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Educated guesses that affect access to educational resources beyond early childhood

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Educated Guesses that Affect Access to Educational Resources beyond Early Childhood

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Abstract

Misconceptions about cognitive development cause damaging assumptions that affect access to academic intervention after middle childhood, especially for older students who *also* have significant disabilities (Aos, Lieb, Mayfield, Miller, & Pennucci, 2005). In this study, possible sources for reduced expectations for post-middle childhood students are discussed and evaluated. *Brigance* test scores of seven adult students labeled with severe cognitive impairment are documented at the beginning of a regular school year, and then compared to scores at the end of the school year. Target students received regular school based speech language therapy and occupational therapy, as well as direct academic instruction by a certified special education teacher. Dramatic improvements in all areas were noted. Improvements in most areas were statistically significant despite the small sample size. This study suggests that cognitive improvement among older students should be given greater consideration as an attainable and worthwhile goal for educators and therapists.

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Introduction

During the 2010/2011 school year, I saw firsthand how the competition for resources in an urban school district most directly affect older students with disabilities. In September 2010, I was hired as the teacher for a class of ten students aged 17 to 22, all of whom had been labeled as having “severe cognitive impairment” (SCI). Other rooms in the building had interactive whiteboards. I started with a chalkboard and no chalk. At the beginning of the school year, every day began and ended with a hunt for materials to teach with and for supplies for the students to use. Soon I stopped looking and asking and just bought everything myself.

Passing conversation among staff at the school led me to believe that many of my coworkers felt that by the time our students are young adults, there’s really very little point in putting a lot of effort into teaching anything beyond a completely “functional” curriculum. On more than one occasion I was literally told to just “shut the classroom door” and ride out the day. Some staff shared their opinion that if my students “hadn’t gotten it by now, then they’re not going to.” Other helpful coworkers advised me not to get my hopes up about seeing progress in “these students.”

Assumptions about cognitive development become a kind of bias against the academic potential of students after middle childhood (Aos, Lieb, Mayfield, Miller, & Pennucci, 2005). Expectations are reduced even more for students who have passed middle childhood and who *also* have significant disabilities. This bias was highlighted as I worked to get occupational therapy and speech services reinstated for my adult students. Most of them had been dropped from speech and occupational therapy at some point during middle childhood. The standard rationale offered for discontinuance of services was failure to show progress, or “plateauing.”

Hypothesis

I did not accept the idea that my students were forever plateaued in their speech, cognitive, and fine motor skills. I suspected that my students' reported lack of progress since middle childhood had more to do with lack of opportunity than lack of ability.

By October 2010, some of my students began to receive speech therapy again for the first time in over 10 years. Eventually, we reestablished speech and OT for all of them, even though in some cases they were given the minimum consultative hours that could be offered. In addition to speech and fine motor intervention, I also established consistent routines of direct instruction in the areas of reading, math, and general knowledge.

To practice skills I used repetition, modeling, faded prompting, chaining, and shaping. In many cases it was simply necessary to teach the students what was expected from a requested task. For example, in the areas of writing personal data or copying forms, some students reacted initially by covering their response sheets with circles. I suspected that somewhere along the way they had come to anticipate being asked to draw a circle every time they were handed a pencil. (In fact, being able to draw a circle was one of the last OT goals in some of their IEPs before services were dropped.) After modeling what was actually expected of a given task, responses improved dramatically and quickly.

Review of Related Literature

The High/Scope Perry Project

Bias toward older students' potential might be in part an unintended consequence of reports that stress the importance of early childhood intervention. The High/Scope Perry Project's reported impressive cost benefit has been used as persuasive evidence for where to invest limited educational resources. High/Scope Perry's researchers were able to demonstrate that well-designed early childhood programs can provide significant economic and social returns on relatively modest investments, concluding that the "economic return to society" for each program participant in the treatment group was $244,812 by the age of 40 (Schweinhart, 2005).

