear, but it was likely mostly retained in memory, and used to inform their interactions with students.

Another study, using a national survey of 108 Montessori elementary teachers (91% were from private schools), found a high degree of congruency among respondents in use of observation, performance assessment of students' skill mastery, anecdotal records, student-teacher interviews, checklists, and journals of student work as formative assessment (Roemer, 1999). Summative assessments were used but to a far lesser degree, although most schools gave a yearly standardized test.

The use of running records as formative assessment for early reading acquisition was investigated in a case study of a Montessori elementary classroom (Stern, 2007). Results indicated that the practice worked well in a Montessori setting, providing more detailed and nuanced understanding of students' reading development, and guiding changes in instruction.

As was true of the Dalton Plan, very little summative assessment is done in Montessori classrooms (Chattin-McNichols, 1992; Lillard, 2007) although many Montessori schools opt to

use annual standardized assessments for the benefit of the teachers' understanding of students'

development as well as providing information to parents (Lillard, 2007; Roemer, 1999).

While the research literature on formative assessment in Montessori lower elementary

classrooms is scarce, there is evidence for its philosophical basis and historical implementation

in the Montessori Method.

Value of This Study

Given the small number of studies on Montessori education, the American Montessori

Society and others have called for more research. Research on formative assessment would be of

particular value for schools and teachers who want to understand what classroom implementation

looks like (Black & Wiliam, 1998; Clark, 2012b) and who want to communicate its value to

stakeholders. This study helps to address these gaps by investigating the uses and views of

Montessori lower elementary teachers around summative and formative assessment.

3. METHODOLOGY

Montessori lower elementary teachers rely more on formative assessments than on

summative assessments to understand what their students know and to decide how to move

students' learning forward. This research project used a survey, classroom observations, and

teacher interviews to elicit detailed information about Montessori lower elementary teachers'

uses and views of formative assessment. The questions that motivated the research were:

1. What is the nature of Montessori teachers' use of formative assessment in lower

   elementary classrooms?

2. Which formative assessment practices do these teachers use most?

3. What role do summative assessments play in their information gathering?

4. What do they see as the benefits and drawbacks of formative assessment?

Because of the varied and complex ways in which formative assessment is used (Leahy, Lyon, Thompson & Wiliam, 2005), I designed a mixed-methods study using a convergent parallel design in which both the survey and the qualitative investigations occurred simultaneously although independently (Creswell & Clark, 2011). The online survey of current Montessori lower elementary teachers' views and uses of formative assessment included both multiple choice questions and optional written responses. Observations were conducted of teachers as they used formative assessment during class work periods. Interviews were conducted with some of the teachers who were observed. This allowed me to triangulate the data, and gave the possibility of creating a more nuanced and detailed picture than either a qualitative or quantitative study alone would have allowed.

Quantitative data were collected in the online survey via multiple-choice questions answered with a rating scale, and by recording and categorizing instances of formative assessment seen during classroom observations. Qualitative data were collected via open-ended responses in the online survey. They were also generated during classroom observations, and in semi-structured interviews with teachers.

Online Survey

This study used an electronic survey hosted on SurveyMonkey to gather information about Montessori teachers' formative assessment practices and beliefs (Appendix A). I decided to do a survey in order to capture a substantial amount of information in a short time. It was formatted to be completely anonymous to foster teachers' comfort in sharing candid responses. Throughout the survey I tried to maintain a somewhat conversational and informal tone of candid sharing between colleagues, and to state questions in a neutral manner to avoid prejudicing

respondents' answers. The design facilitated rapid completion but provided for more detailed written responses from those who wished to include them.

Survey design. The survey investigated frequency of use in five areas of classroom assessment: summative and formative assessments, teachers' written records, students' written work, observation, and conversation. The survey asked for demographic data on years of teaching, degrees and Montessori certificates held. Some of the questions replicated those asked by Roemer (1999) to further the research in that study.

The survey began with an introductory page, "How Do You Know If You Don't Test Them?" which briefly described the purpose and possible benefits of the survey. This was followed by the Informed Consent page. There were five sections to the survey itself: Determining What Students Have Learned; Teacher Records; Observation; Conversations With Students; and Student Work. The last section asked for demographic data. Within the survey there were five opportunities for optional open-ended responses. All the questions (n=20) were multiple choice and used a four-point Likert-type rating scale to gauge teachers' frequency of use of various kinds of assessments. The range of responses, which were the same for all survey questions, was *usually, often, sometimes, and rarely*. In this paper these terms are italicized when used to report survey data.

The terms "summative assessment" and "formative assessment" were not employed in the survey since they are not widely used by private school Montessori teachers. Instead assessments were described concretely first in general terms, and then with specific examples. Each of four kinds of records was surveyed followed by an optional comment box.

The first section on the use of teachers' written records as formative assessment investigated the use of four kinds of assessment records commonly generated by Montessori

teachers: anecdotal records, records of works which students completed, records of lessons given, and informal reading inventories.

The second section investigated teachers' use of observation as formative assessment of: students' concentration during work time, students' choice of learning activities, how they worked with manipulative materials, whether they chose to work alone or with others, and their choice of work partners. The third section investigated teachers' use of conversation as formative assessment: with individual students, in formal conferences, and during small group or whole class discussions. One question addressed the content of the conversation, by asking how often they explained the goal of the work or what mastery looked like in conversation. The fourth section investigated teachers' use of students' written work as formative assessment: free writing, academic work, reading logs or journals, portfolios, and work plans or contracts.

Each section concluded with a space for teachers to add their own comments if they wished. The survey ended with a final comment box inviting any further thoughts about "what you do to understand your students' academic development or to decide what to teach next".

After designing the survey I requested feedback from several people including Montessori teachers, administrators, and a professional in the field of large-scale public relations surveys. Their responses helped me to clarify some questions, reorder others, simplify my rating scale, and realize that I needed to include a question about how frequently lower elementary teachers used summative assessments in order to highlight how much they use formative assessments.

Participants. Participants were recruited through invitations on LinkedIn, Facebook, online Montessori discussion groups, emailed appeals to Montessori schools, and personal emails. Survey responses used in this study were limited to those sent by current lower

elementary Montessori teachers. "Current" was defined as "teachers working during the 2013-2014 school year." This limitation was included to gather the most realistic possible responses and avoid errors of hindsight in self-reporting. "Montessori teachers" was defined to mean a teacher who held Montessori elementary teacher certification. "Lower elementary" was defined to mean a classroom that included any combination of first, second or third graders, or any of those grades along with kindergarten or older grades. Although Montessori lower elementary classrooms are usually a multi-age group of first, second, and third graders, sometimes the realities of school life necessitate other configurations, so my survey took that into account.

How the data were analyzed. More than 70 surveys were received, of which 57 met the criteria for inclusion in the data analysis. Survey question responses were analyzed for mean, median, and mode. The data were disaggregated and graphed to compare public and private school Montessori teachers' practices (Appendix B). Fisher's Exact Test, which takes into account the differences in sample sizes between groups, was applied to the survey data to determine statistically significant differences between public and private school teachers' responses (Appendix C). Only significant p-values are included in the Results section, while the all p-values can be found in Appendix C. Entries in comment boxes were coded and analyzed for themes.

Classroom Observations

Classroom observations were included in this study to provide deeper understanding of teachers' use formative assessments during periods when children were engaged in academic work or were in small group lessons. I expected that this would allow me to triangulate the data gathered in the survey and the interviews, enhancing understanding of survey responses, and of teacher responses in interviews.

Observation design. Observations were conducted for 30-minute or 60-minute periods. The observations were recorded using handwritten descriptions of what I saw, along with some notes about what the room looked like, the number of children in the room, and other details which helped to describe the context of the activity. Later I transcribed my notes onto the computer and coded them. To avoid influencing the activity of the classroom during the observations, I sat or stood off to the side, and tried to be as unobtrusive as possible by not moving much and not making eye contact with teachers or students.

