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Contents

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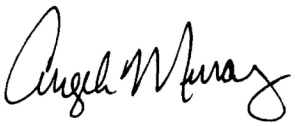
From the Editor

Welcome to the fall issue of the *Journal of Montessori Research*. We hope that you enjoy the new layout premiering in this issue. The articles this fall reflect a range of topics including creativity, repetition among preschoolers, and teacher transformation. The first article examines the impact of Montessori education on third-graders' creativity. The second article investigates children's repetitive behavior in a free-play, daycare setting, examining whether repetition is a characteristic behavior of all young children. Finally, the third article explores selected literature on Montessori teacher identity and the effects of teacher identity broadly, including elements of antibias and antiracist teacher-identity development.

As reported in our spring issue, a Montessori Special Interest Group (SIG) now exists within the American Educational Research Association (AERA). If you are a member of AERA or you have considered joining it, please support the new SIG and invite your colleagues to do the same. We are just short of our required 75 members, so we need your help. If you are renewing or joining the organization, you can add the SIG for only $5.

Sincerely,



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The Montessori Model and Creativity

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Keywords: *Montessori, creativity, creative potential, divergent thinking, convergent thinking, school choice*

Abstract: Prior research has demonstrated that the characteristics of school environments can impact the development of creativity in children. Thus, we explored the construct of creativity in the context of a Montessori environment. We used the Evaluation of Potential Creativity to measure creativity in children during one academic year. The study sample comprised 77 third-grade students at a Montessori public school in the southeastern United States and 71 demographically similar students at a traditional public school. Results show that Montessori students performed somewhat better on the Evaluation of Potential Creativity assessment than similar non-Montessori students did. Subgroup analyses indicate that male Montessori students demonstrated higher creativity than did male non-Montessori students. The findings of this study augment the body of research supporting creative development in Montessori children and suggest that researchers should continue to focus on the measurement of creativity in studies related to the efficacy of the Montessori model.

Considered one of the most important skills for childhood development (Kaufman & Sternberg, 2010; Runco, 2004), creativity contributes to an individual's problem-solving and innovative abilities, which play a crucial role in personal growth and development (Besançon & Lubart, 2008). Creativity is commonly acknowledged as the ability to produce original works (Nijstad & Paulus, 2003; Runco & Jaeger, 2012). Most scholars agree that creativity, often referred to as a *habit of mind*, "involves invention, problem-solving, and adaptation" (Cossentino & Brown, 2014–2015, p. 229). Plucker, Beghetto, and Dow (2004) defined creativity as "the interaction among aptitude, process, and environment by which an individual or group produces a perceptible product that is both novel and useful as defined within a social context" (p. 90). This latter definition suggests that creativity is not an intrinsic characteristic but an ability that can be influenced by contextual factors. Several studies on creative ability also have demonstrated the impact of educational context (Besançon & Lubart, 2008; Besançon, Lubart, & Barbot, 2013). These studies show that characteristics of the school environment—such as instructions from teachers, tasks and exercises, and classroom space—can either foster or suppress creativity development (Besançon & Lubart, 2008; Besançon et al., 2013).

Operationalizing Creativity

While creativity is a difficult construct to measure, many scholars believe it can be "identified, described, and measured" (Cossentino & Brown, 2014–2015, p. 229). A number of researchers have developed assessments that examine different aspects of creativity. One of the most frequently used methods to assess creativity is the psychometric approach (Kaufman & Sternberg, 2010). Such an approach uses various creativity tests to measure an individual's creative potential. Tests of creative potential usually fall into two categories: those that evaluate creative expression, such as verbal responses or drawing, and those that evaluate creative thinking (Barbot, Besançon, & Lubart, 2015; Lau, Cheung, Lubart, Tong, & Chu, 2013). The most widely used creativity tests, such as the Torrance Tests of Creative Thinking, the Wallach–Kogan Creativity Tests, Guilford's Alternate Uses, and the Test for Creative Thinking-Drawing Product, belong to the latter. These tests emphasize subjects' divergent thinking, meaning the extent to which the participant can expand the range of creative problem-solving. Thus, these creativity tests require students to develop multiple alternative concepts based on original ideas (Lau et al., 2013). However, these traditional creativity tests have come under criticism because they fail to evaluate *convergent thinking*, another critical part of creative thinking identified by scholars (Kaufman & Sternberg, 2010). Convergent thinking refers to the process of combining elements and then presenting them in new ways.

To measure creative potential through examining both divergent and convergent thinking, this study employed the Evaluation of Potential Creativity (EPoC)[1], a validated assessment developed by Barbot, Besançon, and Lubart (2011). The EPoC requires participants to generate new ideas based on a stimulus in the divergent task and asks participants to integrate various items into a new product in the convergent task. The EPoC offers multiple test forms to examine different dimensions of creative potential, including verbal–literary, graphic–artistic, and social problem-solving. In this study, the graphic–artistic test is used. The reliability and validity of the EPoC was determined by a confirmatory factor analysis, which demonstrated an acceptable adjustment of the data to the theoretical model for multiple test forms. External validity was confirmed by a comparison of EPoC scores with IQ measurements, as well as a demonstrated correlation between EPoC scores and personality-relevant dimensions. There also were correlations between EPoC scores and the classic subtest of divergent thinking derived from the Torrance Tests of Creative Thinking, indicating both convergent and divergent validity (Barbot et al., 2011).

Evidence of Creativity and Montessori

There are many reasons why Montessori education may affect students' creativity: the independence and freedom offered to students, the structure of the Montessori classroom, the flexibility of space and time, and the emphasis on intrinsic motivation and collaboration. Introduced in the early 20th century, the Montessori pedagogy emphasizes the freedom of children and building an environment that supports each child's development (Gutek & Gutek, 2016; Lillard, 2005). Students are encouraged to learn through doing versus being instructed by teachers (Lillard, 2005). The role of the teacher is as a facilitator of learning, acting to meet students' individual needs through observations (Humphryes, 1998). Children in mixed-aged classrooms are free to choose where to work, who to work with, and which of the specially developed Montessori materials to use at their own pace (Lillard, 2005). Cossentino and Brown (2014–2015) further presented the Montessori classroom as a place where creativity is cultivated: "The Montessori classroom is explicitly designed to enable the acquisition of specific bodies of knowledge alongside the cultivation of cognitive flexibility, risk-taking, and tolerance of ambiguity" (p. 230). These and other scholars believe the Montessori model to be a holistic educational approach that nurtures students' creative development.

Although limited in number, several studies have evaluated the relationship between Montessori education and creativity. Lillard and Else-Quest (2006) conducted a study comparing Montessori and non-Montessori students after both primary and elementary school. The authors examined creativity, in addition to other measures of academic and social development, in a 12-year-old cohort. Students were asked to complete a story within 5 minutes that began "_____ had the best/worst day at school." Researchers found that Montessori

[1] Evaluation du Potentiel Créatif (EPoC) was initially developed and validated in a sample of French students. It is translated as the *Evaluation of Potential Creativity* in the United States but is still commonly referred to using the French acronym.

students produced stories that were significantly more creative than non-Montessori students' stories. A study by Heise, Böhme, and Körner (2010), which examined the development of intelligence and creativity of pupils of Montessori and traditional teaching methods, found that Montessori students showed higher levels of creativity and better performance in geometry. While these studies provided support for the notion that Montessori increases creativity more than traditional education does, a recent evaluation came to a different conclusion. Lillard et al. (2017) conducted a 3-year longitudinal study with a cohort of students, beginning in preschool. In the study, researchers measured numerous aspects of academic, social, and cognitive development, including creativity. Lillard et al. used Guilford's Alternative Uses to measure creativity. Results demonstrated no statistically significant differences between Montessori and non-Montessori students on the measure of creativity across the years of the study. In light of the conflicting conclusions regarding the effect of Montessori on creativity, the study presented in this paper provides additional insight into this debate.

In addition to studies that directly explore Montessori and creativity, the various elements of Montessori have also been shown to benefit creative development in children. For example, several studies have found that educational environments in which children view themselves to have some level of control and that allow for free choice in activities and collaborative learning have been shown to produce higher levels of creativity (Amabile & Gitomer, 1984; Ryan & Grolnick, 1986). In addition, focusing on intrinsic motivation rather than extrinsic rewards, as is the case in Montessori education, has been shown to affect creativity. A number of studies investigated the influence of extrinsic rewards on creativity. According to Lillard (2005), the use of rewards was shown to reduce intrinsic motivation to learn and think creatively, leading students to learn only material on which they expected to be evaluated and rewarded. Lepper, Greene, and Nisbett (1973) found that children who self-selected to draw, but were later prompted to draw with the knowledge that an award would be given, showed lower levels of creativity compared to children who were never presented with the possibility of receiving an award. Another study produced similar findings when researchers asked elementary school students to take two photographs and then create a line of text to go with each picture (Amabile, Hennessey, & Grossman, 1986). Students who were led to believe that the photography task was an advance reward produced fewer creative lines. Moreover, Amabile (1979) found that undergraduate students' awareness that a work would be evaluated, without knowing the specific criteria for evaluation, reduced the originality and creativity of the work.

While creativity may differ by school context, student characteristics also play an important role. For example, several studies have focused on gender in the development of creative potential. A study by Sayed and Mohamed (2013) explored gender differences in divergent thinking in approximately 900 Egyptian children from kindergarten through grade 6. The students' divergent thinking was assessed using the Test for Creative Thinking-Drawing Production. Results of the study indicated no consistent gender differences in divergent thinking. Additionally, a longitudinal study by Lau and Cheung (2015) that used the Wallach–Kogan Creativity Tests to measure creativity in nearly 2,500 junior high students in a Chinese school showed some patterns of gender differences in scores, depending on the grade levels; however, gender differences narrowed by grade 9. Another study investigated gender differences in creativity among 985 schoolchildren using the Test for Creative Thinking-Drawing Production (Wu-jing & Wong, 2011). Results showed complex patterns of gender differences and no consistent advantages for either boys or girls (Wu-jing & Wong, 2011). The relatively few studies focusing on gender and creative development warrant additional research in this area.

Method

Participants

In this study, we examined how the performance of Montessori and non-Montessori students differed on the graphic–artistic section of the EPoC assessment. The sample comprised 148 third-grade students at two public schools during the 2015–2016 academic year. Of these, 77 attended a Montessori public school and 71 attended a traditional public school. Previous evaluations of Montessori programs have noted varying levels of fidelity to the Montessori model in Montessori schools (e.g., Lillard, 2012). Proper implementation of Montessori may be particularly difficult in public-school settings, as some standards and accountability requirements may prove incompatible with high-fidelity Montessori education.

To ensure that the public Montessori school participating in this study was of high fidelity, trained Montessori professionals observed the classrooms and interviewed Montessori teachers in the school. Based on the findings of Montessori observers, the research team was confident that this school implemented the Montessori model with high fidelity.

The Montessori school included in this study was selected because it was a no-choice situation regarding participation in a public Montessori program; in other words, all students in the district enrolled in preschool were placed in a public Montessori program. Thus, the third-grade students in the sample began Montessori education in the district at age 3 or 4. This was important because, whereas Montessori education is a parental choice in most public schools that offer a Montessori program, this school offered only Montessori classes to children aged 3 and 4, thus helping to mitigate some of the issues related to selection bias.

The Montessori school in this study did not have a waiting list of students, so a randomized control trial was not possible. When selecting the non-Montessori sample of students, the research team considered traditional public schools that were similar to the Montessori school in the study in a number of important dimensions, including school size, grade configuration, location, and student demographics. The Montessori school and the traditional comparison school used in this study are both in rural areas of the same state in the southeastern United States. While there were demographic differences between the samples in this study, we were primarily concerned with ensuring that the samples were similar in the percentage of low-income students. This factor was emphasized in the comparison-school selection process because of the important effect that parental income can have on student outcomes.

Design and Procedure

The research team merged the EPoC results with a state database, which provided demographic information on the study participants. This allowed for a demographic comparison between the Montessori and non-Montessori students in this study. Further, these demographic variables (i.e., race, free/reduced meal eligibility, gender, English language learners, special education status) may affect student creativity and, therefore, were taken into account when examining the relationship between Montessori participation and creativity. These demographic variables, as well as the Montessori indicator variable, were dummy coded (1 = yes, 0 = no) for inclusion in the multivariate analyses described below.

Trained researchers administered the EPoC assessment to both Montessori and non-Montessori students in comparable school-day settings. The EPoC assessment was standardized (i.e., same task materials, same time allotted, same instructions, same scoring method) and required students to produce work (i.e., drawings) based on a specific set of stimuli. The researchers asked students to complete one divergent-exploratory task and one convergent-integrative task during the first session and then another divergent-exploratory task and convergent-integrative task in a second session approximately two weeks later. This allowed each child to show his or her creative potential on two occasions with two slightly different tasks for divergence and convergence.

For the divergent-exploratory tasks, we showed students a picture of an abstract shape (see Figure 1) and asked them to complete as many drawings as they could that incorporated the object. Students also completed a similar task using a picture of a concrete object, such as a carrot (see Figure 2). The more drawings they completed, the higher score they achieved on the divergent task. The divergent-exploratory task score equaled the number of legitimate ideas (i.e., drawings) produced.

For the convergent-integrative tasks, we showed students one image of a set of eight different and unrelated abstract shapes and one image of a set of eight different

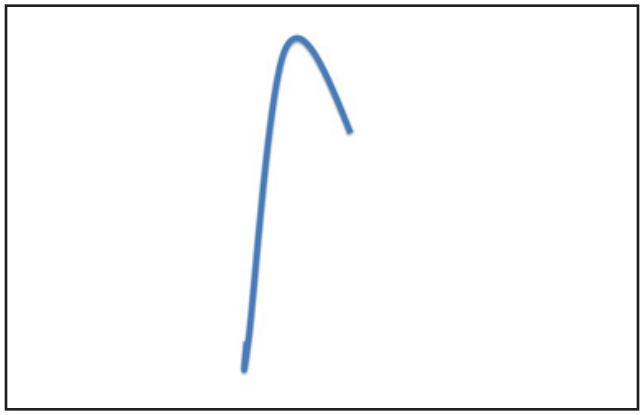

Figure 1. Example of divergent-exploratory (abstract) object from Evaluation of Potential Creativity assessment.

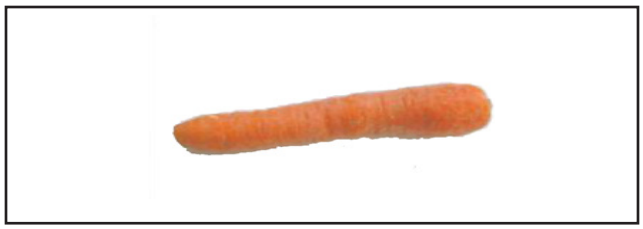

Figure 2. Example of divergent-exploratory (concrete) object from Evaluation of Potential Creativity assessment.

and unrelated concrete objects. Each child was asked to complete two drawings: one drawing using the eight abstract shapes and one drawing using the eight concrete shapes. We then asked the students to tell the story behind each drawing, and scored the students on a 7-point scale for each drawing based on detailed EPoC guidelines, with 1 the lowest score and 7 the highest. See Figure 3 for an example of a drawing that received the lowest score of 1 on the convergent-integrative task using concrete objects. See Figure 4 for an example of a drawing that received a 7, the highest possible score, on the same task.

Scoring for the convergent tasks accounted for a number of elements, including whether the participant

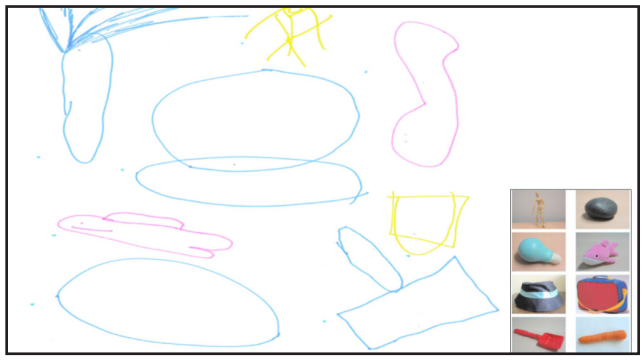

Figure 3. Example of low-scoring convergent-integrative (concrete) task from Evaluation of Potential Creativity assessment.

Figure 4. Example of high-scoring convergent-integrative (concrete) task from Evaluation of Potential Creativity assessment.

used all eight elements, the ways in which elements were combined in new and creative ways, whether the drawing was meaningful, and the originality of the idea being expressed. Participants' divergent-exploratory and convergent-integrative scores were not based on their craftsmanship or technical drawing ability. Two trained evaluators blindly scored each of the 148 convergent-integrative abstract drawings and 124 convergent-integrative concrete drawings. The average of the two scores for both the abstract and concrete drawings constituted the students' total scores on these two assessments. Using a weighted interrater-reliability procedure, we found that the ratings from the two coders produced a kappa statistic of .65 on the abstract drawings. This was considered a *substantial* level of agreement (Landis & Koch, 1977). For the concrete drawings, kappa was .58, a *moderate* level of agreement (Landis & Koch, 1977). A summary of the four parts of the EPoC assessment is presented in Table 1.[2]

Following the EPoC scoring guidelines, we used the abstract and concrete divergent-exploratory measures to create a single divergent-exploratory score. The final EPoC score, which is the focus of this study, is a combination of the divergent-exploratory score, the concrete convergent-integrative score, and the abstract convergent-integrative score, as specified by the EPoC guidelines. In addition to these outcomes, coders on the research team also measured technical drawing ability by assessing each student's ability to create a meaningful and visually appealing drawing by incorporating a variety of skills and abilities, including perspective, proportion, texture, differential shapes, and size.

Statistical Analysis Approach

The main analyses proceeded as follows. First, we compared the demographic characteristics of the Montessori and non-Montessori students. Then, the relationship between Montessori participation and creativity was examined. We used difference-in-means

[2] Despite the best efforts of the research team, some students did not complete all four assessments. Twenty-four students were missing the convergent-integrative concrete score. Following guidance from the creators of the EPoC, we used these students' convergent-integrative abstract scores in place of their concrete scores when computing the total score. This maximizes the sample sizes for the analyses. When the analyses are limited to students who have complete data (n = 124), the results are substantively similar to what is presented in the results section.

