ACADEMIC BENEFITS OF
Fine Motor Skill Development

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Fine motor skill development and art education go hand in hand. These small muscle movements are primarily in the hands, wrists, and fingers and are used for drawing, writing, and holding, grasping, or manipulating objects (Józsa, K et al., 2023). By two months, fine motor skill development begins as babies grasp a rattle when placed in their hands (Children's Minnesota, n.d.).

AUTHORS

Dr. Theresa Haugen
The Art of Education University

Dr. Heather Crockett
The Art of Education University

Lynisa Ross
The Art of Education University

While fine motor skills are essential for coordination and tasks requiring muscle groups for manipulation and execution, the benefits of fine motor skills go well beyond drawing, writing, building, or cutting. These skills also boost neural development, improve handwriting skills, increase academic achievement in math and reading, and indicate higher IQs and fewer occurrences of attention-deficit /hyperactivity disorder (ADHD) and autism traits.

Fine motor development is also needed professionally. Coughlan (2018) stated that a more well-rounded curriculum is needed which includes creative and artistic subjects, so students can gain fine motor skills and "learn to use their hands" (paras 5). Prof Kneebone, professor of surgical education at Imperial College, London stated many tasks are reduced to swiping on a flat screen, which lowers the ability to use one's hands for tasks that require more fine motor development (Coughlan, 2018). Kneebone warned that medical students have high grades but lack the fine motor skills needed for surgical cutting and sewing. Kneebone stated, "It is a concern of mine and my scientific colleagues that whereas in the past you could make the assumption that students would leave school able to do certain practical things - cutting things out, making things - that is no longer the case" (Coughlan, 2018, para.4). Painting, cutting, assembling, drawing, gluing, and writing, activities practiced in the art room, can reinforce fine motor skills necessary for other academic subjects, life tasks such as buttoning, tying, and manipulating everyday objects and professional skills such as surgical cutting and tying among others. Art educators should review the

curriculum and allow opportunities for all ages to boost fine motor skill development in the art room.

NEURAL DEVELOPMENT

When children enter kindergarten with the ability to draw and trace designs, they can concentrate on the more cognitive tasks of reading and writing than children who struggle to hold a pencil (Cameron et al., 2012; Suggate et al., 2018). A study with 213 kindergarteners documented more robust academic growth from fall to spring in children with advanced fine motor skills (Cameron et al., 2012). Fall to spring academic gains such as decoding, reading comprehension, and overall reading also include increased executive functioning in the brain. Tasks that stimulate the brain's prefrontal area associated with executive function often activate parts of the brain, such as the cerebellum, used for fine motor processing (Cameron et al., 2012). Researchers also noticed this effect in students with Down syndrome, where fine motor skills were highly associated with better performance in higher-order cognition, including cognitive planning and verbal working memory (Chen et al., 2014).

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IMPROVED HANDWRITING SKILLS

The ability to write depends on arm movement, fine muscle control within the hand and fingertips that coordinate with cognitive skills, and patience (Huffman & Fortenbery, 2011). Participation in more significant arm movements, such as painting a large area or object, helps young children gain the motor coordination needed to begin writing. Writing can create a path to reading for young learners, building skills in letter identification, phonological awareness, and letter-sound correspondence, which, in turn, can lead to more substantial academic outcomes in reading, writing, and spelling (Wells Rowe, 2017). Interestingly, handwriting skills can also affect perceived academic abilities, as noted in studies where students with poorer handwriting received lower grades

Developed fine motor skill abilities can be powerful predictors of academic achievement, especially prior to entering kindergarten *(Cameron et al., 2012; Dinehart & Manfra, 2013; Grissmer et al., 2010; Katagiri et al., 2021; Pitchford et al., 2016; Wells Rowe, 2017).*

than peers with better handwriting even when the content was similar, potentially impacting academic performance, behavior, and self-esteem (Feder & Majnemer, 2007).

Handwriting and other fine motor tasks can occupy 30-60% of the school day, so difficulties in these areas can have profound effects (Feder & Majnemer, 2007). Between 10-30% of students struggle with handwriting skills. Students with handwriting barriers are susceptible to difficulties in math, a lower verbal IQ, and attention difficulties (Feder & Majnemer, 2007). Graphomotor skills fit within the broader category of fine motor skills, specifically pencil operation in handwriting activities, and connect to letter formation and fluency (Suggate et al., 2018). Students who struggle with graphomotor skills and reading fluency often become more disengaged with school, which perpetuates lower academic performance and potential behaviors. Graphomotor skills play a more significant role than the larger group of fine motor activities in early reading development, even when students do not know their letters (Suggate et al., 2018). This role may include visual perceptual skills, orthographic coding, motor planning and execution, kinesthetic feedback, and visual-motor coordination (Suggate et al., 2018; Thorne, n.d).

Undeveloped writing skills through reduced fine motor development can continue to significantly affect students through college (Connelly et al., 2005). College courses require handwriting clarity and speed for efficiency in note-taking. Increased handwriting speed reduces the burden on working memory, allowing for more metacognitive writing processes (Peverly, 2006). A study with undergraduate students found that undergraduates had the handwriting speed, fluency, and quality equivalent ability of an 11-year-old, creating difficulties in the extensive handwriting needed for college rigor, including handwritten exams and efficient notetaking (Connelly et al., 2005).