Settings and participants. I conducted nine observations in eight Montessori multi-age, first through third grade classes in a major metropolitan area of the Pacific Northwest. Four classes were in two public schools in the city, and four classes were in two private schools in the suburbs. The public schools each served children from kindergarten through fifth grade with some classes offering Montessori education, and other classes offering traditional education. One private school had a Montessori program for preschool through eighth grade. The other had a Montessori program for preschool through third grade, and a constructivist-type program for fourth through eighth grade. Two teachers were observed in each school. All teachers had Montessori certification. The choice of which teachers were observed rested on the compatibility of their schedules and mine.

Staffing in the classes varied. Traditionally Montessori classrooms are staffed by a teacher and an assistant. In the public school classrooms, three teachers worked alone and one teacher had a student teacher with her. In the private schools, two classrooms were staffed by a teacher and an assistant; one was staffed by two teachers, and one by two teachers and a student teacher. Class sizes ranged from 18 to 24 students. All classes were composed of nearly equal

numbers of boys and girls. Private school classes had higher numbers of minority students—

from 30% to 60%—primarily Asian.

How the data were analyzed. I broke the one 60-minute observation into two 30-minute

sections, since the same type of activity occurred throughout the session. This yielded a total of

ten data sections of 30 minutes each. Observations were analyzed for teachers' use of formative

assessment through their written records, existing student written work, observation and

conversation with students—the categories investigated in the survey—as well as looking for

other types of formative assessment that might have occurred. After reading through the notes

several times, I tallied the instances of each type of formative assessment and ranked them by

frequency. Next I paraphrased my observations with short descriptions. As I started to locate

themes, I assigned a color to each one, and highlighted each occurrence which helped me to

group instances of themes together on charts. During this process of emergent coding (Strauss &

Corbin, 1994), I began to see larger categories and connections between the patterns. The

framework of the survey provided an initial set of codes, but as the analysis proceeded, some of

the categories turned out not to be relevant, and were dropped.

Semi-structured Interviews

To add to my understanding of the observations and the survey results, I included semi-

structured interviews in the research design. A semi-structured interview format was used to

cover consistent questions within a free-flowing conversation. Interview questions were designed

to amplify information gathered in the questionnaire, prompt teachers to verbalize their thinking

about assessment in general, delve more deeply into their thinking about formative assessment,

and provide insight into what I observed in their classrooms (Appendix D). To minimize an over-

representation of the thinking in a local culture, I interviewed at least one teacher in each school where observations were conducted.

Settings and participants. Five teachers were interviewed, two in person in their classrooms and three via phone while they were at home. Three teachers taught in public school Montessori programs, and two taught in private Montessori schools. Four teachers had been observed before I interviewed them. I interviewed the last teacher before I observed her. I was surprised and chagrined to discover how valuable this latter sequence was. By knowing her thinking on her uses of formative assessment during the observations, her actions took on a richness and meaning that I wouldn't have understood otherwise.

How the data were analyzed. During the interviews I took detailed notes on the teacher's responses to my questions. I entered the notes on the computer so that they were complete and understandable. Coding involved multiple readings followed by analysis of teachers' answers to each question. As patterns and themes emerged during coding I named them, and tallied instances of each one to look for patterns within the responses in a process similar to that used for analyzing the observations. I included each teacher's initials after each tally mark; this allowed me to see more clearly the patterns within an individual teacher's responses. As I created diagrams of emerging themes with quotes that illustrated the themes, I saw connections I hadn't seen earlier. This also allowed me to understand more about what I had seen in the observations, because I knew more about the meaning which teachers assigned to their practices.

4. RESULTS

This study investigated some Montessori lower elementary teachers' uses and views of summative and formative assessment. The purpose of this was a) to provide information about

what routine implementation of formative assessment can look like, and b) to clarify and articulate the practices, beliefs and experiences of Montessori lower elementary teachers around assessment, particularly formative assessment.

The three investigations in this study, (survey, classroom observations, and teacher interviews) showed a high degree of unanimity among Montessori lower elementary teachers in in practice and views around summative and formative assessment. Some differences were seen between public and private school teachers due to the requirements of public school administrations for multiple forms of data on student achievement, and the absence of those requirements from private school administrations. This study found that teachers relied heavily on formative assessments in gauging their students' learning and deciding how to mentor them. The study found that the formative assessment practices of these Montessori teachers aligned with research on effective practices, and their experience of the results also aligned with those shown in research. All three investigations showed that, consistent with Montessori practice, teachers used observation and formative assessment to track and mentor their students' social and emotional development as well as their academic growth.

This section has two main parts. First some overall results for the survey, observations, and interviews are discussed. Then findings from the three investigational sources are examined for each of four major areas which Montessori teachers reported using for formative assessment:

- Teachers' written records

- Students' written work

- Observations of students

- Conversations with students

Where results of specific survey questions are reported, the subject of the question is underlined.

The terms of the Likert-type scale used in the survey are italicized.

Survey, Observations, and Interviews

   Survey. Over 70 people took the survey during the eight weeks it was active. The

responses of the 57 teachers who met the qualifications for the study (i.e., were certified

Montessori elementary teachers currently teaching lower elementary students) were used in the

results analysis. The responses came mostly from the United States, and mainly the Pacific

Northwest, but judging from remarks included in survey comments and in emails sent to me,

some were from as far away as South Africa and Australia. Over half (60%) of respondents

taught in private schools and while 40% taught in public schools. All taught in multi-age

classrooms, with 82% of respondents (n=47) teaching in classes of first-, second- and third-

graders. The remaining 18% of respondents (n=10) taught in various other configurations of

grades such as first through sixth grade or second and third grade; all taught at least one lower

elementary grade. The number of years of teaching experience ranged from 1 to 26 with a mean

of 8.5 years. Participants all had bachelor's degrees; over one-third had master's degrees. State

teaching credentials were held by 58% of participants. All respondents held Montessori

elementary teacher certification designated as either for ages 6 to 9 years, or for ages 6 to 12

years. Nearly 30% held Montessori certificates for other ages as well.

   Classroom observations. Four public school and four private school classrooms were

included in observations for the study. They were typical Montessori lower elementary spaces in

appearance, and in activities of teachers and students. In Montessori philosophy, the environment

(understood as the classroom itself as well as the whole school) is considered an essential part of

the triad of teacher-child-environment that supports the child's total development. The

classrooms were inviting spaces. Each had many shelves filled with books, Montessori materials,

and other manipulatives and supplies such as a variety of papers, and colored pencils. Child-

sized tables and chairs were arranged in small groups. Some classrooms were carpeted; others

had large area rugs. Walls were adorned with children's work including self-portraits, water-

colored maps of the world, pictures of mental images formed during reading, and a class mural

of the Big Bang. Hanging from ceilings were origami cranes and students' models of planets.

Classrooms displayed art prints and educational charts; cultural artifacts such as baskets, or

woven hangings; and natural artifacts such as snake skins, bones, rocks, and shells.

     The environment is most obviously the physical one, but also includes the whole class

and the social tone of the group. Each class had a relaxed but business-like atmosphere in which

students seemed comfortable with each other and with the adults. As is typical in Montessori

classrooms, children chose whether to work alone or with others, and where they wanted to

work. Students worked at desks, at tables, and on the floor, by themselves, and in two-and three-

person groups. Very little friction was observed between students. Some classes were quieter and

some had more conversation and movement. Some classes displayed intense concentration and

others less so. The style of the adults varied with some displaying more warmth, and others

seeming more focused on the work at hand, but all seemed to convey acceptance of the children.

     Observations were arranged with the teacher to coincide with periods when students were

working independently on assignments or self-chosen academic work. I positioned myself near

the edge of the classroom, but close enough to the teacher that I could hear most conversations.

Three of the teachers spoke briefly to me once during the observation; the other five did not

interact with me at all. In four classes one or two children wanted to know why I was there; in

the other four classes the children ignored me. During seven of the nine observation periods,

teachers gave lessons to groups of two or three students. These lessons (on phonics, investigating and writing about properties of minerals, properties of triangles, and math operations) lasted between five and 30 minutes. During the lessons teachers also interacted with students who came to them for help with their work.

