



Multigrade education and the montessori model: A pathway towards inclusion and equity

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ABSTRACT

This paper explores the integration of multigrade education and Montessori pedagogy as a pathway toward creating more inclusive and equitable learning environments. Through a comprehensive theoretical analysis, we examine how these complementary approaches can respond to diverse learning needs while challenging traditional age-based educational structures. The study employs critical analysis to situate both multigrade teaching and Montessori principles within their historical, cultural, and social contexts, interrogating their efficacy across different demographic settings. Drawing upon disability studies, constructivism, pedocentrism, and equity-centered pedagogies, we develop a theoretical framework that conceptualizes a culturally responsive adaptation of Montessori principles for inclusive multigrade settings. Our research identifies structural barriers to inclusion in conventional educational models and analyzes how contextualized Montessori practices in multigrade environments can dismantle these barriers while honoring cultural diversity. We introduce the Culturally Responsive Multigrade Montessori (CRMM) framework, which reconceptualizes key elements of the Montessori model through an inclusive lens. The framework provides a theoretical foundation for adapting Montessori practices to diverse contexts while challenging historical implementations that may inadvertently reinforce exclusionary practices. Our findings suggest that when contextualized with inclusion at the center, the integration of Montessori principles within multigrade structures fosters adaptive, collaborative learning experiences for students of varying abilities and backgrounds. However, this integration must explicitly address power dynamics, ableism, cultural hegemony, and systemic inequities that have shaped educational models. This research contributes to scholarship on inclusive and culturally sustaining pedagogies while providing a foundation for empirical investigations of Montessori principles in diverse multigrade settings.

1. Introduction

As educational institutions worldwide face heterogeneous student requirements, the capacity for systemic adaptability has become increasingly recognized as fundamental. As scholars have noted, educational inclusion's conceptual ambiguities may divert attention from the more important issue of student learning outcomes. This recognition that inclusive practices take different forms across diverse geographical and sociocultural contexts aligns with postmodern theoretical frameworks common during this era of educational

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reform.

For educational frameworks to demonstrate efficacy across diverse student populations, they must inherently embody principles of diversity, inclusivity, and flexibility. Such characteristics enable these systems to adequately serve learners across the socioeconomic spectrum (Florian, 2014). The institutional capacity to respond to and support varied learning profiles, sociocultural backgrounds, and economic circumstances represents not merely an aspirational quality but rather a functional necessity for educational systems seeking to fulfill their fundamental purpose in increasingly diverse societies. Inclusive education represents a civilizational asset of developed societies. It requires first and foremost a cognitive approach to ensure equal opportunities in education and to remove or reduce barriers that prevent students from reaching their full potential (Haug, 2016).

Multigrade education and the Montessori model represent two such approaches that offer promising pathways toward creating more inclusive and equitable learning environments. Both methodologies share core principles of flexibility and individualized learning that may help address the varying needs of students from different socioeconomic backgrounds while promoting educational equity. Modern formal education is predominantly structured around single-age cohorts progressing through sequential grade levels - a relatively recent historical development. However, multigrade classrooms remain widespread across both industrialized and emerging education systems, particularly in rural and underserved communities (Little, 2001; Quail & Smith, 2014). These settings require teachers to implement adaptive pedagogical strategies that facilitate diverse student needs, fostering differentiated instruction and peer-supported learning.

Historical shifts toward multigrade learning models illustrate both intentional educational reforms and pragmatic responses to demographic and resource constraints. In the mid-to-late 20th century, England, Sweden, Finland, and Australia all experimented with variations of multigrade and mixed-age learning, often framing these approaches as tools for promoting collaboration, social integration, and cognitive flexibility (Little, 2001). However, by the 1980s, economic and demographic pressures led to a shift in how multigrade classrooms were perceived - less as a pedagogical choice and more as a necessity driven by declining school enrolments and resource shortages (Little, 2001).

Despite these challenges, research has increasingly recognized the benefits of multigrade education, particularly its potential to promote inclusion by accommodating students with diverse learning needs. Studies indicate that when appropriate pedagogical strategies are implemented, multigrade classrooms can provide sustainable, effective learning environments (Barbetta et al., 2021; Bongala et al., 2020). However, much of the existing literature remains focused on the challenges of implementation, rather than the transformative potential of multigrade education as an equity-driven pedagogical approach.

The Montessori model, developed in the early 20th century, offers an alternative to traditional monograde classrooms by emphasizing self-directed learning, peer collaboration, and individualized instruction. Rooted in progressive educational thought, Montessori classrooms are intentionally structured to support mixed-age learning, often spanning three-year age ranges (Raggi, 2015). Maria Montessori and her contemporaries, such as Peter Petersen, argued that age diversity within the classroom fosters social-emotional development, cognitive flexibility, and peer mentoring - principles that closely align with the pedagogical philosophy of multigrade education.

Historically, Montessori education emerged as a response to the rigid, standardized schooling models of the early 20th century. Designed initially for children from disadvantaged backgrounds, the Montessori approach sought to create learning environments that supported individual differences while encouraging autonomy and social responsibility. Over time, the method has gained recognition for its emphasis on hands-on learning, intrinsic motivation, and holistic development - elements that directly contribute to more inclusive educational settings (Mallett & Schroeder, 2018). Despite its demonstrated benefits, the integration of Montessori methodologies into mainstream public education has been uneven. While research has extensively documented the effectiveness of Montessori pedagogy, less attention has been paid to its potential for adaptation within multigrade classrooms (Brehony, 2000).

The integration of multigrade and Montessori educational approaches requires empirical investigation to evaluate long-term student outcomes and pedagogical effectiveness. Policymakers and educators must explore practical strategies for adapting Montessori methodologies to multigrade settings, particularly in public education systems that may lack the resources or institutional support for full Montessori implementation. Additionally, intersectional research on gender, class, and age within these learning environments can provide deeper insights into how these models contribute to educational equity - a critical aspect that will be thoroughly examined in the final section of this paper.

This paper aims to investigate the synergistic relationship between multigrade education and Montessori pedagogical principles, examining how their integration can create more inclusive, equitable, and effective learning environments. Through a comprehensive literature review and conceptual analysis, this paper seeks to respond to the following research questions:

1. How can Montessori model and multigrade education be integrated to create more inclusive and equitable learning environments?
2. What adaptations to traditional Montessori principles are required to ensure cultural responsiveness in diverse multigrade settings?
3. How does the Culturally Responsive Multigrade Montessori framework tackle systemic barriers to educational equity?