Table 1
Four Tasks Constituting the Evaluation of Potential Creativity Assessment

	Dimension	
Stimulus	Divergent-exploratory	Convergent-integrative
Abstract	Creating a number of unique drawings using an abstract stimulus	Combining eight abstract shapes into one meaningful drawing
Concrete	Creating a number of unique drawings using a concrete stimulus	Combining eight concrete objects into one meaningful drawing

t tests to investigate the bivariate relationships between Montessori status and creativity. Then, we employed ordinary least squares (OLS) regression to estimate differences in final EPoC scores between Montessori and non-Montessori students. Given that the component and final EPoC scores were continuous, researchers employed OLS regression to isolate the relationship between Montessori status and the dependent variable while accounting for differences in student demographics.

After finding that Montessori students exhibited higher levels of creativity than did non-Montessori students, we examined the different components of the EPoC assessment to identify areas in which Montessori students outscored their counterparts. Further, we explored whether Montessori education increased creative potential for some groups of students more than for others. To examine this possibility, we estimated multivariate OLS regressions that interacted the Montessori indicator variable with various subgroups. In the first model, we interacted the Montessori indicator with student gender, allowing examination of whether the Montessori effect was different for male and female students. In the second model, we estimated the interaction between Montessori participation and free-reduced meal eligibility. In the third model, we investigated the interaction between Montessori participation and student race. Because of the small sample sizes, the analysis was limited to an examination of White, non-Hispanic students and non-White students. Besides the main effects and interaction terms of these variables, the analyses also controlled for the other demographic variables that were included in the other regressions. Finally, we performed robustness checks that examined the extent to which selection bias may explain the results found in these analyses.

Results

Preliminary Analyses

We first established that the two groups of participating third-grade students in this study were similar according to demographics. Significantly, the two samples were found to be very similar in terms of the proportion of students who were eligible for free or reduced meals, our proxy for low-income status, as seen in Table 2. Montessori students were more likely to be male, non-Hispanic White or Black, and not using special education services, when compared to non-Montessori students. However, these differences were not statistically significant. There were statistically significant differences between the two groups in terms of the proportion of Hispanic students and those deemed English language learners. Approximately 10% of Montessori students were Hispanic compared to 23% of traditional students in the sample, and 7% of Montessori students were English language learners compared to 17% of traditional students. While the samples were found to be similar overall, we performed additional statistical procedures, described below, to account for the differences found.

To get a sense of the differences in the total raw EPoC scores and the different EPoC components individually, we performed multiple bivariate, difference-in-means tests to examine the relationship between school type and students' scores before adjusting for student demographic factors. The results are in Table 3, which shows that, before adjusting for demographics, Montessori students' final EPoC scores were higher than those of non-Montessori students. This difference was significant at the $p < .10$ level (two-tailed). Montessori students also outscored non-Montessori students on the divergent-exploratory tasks. On average, Montessori students

Table 2
Demographics of Montessori and Non-Montessori Study Participants

Characteristic	Montessori (n = 77)	Non-Montessori (n = 71)
Female	36 46.8%	38 53.5%
White	57 74.0%	46 64.8%
Black	12 15.6%	7 9.9%
Hispanic	8** 10.4%	16 22.5%
Poverty status	57 74.0%	51 71.8%
Special education status	9 11.7%	9 12.7%
English language learner status	5** 6.5%	12 16.9%

*** $p < .01$.** $p < .05$. * $p < .10$.

Table 3
Raw Evaluation of Potential Creativity Scores of Montessori and Non-Montessori Participants

Outcome	Montessori	Non-Montessori	Difference	
Final EPoC score	22.97	19.65	2.31*	(1.29)
Divergent-exploratory	15.05	12.55	2.50**	(1.25)
Convergent-integrative (abstract)	3.40	3.67	-0.26	(0.24)
Convergent-integrative (concrete)	3.45	3.43	0.02	(0.21)
Technical drawing ability	3.32	3.46	-0.14	(0.27)

Note. Standard errors in parentheses.
*** $p < .01$.** $p < .05$. * $p < .10$.

created 2.5 more drawings than did their non-Montessori counterparts, a statistically significant difference. The differences for technical drawing ability and both of the convergent-integrative outcomes, however, were small and not statistically significant.

Main Effects of Montessori Education on Creativity
While these results suggested a Montessori advantage on two outcomes, there were demographic differences between the two groups to consider, as demonstrated in Table 2. Thus, a multivariate analysis was used to examine these scores. To examine whether demographic factors accounted for Montessori students' performance on the EPoC test, we estimated a linear regression predicting students' final EPoC scores, the main outcome of this analysis. Table 4 presents the regression coefficients and robust standard errors. After controlling for race, poverty status, gender, student disability, and English language learner status, Montessori students scored 2.28 points higher on the EPoC than did non-Montessori students.

This is a marginally statistically significant difference with a *p* value of .077. To get a sense of the magnitude of this difference, we reestimated the regression, using standardized scores as the dependent variable, by converting the final EPoC score to a *z* score, which had a mean of 0 and a standard deviation of 1. The regression coefficients were now in standard deviation units, similar to Cohen's *d*, a popular measure of effect size. Other education evaluations have implemented this approach as well (e.g., Center for Research on Education Outcomes, 2013; Jenkins et al., 2018). Montessori students scored 0.28 standard deviations (*SE* = 0.16) higher than non-Montessori students on the EPoC assessment. This is a substantively large difference. Meta-analyses that examine the effect sizes of various education interventions provide a benchmark for the .28 effect size presented here. Cheung and Slavin (2016) found that the mean Cohen's *d* effect size for analyses with sample sizes similar to those in this study was 0.26, and the mean effect size across 449 quasiexperimental education studies was 0.23. The effect size of Montessori education on creativity in this study was similar to the average effect size of comparable studies. Special education status is the only other covariate that was statistically significantly related to final EPoC scores; students who received special education services scored about 3 points lower than students who did not.[3]

Because Montessori education may enhance different aspects of creative potential, we also examined the differences between Montessori and non-Montessori students in terms of the constituent parts of the EPoC, as well as the students' technical drawing ability, after adjusting for student demographics. Table 5 indicates that Montessori students scored 2.63 points higher on the divergent-exploratory score than did non-Montessori students. This result means that Montessori students, on average, drew 2.63 more pictures than non-Montessori students did, incorporating the abstract and concrete stimuli. While this outcome had direct interpretability, it also was converted into a standardized score with a mean of 0 and standard deviation of 1, as was done with total EPoC score. When these standardized scores were used as the dependent variable, Montessori students scored 0.34 standard deviations higher than non-Montessori students on the divergent-exploratory score. While Montessori students achieved lower scores on the two convergent tasks and technical drawing ability than non-Montessori students did, none of the results were statistically significant.

Table 4
Predicting Final Evaluation of Potential Creativity Score—Multivariate Ordinary Least Squares Regression Results

Characteristic	Final EPoC score
Montessori	2.28* (1.28)
Poverty status	-0.37 (1.69)
Special education status	-2.96* (1.67)
English language learner status	0.37 (2.93)
Female	-0.19 (1.32)
Black	-1.46 (2.11)
Hispanic	-1.46 (2.33)
Other race	2.19 (4.94)
Constant	20.75*** (1.54)
Observations	148
F statistic	0.93
R^2	0.05

Note. Robust standard errors in parentheses.
*** $p < .01$. ** $p < .05$. * $p < .10$.

Interaction Effects

The above analyses suggest that Montessori education is associated with higher levels of creativity. However,

[3] Our analyses are sensitive to the presence of outliers on the dependent variable. When these observations are excluded from the regression in Table 4, Montessori students still outscore non-Montessori by 0.24 standard deviations, but this difference is no longer statistically significant (*p* value = .106) at the $p < .10$ level. Given our role in data collection, we believe that the outlier cases do not reflect errors in measurement, but rather simply high scores on the EPoC tests. Therefore, we included all cases in the analyses we present here. However, we acknowledge that the presence of outliers in conjunction with the small sample sizes are a limitation of this study.

Table 5
Examining Components of the Evaluation of Potential Creativity Assessment

	Divergent-exploratory	Convergent-integrative (abstract)	Convergent-integrative (concrete)	Technical drawing ability
Montessori	2.63**	-0.37	-0.02	-0.14
	(1.25)	(0.24)	(0.21)	(0.28)
Poverty status	-0.36	0.22	-0.33	-0.16
	(1.62)	(0.29)	(0.26)	(0.34)
Special education status	-2.11	-0.43	-0.19	0.09
	(1.52)	(0.38)	(0.27)	(0.40)
English as a second language status	2.51	-0.91	-0.84*	-1.23**
	(2.99)	(0.59)	(0.50)	(0.48)
Female	-0.86	0.25	0.41*	0.79***
	(1.27)	(0.24)	(0.22)	(0.28)
Black	-1.13	-0.13	-0.10	-0.47
	(1.97)	(0.37)	(0.27)	(0.37)
Hispanic	-2.13	0.02	0.42	0.62
	(2.37)	(0.58)	(0.45)	(0.41)
Other race	4.61	-1.24***	-1.15***	-1.21
	(5.13)	(0.37)	(0.23)	(0.84)
Constant	13.58***	3.63***	3.57***	3.29***
	(1.56)	(0.27)	(0.26)	(0.35)
Observations	148	148	124	148
F statistic	1.08	2.81***	13.57***	2.80***
R^2	0.05	0.07	0.08	0.10

Note. Robust standard errors in parentheses.
***$p < .01$. **$p < .05$. *$p < .10$.

whether attending a Montessori school may be particularly effective for certain subgroups of students remains an open question. To examine this possibility, we estimated three interaction models, which examined differences in the effect of Montessori education by gender, free/reduced meal eligibility, and race. These models included controls for all student demographic factors used in Table 4.

After estimating these regressions, we determined the predicted final scores for these subgroups of students.[4] Figure 5 displays the predicted final EPoC score from the separate regressions for gender, income, and race.[5] The other variables in the model were held at their observed values (Williams, 2012). According to Figure 5, male Montessori students had a predicted final EPoC score of 23, while male non-Montessori students had a score of 18. This marginal effect was statistically significant at the $p < .05$ level, meaning that Montessori participation was associated with greater levels of creativity for male

[4] Full regression results are available from the authors upon request.

[5] The predicted outcomes reflect average marginal effects estimated using the Margins command in Stata. The significance tests used in Figure 5 correspond to the relationship between Montessori participation and final EPoC score within each subgroup (e.g., Montessori female students vs. non-Montessori female students, White Montessori students vs. White non-Montessori students).

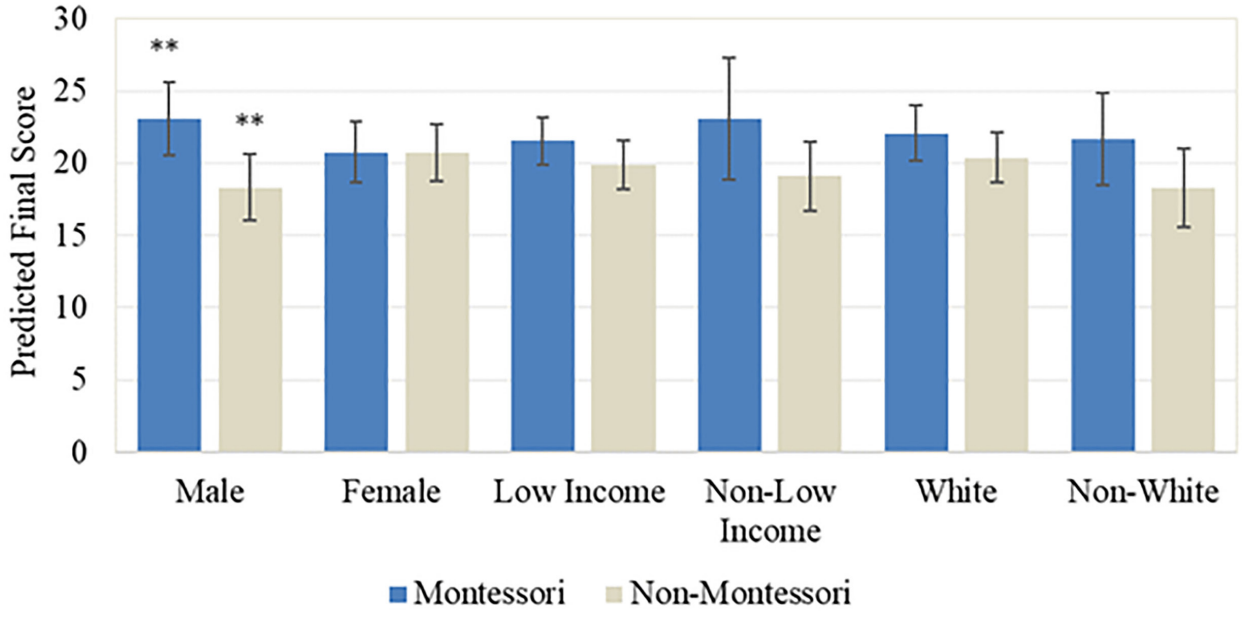

Figure 5. Predicted final scores for interaction models. Figure depicts predicted final score with 90% confidence intervals. $^{***}p < .01$, $^{**}p < .05$, $^{*}p < .10$.

students. We then examined the differences between male students when using the standardized EPoC final score as the outcome variable. Male Montessori students scored 0.59 standard deviations above male non-Montessori students. When examining the other subgroup analyses for income and race, Montessori students consistently scored higher than non-Montessori students. However, these differences were not statistically significant. The small sample size of this study was particularly limiting for these subgroup analyses, as there was not enough power to detect small differences between Montessori and non-Montessori students.

Robustness Analyses

A major challenge in evaluations of this type is selection bias. In the case examined here, selection bias may occur if important factors led some parents to choose public Montessori education for their children and if these factors were related to student creativity. For example, more-involved parents may have been more likely to send their children to Montessori programs. These parents also may have been more active with their children at home and may have encouraged creative problem-solving. If selection bias is not accounted for, the higher levels of creativity exhibited by Montessori students on the final EPoC score may simply be because their parents were more involved, not because they participated in Montessori education. Unlike some other studies that examined the effects of Montessori education (Lillard & Else-Quest, 2006; Lillard et al., 2017), we were not able to use a randomized lottery to account for selection bias. Rather, we hoped to decrease the chances of selection bias by selecting a school district that did not allow parents to choose between public Montessori education and traditional preschool: Montessori education was the only public option. Further, the analyses accounted for a number of important student characteristics in the form of control variables in the OLS regressions.

Because selection bias may be unobserved, we were unable to estimate how selection bias affected the results presented here. However, methods exist that allow researchers to examine the percentage of the estimated effect that must be caused by bias to invalidate the inference that there is a difference between the scores of Montessori and non-Montessori students (i.e., to no longer have a statistically significant result). We applied such a procedure (Rosenberg, Xu, & Frank, 2018) to the main result of this analysis. Using the Montessori coefficient (2.28) and standard error (1.28) from the regression in Table 4, which predicted the final EPoC score, we estimated that 7% of the Montessori effect would have to be caused by selection bias to infer that

there was no statistically significant relationship between Montessori status and final EPoC score.

Frank, Maroulis, Duong, and Kelcey (2013) examined a number of evaluations on these dimensions and found that the bias necessary to invalidate the results ranges from 2% to 60% for these education studies. The result here of 7% was on the low end of that distribution, but it was higher or equivalent to the bias needed to invalidate inferences related to a tutoring program (Miller & Connolly, 2013) and a counseling program to encourage college enrollment (Stephan & Rosenbaum, 2013).

Another way to consider the threat of selection bias is to examine the impact threshold for confounding variables (Crosnoe & Cooper, 2010; Frank et al., 2008). This value quantifies how powerful an unknown confounder must be correlated to both Montessori participation and creativity to negate the relationship found in this analysis or to make the relationship between Montessori participation and final EPoC scores no longer statistically significant at $p < .10$. For example, how correlated must parental involvement be with Montessori participation and creativity to make the Montessori estimate in Table 4 no longer statistically significant? Using the technique presented by Rosenberg et al. (2018), the impact threshold for confounding variables was estimated to be .012. This estimate meant that, for the Montessori coefficient to no longer be statistically significant, the confounding variable must be correlated at .11 with Montessori participation and with the final EPoC score at .11, conditional on the covariates included in the model. For comparison purposes, we examined the other covariates in the regression model. None of the covariates was correlated with both Montessori participation and creativity at the impact threshold for confounding variables level. This result meant that the omitted confounder would need to be more strongly related to Montessori participation and the final EPoC score than are free or reduced meal eligibility, race, English language learner status, gender, and special education status in the data.

Discussion

Prior research shows that creativity, which is critical for children to develop as they move toward adulthood, can be be affected by the educational context in which students learn. The question then centers on which educational environments are most conducive to the development of creativity in children. This study explored the potential of Montessori education to affect creativity in children. Several of its key elements make it likely to affect this construct, particularly the independence and freedom of choice given to children and the lack of extrinsic rewards to motivate them, both of which provide an environment for children to develop creative skills. Past research has supported the notion that components of Montessori education could increase students' creativity.

This study suggests that experience with Montessori education may be related to greater levels of creative potential. This relationship was particularly pronounced for male students, as male Montessori students scored significantly higher on the final EPoC than male non-Montessori students. We were unable to identify why Montessori education may be particularly effective for male students. Future studies should more closely examine the mechanisms through which Montessori education may enhance the creativity of male students.

The findings of this evaluation should not be overstated. While this study provides some evidence that Montessori education may enhance creativity, the analyses suggest no statistically significant differences between Montessori and traditional students for most of the results presented here. For example, we found insignificant interaction effects between Montessori participation and race and poverty status. Further, because the positive relationship between the main effect of Montessori participation and final EPoC score was statistically significant at the $p < .10$ level (two-tailed), readers should interpret this association with caution. The marginal statistical significance can be partially explained by the small sample size, as the estimated effect size of Montessori participation was near the mean effect size of education evaluations of a similar type. The Montessori advantage on the divergent-exploratory component of the EPoC and the higher final EPoC score for male Montessori students compared to that of male traditional students was significant at the $p < .05$ level (two-tailed), and the effect sizes were substantively important.

Like all evaluations of this type, this study has limitations. First, creativity, by its very nature, is difficult to study and measure. The use of the EPoC in this study allowed us to

examine both divergent and convergent creativity with a validated instrument, but it was limited to graphic–artistic tests. Other researchers may prefer different measures of creativity than what was analyzed here. Additionally, only one public Montessori program in a rural school district in the southeastern United States, with 77 third-grade Montessori students, participated in this study. It is unclear if the results of this study would apply to Montessori students in different grades, different types of Montessori schools (e.g., private vs. public), and different locations (e.g., urban vs. rural). Further, the small sample size limited the power of the study and made subgroup analyses particularly challenging. The non-experimental nature of this study is the final significant limitation. As noted above, unobserved selection bias in the form of omitted variables threatens the internal validity of this study. Because a randomized control trial was not feasible, the research team chose a comparison school that was demographically similar to the Montessori school; the team also used important covariates in a multivariate analysis to try to mitigate the problem of selection bias. Acknowledging that selection bias may exist despite these efforts, we provided robustness checks, which quantified how large selection bias would need to be to invalidate the result.