ENHANCED ACADEMIC PERFORMANCE IN MATH AND READING

Developed fine motor skill abilities can be powerful predictors of academic achievement, especially prior to entering kindergarten (Cameron et al., 2012; Dinehart & Manfra, 2013; Grissmer et al., 2010; Katagiri et al., 2021; Pitchford et al., 2016; Wells Rowe, 2017). Grissmer et al. (2010) also found that fine motor skills can strongly predict later academic success. When considered together, attention, fine motor skills, and general knowledge are more accurate predictors of math, reading, and science scores than early math and reading scores alone (Grissmer et al., 2010).

Studies show that developing fine motor skills can increase academic achievement in math and reading.

(Asakawa et al., 2019, Cameron et al., 2012, Pitchford et al., 2016)

Studies show that developing fine motor skills can increase academic achievement in math and reading. Cameron et al. (2012) found that children entering kindergarten with more developed fine motor skills scored higher in fall outcomes in all areas except for applied problems. Kindergartners with stronger fine motor skills also improved in reading from fall to spring, with significant gains in passage comprehension and sound awareness and marginal improvement in letter-word identification (Cameron et al., 2012). In a study of 62 preschoolers in a low socioeconomic area of Nottingham, Pitchford et al. (2016) found that fine motor skills were a better predictor of early abilities in math than reading. They recommended that fine motor skills should have intentional intervention, especially when needed to support math (Pitchford et al., 2016). In a European research study with 80 first graders, Asakawa et al. (2019) found that fine motor skill ability also significantly impacted arithmetic skills. Students provided fine motor skills training for 10 minutes showed higher mastery of an arithmetic task and a pegboard than students who read their favorite book for 10 minutes (Asakawa et al., 2019). Finally, a Florida study of pre-kindergarten and 2nd-grade students revealed that fine motor skill abilities in pre-kindergarten are significant predictors of academic achievement, with raised grades

A 16-week visual-motor intervention showed significant improvement in visual-motor skills for students from low socioeconomic households.

(Hamilton & Lui, 2018)

and standardized test scores in both math and reading by 2nd grade (Dinehart & Manfra, 2013). Early fine motor skills allow children to concentrate more on cognitive growth and learning. The development of fine motor skills can continue to strengthen through elementary and secondary school, as added hand strength and coordination are needed throughout life.

In a recent interview, Aislinn Bowler, a postdoctoral research associate at King's College in London, said:

> I was surprised by the extent of the results we found. When I set out to do this study, I suspected that early fine motor skills might be important. I was startled to find that fine motor skills have such wide-ranging connections to later outcomes, extending not only into primary school age but into adolescence as well. (University of Surrey, 2024, para. 7)

Professor Angelica Ronald of the University of Surrey added:

> Activities that fall under fine motor skill development, such as block building and drawing, may often be perceived as simply 'play' by parents, caregivers, and education providers. But, our study suggests that the development of fine motor skills is part of the pathway that leads to educational outcomes and better behaviour later on. (University of Surrey, 2024, para. 3)

Visual-motor skills, a subset of fine motor skills, have also been linked to academic achievement and school readiness. Intervention is vital because children of lower socioeconomic levels tend to have lower fine motor and visual-motor skills. Studies found that increasing fine motor skills for children at risk for lower academic achievement is essential through early focused curriculum and intervention (Carlson et al., 2013; Hamilton & Lui, 2018). A 16-week visual-motor intervention showed significant improvement in visual-motor skills for students from low

Klupp et al. (2021) found a significant positive relationship between fine motor skills and full-scale IQ, perceptual reasoning, working memory, and processing speed for children with an even stronger connection when students have ADHD.

socioeconomic households (Hamilton & Lui, 2018). However, the need for fine motor skill development continues beyond elementary school. Allowing students of all ages to continue to develop and strengthen motor skills through visual art education allows students to strive for independent life skills or the writing rigor needed for college.

HIGHER IQ

Students with more developed fine motor skills can concentrate on higher cognitive skills in school. Studies suggest that children with more developed fine motor skills are also likely to have a higher intelligence quotient (IQ)(Klupp et al, 2021, Yu et al., 2018). Klupp et al. (2021) found a significant positive relationship between fine motor skills and full-scale IQ, perceptual reasoning, working memory, and processing speed for children with an even stronger connection when students have ADHD. Higher verbal IQ was also noted in students with stronger fine motor skills (Feder & Majnemer, 2007). This effect also extends to neurodiverse students. In a study, preschool children with autism, who had more developed fine motor skills, were associated with a higher verbal IQ (Yu et al., 2018).

INCREASED FOCUS AND PERSISTENCE

More developed fine motor skills may lower ADHD traits. A Japanese study with 2,501 students in preschool and elementary school received a fine motor skills assessment before beginning elementary school (Katagiri et al., 2021). Students with gross and fine motor struggles significantly affected academic achievement and psychosocial difficulties until 6th grade. A study with more than 9,000 preschoolers assessed fine motor skills (drawing, building with blocks, and paper folding skills) at two, three, and four years of age and then reassessed at three later touchpoints, ages 7-8, 12, and 16 years of age to examine the relationship between early fine motor scores and academic outcomes,

Visual art experiences can strengthen fine motor skills giving students the best chance at success in school and life.

neurodevelopmental traits, and psychopathy (Bowler et al., 2024). Fine motor skill development showed fewer neurodevelopmental traits among students studied and higher educational achievement. Superior fine motor skills were associated with better educational outcomes and lower ADHD and autistic traits.

CONCLUSION

Pathways afforded when developing fine motor skills early in their academic career may lead students to better life outcomes (Bowler et al., 2024). Acquiring fine motor skills in early elementary grades is important, even if intervention is required, to give students the best chance at academic success. Visual art experiences can strengthen fine motor skills through artmaking tasks such as drawing, writing, coloring, cutting, and assembling, giving students the best chance at success in school and life.

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