2. Constructivism and pedocentrism - A delineation of “Big (Theoretical) stories” underpinning multigrade learning

The multigrade learning approach and Montessori model are deeply rooted in two significant theoretical frameworks: constructivism and pedocentrism. Both theories provide a foundation for understanding the benefits and underlying mechanisms of multigrade learning environments. This academic exploration aims to delineate these “big stories” or theoretical ideas, demonstrating how they collectively underpin multigrade education and promote a holistic, child-centred approach to learning. A pedocentric approach, as advocated by Key (2000) and rooted in the ideas of Rousseau and Pestalozzi, emphasizes the integration of intellectual education, work

education, and heart education (kindness), promoting learning through the head, hands, and heart. Constructivist theory suggests that students develop their understanding and knowledge through experiences and reflection (Saarsar, 2018). In a multigrade classroom, this perspective encourages students to actively explore concepts and ideas through hands-on activities, experiments, and projects. Montessori education, described by Keefe and Jenkins (2002) as a synergy between teachers and students, fosters a constructivist environment adhered to the needs and characteristics of learners. Within such a system, students have the autonomy to make decisions in their learning process while engaging in interaction, dialogue, and learning through work and reflection (Mavrič, 2020). Rather than positioning the teacher as the primary source of knowledge, the constructivist paradigm places students in a leading role, guiding their own learning (Ültanır, 2012). Pedocentrism, constructivism, multigrade classroom theory, and Montessori model are interconnected through their shared emphasis on learner-centered education, fostering individualized learning experiences, promoting active knowledge construction, and encouraging autonomy, collaboration, and adaptability within diverse and flexible learning environments. If knowledge as such is determined through the constructivist prism, then it could be viewed as a relative and value-laden personal construction formed within the individual and depending on activity and interaction of the individual with its environment (Babić, 2007). An age-diverse environment provided by multigrade classrooms could be seen as embracing the well-known construct of the 'more knowledgeable other' (Vygotsky, 1998) providing varied interactional experiences for children to experience and engage in, enabling more opportunities for meaning making (Hviid, 2008). A constructivist teaching approach is therefore of primary importance in a multigrade classroom where the teacher cannot always be interacting with all the grades at the same time.

While theoretical recommendations for this approach are straightforward, the practical implementation presents significant operational and systemic challenges. An obvious requirement for multigrade teachers is provision of suitable materials, specifically, of differentiated student-centred activities for different grades. Such activities need to consist of both individual and small-group activities (Poonam, 2017). In practice, multigrade classrooms that are informed by these theories tend to be more dynamic and responsive to the needs of individual students. They offer a flexible curriculum that facilitates a variety of learning styles and developmental stages, promoting a community of students who support and learn from one another (Charles et al., 2018). This synergy between constructivist and pedocentric principles creates a learning environment that not only enhances cognitive development but also supports the social, emotional, and moral growth of every child (Liang & Akiba, 2015). As education continues to evolve, embracing these theoretical foundations can help create more inclusive, adaptive, and holistic learning environments that cater to the diverse needs of all students. In multigrade classrooms, constructivist and pedocentric principles are effectively applied by encouraging a child-centred, inquiry-based learning environment. Through differentiated instruction, peer learning, and developmentally appropriate practices, multigrade classrooms support the holistic development of each child, making them a dynamic and inclusive educational model.

3. Examining montessori and multigrade educational models through the lens of mixed-age learning

To fully understand the unique contributions of the Montessori model to multigrade education, it is essential to examine the key distinctions between Montessori methodology and traditional multigrade teaching practices.

The distinctive features of Montessori education's mixed-age classroom approach represent a transformative departure from conventional educational paradigms. While mixed-age groupings appear in various educational contexts, the Montessori model's comprehensive philosophical framework and systematic implementation offer unique insights into effective pedagogical practice. Similarly, multigrade education, often implemented out of necessity in rural or under-resourced settings, provides its own valuable framework for mixed-age learning communities, though typically emerging from different motivations and pedagogical traditions than the Montessori approach (Hyyri-Beihammer & Hascher, 2015a). While both concepts involve mixed-age classrooms, they differ significantly in their implementation, philosophy, and specific practices (Fleming et al., 2023; Macià-Gual & Domingo-Peñañiel, 2021).

Multigrade education has a rich history and theoretical foundation that deserves thorough examination. Little (2001) defines multigrade teaching as "the teaching of students of different ages, grades and abilities in the same group" (p. 483). Unlike Montessori's deliberate developmental approach, multigrade education often emerges from necessity, particularly in rural areas with low population density or limited resources. Despite these pragmatic origins, researchers have identified significant pedagogical value in well-implemented multigrade settings. Veenman's (1997) influential meta-analysis examined 56 studies comparing multigrade and single-grade classrooms, finding no significant differences in academic achievement while noting potential advantages in social-emotional development and attitudes toward school. This foundational research challenged prevailing assumptions that multigrade settings were inherently disadvantageous. Building on this work, Pridmore (2007) conducted extensive research in developing countries, demonstrating that properly supported multigrade teaching can effectively address educational access challenges while maintaining quality. Her research highlighted the importance of specialized teacher training and appropriate curricular adaptation—themes that resonate with, yet differ from, Montessori's approach. Pridmore and Vu (2006) further elaborated on effective multigrade practices, identifying several key strategies: alternating curricula across years, adapting whole-class teaching with differentiated tasks, employing peer tutoring, and developing independent learning skills. These strategies, while sharing some superficial similarities with Montessori methods, emerge from distinctly different theoretical foundations. As Hargreaves (2001) notes, successful multigrade teachers develop a unique pedagogical approach that deliberately leverages age differences rather than attempting to replicate single-grade instruction in a combined setting. Empirical investigations by Lillard and Else-Quest (2006) reveal that Montessori students demonstrate significantly stronger communal bonds compared to peers in traditional settings. Building on this foundation, Rathunde and Csikszentmihalyi's (2005) research uncovered enhanced intrinsic motivation and sophisticated emotional regulation patterns among Montessori learners, suggesting deeper engagement with both academic content and social interactions.