Semi-structured interviews. I interviewed five of the teachers I observed. Three were from the two public schools; the two private school teachers each taught in a different school. The interviews provided insight into the thinking behind the actions that I observed in the observations. They also helped me to understand how the teachers thought about formative and summative assessments, how they coordinated sources of information, and the benefits and drawbacks they found in formative assessment practices.

Montessori Teachers' Uses and Views of Summative and Formative Assessment

To provide a context for understanding the place of formative assessments in Montessori lower elementary teachers' thinking and practice, this project included investigations into both summative and formative assessments. The first two questions in the survey were designed to find out how frequently respondents utilized either kind of assessment in gauging their students' knowledge and deciding how to mentor them. Formative assessments were used *usually* or *often* by 100% of survey respondents (Fig. 4.1). Among all the respondents, 37% reported using summative assessments *usually* or *often*, while 63% said they used them *sometimes* or *rarely*.

When the responses were disaggregated between public and private school teachers, a contrast appeared. Summative assessments were used *usually* or *often* by only 24% of private school teachers but 57% of public school teachers used them *usually* or *often*. They were used *rarely* by fully 47% of private school teachers but no public school teachers chose this response (Fig. 4.2).

Figure 4.1

Frequency of Use of Summative and Formative Assessments

Rating	Summative Assessments	Formative Assessments
Usually	11%	75%
Often	26%	25%
Sometimes	35%	-----
Rarely	28%	-----

Figure 4.2
Frequency of Use by Public and Private School Teachers

Rating	Summative Assessments		Formative Assessments	
	Public	Private	Public	Private
Usually	17%	6%	65%	82%
Often	39%	18%	35%	18%
Sometimes	43%	29%	-----	-----
Rarely	-----	47%	-----	-----

These results highlighted the different requirements of public and private schools for identifying

students' academic progress. They also showed that Montessori teachers in both settings relied

heavily on formative assessments, whether or not they used summative assessments.

In open-ended survey responses and in interviews, Montessori teachers in public schools

talked at length about the impact of frequent summative assessments on teaching and learning,

while private school teachers barely mentioned summative assessments except as something they

did occasionally to provide objective measures of progress and to give students the experience of taking those types of tests. Public school teachers chafed at the quantities of data they were required to amass, and at the disregard of most of their districts for formative assessment data. They discussed the pressure from school districts to raise test scores, resulting in time and resources being diverted from learning to preparing for and taking tests. Teachers mentioned the increased student anxiety over the multiple tests they were required to take, and the ways they tried to mitigate the anxiety. This included trying to incorporate tests into the daily routines of their Montessori environments when feasible, and characterizing the tests as being for the benefit of the teachers, so that they could find out how to be better teachers, rather than as being about what the children did or did not know.

Teachers in private and public schools discussed ways in which they used information derived from summative testing (including standardized tests, spelling tests, math facts tests, and reading assessments) as formative assessment. Some teachers shared test results with students, when they felt it was appropriate, to show students their progress toward over all learning goals. They also used the information to design individual or very small group lessons for students who needed reteaching. One teacher said she did all reteaching individually, "…because [students] with problems have different understandings and need different things. It wastes a lot of kids' time if I do reteaching to the whole group." Teachers who used reading assessments such as the Teachers College Reading and Writing Project (TCRWP), or the Dynamic Indicators of Basic Literacy Skills (DIBELS) valued their guidance for individualizing reading instruction.

Teachers found summative assessment results useful for communicating with parents, both as stand-alone information, and for providing a context for information derived from formative assessments. One teacher described how she blended this information to help parents

understand their child when she said, "Parents want concrete numbers and information. Then they relax. I can use those to provide context for other things I want them to know, like, 'These results show potential, but in the classroom I'm not seeing the focus I would expect.'"

Teachers in private and public schools trusted that their own perceptions of their students' knowledge were accurate and more useful than standardized test results. One teacher highlighted reasons for what she believed to be fundamental drawbacks to the validity of results of standardized tests, especially for first graders:

> I don't pay much attention to state testing results unless the scores are way outside what I would have expected. Knowing that the tests are administered on a computer, in a location outside the classroom, in tiny text, without using [Montessori] manipulatives [which children are accustomed to]…it's just not OK to do this to kids and call it valid assessment.

Another teacher addressed the value of both summative and formative assessments, writing,

> I am not totally against…paper and pencil assessments. I think they certainly play a part if done well and administered appropriately. They hold out a more objective piece of information on the child's academic[s] than just straight observations which I realize can be extremely subjective. So I think both are valuable to balance the picture of the child.

Four Ways Montessori Teachers Do Formative Assessment

This study found three main sources of information that Montessori lower elementary teachers used to understand where their students were in their learning and to decide how to help them take the next steps. The teachers collected data in multiple kinds of written records; they reviewed students' written work; and they observed their students during work time. The study found that teachers coordinated what they learned from these three sources in conversations with

students during class periods when students were working individually or in small groups. Each

of these four findings will be discussed below. Results of this investigation were similar to those

in Roemer's investigation of Montessori elementary teachers' assessment practices which

showed that while Montessori teachers used summative assessments, they relied far more on

anecdotal records, observation, and conferences with students (1999).

Teachers Use Their Written Records as Formative Assessment

Teachers reported using a variety of records to capture information and inform their

understanding of their students. These included records of work that students completed, records

of lessons the teachers had given, anecdotal notes, and results of informal reading inventories

and summative assessments.

Records of work that students completed. In Montessori practice, records of work

which students have completed serve as evidence of progress through the curriculum for

individual students, and as a means of comparing the progress of students to one another,

revealing outliers at either end of the spectrum. Since the curriculum in Montessori lower

elementary classes is highly individualized, and work is not generally considered finished until it

is fairly accurate, records of work that students completed are not so much a measure of

assignment completion as records of where each student is in the curriculum. A survey comment

by one teacher noted that in a Montessori classroom, "…a record of work completed usually

assumes 100% mastery before the student is ready to move on, as opposed to checking off that

an assignment was turned in but may or may not be correct." The survey question on use of

records of work which students have completed showed that 92% of public school teachers and

94% of private school teachers used these *usually* or *often*.

Records of lessons that teachers had given. In Montessori classes, much of the curriculum is delivered via lessons to individual students or to small groups of students, particularly in math and language. Teachers' decisions about which lessons to give are based on their records of which lessons a student has already had, assessments of work which has been completed, degree of understanding shown, and the scope and sequence of the curriculum itself. Records of lessons given contain information about where students are in the curriculum, their rate of progress, and by inference, what would be expected to come next. Records of lessons given were used *usually* or *often* by 91% of the teachers, although private school teachers reported using them *usually* 76% of the time and public school teachers reported using them *usually* 57% of the time. Again, this contrast is probably due to public school teachers' use of other sources such as district-mandated curriculum pacing guides in determining what to teach next.

Two kinds of written records included in the survey showed greater contrast in their use by public and private Montessori lower elementary teachers: anecdotal records and informal reading inventories.

Anecdotal records. Anecdotal records are a hallmark of "scientific pedagogy" which was Dr. Montessori's name for her method, based as it was on observing children and the activities in the classroom, recording those observations, and then studying the amassed data to see what it revealed. Montessori teachers take anecdotal records to capture observations of small instances of behavior, academic performance, social interactions, and thoughts about each student. They may also record interactions with their students, and how successful particular lessons or activities were because these notes "serve as a way to inform future instruction and to review [the success of] instructional methods." Anecdotal records might be kept in a notebook

containing a section for each student, on an iPad, on a computer program designed for the purpose, or on paper on a clipboard. Taken separately, each data point is fairly useless, but taken together they can build a significant portrait of a child, just as in a pointillist painting where individual dots of paint are meaningless, but taken together, they create a picture.

Anecdotal records were used *usually* or *often* by 74% of private school teachers, and 59% of public school teachers. Recognizing the value of this type of data, public school teachers mentioned their frustration at not having time for keeping anecdotal notes on their students. One teacher wrote that of the four types of written records in the survey, anecdotal notes were the type she used least, because "…unless I am tracking behavior with specific students…I rarely have time to go back and read them." Another teacher wrote, "In the public schools there is no time in the teacher's school day given to writing thoughtful anecdotal records. If the system is not quick and easy I do not use it. It is all about the data—which for the most part are standardized tests because that is all the district is interested in and considers as data." One teacher noted the value of anecdotal records in assisting the growth of the whole child since they "…help me track the emotional growth of a child. Noticing when big things happen can help me link breakdowns in academics or social skills [with the child's emotional life]."