In reviewing means of measuring the efficacy of models in pre-K–12 education, such as Montessori education, many researchers have begun to realize the importance of including measurements of social-emotional skills, such as creativity, in any comprehensive study. Although the importance of these types of skills is recognized intuitively, longitudinal research also has confirmed that such qualities predict academic, social, psychological, and physical wellbeing (Duckworth & Yeager, 2015). The findings of this study, which suggest that Montessori students perform better on an assessment of creativity, add to the body of research supporting creative development in Montessori children and suggest that researchers should continue to focus on the measurement of creativity in studies related to the efficacy of Montessori education.

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A Natural History of Repetition

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Keywords: *repetition, preschool-aged children, Montessori*

Abstract: The purpose of this study was to understand typically developing children's repetitive behavior in a free-play, daycare setting. By studying repetition in a non-Montessori setting, we tested the assumption that repetition is a characteristic behavior of all young children and not limited to the Montessori environment. Although Maria Montessori identified repetition during her observations, there is little empirical evidence to support her claim: most research has considered repetition in terms of psychopathology. We collected naturalistic observational data on 31 3- to 6-year-old children for a total of 101 hours to investigate the frequency, contexts, and structure of repetitive bouts. Multilevel model results suggest the ubiquity of repetition, as all children in the study engaged in motor repetition. Furthermore, repetition occurred throughout all free-play activities (construction, animation, fantasy play, rough-and-tumble play, and undirected activity), although repetition was not equally distributed across activities. Motor repetition was not equal across ages either; younger children engaged in more motor repetition than did older children. To understand the structure of repetition, our study also looked at the length of repetition bouts, which ranged from 2 to 19 repetitions and averaged 2.86 repetitions per bout. This natural history of repetition is an influential starting point for understanding the role of repetition in development and is informative to both Montessori and non-Montessori early childhood educators.

Scientific Origins of the Montessori Method

Montessori education presents a distinct alternative to mainstream education programs and is known for its multiage classrooms, provision of developmentally appropriate learning materials (M. Montessori, 1966; M. Montessori, 1948/2007b), emphasis on developing children's ability to learn independently (M. Montessori, 1948/2007b), freedom to choose and engage with work at children's own pace (M. Montessori, 1918/2007a; M. Montessori, 1948/2007b), and acquisition of the social skills needed to cooperate and coordinate with others (M. Montessori, 1967/1995; M. Montessori, 1972/2007c). These components of child-centered education are advertised on Montessori websites, along with the claim that Montessori education is scientifically supported (Montessori Alberta, n.d.; Montessori & Me Private Schools of Edmonton, n.d.; Mosaic Montessori Academy, n.d.; Montessori School of Calgary, n.d.); emphasizing that Maria Montessori was a scientist (Montessori Alberta, n.d.; Montessori Children's House Academy, 2019; Montessori Children's House, 2019; Rising Scholars Montessori, n.d.; One World Montessori School, n.d.; Sunflowers Bilingual Montessori Centre, n.d.).

Such claims of Montessori education's scientific origins are not new; Dr. Montessori herself, who began developing her educational Method in the early 1900s, promoted her work as scientifically based. Specifically, Dr. Montessori posited that, unlike previous pedagogies that were based on the "good sense" (M. Montessori, 1918/2007a, p. 57) of instructors, her new pedagogy belonged in the realm of modern science:

> *The "method," which informs* [this new pedagogy]—*namely experiment, observation, evidence or proof, the recognition of new phenomena, their reproduction and utilization—undoubtedly places it among the experimental sciences.* (M. Montessori, 1918/2007a, p. 58)

Dr. Montessori's pedagogy was founded on the idea that children, directed by internal impulses, seek out activities that satisfy their developmental needs (M. Montessori, 1967/1995; M. Montessori, 1918/2007a). Developmentally appropriate activities could be identified by observing children's behavior; tasks that children tended to repeat and that elicited high levels of concentration were considered to fulfill a developmental need. Dr. Montessori adopted this view after observing a young girl in the original Children's House in the San Lorenzo quarter of Rome (1918/Montessori 2007a). The girl, around three years of age, was working with the learning material known as the Cylinder Block (i.e., a wooden block with cylinder cutouts of varying size). The girl was repeating her work with the blocks—removing the cutouts and replacing them in the block—with intense concentration. Dr. Montessori counted the number of times the girl repeated the task while also attempting to distract the child by recruiting other children to march around the girl as she worked. When this was unsuccessful, Dr. Montessori picked up both the girl and her chair. This distraction attempt was also ineffectual; the girl clutched the materials on her lap and continued working. When the girl finally stopped working on the task of her own accord, "she looked round with a satisfied air, almost as if awaking from a refreshing nap" (M. Montessori, 1918/2007a, p. 54). By the time the child had finished, Dr. Montessori had counted 44 repetitions.

This anecdote is part of the narrative recounting the origins of the Montessori Method and describes how repetition first came to Dr. Montessori's attention. After her original observation, she began to notice that repetition was "common to all and nearly constant in all their actions" (M. Montessori, 1966, p. 120). Repetition was thus installed as a central concept in Montessori theory and was later classified as a human tendency by her son, Mario Montessori (M. M. Montessori, 1956). Dr. Montessori claimed that the tendency to repeat was driven by nature and occurred spontaneously because of a powerful and irresistible energy (M. Montessori, 1918/2007a; Standing, 1957/1998). Unlike other educational theories of the time that proposed that children needed to be molded into respectable adults (M. Montessori, 1918/2007a), Montessori theory advocated that children's inherent nature be the guide: there is a natural plan to development that unfolds when children are given the opportunity to develop without interference (M. Montessori, 1966). The adult's role, therefore, is to observe and present children with developmentally appropriate materials (M. Montessori, 1918/2007a; M. Montessori, 1948/2007b).

Dr. Montessori described the material-selection process as "psychical" (M. Montessori, 1918/2007a, p. 59) experimentation. Materials of "every kind of quality" (M. Montessori, 1918/2007a, p. 58) were presented to children; only variations in color and size were mentioned specifically. The developmental usefulness of a material was assessed by children's reactions to it; to be included in the learning environment, the material needed to elicit concentration and repetition (M. Montessori, 1918/2007a).

Despite describing her experimental process as "laborious, prolonged, and exact" (M. Montessori, 1918/2007a, p. 57), Dr. Montessori did not provide detailed methods of how she collected her data. To our knowledge, there is no operational definition of concentration, which is necessary for others to replicate her work, nor is there any indication of the number of repetitions needed for an activity to be considered developmentally advantageous. There is also no information on how many children were tested; Dr. Montessori reported simply that there were "a number of children" (M. Montessori, 1918/2007a, p. 58). Finally, Dr. Montessori did not explain the process of varying material qualities other than providing a single example; she described varying the size of the Geometric

Solids (i.e., 10 blue, wooden, three-dimensional shapes intended to refine tactile awareness) to determine which set children found most attractive. Thus, not only are procedural details scanty but empirical results are completely absent. Readers have access only to Dr. Montessori's interpretation of her findings. Granted, today's expectations for empirical evidence differ from those of the early 1900s when Dr. Montessori conducted her research; however, as Montessori advocates claim the Montessori Method is scientifically supported, it is necessary to test her findings according to today's scientific requirements. This is the case not only for the material-selection process but for all aspects of Dr. Montessori's developmental theory.

During Dr. Montessori's early observations, which ultimately led to the establishment of her Method, she observed behavior not typically attributed to young children (Standing, 1957/1998). In addition to repetition and concentration, she observed children's capability to choose, discipline, love of work, love of silence, indifference to reward and punishment, and sense of dignity (M. Montessori, 1966; Standing, 1957/1998). She concluded that children engaging in these behaviors were expressing their true natures. As with her descriptions of learning-material selection, however, no evidence is available indicating how often these behaviors occurred or whether they were spontaneous.

All of the behaviors that Dr. Montessori identified as expressions of children's true nature thus require empirical study, but repetition is a reasonable starting point because of its importance in Montessori theory. Repetition is a frequently reported characteristic of children's nature or, at least, it is often recounted as such because it is inextricably tied to the origin of the Montessori Method (M. Montessori, 1966; M. Montessori, 1918/2007a; Standing, 1957/1998). Its importance in day-to-day practice also makes repetition an important topic for scientific investigation. In the Montessori Primary training of one of the authors, repetition was said to foster skill acquisition across the Primary learning activities.[1] Repetition thus serves a functional purpose in the Montessori environment and has a considerable impact on children's learning and development.

[1] All cited curriculum material is from Association Montessori Internationale Primary Training.

Repetition Research

Current research does little to support the argument that repetition is a natural tendency, which may be caused by the focus of repetition research on atypical rather than typical development. Although we did not perform a systematic review of the repetition literature, we conducted an informal search of a number of psychology databases, discovering that the majority of literature focuses on cases of psychopathology, such as obsessive-compulsive disorder (Eilam, 2015; Radomsky, Dugas, Alcolado, & Lavoie, 2014) and autism spectrum disorder (Bodfish, Symons, Parker, & Lewis, 2000; Honey, Leekam, Turner, & McConachie, 2007; Mooney, Gray, & Tonge, 2006; Turner, 1999). Research on typically developing children, however, is limited, and what is available concerns mostly repetition during infancy. For example, Piaget (1952) commented on repetitive motor behavior in infants, which was later empirically supported by Thelen (1979, 1980, 1981), who identified 47 motor patterns involving legs, feet, arms, hands, fingers, head, and torso in infants. To our knowledge, repetition among typically developing children is limited to a survey conducted by Evans et al. (1997), which asked parents about their typically developing children's compulsive-like behavior (including repetition) in infancy and preschool. Parents reported repetitive behavior in their children's daily activities, with repetition peaking between 12 and 47 months of age. Although this study is based on parental reports rather than researchers' observations of children's repetition, it does provide a starting point for the study of repetition as characteristic preschool behavior, in other words, empirical evidence for the age groups most prone to repeat tasks, which is unavailable in Montessori theory.

Dr. Montessori's original research does not provide the procedural details and empirical support required by today's scientific standards. It would be unfair, however, to expect the same level of scientific rigor that we see today; scientific reporting and research techniques from the 1900s differ from those that are commonplace today. For example, the academic journal *Child Development* recently published methodological recommendations for high-quality, reproducible research, recommending that sample recruitment and selection, data collection and coding, descriptive statistical information, and model specification be included in empirical research papers (Coll, n.d.). Although these contemporary

expectations for scientific reporting are not present in Dr. Montessori's research, she was not alone in the way she reported on her methods. Piaget similarly provided scant procedural details in his classic work (Bond & Tryphon, 2009). Today, such details are obligatory: all methods and procedure must be reported so other researchers can evaluate them and try to replicate them in their own studies. With respect to the kinds of observational techniques Dr. Montessori employed, it was not until the late 1960s that ethologists (i.e., scientists who study behavior in naturalistic settings) developed methods for systematic observation that were able to address concerns about time sampling and reliability (Smith & Connolly, 1980). It is also important to note that Dr. Montessori's main goal in observing children's behavior was not research, but rather to inform practical application in a classroom setting (M. Montessori, 1918/2007a).

Thus, while it is inappropriate to criticize Dr. Montessori's research by applying current scientific standards, it is still necessary to address whether her educational and developmental claims stand up to scientific scrutiny. As already noted, Montessori proponents claim that Montessori education is based on scientific study, and it is promoted as an evidence-based approach to schooling. As we have seen, however, Dr. Montessori's original work provided anecdotes of children's so-called characteristic behaviors but did not provide measures of variation in behavior or of the frequency and contexts in which behavior occurs. Consequently, Montessori guides (particularly new guides with less experience) have little guidance on the amount of repetitive behavior to expect. For example, in the Montessori Primary education training of one of the authors, future guides were taught that developing refined movement required "prolonged repetition."[2] This lack of specificity can be considered advantageous as it allows guides to make judgments on a case-by-case basis; again, in the same author's training, it was acknowledged that some work does not elicit as much repetition as others (for example, the Teen Boards). The problem, however, is that the expectation of repetition rests on anecdotes; in other words, we currently have no idea whether repetition is, in fact, characteristic behavior of young children. This, in turn, means that we have no idea whether Montessori education simply capitalizes on children's tendency to repeat actions as a way to enhance learning or whether the use of repetition represents the application of a particular kind of pedagogy in the Montessori classroom. A more-detailed, scientific understanding of central concepts like repetition and concentration can provide Montessori guides with valuable information on prevalence and variability within and between children and determine whether intense repetition is, in fact, a spontaneous feature of children's engagement with learning materials.

Furthermore, current academic literature on repetition is limited, focusing almost exclusively on repetition as a psychopathological behavior. Pathological studies of repetition report repetition as nonfunctional, or even detrimental, differing from the type of repetition Dr. Montessori described. In the Montessori context, repetition is considered typical (as opposed to psychopathological) and developmentally advantageous. It is necessary to differentiate types of repetition, first by determining whether observable differences exist. Not only would differentiating repetition types benefit child educators, but recognizing structural differences between pathological and developmentally typical repetition may improve psychologists' ability to accurately diagnose autism spectrum disorder and obsessive-compulsive disorder. Recognizing structural differences between types of repetition can then lead to studying the functional aspects of repetition, such as whether developmentally typical repetition facilitates skill development.

Aims of the Present Study

The aim of the current study was to gather data on the natural history of repetition—an account of spontaneously occurring repetition among children. To do so, we conducted an exploratory observational study of children in a non-Montessori, free-play daycare setting as a means of answering questions concerning children's spontaneous repetitive behavior and how it compares to Dr. Montessori's famous anecdote. By conducting our study at a free-play daycare rather than in a Montessori environment, we could address the assumption that repetition is characteristic behavior in all young children; if it is a natural tendency, we can expect repetition to occur outside of the Montessori environment. Free-play daycare provides an appropriate environment to test this assumption as children's activities are unguided during

[2] Curriculum material from Association Montessori Internationale Primary Training.

free-play periods. During such periods, children are free to engage with any of the classroom materials and to decide how to engage with the materials, (i.e., materials do not have a prespecified use or learning goal; Santer, Griffiths, & Goodall, 2007). This is in contrast to Montessori environments, in which each set of materials has a purpose. Furthermore, Montessori guides demonstrate how to use the materials, and children can engage only with materials that the guide has presented them.

Conducting our research in a free-play environment allowed us to examine the spontaneous nature of repetition by observing children when there were few restrictions on their behavior. We first predicted that all children would engage in repetition (Prediction 1). This prediction is supported by Dr. Montessori's claim that repetition was "common to all," (M. Montessori, 1966, p. 120) as well as by her concept of developmental planes. Montessori theory posits that individuals within the same developmental period (i.e., plane) exhibit the same characteristic behaviors (M. Montessori, 1967/1995). As all children in the current study were in the second phase of the first developmental plane, we expected all children to engage in repetition if it is, in fact, a natural tendency of this age group. We further predicted that repetitive behavior would be found across all activities observed in free play (Prediction 2). Prediction 2 is grounded in Dr. Montessori's claim that repetition was "nearly constant in all [the children's] actions" (M. Montessori, 1966, p. 120). To determine whether there were frequency differences across children, we also predicted that children 47 months and younger would engage in more repetition than older children (Prediction 3), based on Evans et al.'s (1997) study. Finally, to better understand the structure of repetitive bouts, we predicted that bouts of repetition would be of a comparable length (i.e., approximately 40 repetitions) to those described by Dr. Montessori (Prediction 4; M. Montessori, 1966).

Methods

Study Site

Data were collected at a not-for-profit daycare center in a Canadian city. The center accommodated 84 children ranging from 12 to 72 months in age and employs 18 full-time staff members. The daycare had a free-play philosophy and differed from Montessori environments in both daily routine and classroom-age composition. Unlike Montessori education's uninterrupted work periods, morning and afternoon play sessions at the daycare were interjected by transition periods (e.g., indoor to outdoor play), snack and nap times, or group activities (see Appendix A for full schedule). Also unlike Montessori education, the daycare segregated classrooms by age. Classrooms observed in this study are given in Table 1 with the corresponding age ranges.

A researcher ("AJ") conducted observations in both the classrooms and a shared outdoor area. Each classroom (Figures 1 through 4) differed in spatial layout but consisted of similar play areas. Children from all four classrooms shared a single outdoor area (Figure 5). The toddler area was fenced off and not accessible to the children participating in the study. Occasionally, children were given the opportunity to play with chalk and bikes or scooters on the deck.

Participants

Thirty-one children, ranging in age from 33 to 72 months (M = 50.94; SD = 11.56), participated in the study. Children had exclusive membership to one age-based classroom (i.e., Jr.1, Jr.2, Senior, Kinder). Children were randomly selected for focal sampling (i.e., consent was general, but only a sample of children were included in the study). There were some limitations to random selection, however; children who were not available for the entire study period, as indicated by the daycare

Table 1
Classroom, Adult–Child Ratio, Age Range, and Number of Children

Classroom	Adult–child ratio	Age range (months)	*n*
Jr.1	1:5	33–40	10
Jr.2	1:7	41–49	14
Senior	1:8	50–60	16
Kinder	1:10	61–72	20

Figure 1. Layout of Jr.1 classroom.

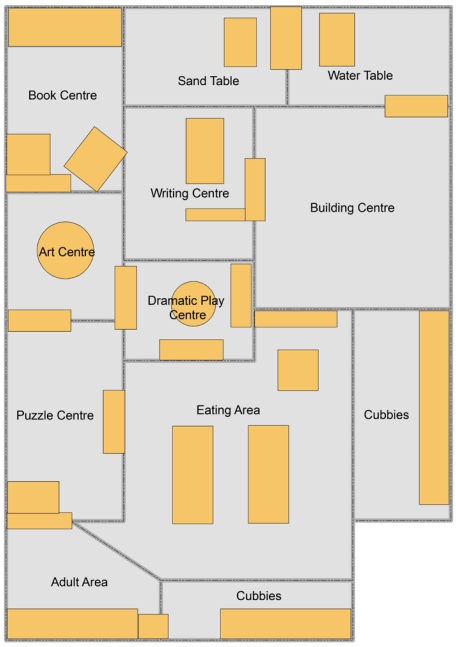

Figure 3. Layout of Senior classroom.