The academic impact of this educational philosophy extends well beyond the immediate learning environment. Longitudinal studies by [Dohrmann et al. \(2007\)](#) document sustained advantages in mathematics and science achievement through secondary education. More recent research by [Snyder et al. \(2022\)](#) identifies significant performance differentials in language arts, while [Lillard et al. \(2021\)](#) demonstrate enduring societal benefits, including elevated levels of civic engagement and interpersonal trust among Montessori alumni.

The theoretical framework underlying these outcomes rests on three interconnected pedagogical principles. First, individualized instruction positions educators as specialized guides who craft precise educational interventions ([Lillard & Else-Quest, 2006](#)). Second, self-directed learning enables students to engage with materials and concepts aligned with their developmental progression ([Rathunde & Csikszentmihalyi, 2005](#)). Finally, peer-mediated learning through vertical age groupings creates opportunities for knowledge exchange and leadership development ([Flynn, 1991](#)). These principles work in concert to create an educational environment that nurtures both individual growth and collective advancement.

The distinctive nature of Montessori mixed-age classrooms becomes particularly evident when contrasted with traditional multigrade settings. Whereas multigrade classrooms often maintain grade-specific curricula taught simultaneously to different age groups, Montessori environments feature a unified developmental curriculum that provides diverse learning paces ([Lillard, 2018](#)). This fundamental difference is further illuminated by [Cossentino's \(2009\)](#) ethnographic research, which reveals how Montessori environments deliberately cultivate "intellectual apprenticeships" through mixed-age interactions that transcend conventional teacher-student dynamics. These apprenticeships foster what Vygotsky described as learning within the "zone of proximal development," a concept thoroughly explored in [Diamond and Lee's \(2011\)](#) investigation of executive function development within Montessori settings.

However, it would be an oversimplification to view multigrade education as merely a pragmatic compromise. As [Mulryan-Kyne \(2007\)](#) argues, multigrade settings can develop their own distinctive pedagogical strengths when teachers receive appropriate preparation and support. Her research reveals that successful multigrade teachers develop sophisticated classroom organization strategies and flexible grouping practices that respond to both curricular demands and student needs. These findings align with [Little's \(2006\)](#) identification of three distinct models of multigrade teaching: quasi-monograde (treating grades separately), differentiated (shared topics with grade-level objectives), and integrated (unified curriculum with individualized expectations) - with the integrated approach sharing certain philosophical similarities with Montessori methods.

[Galton and Hargreaves \(2009\)](#) extend this analysis by examining the social dynamics of multigrade classrooms, finding that well-structured multigrade environments can foster particularly strong peer relationships and collaborative skills. Their ethnographic studies revealed how multigrade settings naturally create opportunities for cross-age interactions that benefit both younger and older students, though these benefits depend heavily on teacher facilitation, a finding that echoes Montessori's emphasis on prepared environments, albeit from a different theoretical perspective.

The socioemotional benefits of Montessori's mixed-age approach have been substantiated by [Murray's \(2012\)](#) comprehensive meta-analysis, which identified consistent patterns of enhanced prosocial behavior, conflict resolution skills, and emotional

Table 1
Multigrade education and montessori model: main characteristics.

Aspect	Multigrade Education	Montessori Model
Age grouping	Typically combines two or more grade levels in one classroom	Uses three-year age spans (e.g., 3–6, 6–9, 9–12 years)
Curriculum	Often follows a standard curriculum adapted for multiple grades	Uses a specially designed curriculum with hands-on materials
Learning approach	May use a mix of whole-class, small group, and individual instruction	Emphasises self-directed learning and individualized instruction
Teacher's role	Teacher as an instructor, adapting lessons for multiple grade levels	Teacher as a guide, facilitating individual and small group learning
Peer interaction	Encourages peer tutoring and collaboration across grade levels	Promotes peer teaching and social learning within the age group
Learning materials	Uses standard textbooks and materials, adapted for multiple grades	Employs specific Montessori materials designed for hands-on learning
Assessment	Often uses traditional grading and standardised testing	Focuses on observation and individual progress rather than grades
Classroom environment	Standard classroom setup, possibly with grade-level areas	Carefully prepared environment with specific learning areas
Student autonomy	Varies, but often less emphasised than in Montessori	Highly emphasised, with students choosing their activities
Pacing	May need to balance different grade level requirements	Allows for individual pacing based on student readiness
Social development	Promotes interaction between different age groups	Fosters community building and social skills within the age group
Adaptability	Can be applied in various educational settings	Requires specific training and materials to implement properly
Philosophical foundation	Often a practical solution for small schools or communities	Based on Maria Montessori's educational philosophy and observations
Focus on independence	May vary depending on implementation	Strongly emphasises developing student independence

intelligence among Montessori students compared to peers in single-age classrooms. These findings are further contextualized by [Ansari and Winsler's \(2020\)](#) research with diverse urban populations, demonstrating how Montessori's mixed-age structure creates particularly powerful learning opportunities for students from varied socioeconomic backgrounds. This aligns with ecological systems theory as articulated by [Bronfenbrenner \(1979\)](#), who emphasized the importance of diverse microsystems in child development, a principle deliberately enacted through Montessori's mixed-age structure.

[Miller's \(1991\)](#) investigations into multigrade environments provide an interesting counterpoint, finding that rural multigrade classrooms often develop similarly strong community bonds, but through different mechanisms. While Montessori environments deliberately structure materials and activities to foster specific types of interactions, Miller found that successful multigrade teachers create community through shared responsibilities, collaborative projects, and explicit attention to group dynamics. [Little's \(2001\)](#) subsequent research confirmed these findings, suggesting that the social benefits of mixed-age grouping may transcend specific pedagogical approaches when certain fundamental conditions are met.

Research by [Quail and Smyth \(2014\)](#) examining cognitive development in multigrade settings found similar patterns of enhanced executive function development, albeit through different pathways. Their longitudinal study of Irish multigrade schools revealed that students in well-structured multigrade environments demonstrated advanced metacognitive skills and self-regulation compared to peers in single-grade classrooms. These findings suggest that mixed-age grouping itself may provide certain cognitive benefits regardless of specific pedagogical approach, though the mechanisms and magnitude may differ between Montessori and traditional multigrade implementations.