Today early childhood is regarded as a time during which academic skills must be learned or else the opportunity is lost forever (Bruner, 2005). By the age of five, children are expected to demonstrate measurable school readiness skills to be considered normal (Halfon, 2001; Brigance, 2011). And early elementary educators and administrators expect four and five-year-olds to already understand the fundamentals of school culture and curriculum (Georgia, 2003; City of Denver, 2007). This is despite the fact that 30 to 50% of children reportedly fail to meet these expectations by age five. The gap between reality and expectations is treated as an early childhood crisis:

> It is critical that our children grasp basic and fundamental abilities early so they are prepared to learn when they enter kindergarten. Sadly, Colorado kindergarten teachers report that 1/3 of children come to school unprepared to learn, and national research shows that children who start school behind their peers tend to stay behind (City of Denver, 2007, para. 3).

But do students tend to stay behind because of missed windows of opportunity, or because of policy makers and educators' expectations?

The Carolina Abecedarian Project

Another well-known early childhood study, the Carolina Abecedarian Project, concluded that by age 21 the cost-benefit ratio for their early intervention program was 2.5:1— "meaning for every dollar spent on the program, taxpayers saved $2.50 as a result of higher incomes, less need for educational and government services, and reduced health care costs" (Henry et al., 2004, p. ix). It is less well known that the Abecedarian project also tested intervention efficacy among a smaller group of school-aged children up to the 3rd grade.

Four groups were established for comparison in this portion of the study: 1) children participating in the Abecedarian birth-five intervention *and* school-age intervention, 2) children placed in the treatment group only until age five, 3) children who were only in the school-age Abecedarian intervention group, and 4) the control group of children who participated in neither intervention. Campbell and Ramey (1994) found that the treatment effect was directly proportionate to the total number of years of intervention; and not necessarily dependent upon intervention during early childhood. In fact, they specified that the results should *not* be interpreted as proof of the benefits of preschool intervention. Rather, Campbell and Ramey caution that the study was designed to measure benefits related to the *duration* of treatment, not the age at which treatment begins:

> While these results imply that very early treatment is important, they do not permit a definitive test of the degree to which having intervention during the sensorimotor period might have been critical to the maintenance of an IQ advantage. Only a study with staggered age at entry could definitively address that question (p. 694).

Methodology

Participants

Of the ten students on my caseload during the 2010/2011 school year, seven were between 18 and 22 years old. I chose the seven adult students as the study subjects. I was most interested in measuring the progress of these students because of the tendency among my coworkers to have the lowest expectations for significantly impaired adults. As a happy coincidence the seven adult students on my caseload also had the most consistent school attendance. Of these seven participants, six were male and one was female. Six were identified as having autism with SCI, while the seventh student had a primary disability label of “severely multiply impaired” (SXI).

Instruction

There were three notable changes made to the students’ learning environment starting at the beginning of the 2010/2011 academic school year. 1) A certified special education teacher was assigned to the classroom. For the preceding three years these students had been instructed by a series of long-term substitutes. 2) Ancillary services in speech/language and occupational therapies were restored. Most of the students had not received ancillary services since middle childhood, even though they still met the criteria. 3) Academics aligned to the general education standards were reintroduced as the core curriculum for the classroom. In recent years their curriculum had been exclusively “daily living skills” and “prevocational skills”—cleaning tables, sorting parts into bins, and hammering pegs into boards.

The purpose of this study was *not* to evaluate the efficacy of a new kind of teaching strategy. This study did not introduce a great innovative system designed to enhance the learning of students with significant disabilities. Academics were taught using evidence-based practices commonly used in general education classrooms.

I frequently used Thinking Maps and other graphic organizers (also called “visual displays”) to present materials. Modified graphic organizers were used for scaffolding and ongoing formative assessments. I chose to primarily use the “Thinking Maps” brand of graphic organizer, and to implement ongoing formative assessments, because both Thinking Maps and formative assessment were part of the district-wide initiatives to improve standardized test scores and performance across schools and grade levels. According to our school improvement plans, all classrooms in the district were expected to implement the systematic use of Thinking Maps and formative assessment. The use of graphic organizers is a simple low-tech intervention that has been recognized for several years as an effective means to support academics instruction for all students, not only students with disabilities (Wolgemuth, Trujillo, Cobb, & Alwell, 2008). Formative assessment is a proven means to help teachers guide instructional goals (Militello & Heffernan, 2009).