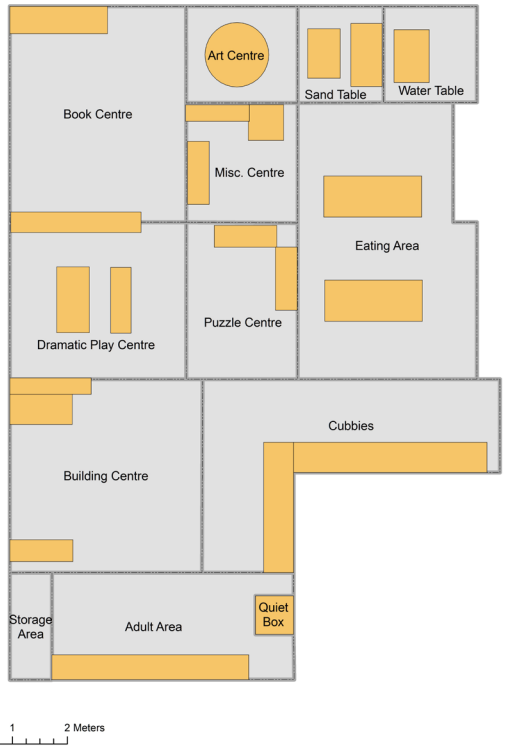

Figure 2. Layout of Jr.2 classroom.

Figure 4. Layout of Kinder classroom.

Figure 5. Layout of outdoor play area.

director, were not included in the sampling pool. Two children were excluded from analysis because they changed classrooms during the study.

Data Collection Procedure

Naturalistic observational data were collected during free play over 8 weeks, for a total of 101 hours. Free play was considered to occur any time children freely chose to engage in play activities; that is, the child chose the activity, how to engage with it, and for how long. Thus, free play did not have external goals put in place by childcare workers but was child led (Santer et al., 2007). Data were not collected during activities such as circle time, snack time, and designated craft time. However, optional, nondirected activities set out by adults, featuring materials such as play dough or coloring sheets, were included as free play since participation was not mandatory.

Pilot data were collected over a 7-day habituation period. The purpose of this period was to accustom the children to a researcher in the classroom. The researcher sat unobtrusively out of direct traffic but in view of the child under observation (i.e., *focal child*), changing locations if the focal child moved out of view. By the end of the habituation period, the children no longer seemed interested in the researcher's presence since they stopped attempting to interact with her. The short habituation period may be the result of practicum students and support workers often observing children in the classroom. However, the researcher still attempted to observe the children inconspicuously by glancing rather than fixating her gaze on the focal child.

During each *focal follow* (i.e., observation period in which one child was continuously observed), detailed action descriptions were recorded on an iPhone 4 using a Microsoft Excel spreadsheet designed for data collection (see Appendix B). An example action-description sequence for a child during outdoor play may be: scoop rocks from path with shovel; dump rocks into bucket; run to slide; dump rocks out of bucket; go down slide. This example action sequence would be a portion of a longer observation period, or focal follow. Location (i.e., indoor or outdoor) and companions (Table 2) were recorded for each action description.

Focal follows lasted 20 minutes, but it was common for children to leave the observation area during follows. If a child left during the focal follow, data collection was paused for a maximum of 10 minutes. If the child did not return within the 10-minute period, the focal follow ended and a new focal follow of a different child began. Focal follows under 5 minutes were excluded from analysis. Mean duration of focal follows was 18.8 minutes, with a standard deviation of 6.6 minutes. Total observation times per child ranged from 157 to 210 minutes.

Coding Procedure

Following observation sessions, action descriptions were coded according to operational definitions (see Appendix C). A second researcher later coded 20% of the action descriptions. Interobserver reliability was found to be 87% (i.e., the number of agreed codes/total codes × 100). Action codes were then classified according to the kind of play activity involved; each action was therefore part of a higher level of organization called an *event* (see Appendix D). *Undirected* events included random manipulation of objects. *Construction* events involved building a structure from multiple parts, such as art activities or block/puzzle building. *Fantasy play* involved as-if, pretend-play scenarios, such as playing house. *Animation* involved animating inanimate objects, such as pretending figurines

Table 2
Companion Categories

Category	Criteria
Alone	No other children or adults in play area
Child–child pair	One other child in play area
Adult–child pair	Adult in play area
Small child subgroup	≤2 other children in play area
Large child subgroup	≥3 other children in play area
Small adult–child subgroup	Adult and ≤2 other children in play area
Large adult–child subgroup	Adult and ≥3 children in play area

or stuffed animals were alive. As we were interested in differences between motor and object-manipulation repetition, animation events, which necessitate object use, were coded separately from fantasy play events. *Rough-and-tumble play* was social play involving nonaggressive physical contact, such as grappling or wrestling. A second coder coded 20% of the original data. Reliability between the researcher and the independent coder was 89% (i.e., the number of agreed codes/total codes × 100) for events.

Although all action descriptions were recorded and coded, only movement actions were included in analysis: object-manipulation actions, which were defined as movements involving objects, and motor actions, which were defined as movements without objects. We limited our study to movement repetition, as that type of repetition was featured in Dr. Montessori's anecdote of the Cylinder Block. Object manipulation and motor repetitions were treated as separate categories to account for repetition differences that may result from learning to deal with objects versus learning to deal with oneself. Action descriptions that did not fall into these categories (e.g., observation, social actions, inactive) were not included in analysis.

Repetition Coding

Repetitive sequences, referred to as *repetition bouts*, were extracted from the data using a VBA macro in Microsoft Excel. Repetitions were recorded when an object manipulation or motor action code was repeated within two actions. The occurrence of three or more nonrepetitive actions was considered an interruption to the repetitive sequence and ended the bout. The researcher reviewed the macro output to ensure that bouts met repetition criteria; all motor and object-manipulation actions were included except actions that were necessary for moving and engaging with objects (e.g., walk, run, pick up, put down). Postural repetitions (e.g., lie, kneel, reposition, sit, stand) also were excluded.

Statistical Analysis

Multilevel models were used for all analyses and were run using the *lme4* package (Bates, Maechler, Bolker, & Walker, 2015) in R version 3.4.0 (R Core Team, 2017). R^2 marginal values were used to assess main effects (i.e., how much of the variance in behavior identified as the dependent variable can be explained by the independent variables), and R^2 conditional values were used to estimate the effect of the full models (i.e., how much of the variance in the dependent variable can be explained by main and random effects). R^2 marginal and R^2 conditional values were generated by the *MuMIn* package (Bartoń, 2016). For more details on multilevel models, see Appendix E.

Distribution of repetition over events

A linear multilevel model (i.e., a multilevel model that assumes a Gaussian distribution) was run to test Prediction 2 (i.e., that repetition would occur across all play events). The dependent variable was actions per minute. Main effects were event, age, and setting. We specified a random effect of "child nested in classroom." Residuals were tested for the assumption of normality using QQ plots, which showed some deviation from normality. Subsequent modeling using a truncated beta distribution suggested no qualitative difference from the Gaussian model; therefore, we report results from the Gaussian model.

Number of repetitive bouts

A Poisson generalized linear multilevel model (i.e., a multilevel model used to deal with count data), was run to test Prediction 3 (i.e., that there would be a difference in the amount of repetition by age). Number of repetitive bouts per focal follow was the dependent variable. The model included follow duration (in minutes), age, setting, and repetition type (motor or object manipulation) as main effects. To allow for the possibility that children of different ages react differently to changes in setting with either object manipulation or motor repetition, a three-way interaction between, age, setting, and repetition type was included in the model. We specified "follow ID nested in child, nested in class" as the random effect. The model did not converge with the default optimization algorithm for *lmer* (nelder-mead); therefore, the bobyqa optimizer (Ypma, 2014) was used to allow convergence. The *DHARMa* package in R was used to test residual assumptions (Hartig, 2017), and revealed overdispersion and zero inflation in the data (for more information, see Appendix F). Overdispersion and zero inflation were removed by creating observation-level random effects, in other words, giving each data point a unique ID that could be included in a new grouping variable (Harrison, 2014).

This full model was compared to a partial, spontaneous repetition-bout model in which only spontaneous, repetitive bouts were included in the dependent variable. Repetitive bouts were coded as spontaneous if there was no observable outcome beyond the repetitive actions themselves or if the outcome did not require repeated action (see Appendix G for coding criteria). The purpose of the partial model was to determine whether there were differences by repetitive-bout type, in other words, differences between activities that require repetition (e.g., filling a bucket) and activities that need to be done only once for completion (e.g., going down a slide). There was no difference between the full and partial model; therefore, the full model is reported in the results (see partial model in Appendix G).

Results

Of 321 focal follows, 265, or 82.6%, contained repetitive activity (either object manipulation or motor repetition or both). The average rate of total repetition per focal follow was 0.08 bouts per minute (i.e., one repetition bout every 12.5 minutes). The average rate of object-manipulation repetition per focal follow was 0.14 bouts per minute (i.e., one object-manipulation repetition bout every 7 minutes). The average rate of motor repetition per focal follow was 0.02 bouts per minute (i.e., one motor repetition bout every 50 minutes). Other relevant descriptive statistics can be found in the Methods section.

Prediction 1: Repetition Across Children

All children engaged in at least one form of repetition (Figure 6). All children performed object manipulation, the most frequently occurring type of repetition (Figure 7). Not all children, however, engaged in motor repetition (Figure 8); four children in total (two Jr.2 children and two Senior children) did not engage in any motor repetition during the study period. This is not surprising, however, as the overall frequency of motor repetition was low.

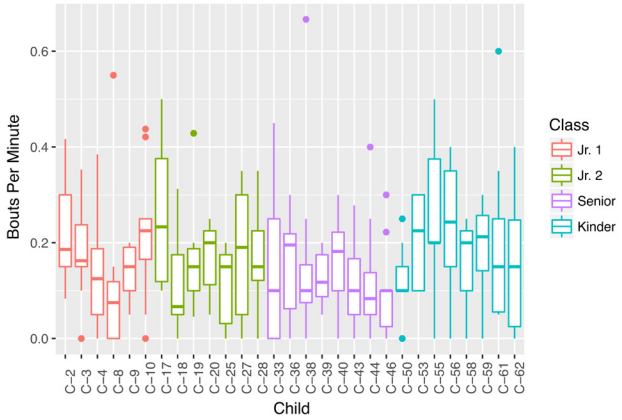

Figure 6. Total number of repetitive bouts per minute.

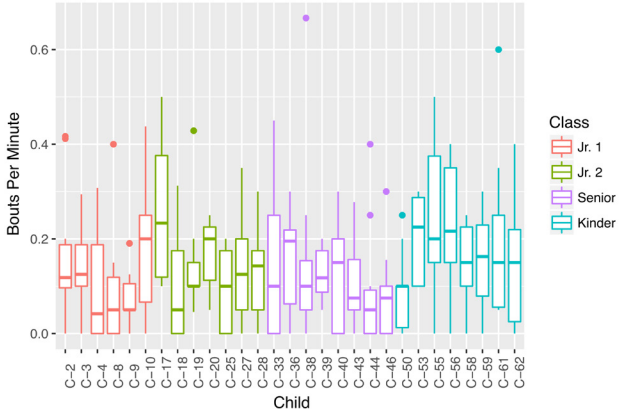

Figure 7. Number of object-manipulation repetitive bouts per minute

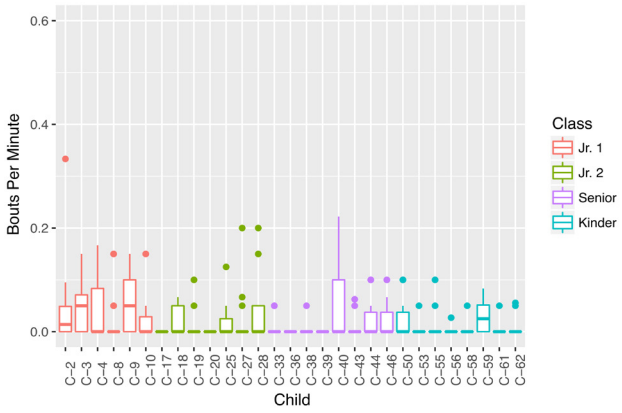

Figure 8. Number of motor repetitive bouts per minute.

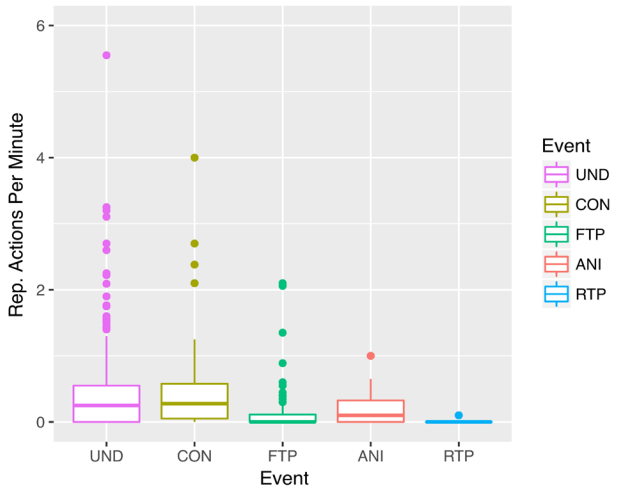

Figure 9. Repetition actions per minute by event.

Prediction 2: Distribution of Repetition Over Events

In line with our prediction, we found that children engaged in repetitive activity across all events (undirected, construction, animation, fantasy play, and rough-and-tumble play; see Figure 9); however, modeling the amount of repetitive activity by event demonstrated that repetitive activity was not equal across events. This is to be expected as overall activity in each event differed (events also differed in the amount of nonrepetitive actions; Figure 10), but even when taking the proportion of repetitive activity (repetitive actions/total actions) in each event into account, repetitive activity was not equal over events (Figure 11); that is, there were higher frequencies of repetition in some events over others.

Construction and animation had the highest proportions of repetitive activity. Repetition occurred for 31.6% (*SE* = 3.0%) of total actions in construction and 26.4% (*SE* = 8.7%) of total actions in animation (see Table 3). Less repetition was observed in fantasy play and

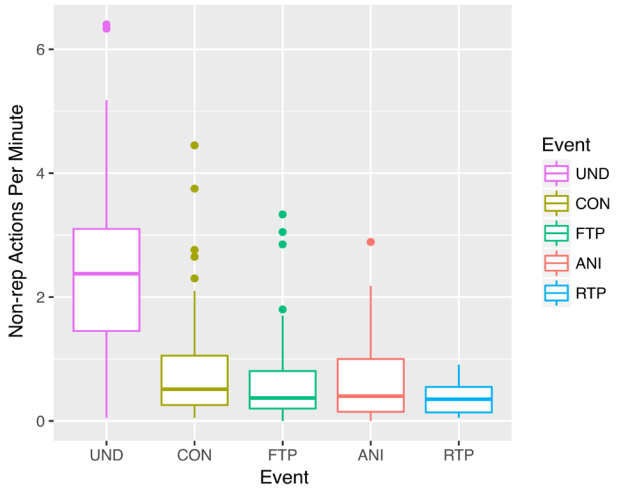

Figure 10. Nonrepetition actions per minute by event

Table 3
Events Linear Multilevel Model Main Effects

Main effects	ß value	*SE*	*t* value	*p* value
Intercept (REF:Animation)	0.26	0.09	3.04	.03
Age	-0.00	0.00	-0.27	.80
Setting (REF:indoors)	0.04	0.02	1.77	.08
Undirected	-0.12	0.03	-4.12	< .01
Construction	0.05	0.03	1.74	.08
Fantasy play	-0.10	0.03	-3.05	< .01

Note. REF = reference

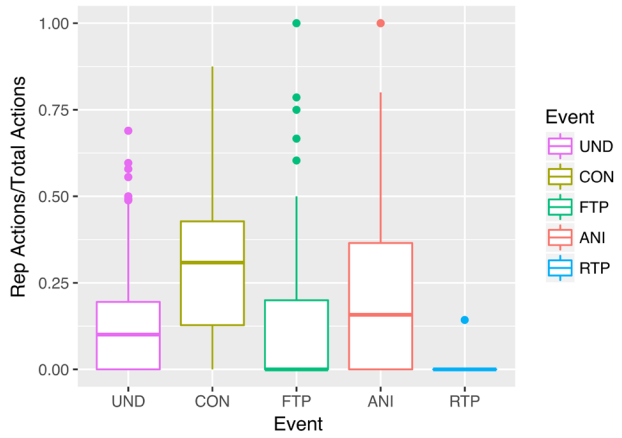

Figure 11. Proportion of repetitive actions to total actions.

undirected activity, where repetition accounted for 16.9% (*SE* = 3.1%) of total actions in fantasy play. The least amount of repetition occurred in undirected activity, at 14.8% (*SE* = 2.8%) of total actions being repetitive). Rough-and-tumble play was excluded from statistical analysis as there was only one incident of repetition in that event.

Overall, the model explained 18% of the variance (Tables 3 and 4). The random effect of child nested in class accounted for 6% of that variance (R^2 marginal value = .12; R^2 conditional value = .18).

Prediction 3: Number of Repetitive Bouts

Model comparison demonstrated no qualitative differences between the full number of bouts model and the spontaneous number of bouts model (see Appendix D for spontaneous bout model). Therefore, we used the full model in our analysis. The full model is displayed in Table 5 (main effects) and Table 6 (random effects). As predicted, there was a small, negative effect of age: younger children engaged in more repetitive activity than older children in both the indoor and outdoor setting, but the effect of age was found only for motor repetition (see Figure 12 for a visual representation of this interaction term). The random effects (Table 6) did not account for any additional variance beyond that explained by the main effects, but the full model was able to explain 53% of the variance in the number of repetitive bouts (R^2 marginal value = .53; R^2 conditional value = .53).

Table 4
Events Linear Multilevel Model Random Effects

Random effects	Variance	*SD*
Child:class (Intercept)	< 0.01	0.03
Class (Intercept)	< 0.01	0.04
Residual	0.03	0.18

Table 5
Number of Repetition Bouts per Focal Follow: Poisson Generalized Linear Multilevel Model Main Effects

Main effects	ß value	*SE*	*z* value	*p* value
Intercept	-1.52	0.14	-10.52	< .01
Follow duration	0.31	0.05	6.77	< .01
Age	-0.53	0.13	-3.95	< .01
Setting (REF: indoor)	0.57	0.25	2.28	.02
Rep. type (REF: motor)	2.35	0.15	15.63	< .01
Age*Setting	0.08	0.25	0.32	.75
Age*Rep. type	0.61	0.15	4.20	< .01
Setting*Rep. type	-0.89	0.28	-3.18	< .01
Age*Setting*Rep. type	-0.08	0.28	-0.29	.77

Note. REF = reference; Rep. = repetition.