When teachers do not have time to take anecdotal records, they run the risk of only having impressions and opinions to guide their decisions about how to help a child, rather than data derived from recording instances of actual behavior. Although checklists of some behaviors might be used to capture some of this information more quickly, the richness of the data in anecdotal records would be lost.

Informal reading inventories. The question on teachers' use of informal reading inventories such as running records or leveled reading assessments, e.g., the Teachers College

Reading and Writing Project (TCRWP), or the Dynamic Indicators of Basic Literacy Skills

(DIBELS), showed these were used *usually* or *often* by 74% of public school teachers, but only

44% of private school teachers. Among private school teachers 18% reported *rarely* using these

measures, but no public school teachers chose this response. Teachers who used informal reading

inventories valued the detailed information they gave on individual students' progress across

several components of skilled reading, and they valued knowing where students were relative to

grade level benchmarks —information that they put to use in designing lessons for their students,

and that let them track progress over time with concrete measurements.

Coordinating the information in written records for formative assessment. During

the observations, all the teachers created written records containing information such as lessons

they gave, work that students' completed, and reteaching that was needed. These were recorded

in multiple locations including iPads, clipboards, spreadsheets, and students' work charts which

serve as records of lessons students have had, assignments, and work which has been completed.

In the interviews teachers said they used the information they gathered to plan individual and

group lessons, to guide students in choosing their work, and to assess academic and social

growth.

I did not see teachers referring to their own written records during the observations

sessions, but I did see them incorporating the kinds of things contained in their records into their

classroom interactions, suggesting that outside of class they were studying their information and

making decisions about what to do with it. Comments to students such as, "You haven't done [a

particular kind of math] for awhile. Let's talk about why that is" or "[For the next math

activity]…we're going to use the same math facts you've been using and it's going to go really

quickly because you've done this a lot" indicated teachers were coordinating a range of

knowledge about the students. It seemed they had tracked the information about what math the individual student had been doing (or not!), assessed the implications of that for moving the student along in learning, and were also taking into account social and emotional overlays which may have been impacting progress in math—something blocking a child from getting his math done, maybe some kind of anxiety about math which the teacher hoped to relieve with encouraging comments that would energize the student.

In interviews several teachers talked about this, and about the need to create and coordinate multiple data sources. Some found this fun and challenging; one found it frustrating and overwhelming, but all indicated it was ultimately useful and that without creating and using their records, they couldn't do the kinds of formative assessment that seemed to an observer to be second nature.

Teachers Use Students' Written Work as Formative Assessment

In discussions and in survey comments, teachers talked about their high regard for students' work as a source of information about their understanding and skill development. Teachers mentioned the value of looking at students' written work to assess development over time, particularly through the use of portfolios. Written work was also valued for "making errors visible" and for evidence of development of handwriting and basic writing skills. One teacher said, **"**Their work is just gold."

Montessori students typically keep their academic work in notebooks which then serve as a record both of lessons students have had, and a repository of the work they have done. In the survey, fully 99% of teachers reported using students' academic work *usually* or *often* to understand what their students had learned and to decide what to teach next. Students usually use work plans (also called contracts or work charts) over a period of a week or two to record the

work they have done. Teachers reported using students' work plans as formative assessment

usually or *often* 82% of the time. One teacher said that in addition to helping "teachers to track

what has been accomplished daily…[work plans] help the student to stay organized in their

independent work."

The survey asked about use of three other forms of students' written work: free writing,

portfolios and reading logs or reading journals. Public school teachers reported using these

sources less than private school teachers did, indicating their reliance on other data sources for

information, while private school teachers valued these sources of information to build a more

complete picture of their students' progress as individuals and to obtain group comparisons.

During the classroom observations, teachers were not observed looking at students'

previously completed written work in order to do formative assessments, but they paid a lot of

attention to what students were producing at the moment. As teachers determined students'

progress by reviewing the written work they were generating during class, they made formative

assessment comments which fell into three categories:

- suggesting next steps

- clarifying students' perception of the learning goal

- checking for understanding.

Some comments about the next steps to take were explicit ("Which do you want to identify—the

adjectives or the adverbs?"). Some helped students to develop their critical stance toward their

own work and their develop their sense of agency by determining for themselves how to proceed

("What could you improve that would be a little bit of work, but not too much for you?"). Some

comments helped students to clarify their understanding of learning goals, as when a teacher said

to her student, "Next you need to describe each mineral. That's what we're doing in this work."

Teachers determined when students were ready for an informal oral quiz to check for understanding ("Can you tell me the parts of the flower?" or "Can you read this?"). I observed one teacher using students' corrected assignments as formative assessments. As she handed them back to each student individually, she gave some direction on what needed to be improved saying for example, "Let's work on where the capitals go" and indicated her expectation that the corrections would be made and the work returned to her.

The close attention which teachers gave to their students' written work indicated they saw it as a rich source of information for formative assessment opportunities.

Observations and Conversations as Formative Assessment

Observation and conversation were the two major ways that teachers used formative assessment in during class sessions. Survey responses, classroom observations, and teacher interviews clearly showed the value teachers placed on these two sources of information gained during class periods because of their real time relevance, and their revelation of the intellectual processing and the emotions that were shaping students' learning. Results for each of these formative assessment practices are discussed in the next sections.

Teachers' Use Observation as Formative Assessment

Dr. Montessori emphasized the centrality of observation to her method, and Montessori teachers highly value the practice of spending several minutes apart from classroom activity carefully watching while making notes on students' academic and social behavior. The data points collected become useful as an aggregate picture of individuals and of social dynamics in a class.

Because of the Montessori emphasis on educating the whole child, two types of observations were included in the survey—of students' academic work and of their social

interactions. Data on observation of social interactions during work periods showed that teachers valued knowing whether <u>students worked alone or with others</u> since this provided another set of clues to students' academic and social development which helped the teachers shape effective responses to students. In answers to the three questions on academic work, slightly over 90% of responses showed teachers *usually* or *often* observed <u>students' concentration as they worked</u>, <u>which learning activities they chose</u>, and <u>how they did the work</u>. In a survey comment, one teacher wrote,

> "Observation is key to understanding students. I spend time daily in observing and working one on one with children. This helps me figure out their level of understanding, grasp of concepts, when it is time to move them on and when to stay and let them become more confident with a concept or material, when to take them to the next level of abstraction and how to help them accomplish their goals."

There were over 30 written comments on observation—more than on any other topic in the survey. They were located not only in the Observation Comment Box, but in other comment boxes as well. Teachers discussed ways in which they observed, and the benefits and uses they made of the information gained through observation on students' academics and social development.

Teachers discussed observing students' faces and body language to discern information that might be more difficult to pick up in conversation, if it emerged at all. Signs of stress might indicate an unspoken need for assistance. Diffident engagement with work might indicate readiness for more challenge. A student who avoided working alone or who wandered might be showing that learning was difficult and the teacher needed to investigate and intervene. One teacher wrote about why she observed, and the use she made of the information gained saying,

"Observing their body language and what they say in discussion gives me loads of information about their vocabulary, understanding and knowledge of all kinds, interests, reasoning, meta-knowledge, and self-awareness. All of these observations affect my choices."

Comments on the value of observation were the only ones that included capital letters and exclamation marks, indicating the passion Montessori teachers feel for this topic. "One must CONSTANTLY observe. The children show you what they need and when they need help or a challenge if you are paying attention," wrote one. Another said, "Observation is KEY to 'assessing' students! Watching how students work and seeing how they think things through…is THE way to understand [a child]."