To fully understand the unique contributions of both approaches to mixed-age education, it is essential to recognize that their effectiveness emerges not merely from age diversity, but from carefully orchestrated educational ecosystems. In Montessori settings, this involves developmental appropriateness, prepared environments, and specialized teacher training ([Lillard, 2019](#); Montessori, 1912/2012). In effective multigrade environments, as [Pridmore \(2007\)](#) demonstrates, success depends on adapted curriculum materials, flexible classroom management strategies, and specialized preparation for teachers. Both approaches, when properly implemented, create distinctive learning communities that challenge the conventional mixed-age paradigm of education, but from different philosophical foundations and practical traditions. [Table 1](#) provides a comparison between multigrade education and Montessori model across various aspects of their educational approaches.

A systematic comparison reveals several key distinctions that highlight their unique characteristics and potential contributions to educational practice. This provides essential insights for both theoretical understanding and practical application. These dimensions warrant specific examination for several compelling reasons.

When critically analysed in comparison with traditional multigrade teaching models, Montessori education offers a more comprehensive and theoretically refined approach. Key differentiating features include meticulously curated learning environments, specialized, self-correcting instructional materials and a fundamentally facilitative pedagogical stance ([Mulryan-Kyne, 2007](#)). Montessori education represents a sophisticated reimagining of educational epistemology, prioritizing individual development, collaborative learning, and intrinsic motivation. As [Angell \(2004\)](#) posits, this approach potentially offers a superior mechanism for promoting community values, particularly for students from diverse backgrounds.

However, as [Little \(2006\)](#) argues, well-implemented multigrade education offers its own distinctive advantages, particularly in promoting flexible cognitive frameworks and adaptive social skills. Her extensive field research across multiple countries suggests that multigrade settings can develop particularly strong community bonds when teachers deliberately leverage age diversity as a pedagogical resource rather than attempting to replicate single-grade instruction. These findings challenge simplistic hierarchical comparisons between the two approaches, suggesting instead that each offers unique contributions to educational practice.

While both models embrace mixed-age classrooms, they differ fundamentally in their philosophical rationale and implementation. Montessori's three-year age spans are deliberately designed to align with developmental plans, whereas multigrade configurations often emerge from pragmatic considerations related to enrolment or resource constraints. This distinction influences everything from curriculum organization to assessment approaches and merits careful examination for its implications on educational equity. Despite its innovative potential, the Montessori approach confronts significant systemic challenges. [Fleming et al. \(2023\)](#) critically examined demographic representation, revealing substantial underrepresentation of students from marginalized socioeconomic backgrounds.

[Mohamed \(2017\)](#) problematizes conventional educational metrics, arguing for a paradigm shift that transcends standardized assessment, emphasizing instead the cultivation of metacognitive capabilities and holistic developmental processes. While both approaches offer valuable alternatives to traditional age-graded education, they face distinct challenges in implementation. The Montessori model requires specific training and materials, making it more resource-intensive to implement properly. This has led to several equity-related concerns: access barriers due to concentration in private school settings, resource requirements that may limit implementation in disadvantaged communities and risk of the Montessori approach becoming an exclusive educational option rather than the inclusive model it was designed to be.

Similar challenges exist in multigrade education, as [Pridmore \(2007\)](#) documents in her analysis of rural schools in resource-constrained environments. Her research reveals that without adequate teacher preparation, curricular resources, and administrative support, multigrade settings can exacerbate educational inequities rather than mitigating them. However, they also identify promising models where multigrade education serves as an effective equity strategy when properly supported, an important counterpoint to assumptions that mixed-age grouping is inherently problematic in resource-limited contexts.

These distinctions highlight how each approach offers unique benefits while facing different challenges in promoting educational equity and access. Understanding these differences is crucial for educators and policymakers working to implement effective mixed-age learning environments that serve diverse student populations. In response to these challenges, educational researchers and practitioners have begun exploring innovative frameworks that integrate the strengths of various pedagogical traditions while

addressing their limitations. By synthesizing culturally responsive teaching methodologies with established mixed-age learning approaches, a more inclusive and equitable educational model becomes possible. It is within this context of seeking transformative educational practices that a new integrative framework has emerged, offering promising pathways for serving diverse student populations across various educational settings.

4. The culturally responsive multigrade montessori (CRMM) framework

The Culturally Responsive Multigrade Montessori (CRMM) Framework emerges at the intersection of Montessori pedagogy and culturally responsive teaching practices, addressing the unique challenges and opportunities presented by multigrade classrooms in diverse cultural contexts. As Montessori (1912/1964) originally envisioned, children learn optimally in environments that respect their natural development and foster independence through carefully prepared learning spaces. This foundational principle becomes particularly salient when considering the implementation of Montessori methods across culturally diverse multigrade settings (Lillard, 2017). The theoretical underpinnings of the CRMM Framework draw significantly from Ladson-Billings' (1995) groundbreaking work on culturally relevant pedagogy, which emphasizes academic excellence while affirming students' cultural identities. Gay (2018) further articulates that culturally responsive teaching requires educators to use "the cultural knowledge, prior experiences, frames of reference, and performance styles of ethnically diverse students to make learning encounters more relevant to and effective for them" (p. 36).

When these principles are synthesized with Montessori's mixed-age classroom model, a unique pedagogical approach emerges that addresses both developmental and cultural dimensions of learning. Research by Cossentino (2005) illuminates how Montessori method's emphasis on observation and individual progression aligns naturally with culturally responsive practices, as both prioritize responding to the unique needs and backgrounds of each child. Additionally, Torrence and Chattin-McNichols (2000) note that the multigrade structure inherent to Montessori classrooms creates a community of learners that mirrors many indigenous and traditional educational models where children of various ages learn together in natural social groupings.

The implementation of the CRMM Framework necessitates what Hammond (2015) describes as "culturally responsive brain-based teaching," which recognizes how cultural contexts shape cognitive development and learning processes. This neuroscience-informed perspective complements Montessori's (1949/1995) observations about sensitive periods in development and the importance of matching educational experiences to developmental readiness. Empirical studies conducted by Debs and Brown (2017) suggest that intentional cultural responsiveness in Montessori settings can mitigate educational disparities while preserving the core elements of the Montessori approach. Similarly, Banks (2019) argues that multicultural education principles can be effectively integrated with progressive educational models like Montessori to create more equitable learning environments.