Table 6
Number of Repetition Bouts per Focal Follow: Poisson Generalized Linear Multilevel Model Random Effects

Random effects	Variance	*SD*
Number of observations	0.37	0.61
FollowID:ChildID:Class	< 0.01	< 0.01
ChildID:Class	< 0.01	< 0.01
Class	< 0.01	< 0.01

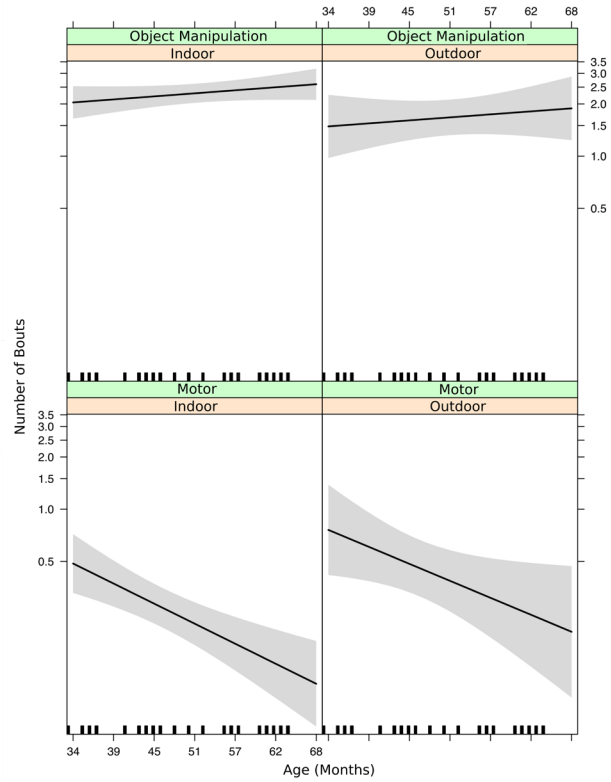

Figure 12. Interaction plot for age, setting, and type of repetition.

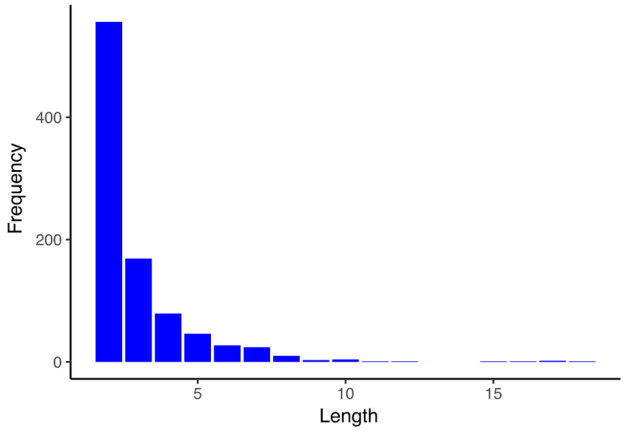

Figure 13. Frequency of repetition-bout length.

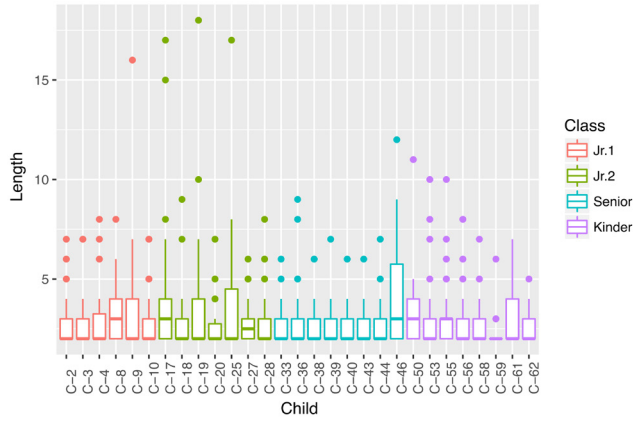

Figure 14. Repetition-bout length by child.

Prediction 4: Repetition-Bout Length

Repetition bouts tended to be short rather than long (M = 2.97 actions; SD = 1.82 actions) and ranged from two to 18 repeating segments (Figure 13). Bout lengths were similar across ages (Figure 14).

Discussion

This study provides empirical support to Dr. Montessori's assertion that repetition is characteristic behavior in preschool-aged children. Predictions 1 and 2, which addressed general statements Dr. Montessori made about repetition, were confirmed. First, as predicted, all children engaged in repetition. Not all children, however, engaged in both types of repetition; while all children engaged in object manipulation (i.e., the most common type of repetition), four (two Jr.2 children and two Senior children) of the 28 children did not engage in any form of motor repetition. Considering the overall low level of

motor repetition, however, it is not surprising that some children did not engage in it during the study period. Although we were interested in possible differences between motor and object-manipulation repetition, Dr. Montessori did not refer to any particular form of repetition, and, consequently, we did not specify repetition type in our prediction. Therefore, our prediction that all children would engage in repetition was confirmed.

Our intent with differentiating between repetition types was to establish whether there was a difference in repetition for learning to deal with objects versus learning to deal with one's body. There was a clear difference in the frequency of repetition types, in which object manipulation made up the majority of overall repetition. When considering the role that repetition may play in skill development, the low level of motor repetition may be due to object-manipulation repetition fulfilling skill development in both of these areas. That is, one could hypothesize that object-manipulation repetition develops both the gross and fine motor skill required for manipulative and nonmanipulative motor activity.

Prediction 2, which hypothesized that children would engage in repetition in all events, was based on Dr. Montessori's claim that repetition was "nearly constant in all [the children's] actions" (M. Montessori, 1966, p. 120). We found that children engaged in repetition during all five event categories we considered (i.e., undirected, construction, animation, fantasy play, rough-and-tumble play). There was only one instance of repetition in rough-and-tumble play, however. Rough-and-tumble play is a social activity involving repeated physical contact, and it is expected that repetitions in this event category would largely be social repetitions. As our study recorded only motor and object-manipulation repetition, it is not surprising that we observed just one repetition during rough-and-tumble play. Future work is needed to describe possible types of repetition not included in the current study.

Our study suggests that future work is also needed for understanding how different contexts can affect repetition. Although repetition occurred in all events, we found that the proportion of repetition (i.e., number of repetition actions/total actions) was not equal across events; construction and animation had higher proportions of repetition than fantasy play and undirected events. Therefore, it seems as though some feature of construction and animation elicits more repetition than the characteristics of fantasy and undirected play. In terms of skill development, the difference in object manipulation and motor repetition across contexts may be explained by two possibilities. First, it may be that some skills (e.g., coordination skills required for stacking blocks) are better acquired through repetition, thus increasing the amount of repetition in events that feature that type of skill development. Second, low levels of repetition may be explained by certain skills not requiring as much repetition as others to gain mastery. Consequently, repetition is lower in events that feature that type of skill.

Prediction 3 hypothesized that the younger children in the study would engage in more repetition than the older children. Model comparison was used to determine whether there was a difference between outcome-oriented and spontaneous repetition bouts that required them to be analyzed separately; in other words, outcome-oriented and spontaneous repetition could not be considered a single category. After all, it could be argued that since outcome-oriented repetition tasks necessitate repeated action (i.e., repetition is motivated by the nature of the task) outcome-oriented repetition qualitatively differs from spontaneous repetition, which may better represent repetition for the purpose of skill development. As the model comparison found no difference between the full and spontaneous models, however, all repetition bouts were included in final analysis.

The results supported our prediction that younger children would engage in more repetition than older children; however, the age effect was present only for motor repetition. This suggests an interesting difference in the type of activities that children repeat, particularly when considering repetition for the purpose of skill development. All children in our study displayed equal frequencies of repetition with respect to object manipulation. In terms of motor repetition, however, younger children had higher frequencies. It may be that younger, but not older, children are developing motor skills that require repetition. These results highlight a potentially important difference in how children of various ages use repetition to develop specific skills.

Although there was an effect of age in motor repetition, the effect was small. From a Montessori perspective, this may be explained by developmental plane. Dr. Montessori proposed a stage-like theory of development, which describes distinct periods of mental and physical growth (M. Montessori, 1967/1995). She based her theory of developmental planes on the observation that as children age, they undergo qualitative, rather than quantitative, changes, in other words, changes in kind rather than degree. Dr. Montessori (1967/1995) posited that the characteristics of each plane are fundamentally different from other planes, to the extent that progressing from one plane to the next can be described as a rebirth. Within each phase, children engage in the same behaviors and undergo similar developmental achievements that are unique to that stage. Children between the ages of 3 and 6 are in the second plane of development; during this plane, they are constantly acting on the environment as a means of self-construction or, as Dr. Montessori (1967/1995) expressed it, internalizing their outward experience. As children in this study were all in the same developmental plane, we would expect to observe characteristic behaviors of this age group behavior across all children. This does not mean, however, that frequency differences do not occur. After all, the theory of developmental planes suggests qualitative rather than quantitative changes within a stage.

Prediction 4 hypothesized that repetition bouts would be comparable to the long bouts described in Dr. Montessori's Cylinder Block anecdote (M. Montessori, 1966; M. Montessori, 1918/2007a). Against prediction, repetition bouts tended to be short rather than long, with an average bout length of 2.97. Even the longest bout of 18 repetitions did not approach the 40 repetitions described by Dr. Montessori. Although these results did not match the bout length described in the anecdote, short bouts of repetition are consistent with practice research, which suggests that short, distributed intervals are better for long-term learning than massed practice (Gerbier & Toppino, 2015; Lee & Genovese, 1988; Schutte et al., 2015). If repetition is a self-initiated strategy for learning, it is reasonable to suppose that repetition would be similar to practice patterns known to aid learning. Future work could further examine repetition-bout structure and compare it to other practice patterns known to aid learning, such as practice variability.

Our results may have differed from bout length in the Cylinder Block anecdote due to differences between Montessori and free-play environments. First, there is a fundamental difference between the work done in Montessori classrooms and the activities in free-play environments. Unlike free-play environments, where freedom to choose how to engage with materials is one of its defining features, Montessori work involves sets of materials with specific uses and learning goals.[3] For example, the purpose of the Cylinder Block is to teach children how to discriminate size. Additionally, the Montessori guide introduces each activity by demonstrating the series of steps the child is expected to perform, which may affect the length of repetitive bouts, as well as other structural aspects of repetition. For example, repetition in Montessori environments may be event-like, in which a whole sequence of activities is repeated, whereas free-play daycare repetition may feature shorter, individual action repetitions (as recorded in this study).

Another possible reason the repetitive activity we observed differed from the Cylinder Block anecdote is an absence of prolonged concentration among children in the free-play environment. Dr. Montessori described the young girl to be in deep concentration while repeating the Cylinder Block activity, to the extent that she could not be distracted (M. Montessori, 1966; M. Montessori, 1918/2007a). It is possible that long bouts of repetition occur only when high concentration is also present. Thus, it is possible that long bouts of repetition are rare in daycare settings because high levels of concentration are also rare. Most free-play environments do not actively work to develop children's concentration, whereas it is a priority in Montessori education; developing concentration is facilitated through uninterrupted work periods and allowing children to work without social interference.[4] The absence of long repetitions in the daycare setting leads to the question of whether repetition and concentration are truly natural tendencies or behaviors elicited by particular learning environments. To verify that repetition and concentration are, in fact, natural tendencies, these behaviors must be observed across settings and under varying circumstances.

[3] Curriculum material from Association Montessori Internationale Primary Training.
[4] Curriculum material from Association Montessori Internationale Primary Training.

Refuting the prediction that bout length would be similar to the bout in the Cylinder Block anecdote does not disprove Dr. Montessori's theory of repetition. Rather, it demonstrates that her classic repetition anecdote was not a typical case of repetition; she likely used this anecdote as an illustrative example rather than a prototypical one. Although the anecdote is striking, practitioners need accurate representations of day-to-day repetition. Knowing the frequency, contexts, and structure of repetition is particularly necessary for new Montessori guides, who have limited practical experience on which to base their understanding of repetition.

The results of this study are informative to both Montessori guides and other early childhood educators. Although repetition is commonly viewed as pathological, our results suggest that repetition is not exclusively a feature of psychopathology, as it is also common in typically developing children. Differences between developmentally typical and psychopathological repetition are likely, however. Whereas pathological repetition is described as purposeless and stereotyped, typical repetition may be more variable if it is performed for the purpose of skill development. Research examining motor-skill acquisition suggests that early movements vary highly but become more stable as skill develops (Barbado Murillo, Caballero Sánchez, Moreside, Vera-García, & Moreno, 2017). Identifying differences in variability between pathological and typical instances of repetition would not only help distinguish between the two types of repetition, but also recognize when and how repetition aids skill development. As the progression from variable to stable movements would indicate the shift from novice to expert, it could help educators recognize if mastery has been achieved and when a child is ready to move on to the next activity.

Limitations and Implications

The current study provides useful information on the context of repetition, who engages in repetition, and the structure of repetition bouts—none of which is currently adequately described in Montessori theory. Continued caution is warranted, however, as the present study is only a single study on a small sample, and its findings need to be replicated. Additionally, there are aspects of the environment in the current study that may have created a natural history of repetition unique to the free-play environment. Therefore, future research could include a comparison to a Montessori environment to determine how repetition looks under these conditions. Differences in types of activities may cause repetition to differ between Montessori and free-play environments. For example, while free-play activities do not have set start and end points, Montessori activities follow a set sequence. Therefore, repetition in free play may comprise individual actions (as recorded in the current study), whereas repetition in the Montessori environment may be more event-like, including a whole sequence of events. Additionally, the schedules between Montessori and free-play environments differ. Montessori environments have an uninterrupted, 3-hour work period, whereas free-play environments have many transition times during the morning and afternoon periods. It may be that longer work periods are more conducive to repetition, as children's activities are not interrupted.

Nonetheless, the current study provides some empirical backing for Dr. Montessori's original claims. Future work can continue to improve descriptions of repetition structure, such as event-like versus individual action repetitions, whether there is a difference between variable and stereotyped repetition, and how repetition is performed under different contexts. The second step in investigating whether repetition is a natural tendency is to establish whether repetition contributes to development and learning. For example, does object-manipulation repetition develop both gross and fine motor skills? And is social repetition a separate category of repetition that develops social skills? An extensive description and thorough investigation into the function of repetition are necessary for determining whether repetition is a natural tendency among young children.

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Appendix A: Daycare Schedule

Time	Activity
07:30	Daycare opens and child drop-off begins; all children begin with free play in Jr.2 classroom
08:00	Children transition to their own classrooms for free play
09:00	Morning snack; children continue free play once snack is finished, i.e., overlaps with free play
10:00	Snack ends; free play continues
10:30	Children transition from indoor to outdoor free play
11:30	Children transition from outdoors to indoors for lunch
12:00	Lunch
13:00	Nap time for Jr.1 and Jr.2; free play for Senior and Kinder
15:00	Afternoon snack/free play; child pick-up begins
15:30	Children transition from indoor to outdoor play
18:00	Daycare closes

Appendix B: Data Collection Spreadsheet

Table B1
Type of Data Collected and Recorded in Spreadsheet

Data type	Explanation
Follow ID	Number
Child ID	Number
Sex	Male or female
Class	Jr.1, Jr.2, Senior, Kinder
Age	Number of months
Time	24-hour clock
Location	Name of center (later used to categorize location as outdoor or indoor)
Companion	See Table 2
Action description	What the child is doing (e.g., scooping rocks from path with shovel)

Figure B1. Example of data collection spreadsheet.

	A	B	C	D	E	F	G	H	I
1	Follow ID	ChildID	Sex	Class	Age (months)	Time block	Location	Companion	Action description
2	1	Child-1	Female	Jr.1	36	9:00	Building centre	Alone	Pick up block
3	1	Child-1	Female	Jr.1	36	9:00	Building centre	Alone	Place block on tower
4	1	Child-1	Female	Jr.1	36	9:00	Building centre	Alone	Pick up block
5	1	Child-1	Female	Jr.1	36	9:00	Building centre	Alone	Place block on tower
6	1	Child-1	Female	Jr.1	36	9:00	Building centre	Alone	Knock tower to ground
7	1	Child-1	Female	Jr.1	36	9:00	In transit	Alone	Walk to art centre
8	1	Child-1	Female	Jr.1	36	9:00	Art centre	Small child subgroup	Sit at table
9	1	Child-1	Female	Jr.1	36	9:00	Art centre	Small child subgroup	Pick up crayon
10	1	Child-1	Female	Jr.1	36	9:00	Art centre	Small child subgroup	Colour on colouring sheet
11	2	Child-4	Male	Jr.1	40	9:10	Dramatic play centre	Child pair	Pretend to stir soup in pot
12	2	Child-4	Male	Jr.1	40	9:10	Dramatic play centre	Child pair	Pretend to eat from spoon
13	2	Child-4	Male	Jr.1	40	9:10	Dramatic play centre	Child pair	Pretend to ladle soup from pot into bowl
14	2	Child-4	Male	Jr.1	40	9:10	Dramatic play centre	Child pair	Give Child-6 bowl
15	2	Child-4	Male	Jr.1	40	9:10	Dramatic play centre	Child pair	Pretend to eat soup
16	2	Child-4	Male	Jr.1	40	9:10	Dramatic play centre	Child pair	Pick up pot

Appendix C: Ethogram

An ethogram is a list of defined behavior codes. The action descriptions collected during focal observations were coded using this ethogram, which was created prior to data collection. As not all behaviors were exhibited during data collection, not all behavior codes were used during coding.