Montessori elementary teachers in private and public schools alike frequently lament not having time to sit and observe, and indeed no observations longer than about one minute occurred during any of the ten sessions I watched. In coding my observations of classrooms, I decided to define observation as "a teacher looking at something or someone intently for several seconds without talking." It was hard to say what was observation by teachers and what wasn't, partly because I didn't take good notes on this, partly because it is an internal process which makes it hard to determine, and partly because most of the observations I did see lasted only a matter of seconds before being followed by some action. Teachers thoughtfully observed the room as they moved from one place to another, or as they glanced up while giving lessons. Sometimes teachers had time to walk around, and look over children's shoulders to watch them work, or to stand still a moment scanning the room, and the variety of activities happening simultaneously. But observations were done "on the fly."

One sign of a teacher's having made an observation was a momentary pause followed by purposeful action. Observations seemed to serve two main purposes:

- gauging academic progress

- assessing social behavior.

Gauging academic progress. Teachers use observations to understand students' level of engagement with the work, degree of facility with the materials, and ability to demonstrate creative extensions showing higher level thinking. The kinds of errors teachers observed were seen as a window into children's thinking. Work students chose to do was assessed for evidence of appropriate degree of difficulty; teachers used their assessment of this to intervene if they thought the work was too easy or too difficult.

Teachers observed students as they worked with materials, standing nearby or kneeling to get a better look as they assessed students' understanding and proficiency. Sometimes they moved on without comment, or pointed without speaking to indicate the place where a student had missed something, or the place where the process had gotten off track. Sometimes an observation was followed by formative assessment in a brief comment, a short conversation, or a question such as, "Can you show me how you organized these minerals?" or "Tell me how you decided what to do."

One teacher walked around the perimeter of the class's large rug, doing a quick check of ten students working side by side on math, geography, science, and grammar. She paused by each one to look at their work, quietly telling one girl how to fold paper to create a booklet, quizzing another about her geography, and directing a boy to a more advanced math work. This teacher used her observation of one girl to decide that she was ready for a quick assessment of

her understanding, saying, "I'm going to ask you the three things you think are most important, so be ready to tell me when I come back."

Sometimes teachers stopped to observe and then responded by deciding to participate in the work. A teacher noticed two boys setting up a large multiplication problem and said, "I'd like to watch you. What's the first step? What do you need to get started?" As I watched it was apparent that the teacher realized the work was a bit beyond the two boys who had chosen it, but by sitting with them and coaching them they were able to complete it and advance their grasp of the process. Through intentional observation and analysis such as this, teachers closely monitored their students' progress and intervened, saving the students time, frustration, and saving them from learning errors which would have to be unlearned later.

Assessing social behavior. The Montessori method aims to cultivate not just the child's mind, but the whole person, and so observations of social behavior serve as formative assessment for the purpose of assisting growth in individual children, and in improving group interactions.

Teachers observed social behavior and followed this with conversations coaching children on strategies for working effectively and making good decisions. They noticed when students were working too fast and making mistakes, or when they needed help choosing a good spot to work. They noticed children who had lost their concentration or who were upset.

Teachers conveyed the value they placed on observation as a pleasant, worthwhile and even restful activity by inviting children who were upset or wandering to join them in a lesson they were giving to other children. "Come and watch this. I bet you'll find this interesting," said one teacher, holding out her hand invitingly to a little girl who had a run-in with a friend. Another teacher, noticing a wandering child, provided a way for the child to enter the social and academic life of the classroom by patting the seat next to her saying, "Would you sit and watch

this lesson? I think that would be good for you." The child happily settled in and was soon

intently watching a math lesson.

Conversations as Key to Montessori Teachers' Formative Assessment

The most surprising finding of this study was the preeminence of conversation as

formative assessment. Survey results showed that teachers highly valued conversation with

students as a means of formative assessment, with 97% of respondents saying they *usually* or

often used <u>informal conversations with students about their work</u> as formative assessment.

<u>Discussions during whole class lessons or small group lessons</u> were used as formative

assessment *usually* or *often* by 88% of survey respondents. But it was the classroom observations

that revealed conversation's primacy of place in the multiple formative assessment strategies that

Montessori lower elementary teachers employed. In nine of the ten observation periods, the

majority of teachers' time was taken up with short conversations with students that happened

rapidly, one after the other. Although teachers created and studied their own records, perused

students' completed work to see what was there, and observed their students, their quiet, focused

conversations, usually lasting less than 60 seconds, were at the heart of formative assessment

practices.

For purposes of coding the classroom observations, I defined a conversation as "a verbal

exchange between teacher and student that occurred outside the context of a lesson," excluding

the formative assessment conversations that occurred during individual and small group lessons

since these seemed to be fairly routine pedagogical practice. Within the 30-minute observation

sessions, the number of conversations ranged between 8 and 33, with a mean of 20.

Students initiated conversations as teachers circulated through the room, or as students

came to the teacher where she was sitting or standing. Teachers initiated conversations after

reviewing students' work and as a consequence of their observations. Teachers seemed to be observing students' physical and emotional state for clues to what might be affecting their engagement with their work, assessing their success with the work they were doing, and then coordinating this information nearly instantaneously as they asked questions and gave specific feedback, often in the form of more questions ("What do you notice about this number here?"). The success of these conversations was evident as children returned to their work with purpose and energy, sometimes skipping or almost running on the way back.

In the survey and in interviews, teachers talked a lot about observation but they seemed to view it as something done in moments apart from the activity of the classroom, something for which they had regrettably little time. This research showed that the teachers are doing observations constantly, but they do them in micro-cycles of observation followed quickly by a decision on how to use the information gained—whether and how to intervene, or whether to leave a child to work undisturbed. This looked to be a rather stream-of-consciousness process that coordinated multiple sources of information gained in the present moment and through previous study of their records and of student work, but teachers trusted the process deeply because of the results they obtained through its use.

Characteristics of formative assessment conversations. Three characteristics of these formative assessment conversations stood out:

- the teachers' use of questions

- the high level of thinking required of the students

- and the collegial tone.

A striking feature of the conversations, and this was true of all the teachers, was that what they said was almost always in the form of a question. The teachers said, "What goes here?"

rather than, "You need to put a period here." They said, "Can we do that?" rather than, "That's not mathematically possible." They even used questions when they wanted a child to do a particular thing saying for example, "Can you read this to me?" rather than, "Read this to me."

Their questions often elicited higher-level thinking, and tended to require demonstrations of understanding rather than simple memory. Students were asked to analyze and compare qualities ("What difference did you notice here?"); identify characteristics ("Why is this a hexagon?"); and verbalize processes ("What was your strategy?"). After a student identified a right angle her teacher said, "How could you prove that?" and then watched as she tried two ways to show she was correct.

The third remarkable element of the conversations was their collegial tone as teachers and students talked together to unravel difficulties and reach understandings. A back-and-forth exchange of ideas and opinions marked the search for the common goal of moving students along in their work. Sometimes students matter-of-factly stated differing points of view, which was well received by the teachers. In all the classes, the relaxed tone of voice and body language of both teachers and students throughout the conversations indicated trust as well as the routine nature of these interactions.

Kinds of formative assessment conversations. A few conversations were simply chats about the interesting content of the work, and did not seem to be used for formative assessment (at least at that moment). The other 99% of conversations were used as formative assessment and fell into three areas:

- Academics

- Student choice

- Social behavior

The majority of conversations were around academics, but given the Montessori philosophy of educating the whole child it was not surprising to find that 13% of conversations were directed at developing students' skill in making good choices and in guiding behavior.

Figure 4. 3
Content of teacher-student conversations during work periods

Category	$n =$	Percentage of total conversations
Formative assessment for academics	183	86
Formative assessment for student choice	22	10
Formative assessment for social behavior	7	3
Other	3	1

Formative assessment conversations about academics. A number of the conversations about work were recorded in my notes with little detail ("talks to girl about her work" or "talks with a boy about his math"). Among the conversations I recorded in detail, most fell into one of three categories:

- feedback about work in progress

- assessment of understanding

- determining progress toward the goal of the work

Conversation to give feedback about work in progress. Both teachers and students initiated conversations about work in progress, which comprised about 60% of the formative assessment conversations around academics. Teacher comments provided further instruction and discussion of the next steps for student to take in their work ("Let's put all the cards for the animals of South America together. Once we do that, we can sort them into their classes.") Other

comments clarified the goals of the work ("What are they really asking for? What are we looking for?") or assessed the quality of the work ("I like the way you're talking through this together").