The CRMM Framework also builds upon Rogoff's (2003) sociocultural theory, which emphasizes that learning occurs through participation in cultural activities with guidance from more knowledgeable others. This perspective resonates with Montessori's vision of the teacher as a guide and the mixed-age classroom as a microcosm of society where children learn from one another through observation and collaboration. The CRMM framework synthesizes several theoretical traditions: Montessori pedagogy, multigrade education principles and culturally responsive teaching. This integration creates a coherent approach that addresses both the practical challenges of multigrade settings and the equity considerations in diverse cultural contexts.

As educational systems worldwide grapple with increasing cultural diversity and limited resources, the CRMM Framework offers a promising approach that honors both the developmental wisdom of Montessori pedagogy and the critical importance of cultural responsiveness in contemporary education (Paris & Alim, 2017). This framework connects with the inclusive education perspective of UNESCO's Framework (Education 2030: Incheon Declaration and Framework for Action for the implementation of Sustainable Development Goal 4), which emphasizes that inclusion and equity in and through education is the cornerstone of a transformative education agenda. The UNESCO framework commits to addressing all forms of exclusion and marginalization, disparities and inequalities in access, participation and learning outcomes, stating that no education target should be considered met unless met by all. This commitment to making necessary changes in education policies and focusing efforts on the most disadvantaged, especially those with disabilities, ensures that no one is left behind - principles that align closely with the CRMM Framework's objectives. Further, the text delineates the structural components and pedagogical mechanisms through which the framework manifests in educational praxis. Through methodical analysis of these interconnected elements, we clarify how this integrated approach addresses the complex intersectionality of developmental appropriateness, cultural responsiveness, and multigrade instruction within diverse educational contexts.

5. The mixed-age montessori model for inclusive education

The concept of multigrade teaching presents both unique opportunities and significant challenges in contemporary education, particularly within the Montessori framework. While often perceived as pedagogically complex due to the necessity of differentiating instructional materials and activities across varying developmental stages, multigrade structures offer considerable potential for enhancing educational outcomes through peer interaction and inclusive practices (Hyrý-Beihammer & Hascher, 2015b).

The theoretical foundation of age-based educational structuring warrants critical examination. Traditional educational institutions have historically employed age as a primary organizational determinant since the massification of schooling, adhering to Komenský's class/grade-subject-lesson system (Jelovica & Alajbeg, 2023; Norlin, 2020). However, this age-based stratification frequently obscures other crucial social determinants that significantly influence students' educational experiences, including gender, ethnic background, religious affiliation, social class, and individual abilities.

Montessori (2012) offers a contrasting perspective, advocating for the pedagogical benefits of mixed-age groupings in educational settings. She posits that children derive greater developmental benefits from peer interactions when there exists a substantial age difference among them, as such environments foster peer learning, mentorship opportunities, and the development of social competencies across developmental stages. This recommendation aligns with contemporary discourse advocating for more inclusive and socially responsive educational practices that transcend age-based frameworks to address the diverse needs and capabilities of all learners.

The intersectional nature of students' identities, as highlighted by Alanen (2016), suggests that "children are not only children; they are girls/boys (i.e., gendered) and they are also in many cases 'raced,' dis/abled, classed, and ascribed ethnicity" (p. 159). Seminal theoretical developments in childhood studies position children as a minority group within power relations, emphasizing the importance of examining age as a structural determinant affecting children's social positioning (James et al., 1998). This perspective corresponds with broader discussions concerning inequality and structural discrimination in education, where freedom and opportunities are often distributed asymmetrically (Oakley, 1994). The reconceptualization of children as a minority group represents an attempt to contest asymmetrical power relations between adults and children, predicated on socially derived interpretations of age that determine children's positions within the social world (Alanen, 1994).

While these theoretical perspectives illuminate the structural implications of age-based educational systems, empirical evidence further substantiates the value of alternative approaches. Peer learning emerges as a particularly valuable pedagogical component, with students naturally utilizing unstructured time to assist peers, thereby creating supportive learning communities. Studies indicate improved academic outcomes, particularly in early elementary education, where the presence of older students significantly enhances the learning experiences of younger ones (Borbely et al., 2023). Proehl et al. (2013) documented that in multigrade classrooms, students demonstrate increased responsibility, improved behavioral outcomes, and greater interpersonal respect for their peers.

Research indicates that smaller institutional settings are particularly beneficial for mixed-age learning. Consequently, many educators intentionally transition from larger to smaller schools, seeking environments that better support their pedagogical ideals (Raggl, 2015). This transition frequently reflects educators' aspirations to implement pedagogical approaches aligned with Montessori principles, particularly in environments conducive to mixed-age learning and individualized instruction within more intimate institutional settings.

Within this context, Montessori multigrade classrooms offer a compelling model for inclusive education. By emphasizing collaboration, sustainability, and respect for individual developmental progression, the Montessori approach provides a structured yet adaptable framework that aligns with contemporary educational priorities (Wisbey, 2023). The model fosters peer learning, encourages student autonomy, and promotes inclusivity- key elements that support diverse learners in multigrade settings.

The Montessori principle of mixed-age groupings, typically spanning three years, aligns seamlessly with the multigrade classroom model. In this environment, older students assume mentorship roles, guiding their younger peers, while younger students benefit from observational learning and scaffolded instruction (Lillard, 2019). This structure encourages cooperation rather than competition, reinforcing equity through peer support and encouraging a collaborative learning culture where students develop both academic proficiencies and social-emotional competencies (Montessori, 2019).

By reconceptualizing different age groups not as a logistical challenge but as an opportunity for rich, collaborative learning, educators can create more inclusive and dynamic educational environments. The mixed-age grouping characteristic of Montessori classrooms naturally supports inclusive practices by celebrating diversity and promoting peer learning opportunities that benefit children across the developmental spectrum (Lillard, 2019).

Montessori materials offer transformative potential for multigrade classrooms by providing adaptive, student-centered learning tools that transcend traditional age-based educational barriers. These meticulously designed resources enable students to learn at their individual pace while promoting collaboration across different age groups. By promoting self-directed exploration, sensory engagement, and intellectual independence, Montessori materials create a dynamic learning environment where diversity becomes an educational strength (Marshall, 2017). They enable educators to simultaneously support multiple learning levels, encourage peer teaching, and develop students' critical thinking and problem-solving skills through hands-on, experiential learning. In multigrade settings, these materials function not merely as educational tools but as bridges connecting students of different ages, abilities, and backgrounds, ultimately creating a more inclusive and responsive educational ecosystem.