Body Movement Units

- Automanipulation: manipulating oneself (e.g., rubbing eyes or brushing hair, facial movements [sticking out tongue, pouting], touching one's face, putting an object in mouth [includes drinking], or hiding one's face)
- Balance: lifting one or two legs to balance; includes balancing on one leg or buttocks or hanging by hands
- Bend: forward or backward hip flexion
- Crouch: knees bent but weight still on feet
- Fall: going from an upright position to the ground; may be accidental or intentional
- Fine motor motion: single movement of hands or fingers
- Fine motor movement: repetitive or sustained movement of hands or fingers that does not involve manipulating an object
- Gross motor motion: single movement of torso or limbs
- Gross motor movement: repetitive or sustained movement of body or limbs without object (e.g., waving arms up and down through the air, shaking head back and forth [without communicative intent], kicking legs)
- Hands and knees: getting onto hands and knees and remaining stationary
- Hit: extending arm or arms and using one's hand or an object being held to forcefully make contact with another individual or object
- Jump/hop: moving suddenly upward by leg and foot extension, landing on two feet (jump) or one foot (hop)
- Kick: extending one leg suddenly, causing foot to make forceful contact with an object
- Kneel: weight supported on one or both knees and lower legs
- Lie: positioning body horizontally against a surface
- Point: extending arm, either with an extended finger or while holding an object, toward an object or individual
- Reach: extending arm and fingers in an attempt to grasp an object, or extending arm while holding an object to make contact with an object not in possession
- Reposition: making slight changes in bodily position (e.g., repositioning on a couch to make room for another child but not involving moving to a new location)
- Sit: weight supported by buttocks, which are in contact with a surface
- Shuffle: moving feet along the substrate without losing contact with it
- Spin: turning one's body rapidly in circles
- Stand: standing with both feet; weight mainly or wholly on feet
- Trip: stumbling but not falling

Locomotor Units

- Backward movement: backward movement by any modality (walking backward, crawling backward, scooting backward, etc.)
- Crawl: forward movement on hands and knees
- Climb: gross physical activity with three of four limbs, resulting in a vertical motion of the whole body (up or down)
- Circle: walking in a complete circle around an object
- Forward movement: forward movement on knees or buttocks, usually over short distances
- Group run: running in a coordinated fashion with other children

- Run: moving the body forward at a rapid pace, alternating legs and with both feet off the ground instantaneously during each stride
- Roll: moving the body across a surface by turning the body
- Side movement: movement to the side, whether on feet, knees, buttocks
- Skip: moving the body forward by alternating legs, placing one foot on the substrate and hoping slightly on it before shifting the weight to the other foot to repeat the same movement
- Slide: moving the body in constant frictional contact down an inclined surface
- Walk: moving the body forward at a moderate pace, alternating legs and placing one foot firmly on the substrate before lifting the other
- Wander: walking through the room without a direct path; *wander* is indicated by multiple changes in direction

Visual Units

- Examine: looking at an object or a part of one's self (e.g., a scab on one's arm) along with tactile examination
- Glance: visual gaze of one second or less directed to another individual
- Joint attention: attention between two or more individuals is brought to the same point (e.g., looking at a book together)
- Look: visual fixation at an object or an individual's face for more than a second (thus differentiating *look* from *glance*)
- Look around: looking around room or play center without prolonged visual fixation
- Look distance: prolonged visual fixation into the distance beyond the child's immediate surroundings (e.g., looking out the window or, if looking indoors, looking at something outside of the center one is in)
- Stare: unfocused gaze
- Watch: prolonged visual fixation on another individual or group of individuals while the individual or group performs an action (e.g., coloring, walking, talking)

Social Units

- Dispute object: attempting to retain an object in conflict for possession
- Dominate: taking or keeping possession of an object when another child was in possession or attempting to get possession of it
- Fail take object: grasping object in attempt to take from another child, but then letting go.
- Hold hands: grasping another individual's hand
- Hug/hugged: encircling arms around another individual, object, or self (hug); receiving hug (hugged).
- Join: standing in close proximity to an individual or group after traveling toward them
- Listen: focal child listening to another individual with minimal to no response, since the focal child is nonresponsive, he/she must be looking at the individual speaking to him/her to be sure listening is occurring; includes listening when someone is whispering into child's ear
- Nod: nodding head up and down to communicate with another individual, indicating *yes* or agreement
- Receive: grasping an object given by another individual
- Shake no: shaking head from side to side to communicate *no* or disagreement with another individual
- Show: bringing another individual's attention to an object or part of self, typically by holding the object
- Submit: losing possession of an object from another child
- Tease: provoking in a playful way; may involve verbal teasing or facial gestures (e.g., sticking tongue out)

Animation Play Units

- Animation movement: grasping and moving an object while pretending it is an animated being; may include moving the object with wrist rotation when pretending the object is talking or moving the object across a

surface when pretending the object is walking. Moving an object through the air as if it is flying is coded as *fly object*
- Crash: hitting two objects together
- Fly object: moving an object through the air without contact to a surface; includes an arm extension, holding an object up while walking, arm movements causing the object to move up and down, or twisting an object in the air. This behavior state is common in figurine, animation, and vehicle play
- Slide object: grasping an object and moving it across a surface, maintaining contact with the surface

Fantasy Play Units

- Object fantasy play: fantasy play with dramatic play toys (e.g., plastic food, tea set, menus, medical kit). Object fantasy play is part of fantasy play rather than object use because there is an as-if component to the toy use. For example, while the child may perform the action of pouring when tilting a teapot spout over a teacup, the child is not literally pouring. The child is pretending to pour, and the pretending component differentiates this behavior from a general object use unit

Rough-and-Tumble Play Units

- Fighting stance: holding a pose during rough-and-tumble or fantasy play; typically, feet are wider apart than hip width and arms are in the air, bent at elbow, and hands in fists
- Full body contact: putting one's body weight against another individual, object, or surface; includes leaning
- Pull: applying force to an object or another individual by arm and trunk flexion, causing it to move away from its original position
- Push: applying force to an object or individual (in the case of rough-and-tumble play) by limb and trunk extension, causing it or him/her to move away from original position
- Wrestle: mock-fighting with another individual that includes grappling or sustained contact (body contact, limb contact, as in arm wrestling, or repeated hand contact)

Art Activity Units

- Color: back-and-forth motion of a coloring utensil (e.g., crayon, pencil crayon, marker) to create solid sections of color (e.g., coloring a coloring sheet, free-hand coloring)
- Cut: using scissors to sever material (e.g., paper) into multiple pieces
- Draw: using any writing utensil (e.g., pen, pencil crayon, marker) to create fine-lined markings on a surface
- Erase: using an eraser to remove a drawn image
- Fold: creasing bendable material (e.g., folding paper)
- Glue: applying glue to any art material
- Paint: using an object (e.g., brush. sponge, finger) to apply paint to any material
- Stencil: tracing a stencil with any writing utensil
- Stick: attaching materials together using adhesive (e.g., glue)

Building Activity Units

- Build: constructing a structure out of multiple pieces, which may include combinations of different materials, which include but are not limited to wooden blocks, foam blocks, Legos, toilet rolls, and connectors
- Deconstruct: taking apart all or part of a structure or object; unlike *knock down*, *deconstruct* is careful and purposeful and is often part of the building process where part of the structure is taken apart for reconstruction
- Knock down: using a body part or held object to forcefully knock over a structure

Play Dough Activity Unit

- Add: adding more play dough to the amount he/she is already working with
- Press: applying sustained pressure for more than one second with one's palm, finger, or tool being held
- Pat: repeatedly lifting and making contact with an object, substance, or surface (e.g., patting play dough to flatten or a puzzle piece into place)
- Roll object: circular or back and forth movements of the palm to manipulate the play dough into a sphere or cylinder

Puzzle Activity Units

- Fit: joining complementary pieces together
- Rotate: turning an object (e.g., a puzzle piece) to more easily determine which way it fits into the puzzle

Water Table/Sand Table Activity Units

- Dip: dunking an object underwater and immediately lifting it out of the water
- Submerge: pushing an object underwater and holding it under for an extended period of time rather than lifting it out immediately; holding the object underwater differentiates *submerge* from the behavior unit *dip*
- Scoop: using tool or hand to collect water or sand and lifting
- Pour: tipping an object (typically some sort of container) holding liquid (or sand), causing the liquid to empty out
- Stir: moving an object in a circular motion through another substance (e.g., water or sand)
- Insert: placing an object into another object like a malleable object (e.g., stick into sand or play dough) or a tight opening (e.g., stick into vent)
- Dig: using a tool or body part to create a hole
- Cover: covering an object with sand or other object to conceal the object from view
- Uncover: removing an object or substance (e.g., sand) that shielded an object from view

General Object Manipulation Units

- Adjust: repositioning an object (e.g., repositioning blocks in a tower to better balance another block on top, turning a piece of clothing inside out before putting it on)
- Close: making the interior of an object or another space inaccessible (e.g., closing a box or door)
- Dump: tipping a container, causing the contents to fall out; differs from the behavior unit *pour*, which indicates liquid (or sand) being emptied out of a container
- Fine manipulation: movement of an object involving fine muscular activity of fingers or hands
- Fix: repairing a broken part of an object (e.g., putting a broken toy back together); does not include objects that are meant for putting together and taking apart (e.g. puzzle, building blocks)
- Gather: collecting objects into a group or pile; differs from the behavior unit *sort* because *gather* does not involve creating separate groups of objects according to a particular feature
- Give: holding out an object to another individual and releasing grip when the object is taken by the other person
- Grasp: encircling fingers around object and tightening grip
- Gross manipulation: sustained or repetitive movement of an object by gross limb activity (e.g., shaking, hitting, kicking, pushing, pulling an object)
- Hand fumble: moving hands and fingers together randomly; children may hold an object during *hand fumble*
- Hold: holding an object in a stationary position (e.g., holding microphone when singing into it)
- Hold out: attempting to give an object to another individual by holding it out to him or her, but the object is not taken

- Lift: raising an object with a limb extension
- Line: placing objects in a row
- Make contact: touching body part or object to another object
- Open: making accessible an object's interior that was previously inaccessible or making a larger space accessible (e.g., by opening a door)
- Pick up: obtaining an object by grasping, followed by a continuous arm movement
- Pull back: pulling arm back while holding object in to move an object out of reach of another individual
- Put down: releasing an object by loosening grasp; includes dropping
- Put in: placing an object inside another object or cubby
- Rub: back-and-forth or circular movements on an object with palm, side of fist, or thumbs
- Sort: creating groups of objects according to a particular feature (e.g., sorting objects into groups according to color)
- Squeeze: tightening grip around object or person
- Sweep: using a brush or broom to collect objects into a pile or a dustpan
- Take out: removing an object from inside another object (e.g., taking play dough out of a mold)
- Tap: repeatedly and briefly making contact with an object, either with hand, finger, or object being held
- Throw: moving an object through the air by releasing from hand at the end of arm extension
- Wipe: removing a substance by brushing or dusting (e.g., dusting sand off hands, wiping off a kiss given by another child)

Other Behavior Units

- Acted on: passively allowing another individual to act on oneself (e.g., allowing another individual to put a hat on oneself)
- Begin action: beginning an action but not following through (e.g., starting to pick up an object but then releasing it)
- Dress off: taking off an article of clothing or object being worn
- Dress up: putting on an article of clothing or object that can be worn (even if it is not intended for wearing)
- Hide: putting one's body in a place that is out of view of others (e.g., under a piece of furniture or blanket or in cubby space); includes hiding one's face
- Leave room: leaving observation area (classroom or outdoor area)
- Read: looking at a book (not necessarily literal reading; most likely looking at the pictures)

Failed Action Units

- Failed manipulation: failure to manipulate object (e.g., fitting a puzzle piece)
- Failed social action: failure to engage with or act on another individual (e.g., put a shoe on another child's foot)
- Failed automanipulation: failure to perform action on self (e.g., braid own hair)
- Failed motor action: failure to perform a motor action (e.g., climb structure)

Appendix D: Event Coding

General Rules

- Each event is initiated by event-specific rules (see below)
- An event ends after four consecutive nonevent-related actions have occurred
- An event ends if another event begins

Animation: Animating an inanimate object by giving it motion or pretending it is alive. This often involves animating toys (e.g., action figures, stuffed animals, human figurines, animal figurines) that are made to represent living things. Animation play also includes animating objects that are not representative of living creatures (e.g., pompoms, bits of paper). Animation play typically involves pretending objects can talk, walk, and interact with one another. Includes car/train play in which a toy car/train is pushed over solid surfaces (along the ground or a track) and must involve car or train sound effects vocalized by the child.

Animation Rules

- Must be initiated by vocalizations such as sound effects or words that make it clear the child is engaging in animation play. Sounds effects may include "vrmm, vrmm," "beep beep," or "choo choo." Speech during animation play often involves speaking on behalf of the animated object, and children typically alter their speaking voice (e.g., speaking in a higher pitch)
- Animation play can also be initiated by planning animation play (e.g., saying "He's going to fart" about a stuffed dog)
- Once animation play has been initiated by a vocalization, play is continued by actions that follow the theme of animation. If a child is pretending a bottle is a rocket, continuation of animation play may include moving the bottle up and down through the air. If playing with a figurine, continuation of animation play may include walking the figurine across the substrate or using the figurine to knock over blocks

Construction: Activity that involves creating something out of multiple parts. Includes art activities or building from materials like blocks or puzzle pieces; may involve the deconstruction of structures as well.

Construction Rules

- Initiated by bringing two constructive objects together (e.g., bringing marker to paper and coloring, applying glue to paper, stacking blocks on top of each other)
- Once construction is initiated, it can then include deconstructive actions (e.g., knocking down a tower, erasing, taking a puzzle apart). These actions do not initiate construction
- There are a few special instances of construction. One example is constructing with play dough. Often, particularly with young children, playing with play dough seems to be only manipulation. However, a construction event begins when children label something they have made with play dough, such as "Here is a cupcake." We can then suppose that further interaction with the play dough is constructive in nature

Fantasy Play: Play involving as-if situations in which individuals, objects, or settings are other than reality; individuals take on an identity (e.g., mother, another animal) in role play, and objects become something else (e.g., banana used as a telephone; child pretends to be in a different setting, like setting up chairs in the classroom and pretending to be on a plane).

Fantasy Play Rules

- Like animation play, fantasy play is initiated by a vocalization, including planning the play event
- After fantasy play is initiated, it continues through actions specific to that play event, which vary greatly between types of fantasy play. For example, fantasy play in the dramatic play center may be initiated by giving another individual a cup and telling him or her that it's coffee. Then, the fantasy play event continues by moving similar toys (e.g., cups, plates, pots) around the center as a child pretends to prepare a meal. If a child sets up a row of chairs pretends to be sitting on a plane, continuation of the fantasy play event may include buckling up, pretending to fly the plane, or loading up the plane with cargo
- If a fantasy play event has already taken place during a focal follow, a re-initiation of the event during the same focal follow does not require a verbalization. Rather, only the same pattern of actions is required. For example, a child barks to initiate the fantasy play event of pretending to be a dog. Then, the child continues the play event by fetching a ball and bringing it back to another child. After a break of nonfantasy play (more than four nonfantasy play actions in a row), fetching and bringing a ball back to another child can be labeled *fantasy play* even if the child does not bark again to initiate the fantasy play event

Rough-and-Tumble Play: Social play involving physical contact (e.g., grappling, wrestling, other bodily contact); intent is nonaggressive.

Rough-and-Tumble Play Rules

- Rough-and-tumble play can be initiated by sustained physical contact (e.g., wrestling, arm wrestling)
- Rough-and-tumble play can also be initiated by repeated contacts, like hits or pushes. However, isolated hits or pushes do not constitute rough-and-tumble play. Therefore, for rough-and-tumble play to occur, there must be multiple contacts; the third contact is the start of rough-and-tumble play
- In rough-and-tumble play, one child may take a dominating role. If a child is pushed and chased by another child, this counts as rough-and-tumble play; however, the child being pushed and chased must be a consenting play partner
- Noncontact actions (e.g., fighting stance, chase) can continue the rough-and-tumble play event

Travel: Moving between centers.

Appendix E: Explanation of Multilevel Model Statistical Analysis

Multilevel models were used for all analyses, as they provided a means to deal with the hierarchical and nonindependent nature of the data. Here, *hierarchical* refers to the three-level structure of the data (see Figure E1). At the top of the hierarchy is the *class level*, which had four units: Jr.1, Jr.2., Senior, and Kinder. Midlevel is the *child level*, which included 31 children (not all are identified in the figure). Multiple children were observed within each classroom, which is described in multilevel analysis as children nested in class. The bottom level is the *focal follow level*, which represents the repeated observations (not all identified in the figure) for each child (focal follow nested in child). Figure E1 provides a visual representation of our data's hierarchical structure, and Table E1 presents the number of observations at each level.

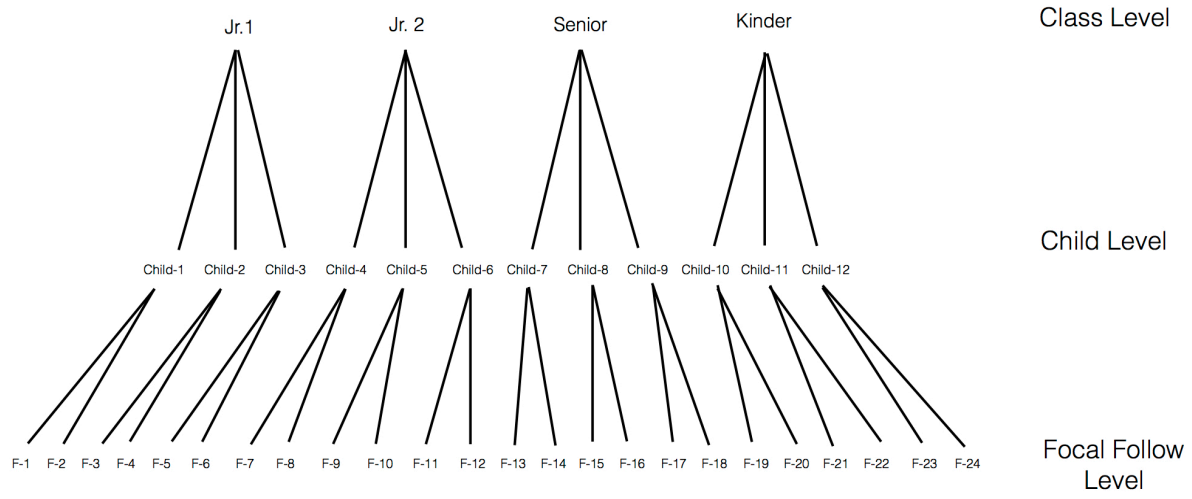

Figure E1. Hierarchical data structure.

Because of the nested structure of the data, we cannot be sure that variable measures are independent. Focal follows nested within child may be more similar than focal follows across children. For example, Child-1 may be more active than Child-2, resulting in Child-1 exhibiting more repetitive activity than Child-2. Furthermore, because children were nested in the classroom, there may also be nondependence on the child level. Children within a classroom may experience classroom-specific features that result in children within a classroom behaving more similarly to each other than to children from a different classroom. For example, the Jr.1 teacher may be more likely to interrupt children's activities than the Jr.2 teacher is, thus reducing the likelihood of long, repetitive sequences occurring in the Jr.1 classroom. Using multilevel model analyses, we were able to account for these possible differences in behavior by child and classroom. The advantage of using a multilevel model to account for these differences rather than building predictor variables into the model is that multilevel analysis allowed us to account for factors we were not aware of; building the nested structure of the data into our model (by including them as random effects, see next paragraph) served a catch-all function for detecting similarities within child and within classroom.