Conversation to assess understanding. About 25% of conversations were formative assessments to determine students' understanding of concepts or skills with processes. These followed teachers' observation of students' work with materials or assessment of their written work. Teachers asked questions of students to determine the level of their understanding, saying, "Can you show me how you do this step?" or, "How did you organize this?" One teacher, noting that a group of four girls were completing a sorting activity with different kinds of triangles, sat down with them and began asking questions of each girl in turn. "Can you show me a right-angled isosceles triangle? How can you prove it's isosceles?"

Conversation to determine progress toward the learning goal. About 15% of conversations involved determining how far the student was toward completing a task or a project, or if the work was finished. When work was determined to be finished and of good quality, the conversations were generally brief and often concluded with a teacher's compliment on the work such as, "Nice job," or "You stuck with it and you finished!"

Formative assessment conversations about student choice. Choice is a key component of Montessori education. Making good choices is viewed as a characteristic of good human development, a key to motivation and concentration, and a window to the personality of the child, so teachers pay a lot of attention to this. Choices occur within a proscribed range based on academic and developmental stages of students, or "freedom within limits." Choices of which work to do, or of locations for doing the work were the subject of 10% of conversations. Teachers engaged students in the process of making good choices of academic activities based on what work they had completed previously, what they were interested in, and what was

possible at the moment considering the time and resources available. They also talked with students about choosing a good spot to work, and helped them think about whether they needed a quieter space, or whether the spot they were choosing was going to impact others by being in place where people would expect to walk.

Formative assessment conversations about social behavior. In their quest to develop the whole child and teach how to interact peacefully and respectfully, Montessori teachers observe and evaluate all aspects of social behavior and do formative assessments around this as well. Conversations about social behavior were the subject of 3% of the conversations I observed during the ten work periods. These conversations were initiated by teachers in response to noticing children who were withdrawn, needed encouragement to take a break, were arguing, or distracted. My favorite was the conversation that occurred after a teacher called aside a boy who had made a poor choice and as she closed the discussion, said with meaningful emphasis, "Usually we ask permission *before…"*

Teachers' views of conversation as formative assessment. In survey comments and in the interviews, teachers discussed using conversations in several different ways. Conversations were characterized as having multiple purposes and being useful in all subject areas. Teachers talked about the value of one-on -one or small group conversations to get accurate information about individual students' understanding and the problems they were experiencing. They said that conversations let them see what next steps children needed to take in their work or assess whether a student who seemed to be behind their peers might have actually mastered concepts well enough to be able to join the next group lesson. Conversations were used to help teachers ascertain what students remembered from previous lessons before beginning a new lesson. They revealed students' personalities, interests and knowledge in areas not necessarily covered in the

curriculum. Teachers noted the access to students' thinking gained through conversations including hearing connections that students made as they verbalized the relationships they had discovered between things. Student self-efficacy was another area which teachers addressed in formative assessment conversations as they decided how to guide students in choosing and planning work.

One teacher described the value of conversation not only for building her own understanding of her students, but also for enhancing learning and sustaining students' motivation.

I feel like I have an ongoing conversation with each one of my students…the timeliness of those 'in the moment' conversations is important. I can ask them some questions that help them unravel the knot or the problem they're having. The learning is so much stronger than talking later about what they didn't do right. In the moment of struggle they're more motivated to solve it and they stick with you because they're really interested.

Differences in Public and Private School Teachers' Use of Formative Assessment

This study showed some differences between public and private school Montessori teachers in their use of assessments and familiarity with assessment theory. In survey responses and in interviews, public school teachers seemed more conversant with assessment theory and practice than private school teachers, highlighting the differences in requirements of each system for data and the resulting differences in professional development.

Survey responses indicated that nearly half of private school teachers rarely used summative assessments, while no public school teachers chose that option. This difference also appeared in the interviews. Again this reflects differing administrative priorities.

Using Fisher's Exact Test, an analysis of survey responses by public and private school Montessori teachers showed statistically similar formative assessment practices by the two groups, with answers to 18 of the 20 survey questions having values of greater than $p = 0.15$. Two questions showed a statistically significant difference in practice between the two groups (Figure 4.4). Public school teachers used informal reading inventories significantly more often than private school teachers ($p = 0.0325$). Consistent with other survey results, this points to the differences between public and private school administrations for "hard data." It may also point to differences in professional development opportunities in public schools where training teachers in assessment practices such as administration of reading inventories is more highly valued than in private schools.

Private school teachers used their students' free writing as formative assessment significantly more often than public school teachers ($p = 0.0464$). Sources for free writing include daily journal entries, poems, stories and other creative writing. This result may indicate that students in private schools do more of this type of writing than students in public schools and therefore it provides a richer source of information. It may indicate that public school teachers have other sources of information about their students' writing that they value more than their free writing.

Figure 4.4
Differences in Public and Private School Teachers' Use of Two Types of Formative Assessment

Data Type	Subject of Survey Question	Fisher Exact Test P-value n=57
Written Records	Records of informal reading inventories such as leveled reading assessments or running records	0.0325
Student Work	Students' free writing	0.0464

Teachers' Views of the Benefits and Drawbacks of Formative Assessment

In the survey and in interviews teachers mentioned that the main value of formative assessments both for themselves and for their students was facilitating an accurate and timely match between students' comprehension and skill levels and teacher feedback or reteaching, which promoted faster progress by lessening the chance of persisting gaps, confusion and misunderstanding. Formative assessments facilitated lesson planning and pacing more in alignment with students' development. Records of formative assessments provide data points that demonstrated patterns of growth which relieved teachers and students of the need for lots of paper and pencil tests, characterized as stressful for students and time-consuming for teachers. Teachers identified benefits to students in their academics and in the development of executive functioning and self-efficacy by fostering students' metacognitive understanding of their problem solving and organization of their thinking as well as building confidence and ability to persevere. Formative assessments let children feel "seen" and acknowledged.

Most teachers did not believe there were drawbacks to using formative assessment, but the interviews, one teacher voiced quite a bit of misgiving about the practice. She noted the difficulty of coordinating multiple data points in multiple locations and felt that the information she gathered was less concrete and reliable than summative assessments recorded in a grade book. She also questioned the value of formative assessments for the students themselves because it didn't provide information about their accomplishments relative to other students. Another teacher cited the possibility of teacher error in not maintaining accurate records as a potential drawback of formative assessment.

5. Implications

This study began to situate traditional Montessori classroom practices in the context of assessment theory and research. By moving toward a more explicit and conscious framing of their assessment practices, Montessorians will find that they can communicate more easily and clearly about their demonstrably effective, if often unarticulated practices. This will require a shift in thinking, as well as ongoing, supportive professional development. For private school Montessori teachers, professional development could help them become conversant with current theory and educational research, and then would require, not a change in practice, but a conscious reframing and use of new vocabulary around that practice. The benefit would be easier, more successful communications with administrators, parents, and the wider community. Professional development for private school Montessori teachers around assessment could use the input and insights of public school Montessori teachers who have experience in this area.

This study points to some professional development opportunities for teachers in traditional lower elementary classrooms as well. For teachers in traditional classrooms, this study begins to paint a picture of how teachers can use and think about formative assessment to help their students in ways that summative data alone cannot. This can then lead to developing new ways of knowing—ways that will actually make teaching easier rather than more difficult—and will relieve some of the burden of worrying about how students are progressing, rather than simply adding one more thing to teachers' very long To Do List. The necessity for on-going, supportive professional development is critical to making this shift in thinking about the nature of the classroom dynamic, and about the value of this kind of information in fostering better student learning (Black & Wiliam, 2009; Clark, 2012b; Volante, Drake & Beckett, 2010). The

stories and anecdotes in this study are a step toward helping teachers to visualize what implementation looks like, and then to place themselves in that story.