6. Contextualized environments for inclusive development

The academic benefits of multigrade Montessori education extend significantly beyond peer interaction. Such environments facilitate interconnected thematic learning, emphasizing vertical progression while cultivating critical thinking and creativity (Bajpai & Pandey, 2023). The multigrade classroom naturally encourages active listening and inquiry as students engage with concepts across different developmental progression. This pedagogical approach aligns substantively with Montessori's vision of education, wherein children's individual developmental needs are addressed within a meticulously prepared environment that supports their natural progression (Grazzini, 2020).

In multigrade classrooms, Montessori's methodology offers a distinctive framework that transforms educational spaces into dynamic learning environments where students of diverse ages engage both collaboratively and independently. The emphasis Montessori places on individualized instruction, in conjunction with the specific roles assigned to educators and peers, creates a multigrade classroom that effectively balances individual autonomy and collaborative learning, fundamentally framed by principles of inclusivity.

The efficacy of multigrade Montessori education ultimately depends on achieving balance between theoretical understanding and practical implementation. As contemporary education systems continue to evolve, insights derived from Montessori multigrade

classrooms can significantly inform broader initiatives to create more adaptive, inclusive, and effective learning environments. Through the refinement of instructional strategies and the strengthening of teacher support systems, multigrade education demonstrates considerable potential to address the diverse needs of heterogeneous student populations while enhancing overall educational quality. This inclusive approach ensures that the prepared environment functions as a democratic space where each child can discover their unique developmental pathway, thereby advancing educational equity through deliberate environmental design and implementation.

The profound influence of environmental factors on child development was established decades ago in the seminal theoretical frameworks proposed by Vygotsky (1978), Piaget (1978), and Bronfenbrenner (1979). Similarly, a fundamental tenet of Montessori pedagogy centers on the meticulously prepared educational environment specifically designed to support multigrade groupings. This pedagogical setting diverges substantially from traditional classroom configurations through its deliberate spatial organization, incorporating developmentally appropriate furnishings, zones that permit unrestricted movement, and carefully curated didactic materials that foster learner autonomy (Al et al., 2012).

The Montessori educational framework is predicated upon three fundamental principles: environmental design, material organization, and an autonomous learning methodology (İslamoğlu, 2017; Montessori, 1994). Within this framework, the prepared environment assumes a central role, facilitating experiential learning through systematically arranged, sensory-based materials that promote cognitive development across diverse subject domains for children aged 0–12+ years (Colgan, 2016; Lillard, 2018). These environments emphasize the ordered arrangement of color-coded materials, which not only support cognitive organization but also foster essential social-emotional competencies, including theory of mind and self-regulation (Lillard et al., 2017; Montessori, 2019).

Macià-Gual and Domingo-Peñañiel (2021) validate that this prepared environment facilitates children's autonomous development through qualified cognitive stimulation and social interactions, enabling them to cultivate their innate capabilities without inappropriate adult interference (Kirk & Jay, 2018; Lillard, 2018). Empirical research consistently demonstrates that participants' perspectives on physical arrangements align closely with Montessori's fundamental concept of the "designed environment."

Within this carefully prepared setting, children are granted freedom of movement and activity, a critical element that Montessori (1995) identified as essential for authentic self-development. This freedom, when integrated with the structured environment, creates a distinctive educational space where children can engage with materials at their individual pace and according to their specific interests, while still maintaining the ordered framework necessary for effective learning.

This meticulously designed environment plays a crucial role in promoting educational inclusion by accommodating diverse learning needs and styles. The inherent flexibility of the prepared environment allows children from various socioeconomic backgrounds, abilities, and learning preferences to access materials and experiences that correspond to their individual developmental progression (Diamond & Lee, 2011). Through this ecological approach to educational design, the Montessori multigrade classroom represents not merely an alternative organizational structure but a comprehensive framework for inclusive, developmentally responsive pedagogy.

7. Sensory integration and individualized development in mixed age environments

Complementing established developmental theories, Montessori's pedagogical principles emphasize the fundamental importance of hands-on learning experiences that seamlessly integrate sensory engagement with cognitive development across multiple disciplinary domains (Frierson, 2015; Gross & Rutland, 2019). Within Montessori educational environments, the strategic implementation of manipulatives and experiential learning tools cultivates an active, student-centered learning atmosphere that address and celebrates diverse learning modalities and cognitive profiles. The inherently self-correcting nature of Montessori materials enables children to pursue knowledge acquisition independently while simultaneously developing a profound sense of competence and belonging, regardless of their initial developmental positions or individualized learning (Marshall, 2017).

By engaging students through methodically individualized, multisensory instructional approaches, this pedagogical framework not only enhances cognitive and social-emotional development but also substantively promotes educational inclusion, ensuring that students with varying abilities, including those with special educational needs and disabilities, receive appropriate support within the communal learning environment. Through its deliberate emphasis on self-directed learning processes and differentiated instructional methodologies, the Montessori model contributes significantly to the establishment of a more equitable and inclusive educational ecosystem, effectively empowering all learners to realize their full developmental potential.

The multisensory dimension of Montessori education provides a neurologically sound foundation for learning that transcends traditional educational practices. Research in educational neuroscience indicates that multisensory integration enhances neural connectivity and strengthens memory formation, particularly in developing brains (Sheppard et al., 2016). The Montessori approach capitalizes on these neurological principles by engaging multiple sensory pathways simultaneously, creating richer, more robust learning experiences that support diverse cognitive profiles. This sensory-rich environment is particularly beneficial for children with neurodevelopmental differences, who may process information more effectively through non-traditional sensory channels (Bodison & Parham, 2018).

The carefully sequenced progression of Montessori materials provides scaffolding that supports children's natural developmental path while encouraging autonomy. These materials are designed with what Montessori termed "control of error," allowing children to identify and correct their own mistakes without external judgment or intervention (Montessori, 2012). This feature is particularly significant for fostering resilience and self-efficacy in mixed-age classrooms, where children develop metacognitive awareness and self-regulation skills essential for both academic success and social integration (Diamond & Lee, 2011; Lillard, 2019).

The individualized learning approach inherent in the Montessori method enables students to progress at their own optimal pace,

addressing their unique cognitive strengths, personal interests, and distinctive learning styles. This student-centered methodology substantially enhances engagement, intrinsic motivation, and comprehensive academic achievement by providing instruction that aligns precisely with students' developmental needs and readiness. Contemporary empirical research suggests that when learners exercise meaningful autonomy in their educational journey, they develop significantly deeper conceptual understanding and demonstrate improved retention of knowledge across domains (Sharma et al., 2023).