In multilevel model analysis, the language used to describe the model differs slightly from that of other types of statistical analyses. There are two main components in a multilevel model: main effects and random effects. Here, *main effects* are the same as in a linear regression model and refer to the independent, or predictor, variables in a model.

Table E1
Number of Observations by Level

Classroom	Child	No. of Observations
Jr.1	Child-2	10
	Child-3	10
	Child-4	13
	Child-8	10
	Child-9	9
	Child-10	10
Jr.2	Child-17	14
	Child-18	11
	Child-19	10
	Child-20	11
	Child-25	11
	Child-27	13
	Child-28	11
Senior	Child-33	13
	Child-36	10
	Child-38	11
	Child-39	7
	Child-40	13
	Child-43	10
	Child-44	10
	Child-46	10
Kinder	Child-50	10
	Child-53	10
	Child-55	11
	Child-56	9
	Child-58	7
	Child-59	8
	Child-61	9
	Child-62	11

Random effects refer to the grouping variables that make up the levels of the hierarchy. In the current analyses, children and classroom were specified as random effects in random intercept models, meaning we grouped focal follows by child and child by classroom, thus accounting for the nonindependence of focal follow and child. Multilevel model outputs provide two R^2 values: one for the main effects only and one for the whole model (main and random effects). R^2 marginal values were used to assess the main effects (i.e., how much of the variance in behavior identified as the dependent variable can be explained by the independent variables), and R^2 conditional values were used to estimate the effect of the full models (i.e., how much of the variance in the dependent variable can be explained by main and random effects; Nakagawa, Jonson, & Schielzeth, 2017). R^2 marginal and R^2 conditional values were generated by the MuMIn package (Bartoń, 2016).

Appendix F: Dealing with Overdispersion and Zero Inflation

We expected overdispersion and zero inflation in the data because focal follows without any repetitive bouts (i.e., zero-value observations) were included in the analysis. We did this because the absence of repetition was considered as meaningful as the presence of repetition; in other words, it is as important to know when repetition does not occur as it is to know when repetition does occur. Overdispersion and zero inflation were managed by creating observation-level random effects, in other words, giving each data point a unique ID that could be included in a new grouping variable (Harrison, 2014). Residual assumptions were tested again with the DHARMa package; the inclusion of observation-level random effects removed overdispersion and zero inflation.

Appendix G: Number of Spontaneous Bouts Model

Each bout was coded as outcome oriented or spontaneous. *Outcome-oriented repetition* included activities directed toward a particular goal that necessitated repeated action. For example, filling a bucket is an activity that requires repeated scooping and dumping to achieve the end result of a full bucket. In other words, there was an observable outcome beyond the repetitive actions themselves. *Spontaneous repetition* included bouts that had no observable outcome or did not require repeated action, for example, repeated spinning in circles. Reliability between independent coders was 92% (i.e., number of agreed codes/total codes × 100) for 20% of the total dataset. Fixed and random effects are reported below in Tables G1 and G2.

Coding Criteria for Outcome-Oriented and Spontaneous Repetition

Two questions were posed for each repetition bout to determine whether it was outcome oriented or spontaneous: (a) Does the repetitive activity have a higher-level outcome beyond the immediate action? and (b) If there is a higher-level outcome, does it require repeated actions?

If the answer to the first question was "no," the bout was coded as a spontaneous repetition. If the answer to the first question was "yes," it was considered a possible outcome-oriented repetition bout.

The second question was used to determine the final coding. If the answer to the second question was "yes," it was coded as outcome-oriented repetition. If the answer was "no," it was coded as spontaneous repetition.

Table G1
Fixed Effects

	Estimate	*SE*	*z* value	*p* value
Intercept	-1.64	0.16	-10.29	< .01
Follow duration	0.30	0.06	5.13	< .01
Age	-0.53	0.15	-3.62	< .01
Setting (REF: indoor)	0.58	0.26	2.19	.03
Rep. type (REF: motor)	1.68	0.16	10.23	< .01
Age*Setting	0.05	0.27	0.19	.85
Age*Rep. type	0.39	0.16	2.39	.02
Setting*Rep. type	-1.07	0.32	-3.36	< .01
Age*Setting*Rep. type	-0.18	0.33	0.54	.59

Table G2
Random Effects

Group	Variance	*SD*
Nobs	0.57	0.75
FollowID:ChildID:Class	0.00	0.00
ChildID:Class	0.02	0.16
Class	0.00	0.00

Montessori Identity in Dialogue: A Selected Review of Literature on Teacher Identity

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Keywords: *teacher identity, Montessori, antibias/antiracist teaching, dialogic identity*

Abstract: Montessori teacher education includes an intensive and ongoing teacher transformation. This experience aids in the development of a clearly defined teacher identity. Research on teacher identity broadly has shown that while such an identity can offer guidance and support, it can also limit teachers and prevent them from exploring other strategies that may support them and, in turn, their students (e.g., Beauchamp & Thomas, 2009; Britzman, 2003; Sumsion, 2002). This effect is problematic when teachers face moments of uncertainty and dilemmas in their teaching practice. As Montessori classrooms become increasingly diverse, teachers may need to adopt identities that are not explicitly defined in Montessori teacher transformation. This review of literature examines components of a Montessori teacher identity and, broadly, the effects of teacher identity as well as elements of antibias and antiracist teacher-identity development that includes inner reflection and an activist approach to teaching.

An experience of transformation is a recurrent theme in describing and promoting Montessori teacher training. Transformative experiences have both epistemic (i.e., knowledge construction) and personal (i.e., preferences and desires) dimensions (Barnes, 2015). The epistemic dimension unveils new knowledge that was previously unavailable to or unknown by the individual before the transformative experience occurred. This dimension is exemplified in the following statement by a preservice teacher as part of an Association Montessori Internationale (AMI) teacher training program: "And I just thought, this is what education could be. And at that point, I realized that, okay, this is something that I didn't even know education could be. I've never seen anything like this" (Montessori School of Beaverton, 2011). The personal dimension of a transformative experience affects an individual's subjective preferences and transforms the self, altering their[1] identity. A personal transformation reorganizes how a person thinks by affecting beliefs, attitudes, personal traits, and even emotions; it is an experience that reshapes one's priorities, preferences, and identity (Barnes, 2015). While Montessori teacher training includes an epistemic transformation, the personal transformation is perhaps more powerful. In texts read today by Montessori preservice and active

[1] The singular "they" is used throughout this paper, in alignment with an antibias perspective on gender identity.

teachers, Maria Montessori included instructions for how a teacher should look and act in the classroom (Montessori, 1967). Further, she identified specific moral character traits, beliefs, and values she felt all teachers must acquire (Montessori, 1936/2005). These explicit directives unique to the Montessori Method have a significant effect on teacher transformation and subsequent identity.

The transformative experience of becoming a teacher is not unique to the Montessori world; teachers frequently describe the process of becoming teachers as one of personal transformation (e.g., Alsup, 2006; Beauchamp & Thomas, 2009; Friesen & Besley, 2013). Friesen and Besley (2013) argued that "learning to *be* a teacher is as important as learning *how* to teach" (p. 23, emphasis in original). A prescribed teacher identity can be both helpful and problematic when teachers face challenging situations, teaching dilemmas, and uncertainty in the classroom and in the school (Cuban, 1992; Lampert, 1985). While teacher identity can offer comfort and resources to successfully tackle those moments, it can also become restrictive and isolating when one is unable to fulfill what often feels like required ways of being. Gee (2014) wrote, "to enact identities people have to talk the right talk, walk the right walk, behave as if they believe and value the right things, and wear the right things at the right time and place" (p. 24). What happens when talk becomes a controversial discussion? Or when the walk veers or swerves? When self-identity is closely intertwined with, or even reliant, on a clearly defined and inflexible social identity, moments of uncertainty can be unsettling and deeply emotional. Yet, while classroom demographics change and student needs shift and evolve, a teacher should be able to perform in a way that serves both their own and their students' needs in creative and effective ways. Therefore, it is critical that teacher identity be allowed to shift and evolve rather than remain stable and static (Fecho, Graham, & Hudson-Ross, 2005; Flores & Day, 2006; Hermans, 2001).

Early Childhood Montessori teachers today need to be prepared for challenges that may not have been directly addressed in their Montessori transformation and at times may require teaching skills and strategies that differ from or even contradict Dr. Montessori's original directions (Christensen, 2019; Loeffler, 2000). Implicit biases about student behavior and lifestyle, among other social markers of difference, are often harbored deep within both a social and a personal identity and can affect a teacher's self-conceptions and social perceptions, as well as the experiences of the students whom they teach. For example, Brown and Steele (2015) examined the relationship between suspension rates and race in Montessori and non-Montessori schools. While Montessori schools suspended students less, on average, than non-Montessori schools did, Brown and Steele's research still showed racial disproportionality: Black Montessori students were three times more likely to be suspended than their White counterparts were. Research (Brown & Steele, 2015; Gilliam, Maupin, Reyes, Accavitti, & Schic, 2016) also has shown that teachers need to become aware of their own implicit biases so that they may work to avoid committing micro- and macroaggressions, as well as address such instances that occur in schools. Critical self-reflection with a social justice lens is essential for teachers today (Ausdale & Feagin, 2002; Derman-Sparks & Edwards, 2010; Jewell, 2018; Jones & Vagle, 2013; Kissinger, 2017). Teachers should examine their own biases, the socialization of others with whom they work, and even the curriculum they follow.

This review of literature examines Dr. Montessori's description of teacher identity, current research on teacher identity, and antibias/antiracist (ABAR) teacher-identity development. ABAR teaching practices and terminology apply to early childhood education (e.g., Derman-Sparks & Edwards, 2010; Kissinger, 2017). However, Montessori-identity and teacher-identity research spans all ages, and much of the literature reviewed can apply broadly. Research on teacher identity writ large is voluminous, and this review only skims the surface of literature on the topic. The intent here is to provide sufficient background to call attention to the existence and complexity of teacher identity and its development as it relates to Montessori education. The purpose of this review is twofold: first, to explore literature on teacher identity, its development, and the ways in which identity can affect teacher experiences, and second, to encourage an intentional, ongoing dialogue between Montessori-identity and ABAR teacher-identity development practices.

Montessori Teacher Identity

Dr. Montessori saw a need for an important personal transformation to effectively enact her Method of teaching. This spiritual preparation (Montessori, 1967/1972b), also referred to as the preparation of the adult, continues to be a central part of Montessori teacher training and establishes a clearly articulated description of who a Montessori teacher should be. In general, research has shown that many teachers feel a need to successfully and impeccably embody an ideological teacher identity (e.g., Britzman, 2003; Cuban, 1992; Green, 2015; Sumsion, 2002). This mindset also holds true for Montessori teachers specifically (Christensen, 2016; Malm, 2004). Exhibiting behaviors and knowledge of the Montessori Method is necessary to self-identify as a Montessori teacher and to be seen as such by others (Gee, 2014). Malm (2004) noted this commitment when studying the biographies of a group of Montessori teachers:

> *Being able to call oneself a Montessori teacher and representing "Montessori education" is an essential aspect related to these teachers' professional identity.... There is thus among these teachers a strong sense of commitment and responsibility, an evident awareness of the convictions they hold as Montessori teachers. They share a common philosophical approach to how they believe an essential Montessori teacher should be.* (p. 404)

Montessori teacher education includes a transformation of age-old beliefs, assumptions, and judgments about children and their role in society. The next section outlines specific components of the Montessori teacher identity that Dr. Montessori meticulously identified and described years ago and that continue to play a central role in Montessori teacher identity today.

Virtuous and Moral

Along with Dr. Montessori's new Method of education came characteristics of "the new teacher" (Standing, 1957, p. 297), one who possessed esteemed virtues, physical grace, and unwavering passion for the work. Spiritual preparation assists in the development of many practical abilities that are essential to fostering a quality Montessori classroom environment, such as skills in observation, formative assessment, and refined movement; it also includes a process of critical self-reflection.

According to Dr. Montessori, pride and anger are human defects rampant in adult interactions and relationships, instigating conflict, greed, and even war (Standing, 1957). These defects not only inhibit Dr. Montessori's vision of peace through education but also negatively influence human development. Therefore, she emphasized the critical role of modeling and nurturing the development of characteristics such as joy, confidence, cooperation, and independence. To this end, pride and anger must be replaced with what she identified as opposite virtues: humility and patience (Montessori, 1936/2005). Dr. Montessori believed it took humility to identify and abandon preconceived notions about children's development and behavior; patience, she explained, was necessary to slow down, see, and appreciate developmental possibilities and to search for ways to best support that growth (Montessori, 1936/2005).

Observing, Reflecting, and Guiding

Observation is perhaps one of the most crucial abilities of the Montessori teacher. First, to truly see and understand children, an adult must commit to many hours of careful and thoughtful observation of children before beginning a career in teaching. While teachers work in the classroom, observation can strengthen and deepen this understanding as well as assess children's learning and behavior, the needs of the classroom community, and characteristics of the physical environment (Montessori, 2016/1921).

Critical self-reflection also includes observation practices. Dr. Montessori believed that the majority of young children's challenging behavior evolved out of misunderstandings, miscommunication, and their unique, unmet developmental needs. She argued that observation combined with self-reflection can help teachers identify those needs, explore the ways in which adult behavior or beliefs may inhibit development, and brainstorm what can be done within the curriculum to better serve the child (Montessori, 1967, 1946/1991, 1967/1972b, 1936/2005). Additionally, the role of the Montessori teacher is grounded in the belief that, when children are given a supportive environment equipped with the necessary tools, they need guidance more than direct instruction as they grow and develop. Therefore, embodying what it means to guide learning and development, rather than direct instruction is fundamental to becoming a Montessori teacher.

Physical Grace

Dr. Montessori saw the act of guiding, rather than directing, as not only a vital mindset and way of teaching but also as a physical change that includes movement and even appearance. The Montessori teacher should "be attractive, pleasing in appearance, tidy and clean, calm and dignified" (Montessori, 1967, p. 277). *Analysis of movement*, a way of moving gracefully and intentionally, is an important concept introduced in Montessori teacher training and embedded in the curriculum. Analysis of movement refers in part to general movement and physical presence in the classroom (e.g., moving through the room quietly and calmly) and relates to the handling and presenting of materials and lessons to children (e.g., with purposeful and deliberate movements, limited and careful word choice; Montessori, 1946/1991). Dr. Montessori's explicit directives for how a teacher should look and act are particularly important when conceptualizing the impact of teacher identity. Becoming and being a Montessori teacher includes an epistemic and personal transformation, as well as a physical transformation that governs how one appears and acts (Barker, 2012; Gee, 2014).

Montessorian

The Montessori teacher is deeply trained in developmental theory, the history of the Method, and the intention of the materials, and, of course, in how to share them with children. Yet what makes the Montessori training unique is the significant attention to teacher inner preparation, transforming the adult's ways of thinking and acting. In a study on Montessori teachers' professional identities, Malm (2004) found that "among Montessori teachers, commitment is not only related to being a teacher, but to being a 'Montessori' teacher, i.e., identifying with/being aware of/adhering to specific educational philosophical principles" (p. 403). This identity is so powerful that many Montessori teachers not only denote their teacher identity specifically with Montessori education but simply use the term *Montessorian*.

A social identity comes equipped with other people's expectations and opinions of our own behavior, knowledge, and beliefs. While such expectations can certainly be important in maintaining order, quality, and goals, they can also be harmful and cause negative reactions such as insecurity, guilt, and stress. Such explicit teacher qualities have the potential to evolve into a seemingly inflexible social identity that may prevent Montessori teachers from exploring and accepting other ways of being in a classroom.

Literature on Teacher Identity

This section provides information on current theories and research on teacher identity broadly. Understanding the ways in which teacher identity has been conceptualized at both a social and an individual level offers important insight into how identity affects the teacher experience.

Born or Made

In her bestselling book, *Building a Better Teacher*, Elizabeth Green (2015) began her historical exploration of research on teaching and teacher education by challenging the common narrative of teachers as naturally born, a narrative she referred to as the "myth of the natural-born teacher" (p. 6). Teacher identity has been viewed as possessing particular character traits that some are born with and others are not. Green argued that this is a misguided conception of becoming and being a teacher and focused her book on if and in what way individuals can be taught how to teach. Britzman (2003) also discussed cultural myths that sustain and reproduce the notion of essential teacher qualities—qualities necessary to not simply teach, but to be seen and accepted as a teacher. Such narratives, or myths, have created a general social identity of what it is to be a true teacher, an identity that Green (2015) suggested relies on the belief in natural personality and character traits. Similarly, Britzman (2003) wrote, "through these myths, [people] recognize themselves as a teacher or feel as if they do not possess what it takes to become one" (p. 223). If teaching is thought to be an ability that individuals are born with, what happens to their identity when that ability is called into question?

Sumsion (2002) followed the career path of an enthusiastic early childhood teacher, a young woman who described her interest in teaching as a lifelong dream, a dream she was born with. As her teaching career progressed, she faced increasingly difficult situations that challenged her professionally and personally. Being a teacher had woven together her self-identity, social identity, and professional identity so tightly that the uncertainty and dilemmas she faced in her teaching practice inhibited the fulfillment of her lifelong dream and achieving her professional goals.

Concluding her report, Sumsion (2002) posed questions concerning the progress of early-childhood teacher education, several of which focus on what teacher educators should consider regarding teacher positionality, emotional preparedness, agency, and self. When overarching teacher-identity discourse revolves around the belief that teaching is an innate, natural ability possessed by certain individuals, teachers who experience moments that question those natural abilities may lack the emotional resilience necessary to overcome such a situation.

Dialogic Identity

While the natural-born-teacher discourse continues to influence some notions of teacher identity, literature on alternative theories frequently conceptualize teacher identity as *dialogic*, meaning an individual's ability to take on multiple identity positions in relation to various social contexts (Hermans, 2001). Hermans (2001) conceived identity as multivoiced and not merely about identifying outwardly as one type of person or another (e.g., "At home, I am a mother; in the classroom, I am a teacher."). Instead, people have an unconscious ability to "construe another person or being as a position that [they] can occupy and as a position that creates an alternative perspective on the world and [themselves]" (p. 250). Because of this constant shift in perspective, identity positions can disagree, oppose, contradict, question, and judge one another.

Hermans (2001) noted the importance of both space and time in dialogic identity development. Which identity position is taken up and how an individual responds depend in part on the present social context, previous experiences, and cultural and social motivations (Akkerman & Meijer, 2011; Hermans, 2001). These variables are further complicated by the dialogic relationships among multiple identity positions, some of which may interpret and respond to a situation in different ways. Additionally, because identity is affected by and relates to the diverse social contexts it encounters, the available positions will expand and construct over time and space. In this view, identity is not fixed and stable, but rather it shifts and evolves as individuals move through the world: identity is continually constructed and deconstructed (Akkerman & Meijer, 2011; Flores & Day, 2006; Geijsel & Meijers, 2005).