The survey showed under-utilization of reading assessments as formative assessment by private school Montessori teachers. Given the data on the value of these assessments for gaining a fine-grained understanding of students' development in this complex process, this is a practice which private Montessori schools should seriously consider adopting. For Montessori teachers, assessing their students' development of the components of skilled reading will help them to use their already-keen abilities at scaffolding learning to assist the progress of all their students, especially those who are not developing well. Reading assessments will also help Montessori teachers communicate with parents about their children's progress, and ways to support reading development at home. Here, too, professional development will be critical to teachers' adoption of this research-supported practice.

This study provides a starting point for describing formative assessment in Montessori lower elementary classrooms. Further research is needed to construct a more detailed picture of how teachers employ formative assessment practices, especially in the use of conversation. What are the characteristics of conversations that support children's development? This study raises questions about the usefulness of more detailed knowledge about assessments on teachers' abilities to guide children: how much data, and what types of data are most useful in achieving higher student learning outcomes?

I hope that this study adds to the conversation about how best to figure out what students know, how to use that knowledge to help them advance, and how to share that knowledge with parents and others who value children and trust teachers to help them be all they can be. Formative assessment holds a valuable key. As one teacher said when asked about drawbacks to

formative assessment, "I don't think there are any drawbacks. It allows us, and the child, too, to know right where they are right now."

Limitations

The overall value and quality of this study are limited by the small sample sizes and by my limitations as a novice researcher. In the survey, different questions or different phrasing might have yielded different results. My data on both the observations and the interviews were limited by the quality of the notes I took. The value of the semi-structured interviews is weakened by the fact that since I did not record the interviews, I could not go back and check them later. The limitations of the questions and the follow-up discussion are mine as well.

APPENDIX A
QUESTIONS FOR ONLINE SURVEY OF ASSESSMENT PRACTICES
of Montessori Teachers in Public and Private Schools
February 3—March 27, 2014

I. Determining What Students Have Learned

1.   How frequently do you use paper and pencil tests (e.g., standardized tests, end-of-unit tests, spelling tests, math tests, quizzes) to determine what your   students have learned?

                Usually   Often   Sometimes   Rarely

2.   How frequently do you use other sources of information (e.g., observing student mastery of materials, conversations with students about their work, reviewing anecdotal records, or records of work completed), to determine what your students have learned?

                Usually   Often   Sometimes   Rarely

II. Teacher Records

Following are some kinds of records which Montessori elementary teachers have reported using to understand where students are in their learning or to decide what to teach next. Please indicate which ones you use and about how often.

3.   Anecdotal records
                Usually   Often   Sometimes   Rarely

4.   Records of work which students completed
                Usually   Often   Sometimes   Rarely

5.   Records of lessons given
                 Usually   Often   Sometimes   Rarely

6.   Records of informal reading inventories such as leveled reading assessments or running records
                Usually   Often   Sometimes   Rarely

7. Any thoughts you would like to share about other kinds of written records you use or about how you use written records to understand where students are in their learning or to decide what to teach next?

III. Observation

Following are some kinds of observations which Montessori elementary teachers have reported using to understand where students are in their learning or to decide what to teach next. Please indicate which ones you use and about how often.

8.   Students' concentration during work time
           Usually   Often   Sometimes   Rarely

9.   Students' choice of work
           Usually   Often   Sometimes   Rarely

10.   How students work with materials
           Usually   Often   Sometimes   Rarely

11.   Students' choice to work alone or with others
           Usually   Often   Sometimes   Rarely

12.   Students' choice of work partners
           Usually   Often   Sometimes   Rarely

13. Any thoughts you would like to share about how you use observation to understand   where students are in their learning or what steps to take next in teaching?

IV. Conversations With Students

Following are some kinds of conversations which Montessori elementary teachers have reported using to understand where students are in their learning or to decide what to teach next. Please indicate which ones you use and about how often.

14.   Informal conversations with students about their work
           Usually   Often   Sometimes   Rarely

15.   One-to-one formal conferences with students about their work
           Usually   Often   Sometimes   Rarely

16.   Explaining or demonstrating to the student the goal of the work, or what mastery looks like
           Usually   Often   Sometimes   Rarely

19.   Discussion and questioning during small or whole class lessons
           Usually   Often   Sometimes   Rarely

18. Any thoughts you would like to share about how you use conversations with students to understand where students are in their learning or to decide what to teach next?

V. Student Work

Thinking about the work that students produce, how often do you use each of the following to understand where your students are in their learning or to decide what to teach next?

19. Students' free writing
    Usually   Often   Sometimes   Rarely

20. Students' academic work
    Usually   Often   Sometimes   Rarely

21. Students' reading logs or reading journals
    Usually   Often   Sometimes   Rarely

22. Students' portfolios containing selected examples of their work
    Usually   Often   Sometimes   Rarely

23. Student work plans/contracts/work charts
    Usually   Often   Sometimes   Rarely

24. Any thoughts you would like to share about how you use student work to understand where your students are in their learning or to decide what to teach next?

25. Any other thoughts or comments you would like to share about what you do to understand your students' academic development or how you decide what to teach next?

VI. DEMOGRAPHIC INFORMATION

26. Where do you currently teach?
    ___ I am not currently teaching.
    ___ Lower elementary in a private school
    ___ Lower elementary in a public school
    ___ Other (Please specify.)

27. Do you have one or more Montessori certificates?
    ___ Yes
    ___ No

28. Which Montessori certificates do you hold? And for each type of certificate, which organization granted it?

   ____ Birth through 3 granted by: ___ AMI ___ AMS ___ Other*
   ____ 2.5 to 6 granted by: ___ AMI ___ AMS ___ Other*
   ____ 6-9 granted by: ___ AMI ___ AMS ___ Other*
   ____ 6-12 granted by: ___ AMI ___ AMS ___ Other*
   ____ 12-18 granted by: ___ AMI ___ AMS ___ Other*
   ____ Administrator certificate granted by: ___ AMI ___ AMS ___ Other*

   * Other (please specify)
   _____

29. Grades you currently teach: _____

30. Number of years you have taught lower elementary Montessori _____

31. Total number of years you have taught _____

32. What is the highest level of education you have completed?
   ____ Bachelor's degree
   ____ Post-graduate work
   ____ Master's degree
   ____ Post-master's degree work
   ____ More than one master's degree
   ____ Ph.D.

33. Do you hold a current state teaching certificate?

   ____Yes ____ No

34. This is an anonymous survey and no one can trace your response to you. When sharing the results of this research, may I have your permission to quote any of the anonymous written remarks you may have made?

   ____ Yes ____ No

APPENDIX B
GRAPHS OF SURVEY QUESTION RESULTS

A. Determining What Students Have Learned

1. Frequency of Use of Summative Tests

	Usually —	Often —	Sometimes —	Rarely —	Total —
Lower elementary in a private school	5.88% 2	17.65% 6	29.41% 10	47.06% 16	34
Lower elementary in a public school	17.39% 4	39.13% 9	43.48% 10	0.00% 0	23
Total Respondents	6	15	20	16	57

2. Frequency of Use of Formative Assessments

	Usually —	Often —	Sometimes —	Rarely —	Total —
Lower elementary in a private school	82.35% 28	17.65% 6	0.00% 0	0.00% 0	34
Lower elementary in a public school	65.22% 15	34.78% 8	0.00% 0	0.00% 0	23
Total Respondents	43	14	0	0	57

B. Frequency of Use of Types of Teacher Records for Formative Assessment

3. Anecdotal records

	Usually	Often	Sometimes	Rarely	Total
—	—	—	—	—	—
Lower elementary in a private school	38.24% 13	35.29% 12	23.53% 8	2.94% 1	34
Lower elementary in a public school	31.82% 7	27.27% 6	31.82% 7	9.09% 2	22
Total Respondents	20	18	15	3	56

4. Records of work which students completed

	Usually	Often	Sometimes	Rarely	Total
—	—	—	—	—	—
Lower elementary in a private school	79.41% 27	14.71% 5	2.94% 1	2.94% 1	34
Lower elementary in a public school	82.61% 19	8.70% 2	8.70% 2	0.00% 0	23
Total Respondents	46	7	3	1	57

5. Records of lessons given

	Usually	Often	Sometimes	Rarely	Total
—	—	—	—	—	—
Lower elementary in a private school	76.47% 26	14.71% 5	8.82% 3	0.00% 0	34
Lower elementary in a public school	56.52% 13	34.78% 8	8.70% 2	0.00% 0	23
Total Respondents	39	13	5	0	57