Moreover, individualized learning methodically fosters self-directed learning competencies and advanced critical thinking skills, which are increasingly recognized as essential for lifelong learning capacity and cognitive adaptability in an evolving educational and professional landscape (Dahal & Bhat, 2024). By systematically accommodating diverse learning profiles and needs, individualized learning also promotes substantive inclusion and educational equity, ensuring that all students, regardless of cultural background, cognitive ability, or socioeconomic status, receive the differentiated support necessary to thrive academically and socially.

This student-centered pedagogical approach demonstrably reduces achievement disparities and fosters a genuinely inclusive learning environment where every learner has equitable opportunity to achieve meaningful success (Tampubolon et al., 2023). By actively promoting student agency and providing personalized scaffolding, this approach empowers learners to assume responsibility for their educational development and cultivate sustained intrinsic motivation, ultimately leading to more profound and enduring learning outcomes.

The mixed-age composition of Montessori classrooms further enhances the effectiveness of individualized learning by creating natural opportunities for peer mentoring and collaborative knowledge construction. Older students consolidate their understanding by explaining concepts to younger peers, while younger students benefit from observational learning and proximal development support (Lillard, 2018, Vygotsky, 1978).

The integration of freedom within boundaries, a cornerstone of Montessori philosophy, creates a balanced educational environment that supports both autonomy and community. Students exercise choice within carefully defined parameters, developing decision-making skills and self-discipline while maintaining the order necessary for productive learning (Cossentino, 2009). This balanced approach is particularly beneficial in addressing the diverse needs present in inclusive educational settings, providing sufficient structure for those who require it while allowing flexibility for individual expression and exploration.

In contemporary educational discourse, Montessori's vision of individualized, inclusive education aligns remarkably well with emerging understandings of neurodiversity and universal design for learning. By recognizing and accommodating the natural variability in human cognitive development, the Montessori approach anticipates modern conceptions of inclusive education that celebrate rather than pathologize differences (Marshall, 2017). The prepared environment, with its emphasis on accessibility, choice, and sensory engagement, exemplifies many principles of universal design, creating educational spaces where diverse learners can thrive without segregation or stigmatization.

Through its comprehensive integration of sensory engagement, individualized progression, and community-building in mixed-age settings, the Montessori approach offers a sophisticated framework for inclusive education that honors both individual development and collective flourishing. This balanced educational paradigm continues to demonstrate remarkable relevance in addressing contemporary challenges of educational equity and inclusion, providing valuable insights for broader educational reform efforts aimed at meeting the needs of increasingly diverse student populations.

8. The teacher as guide in mixed-age learning communities

Unlike traditional educational models that predominantly rely on direct instruction and teacher-centered knowledge transmission, the Montessori pedagogical framework fundamentally prioritizes self-directed learning processes, with adults serving as skilled facilitators rather than mere transmitters of knowledge. Within this distinctive educational paradigm, educators methodically guide children toward developmentally appropriate materials and learning experiences, creating opportunities for intrinsically motivated exploration and sustained skill acquisition across diverse developmental domains (Gross & Rutland, 2019).

This transformative reconceptualization of the educator's role represents a significant departure from conventional teaching practices. Within the Montessori framework, teachers are deliberately characterized as "guides" or "directresses," linguistic distinctions that reflect their primary function in supporting children's natural development rather than imposing externally structured lessons or curricula (Montessori, 2019). This semantic shift embodies a profound philosophical reorientation regarding the relationship between adults and children in educational settings, emphasizing partnership rather than hierarchical authority.

Given the pivotal role of educators in promoting an inclusive and developmentally responsive learning environment, Montessori (2019) emphasizes the critical importance of comprehensive adult preparation and training, ensuring that educators are adequately equipped to support diverse learners with respect, cultural sensitivity, and genuine inclusivity. This imperative is further reinforced by Macià-Gual and Domingo-Peñafiel (2021), who highlight that Montessori educators bear significant responsibility for shaping inclusive practices that authentically honor each child's individual developmental path and learning profile.

The redefined teacher role in Montessori education encompasses several interconnected dimensions that extend beyond traditional pedagogical functions. Montessori educators serve as environmental designers, meticulously preparing and maintaining learning spaces that facilitate discovery and independence. They function as keen observers, systematically documenting children's interactions with materials and peers to identify developmental patterns, interests, and needs. As developmental specialists, they possess comprehensive understanding of typical and atypical developmental paths, enabling them to recognize and respond appropriately to diverse learning profiles (Lillard, 2018).

Educators in Montessori settings also assume the role of community facilitators, developing productive social interactions and collaborative learning opportunities within the mixed-age classroom ecosystem. Their work as curriculum adapters involves

thoughtfully modifying and extending learning materials to meet the evolving needs of their specific student population. Addressing the multifaceted challenges of multigrade teaching requires both practical strategies and research-backed approaches to teacher preparation and support. Empirical studies have consistently demonstrated that successful implementation often depends on flexible teaching methodologies, systematic differentiation of instruction, and the strategic integration of authentic, real-life learning experiences to enhance relevance and engagement across age groups (Bajpai & Pandey, 2023). These evidence-based pedagogical approaches align naturally with Montessori principles, where mixed-age groupings and individualized learning constitute fundamental components of the educational framework.

Equally important is ensuring that multigrade classrooms receive equitable levels of support and resources compared to traditional single-grade settings. This necessitates well-structured teacher preparation programs that specifically equip educators with the specialized skills required to effectively manage diverse learning needs in mixed-age environments (Engin, 2018). Targeted professional development addressing multigrade-specific instructional strategies, differentiation techniques, and classroom organization systems proves particularly valuable for educators transitioning to this complex teaching context.

"Free work" represents a core element of Montessori pedagogy that both supports and challenges teachers in multigrade settings. This structured independence allows children to exercise meaningful choice regarding collaboration partners, learning activities, and work pace, encouraging responsibility for individual learning processes while developing self-regulation capabilities and following intrinsic interests (Hyry-Beihammer & Hascher, 2015b). During these periods of independent activity, teachers must remain attentive and available, providing individualized guidance while respecting student autonomy, a demanding but essential balance.