In contrast to the myth of the natural-born teacher, viewing identity as dialogic and ever changing acknowledges the effects of the social and cultural contexts on individual growth through time. When teacher identity is viewed as ongoing construction, the ability to learn to be a teacher is more possible. An individual may acquire a teacher-positioned identity through social relations, such as teacher education, by being part of a teacher professional community and, of course, as a member of a classroom environment (Beauchamp & Thomas, 2009).

Identity and Self-Conception

A plethora of philosophical, theoretical, and research-based literature exists around notions of identity, self, and voice (e.g., Anzaldúa, 1987/2008; Miller, 1994; Palmer, 1998/2007). In this literature review, *identity* refers to all these elements. However, it is important to recognize the self, particularly self-conception, in a discussion of teacher transformation and teacher identity.

While identity can be viewed as dialogic and in a continual state of construction, many (e.g., Beauchamp & Thomas, 2009; Geijsel & Meijers, 2005) still include self-identification as a part of that construction process. In their review of literature on teacher-identity formation, Beauchamp and Thomas (2009) expressed a common opinion that self-understanding is an important aspect of teacher-identity development. Geijsel and Meijers (2005) argued that learning to be a teacher is not only "a process of social construction, but also one of individual sense-making" (p. 420). They described identity construction as circular, where experience and self-understanding work closely together. As individuals encounter new situations, they must work through their own multiple interpretations and understandings of that experience and respond in their own unique way.

Self-reflection can aid in this sense-making process. When teachers engage in self-reflection, they gain a fuller understanding of how their teacher self fits into larger social contexts (Beauchamp & Thomas, 2009); this understanding can strengthen their self-identity. Palmer (1998/2007) attributed his own ability to teach not to purely pedagogical knowledge, but to "the degree to which I know and trust my selfhood" (p. 10). Cardelle-Elawar and Lizzarraga (2010) found that teachers

who became aware of their multiple roles as a teacher through self-reflection and self-assessment sought ways to be more effective with their diverse students. They surmised that teachers who had a greater self-awareness know "who they are and who they want to become" (p. 207), leading to more intentional teaching choices that enhanced their skills and effectiveness in the profession. Hamman, Gosselin, Romano, and Bunuan (2010) took this self-awareness a step further by asking preservice and novice teachers to identify their possible teacher selves. This future-oriented practice helps teacher educators understand which content is effective and meaningful while also helping teachers develop a goal based on their dialogic identity as a teacher (Hamman et al., 2010). Becoming a teacher is not something that happens to an individual; instead, it is a transformation that is in part self-constructed.

Identity and Emotion

Barker (2012) eloquently explained that "identity involves an emotional attachment to the narratives of our lives" (p. 136). He said self-identity comprises self-conceptions and their related emotional identifications. Thus, emotions arise out of how an identity interprets and reacts to lived experiences, and these reactions between identities can be contradictory. As previously discussed, a dialogic identity is made up of potentially conflicting positions and perspectives. A teacher may face discrepancies between different identity positions, causing emotional uneasiness and vulnerability (Hermans, 2001). As teachers work to interpret, understand, and incorporate a social experience into their own identity and its corresponding social expression, they may encounter situations that challenge their self-concept and cause emotional contradictions (Britzman, 2003).

Challenges between identity and social contexts have been referred to as *boundary experiences*. Geijsel and Meijers (2005) defined a boundary experience as a situation "when a person, trying to participate more fully (centrally) in a social practice, encounters a situation in which one is *unable to function adequately because one cannot fully identify with the new situation and its exigencies*" (p. 424, emphasis in original). Sumsion (2002) depicted the emotional breakdown of a dedicated early-childhood teacher who faced demands that she could not relate to, navigate through, or emotionally handle. The boundary experience was emotionally draining and affected both her ability to do her job and her identity as a teacher.

Flores and Day (2006) noted the "emotional labor" (p. 221) required of teachers on a daily basis, such as having to perform social niceties regardless of inner feelings (e.g., responding politely to parents, even when frustrated) or emotionally coping with the many diverse challenges in a classroom and school community. This tension can become emotionally exhausting. Creating and sustaining parent–teacher relationships, practicing culturally relevant pedagogy, navigating school rules and regulations, and even representing the school for promotion and marketing purposes are just some of the additional demands placed on educators today. These additional tasks may create instances of ideational conflicts, in other words, when one social identity diverges from another (Cuban, 1992; Helsing, 2007; Sumsion, 2002). Adapting and conforming to a teacher identity can be particularly difficult for new teachers facing unfamiliar professional expectations and challenges (Hamman et al., 2010). These conflicts can be referred to as *dilemmas*, meaning "conflict-filled situations that require choices because competing, highly prized values cannot be satisfied" (Cuban, 1992, p. 6). The personal nature of dilemmas can cause uncertainty in a teacher's practice, arising from a variety of educational beliefs and expectations, as well as from the complex social and emotional requirements of teaching (Helsing, 2007; Lampert, 1985). This uncertainty can affect one's teaching practice and even self-identity by instigating emotions and questioning one's self-conceptions. Palmer (1998/2007) wrote eloquently on the vulnerability of being a teacher: "to reduce our vulnerability, we disconnect from students, from subjects, and even from ourselves" (p. 18), a reaction that is detrimental to both teachers and students.

Britzman (2003) analyzed the experience of two teachers caught between two different teacher identities, one depicting teaching as authoritarian and the other as flexible and creative. Faced with this discrepancy, the teachers felt unbearable pressure, and even helplessness, to choose and perform as if teaching were a single, stable identity. Had they been supported in acknowledging the existence of multiple identities, they could have explored "their own contradictory selves in ways that could work

through such a dualist identity in order to consider the multiple choices that contradictions offer" (p. 226).

The stable identity sought is frequently an image of an ideal teacher, maintained by cultural myths or prescribed ways of being. This idealistic expectation, of what and who a good teacher is, may generate feelings of hopelessness and discouragement in teachers when discrepancies and boundary experiences that challenge that ideology occur (Beauchamp & Thomas, 2009; Chang-Kredl & Kingsley, 2014; Flores & Day, 2006). Giving teachers a single, ideal identity to strive for sets the stage for identity conflicts, discrepancies, and boundary experiences derived from unattainable or frequently challenged ideological expectations.

Societal Conceptions of Teacher Identity

The teacher identity can be both helpful and problematic when educators face challenging situations, teaching dilemmas, and uncertainty in their classrooms and schools. While their identity can offer comfort and resources to successfully tackle those moments, it can also become restrictive and isolating when they are unable to fulfill ways of being that often feel required (Gee, 2014).

As Sumsion (2002) described in her research, the pressure to fulfill the image of an ideal teacher can be challenging and even impossible; it can also lead to self-doubt, insecurity, and disenchantment with the profession. However, fostering dialogic identity development is not solely the job of the individual or even of the teacher education program; the societal conception of being a teacher must also expand. The myth of the natural-born teacher still exists today, contributing to the larger social pressures of what and who an ideal and true teacher is. Perhaps a better understanding of what it means to teach and respect for the complexities of the profession—including that of early childhood education—will encourage a societal shift in mindset. Becoming and being a teacher requires sustained flexibility and support, not just defined standards and essential expectations. Such a shift may also be necessary in the Montessori world.

Antibias/Antiracist Teacher-Identity Development

How teachers understand their self-identities and social identities and how they enact those identities is of particular importance when taking up ABAR teaching strategies. From birth, children are developing a social understanding of their world and experiencing self-discovery. Teachers are not only responsible for fostering an awareness and appreciation of diversity through materials and lessons but also are important role models in all they do. However, truly and consistently modeling equitable and nonbiased behavior can be difficult. The early sociologist, Pierre Bourdieu, developed the concept of *habitus,* meaning a "deeply structured cultural grammar for action" (Swartz, 1997, p. 102). Habitus refers to the ingrained socialization individuals experience as they grow and develop, reinforcing cultural norms and expectations of themselves and others. Such socialization includes the explicit and implicit privilege and oppression of varying social identities—a social hierarchy reinforced through actions, language, and other social experiences. Therefore, instances of bias, privilege, and oppression are often so deep-seated in social life that they occur unnoticed and unresolved. However, these conditions lay the foundation for a child's developing understanding of their world and the habitus they experience.

Dr. Montessori viewed education as an essential component of achieving justice and peace, made possible through children (Montessori, 1972a). While it is vital that Montessori teachers create a safe and developmentally appropriate space for children to work together in community, their teacher identity includes the roles of observer and guide, not to interfere in the child's self and social discoveries. In contrast, antibias education places significant responsibility on teachers to intervene during moments of explicit and implicit bias (Derman-Sparks & Edwards, 2010). To do this effectively and appropriately, teachers need to spend considerable time reflecting on their own socialization, considering biases that they may uphold and reproduce in the classroom. Raising awareness of implicit and explicit bias that manifests in teachers' day-to-day actions is a crucial first step to becoming an ABAR teacher.

Bias in the Early Childhood Classroom

A part of the Montessori Method of education includes an emphasis on continual and constructive teacher self-reflection, in part to develop skills in objective observation. A Montessori teacher should "prepare himself *inwardly*. He must examine himself methodically in order to discover certain definite

defects that may become obstacles in his relation with the child" (Montessori, 1936/2005, p. 107; italics in original). Regarding potential bias, prejudice, and assumptions, Dr. Montessori (1967) called on teachers to "free [themselves] from all preconceived ideas concerning the levels at which the children may be" (p. 276). However, eliminating implicit bias is arguably impossible. Swartz (1997) explained that "habitus derives from the predominantly unconscious internalization—particularly during early childhood—of objective chances that are common to members of a social class or status group" (p. 104). Teachers are no exception, having experienced bias as a socially normed practice in their own development. Such long-term, unconscious internalization can be difficult to identify and acknowledge, much less overcome and cast aside. While ABAR teaching approaches generally prioritize the recognition and critical exploration of personal prejudice and bias (Derman-Sparks, 2008; Derman-Sparks & Edwards, 2010; Kissinger, 2017), they also emphasize exploring the ways in which teachers' own identities have evolved and interact with those of the children in their classrooms. Furthermore, ABAR teaching practices encourage the acknowledgment of social identities such as race and social class among students and teachers, as well as ongoing reflection on how those identities affect individual experience and group dynamics (e.g., Derman-Sparks, 2008; Derman-Sparks & Edwards, 2010; Jones & Vagle, 2013; Kissinger, 2017; Kumashiro, 2002).

Research (e.g., Gilliam et al., 2016) has suggested that it is not possible for teachers to be objective in their work with children; this reality is manifest in a variety of ways. A recent study of early childhood teachers' implicit bias, by Gilliam et al. (2016), revealed that teachers not only were more likely to describe a boy's behavior as challenging or requiring attention than a girl's but also were more likely to spend their time watching boys for challenging behavior. Specifically, teachers looked at Black boys more frequently than at any other children. One of the deeply concerning results of this implicit bias is that, at the time of this study, 47% of U.S. preschoolers suspended one or more times were Black boys (Gilliam, et al., 2016). Additionally, a subtle response, like eye movement focused on a specific population, can have a detrimental effect on the development of all children's social understanding. Included as one of the five principles of social-class-sensitive pedagogy, Jones and Vagle (2013) have called for teachers to examine and be aware of their body language when working with students. They wrote,

> *A raised eyebrow, a widening of the eyes, a turning of the back can all be perceived as performances for harsh judgment or dismissiveness. We might use our bodies this way without awareness, thus inflicting injury without intention and moving on to the next encounter similarly—or behave in a class-sensitive way in the very next interaction.* (p. 6)

It is crucial to remember that all adult behavior in the classroom setting is modeled to children learning about their world. Ongoing reflection on personal bias expressed through body language is an important part of being an ABAR teacher. Identity is constantly performed, maintained, and reproduced in verbal and nonverbal ways (Gee, 2014). Therefore, it is critical that teachers consider how their actions perpetuate, or dismantle, social identities that oppress some and privilege others.

ABAR Teacher Self-Reflection

To combat implicit and explicit bias, many scholars (e.g., Ausdale & Feagin, 2002; Derman-Sparks & Edwards, 2010; Derman-Sparks & Ramsey, 2006; Goldstein, 2001; Hawkins, 2014; hooks, 2003; Husband, 2012; Jones & Vagle, 2013; Kemple, Harris, & Lee, 2015; Kissinger, 2017; Kumashiro, 2002) have argued that critical self-examination is a necessary first and ongoing step. Teachers must look inwardly to better understand their own identities, experiences, beliefs, and assumptions in relation to social biases. In their book on how racism develops in early childhood, Ausdale and Feagin (2002) outlined several ways for teachers to address acts of racial prejudice, the first being a call to critically reflect on "internalized negative constructions of the children with whom [teachers] interact" (p. 208). Similarly, Jones and Vagle (2013) believed that analyzing one's personal experience in relation to social class was the first principle of practicing social-class-sensitive pedagogy. Husband (2012) argued that social injustice "exists and is furthered through the formal and informal ideologies, policies, practices, and texts implemented in schools" (p. 366). Husband encouraged those seeking ABAR education to reflect on and critique the systems and practices in which they participate, emphasizing the importance of becoming an active participant in dismantling bias and creating and enacting equitable ABAR teaching practices.

Self-Reflective Practices

As previously mentioned, continual self-reflection is an important part of the Montessori Method and is introduced during teacher education. This practice aligns with several forms of ABAR teacher education. Kemple et al. (2015) outlined three useful activities to facilitate preservice teachers' awareness of bias and prejudice in education. All three activities focus on exploring an individual's own identity through reflection, small-group discussions, and carefully selected readings. The Teaching Tolerance Anti-Bias Framework (2014) includes identity development as the first step in helping students, of any age, to appreciate diversity and become social justice activists. Similarly, Kissinger (2017) shared two approaches to personal reflection as a first step to becoming an antibias and anti-oppression early childhood teacher. Both include reflective narratives, either by answering a series of questions about identity or by exploring gender, race, and culture using creative expression, such as poetry. Kissinger took this practice a step further by encouraging teachers to share their stories in small, safe groups: "I believe that sharing our stories is one of the important steps we must take in reclaiming our full humanity, beginning to heal, and taking action" (p. 11). Hooks (2003) also prescribed a process of reflective writing as a requirement for confronting racial bias and white-supremacist thinking, both in oneself and in society at large, and working to dismantle oppression. She too encouraged people to share their stories and subsequent awareness and understanding of race and racism: "We need to hear from the individuals who know, because they have lived anti-racist lives, what everyone can do to decolonize their minds, to maintain awareness, change behavior, and create beloved community" (p. 40).

Supporting ABAR Reflection

Teachers should be supported in the exploration of their dialogic identity: what those identities are, how they came to be, and contexts that provoke them. Derman-Sparks and Ramsey (2006) wrote that "the anti-racism identity journey is fluid and more spiral than a ladder" (p. 21) and argued that identity and response to racism are greatly influenced by social contexts and the issues an individual experiences. When confronted by a situation that calls their antiracist identity into question, dilemmas, uncertainty, and challenging boundary experiences can arise. Therefore, teachers need the skills and freedom to recognize their varied self-identities and social identities, and they should consider how their identities affect and support their teaching and their students. Social groups that expect individuals to embody one particular way of being a teacher may limit teachers' confidence and ability to adopt different teacher identities and corresponding strategies that may best serve their students.

Future Work and Dialogic Possibilities

Teacher self-efficacy, agency, and retention are important topics associated with identity and its related emotional experiences. For this reason, much of the reviewed research on teacher identity calls for not only a change in the conceptualization of teacher identity but also the acknowledgment and support of its development during teacher education. Specifically, research on the dilemmas and uncertainty that Early Childhood Montessori teachers experience could help to identify both the challenges they face and how their Montessori identity may constrain or support them through such moments. It is crucial to note that many Montessori teachers are adopting ABAR practices in their classrooms. Research that explores their experiences, approaches, and methods, as well as their self-identification as teachers, would help Montessori scholars and teacher educators better understand how the potential dialogic identities are being adopted and how other teachers can be encouraged to follow suit. Finally, additional research examining the characteristics of a Montessori teacher identity today can help the transformational experience of becoming a Montessori teacher to evolve and adapt, perhaps expanding the performance expectations of being a Montessorian.

When identity is viewed as dialogic and as a process of continual construction, teachers have the space and support to explore their experiences as teachers and as socialized individuals. Expecting teachers, or any individual, to assume just one identity limits their ability to acknowledge, accept, and explore the possibilities created through multiple identities. Working in a classroom requires the ability to assume new perspectives and relate to different needs and abilities. While teaching requires flexibility, so too should society's understanding of a teacher's identity.

Incorporating ABAR teacher-identity development with Montessori teacher development is critical in today's society. There are growing factions of Montessori educators and scholars committed to putting this topic at the forefront of discussions of Montessori curriculum and teacher education (e.g., Branch, 2017; Han, 2018; Han & Moquino, 2018; Jewell, 2018; McCaffrey, 2017; Wafford & Rigaud, 2019). These conversations should also consider the effects of a single, stable notion of what a Montessori teacher looks and acts like, a social construct that may limit Early Childhood Montessori educators in their identity development and teaching practice. Becoming a Montessori teacher can be a profound and deeply personal transformation in which secrets are revealed and worldviews are altered. However, while both ABAR teacher reflection and Montessori pedagogy may bring a new, justice-oriented perspective, the terms are not synonymous. While both Montessori pedagogy and ABAR teacher development value self-reflection, ABAR practices stray from the idea that any teacher can become truly objective. Reflecting on verbal and nonverbal actions requires teachers to be able to adapt and evolve their teacher-identity performance to best support their students.

When identity is conceptualized as multifaceted and continuously self-constructing, teachers have the opportunity to recognize a dialogic identity, reflect on the experiences and contexts that have affected them, and become more aware of how those identities influence their practice. Combining the Montessori identity with ABAR's self-reflective tenets and practices can destabilize the clearly defined Montessori social identity. Such a dialogic wobble creates opportunities to consider new ideas, even ones that question former beliefs, and can lead to "classroom reform that otherwise might never happen" (Fecho et al., 2005, p. 180). Viewing Montessori identity as in dialogue with other ways of being a teacher allows for self-exploration, creativity, and innovation. It is from there that teaching practices can be critiqued, revised, and improved to truly liberate and build a peaceful society.

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