6. Records of informal reading inventories

—	Usually —	Often —	Sometimes —	Rarely —	Total —
Lower elementary in a private school	**32.35%** 11	**11.76%** 4	**38.24%** 13	**17.65%** 6	34
Lower elementary in a public school	**56.52%** 13	**17.39%** 4	**26.09%** 6	**0.00%** 0	23
Total Respondents	24	8	19	6	57

C. Frequency of Use of Students' Work for Formative Assessment

7. Students' Free Writing

—	Usually —	Often —	Sometimes —	Rarely —	Total —
Lower elementary in a private school	**26.47%** 9	**50.00%** 17	**20.59%** 7	**2.94%** 1	34
Lower elementary in a public school	**30.43%** 7	**17.39%** 4	**43.48%** 10	**8.70%** 2	23
Total Respondents	16	21	17	3	57

8. Students' Academic Work

—	Usually —	Often —	Sometimes —	Rarely —	Total —
Lower elementary in a private school	**61.76%** 21	**35.29%** 12	**2.94%** 1	**0.00%** 0	34
Lower elementary in a public school	**73.91%** 17	**26.09%** 6	**0.00%** 0	**0.00%** 0	23
Total Respondents	38	18	1	0	57

9. Students' Reading Logs or Journals

	Usually	Often	Sometimes	Rarely	Total
—	—	—	—	—	—
Lower elementary in a private school	**20.59%** 7	**26.47%** 9	**38.24%** 13	**14.71%** 5	34
Lower elementary in a public school	**4.35%** 1	**30.43%** 7	**39.13%** 9	**26.09%** 6	23
Total Respondents	8	16	22	11	57

10. Portfolios of Student Work

	Usually	Often	Sometimes	Rarely	Total
—	—	—	—	—	—
Lower elementary in a private school	**36.36%** 12	**30.30%** 10	**21.21%** 7	**12.12%** 4	33
Lower elementary in a public school	**40.91%** 9	**18.18%** 4	**9.09%** 2	**31.82%** 7	22
Total Respondents	21	14	9	11	55

11. Students' Work Plans/Work Contracts/Work Charts

	Usually	Often	Sometimes	Rarely	Total
—	—	—	—	—	—
Lower elementary in a private school	**50.00%** 17	**35.29%** 12	**8.82%** 3	**5.88%** 2	34
Lower elementary in a public school	**47.83%** 11	**30.43%** 7	**21.74%** 5	**0.00%** 0	23
Total Respondents	28	19	8	2	57

D. Frequency of Use of Observation for Formative Assessment

12. Students' concentration during work time

	Usually	Often	Sometimes	Rarely	Total
—	—	—	—	—	—
Lower elementary in a private school	**64.71%** 22	**20.59%** 7	**11.76%** 4	**2.94%** 1	34
Lower elementary in a public school	**47.83%** 11	**47.83%** 11	**4.35%** 1	**0.00%** 0	23
Total Respondents	33	18	5	1	57

13. Students' choice of work

	Usually	Often	Sometimes	Rarely	Total
—	—	—	—	—	—
Lower elementary in a private school	**58.82%** 20	**32.35%** 11	**8.82%** 3	**0.00%** 0	34
Lower elementary in a public school	**39.13%** 9	**52.17%** 12	**8.70%** 2	**0.00%** 0	23
Total Respondents	29	23	5	0	57

14. How students work with materials

	Usually	Often	Sometimes	Rarely	Total
—	—	—	—	—	—
Lower elementary in a private school	**67.65%** 23	**23.53%** 8	**8.82%** 3	**0.00%** 0	34
Lower elementary in a public school	**60.87%** 14	**30.43%** 7	**4.35%** 1	**4.35%** 1	23
Total Respondents	37	15	4	1	57

15. Students' choice to work alone or with others

	Usually	Often	Seldom	Rarely	Total
—	—	—	—	—	—
Lower elementary in a private school	45.45% 15	30.30% 10	21.21% 7	3.03% 1	33
Lower elementary in a public school	26.09% 6	47.83% 11	26.09% 6	0.00% 0	23
Total Respondents	21	21	13	1	56

16. Students' choice of work partners

	Usually	Often	Sometimes	Rarely	Total
—	—	—	—	—	—
Lower elementary in a private school	38.24% 13	38.24% 13	20.59% 7	2.94% 1	34
Lower elementary in a public school	21.74% 5	47.83% 11	26.09% 6	4.35% 1	23
Total Respondents	18	24	13	2	57

E. Teachers' Use of Conversation for Formative Assessment

17. Informal conversations about work

	Usually	Often	Sometimes	Rarely	Total
—	—	—	—	—	—
Lower elementary in a private school	55.88% 19	44.12% 15	0.00% 0	0.00% 0	34
Lower elementary in a public school	65.22% 15	26.09% 6	8.70% 2	0.00% 0	23
Total Respondents	34	21	2	0	57

18. One-to-one formal conferences about work

—	Usually	Often	Sometimes	Rarely	Total
—	—	—	—	—	—
Lower elementary in a private school	**35.29%** 12	**17.65%** 6	**26.47%** 9	**20.59%** 7	34
Lower elementary in a public school	**34.78%** 8	**21.74%** 5	**39.13%** 9	**4.35%** 1	23
Total Respondents	20	11	18	8	57

19. Explaining or demonstrating goal of work or what mastery looks like

—	Usually	Often	Sometimes	Rarely	Total
—	—	—	—	—	—
Lower elementary in a private school	**35.29%** 12	**38.24%** 13	**20.59%** 7	**5.88%** 2	34
Lower elementary in a public school	**43.48%** 10	**34.78%** 8	**17.39%** 4	**4.35%** 1	23
Total Respondents	22	21	11	3	57

20. Discussion and questioning during group lessons

—	Usually	Often	Sometimes	Rarely	Total
—	—	—	—	—	—
Lower elementary in a private school	**50.00%** 17	**32.35%** 11	**14.71%** 5	**2.94%** 1	34
Lower elementary in a public school	**56.52%** 13	**39.13%** 9	**4.35%** 1	**0.00%** 0	23
Total Respondents	30	20	6	1	57

**Appendix C - Fisher's Exact Test Applied to Survey Answers of
Public and Private School Montessori Teachers**

Data Type	Subject of Survey Question	No. of Responses	Fisher Exact Test P-value
Written Records	Anecdotal Records	56	0.3800
Written Records	Records of work which students completed	57	1.0000
Written Records	Records of lessons given	57	1.0000
Written Records	Records of informal reading inventories such as leveled reading assessments or running records	57	0.0325
Conversations	Informal conversations with students about their work	57	0.1585
Conversations	One-to-one formal conferences with students about their work	57	1.0000
Conversations	Explaining or demonstrating the goal of the work, or what mastery looks like	57	0.7618
Conversations	Discussion or questioning during small or whole class lessons	57	0.2227
Observations	Students' concentration during work time	57	0.3846
Observations	Students' choice of work	57	1.0000
Observations	How students work with materials	57	1.0000
Observations	Students' choice to work alone or with others	56	1.0000
Observations	Students' choice of work partners	57	0.7600
Student Work	Students' free writing	57	0.0464
Student Work	Students' academic work	57	1.0000
Student Work	Students' reading logs or reading journals	57	0.4199
Student Work	Students' portfolios containing selected examples of their work	55	0.5818
Student Work	Students' work plans/contracts/work charts	57	0.5036

APPENDIX D

QUESTIONS FOR SEMI-STRUCTURED INTERVIEWS

1. Can you talk a bit about the ways you figure out where students are in their learning? What role do paper and pencil tests play in guiding students?

2. How do you coordinate the information you get from these different sources to decide what students need to do next or the next steps you need to take in your teaching?

3. Tell me a bit about the value for your students when you use formative assessments to guide their learning.

4. Of the practices you talked about, which are the most valuable and why? What makes an assessment valuable?

5. What are the benefits and drawbacks of using formative assessments for teaching and learning as opposed to relying mainly on summative tests?

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