The implementation of individualized work plans represents another evidence-based strategy for supporting both teachers and students in multigrade Montessori environments. These personalized learning documents help cultivate students' individual responsibility for learning while providing organizational structure that facilitates teacher monitoring and support, as suggested by Hargreaves (2001). Such tools create bridge between student independence and teacher oversight, enhancing accountability while honoring autonomy.

Contemporary research by Carrete-Marín et al. (2024) emphasizes the urgent need for more targeted teacher training programs and systematic resource adaptation specifically designed for multigrade Montessori contexts. This research highlights the importance of developing specialized professional preparation that addresses the unique challenges of facilitating mixed-age learning communities while maintaining fidelity to Montessori principles.

Research indicates that the effectiveness of Montessori resources in supporting teacher facilitation is not necessarily dependent on expensive commercial materials. Brunold-Conesa (2019) presents compelling evidence that the approach to teacher training, particularly in developing cultural sensitivity, respect for diverse learning profiles, and skilled observation matters substantially more than the financial investment in educational tools. This finding has significant implications for expanding access to quality Montessori education in diverse socioeconomic contexts. Perhaps most importantly, teacher education must prepare Montessori educators to serve as advocates for mixed-age, child-centered education within broader educational systems often oriented toward standardization and homogeneity. This advocacy role requires developing articulate explanations of Montessori principles, skill in documenting children's development through authentic assessment approaches, and strategies for educating stakeholders about the benefits of this alternative educational model (Cossentino, 2006).

By comprehensively preparing teachers for their transformed role as facilitators rather than directors of learning, Montessori teacher education programs can support the successful implementation of mixed-age education that truly honors the developmental diversity present in every classroom. The redefined teacher role, when authentically embodied, creates educational environments where children across the developmental spectrum can thrive, developing not only academic knowledge but the independence, intrinsic motivation, and social responsibility that characterize the Montessori vision of education.

9. The contextual dimension of mixed-age learning communities

Montessori philosophy fundamentally emphasizes the interconnectedness of human experience and the critical importance of preparing children not merely for academic achievement but for meaningful participation as active, engaged citizens within democratic societies. In multigrade classroom environments, where students across developmental stages learn collaboratively, community integration assumes heightened significance as both pedagogical strategy and philosophical orientation. This approach provides authentic contexts for experiential learning, models collaborative citizenship, and facilitates students' conceptualization of themselves as integral components within a broader social ecology.

Contemporary research substantiates the developmental significance of integrating children into community structures and promoting multi-age relationships beyond the classroom environment. This ecological approach provides opportunities for meaningful civic participation, authentic learning experiences situated in real-world contexts, and the development of sophisticated social competencies essential for democratic engagement (Leidums, 2016; Rogoff et al., 2010). Anthropological research by Rogoff et al. (2010) documents significant cultural variation in children's social engagement patterns, with certain communities prioritizing integration across developmental stages, while others emphasize age-segregated peer interactions. These cultural differences reflect diverse conceptualizations of childhood, development, and community responsibility that have profound implications for educational practice.

Empirical studies demonstrate that structured reflection on community service experiences significantly enhances student developmental outcomes across multiple domains, with participants frequently applying theoretical classroom knowledge to address concrete community challenges. However, the systematic integration of community experiences into academic curricula remains inconsistently implemented, suggesting a persistent need for more robust support of integrative learning approaches and institutional

collaboration across educational and community contexts (Walton et al., 2022). These findings collectively underscore the substantive value of community integration in educational settings across developmental stages and cultural contexts.

Community partnerships with local organizations, businesses, and governmental agencies create reciprocal relationships that enhance educational experiences while addressing community priorities. These partnerships may involve experts sharing specialized knowledge, organizations providing contexts for applied learning, or collaborative projects addressing local challenges (Montt-Blanchard et al., 2023). Such relationships extend the classroom beyond physical boundaries, positioning students as legitimate peripheral participants in authentic community practices.

Cultural diversity receives explicit recognition through the curriculum that incorporates multiple perspectives and celebrates community traditions and knowledge. This approach includes critical examination of historical narratives, engagement with diverse literature and cultural expressions, and thoughtful inclusion of community members as cultural resources (Rogoff et al., 2010). By situating learning within culturally diverse contexts, Montessori education cultivates intercultural competence essential for citizenship in pluralistic societies.

Multigrade teaching, when implemented without adequate support and resources, can exacerbate rather than mitigate educational inequities. The CRMM framework addresses these challenges by emphasizing adaptability, contextual responsiveness, and resource-sensitive implementation strategies. By focusing on the fundamental principles rather than rigid implementation requirements, this approach allows for contextually appropriate adaptations while maintaining fidelity to core inclusive values. The framework's emphasis on teacher preparation that develops critical consciousness alongside practical skills equips educators to navigate systemic constraints while advocating for more equitable educational structures.

10. Conclusion

The integration of Montessori principles with multigrade teaching approaches, when viewed through the lens of inclusive pedagogy, offers a promising pathway toward more equitable and effective education. This integration creates learning environments that honor diverse developmental paths, cultural backgrounds, and learning needs while fostering community, autonomy, and social responsibility. The Culturally Responsive Multigrade Montessori framework provides a theoretical foundation for implementing this integrated approach in diverse contexts, addressing historical exclusionary practices while centering inclusion and equity.

For this potential to be fully realized, continued attention must be given to issues of accessibility, teacher preparation, and systemic support. Future research should focus on developing and evaluating context-specific implementation models, examining long-term outcomes across diverse populations, and identifying sustainable approaches to resource allocation and teacher development. By confronting these challenges while building on the significant potential of integrated multigrade Montessori education, we can work toward truly inclusive learning environments that serve all children, regardless of background, ability, or circumstance.

The results of this study enhance knowledge of inclusive teaching practices by showing how carefully combined educational methods can establish learning spaces that recognize and respond to the complex aspects of equity and diversity. By reconceptualizing educational spaces, practices, and relationships through an inclusive lens, the integrated multigrade Montessori approach offers not merely an alternative educational model but a transformative vision of education that honors the dignity, potential, and rights of all learners.

CRedit authorship contribution statement

Marija Sablić: Writing – original draft, Supervision, Conceptualization. **Ana Miroslavljević:** Writing – original draft, Visualization, Data curation. **Katarina Bogatić:** Writing – original draft, Validation, Conceptualization.

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