In addition to Thinking Maps and formative assessment, I followed our district's initiative to implement direct instruction as an intervention. The core components of direct instruction are: 1) clear goals and expectations outlined clearly at the beginning of an instructional session, 2) identifying and teaching to the students' current instructional level, 3) modeling successful demonstration of the skill, 4) gradually faded prompts and chaining to build anticipation of success in activities, and 5) generalization of concepts or skills across content areas and settings (Slocum, 2009).

General education classrooms within the district were frequently monitored for compliance with the district initiatives. General education teachers were evaluated according to their effectiveness in implementing these measures. However, students in center-based programs and in self-contained classrooms—those identified with the most significant disabilities—seemed to be exempted from the district's initiatives and accountability. No one ever evaluated my plans to improve academic instruction for my students using the evidence-based practices that general education teachers were expected to implement. I did it anyway.

Measures

Our school district requires *Brigance* testing twice a year for students in self-contained programs. The areas in which we test, which of the inventories we choose to use, and when testing occurs are all left to the teacher's discretion. I chose subtests from the *Brigance Diagnostic Inventory of Early Development II* (2004) based upon my student's IEP goals, my students' current ability levels, and Michigan's Extended Grade Level Content Expectations (eGLCEs). I selected only standardized subtests and test items. Though the inventory is normed to measure the skills of children during early childhood, these subtests are also valid measures for criterion referenced assessment when using age equivalent scores (Brigance, 2004).

Table 1
Full List of Brigance Subtests Administered in September 2010 and June 2011

Subtest	**Category**	**Skill**
C-1	Fine Motor	General manipulative skills
C-3	Fine Motor	Pre handwriting
C-5	Fine Motor	Ability to copy simple shapes
E-6	Speech and Language	Personal data response
E-7	Speech and Language	Verbal directions
E-8.1	Speech and Language	Picture vocabulary (receptive)
E-8.2	Speech and Language	Picture vocabulary (expressive)
F-2a	General Knowledge & Comprehension	Body parts recognition (receptive)
F-3.2	General Knowledge & Comprehension	Color recognition (receptive)
F-3.3	General Knowledge & Comprehension	Color recognition (expressive)

F-5	General Knowledge & Comprehension	Quantitative concepts
F-6	General Knowledge & Comprehension	Directional/positional concepts
F-9	General Knowledge & Comprehension	Knows use of objects
F-10	General Knowledge & Comprehension	Knows function of community helpers
H-1a	School Readiness	Discriminate forms and uppercase letters
H-1b	School Readiness	Discriminate lowercase letters and words
I-5	Basic Reading Skills	Reads common signs
J-1	Manuscript Writing	Prints personal data
K-1	Basic Math	Number concepts
K-4	Basic Math	Numeral comprehension
K-5	Basic Math	Ordinal positions
K-11a	Basic Math	Recognition of money (U.S.)

Pre- and post-testing of the students provided a before-after (panel design) study for analysis. All students were tested first in September. At this time I found that the subtests C-1 (general fine motor skills), E-8.2 (expressive picture vocabulary) and F-9 (knows use of objects) were not accurate measures for two out of seven of my subjects. Meaningful participation in these subtests required accommodations that exceeded those allowed in the *Brigance's* standardized protocol. If their scores had been included as zeros at the start, any improvement over the course of the year would have dramatically (positively) skewed the reported results for the class as a whole. For this reason, their scores were excluded from the statistical analysis for significance of the results. Students were tested again using the same protocols and subtests in June 2011. Scores were recorded for both pre- and post-tests as age equivalents. A one sample *t*-test was used to test for statistical significance in score changes.

Study Results and Discussion

The End of One Academic School Year

After one school year of targeted academic intervention supported by scheduled speech and occupational therapy services, all students showed improvement in all test areas. In the areas of fine motor and speech, the differences between means were statistically significant enough to reject the null hypothesis even at a stringent level of significance ($\alpha = .01$). Across all domains, 16 out of 22 subtest scores produced statistically significant difference between means at a stringent level of significance ($\alpha = .01$). Altogether, 21 out of 22 subtests produced mean score differences that were statistically significant at a conventional level of significance ($\alpha = .05$).

Table 2
Before-After Comparison of Means: Brigance *Subtests Demonstrating Statistical Significance*

Brigance Section	**Skill Measured**	***N***	**Pre-Test Mean**	**Post-Test Mean**	***T***
	Fine Motor				
C-1	General manipulative skills	5	3.50	6.40	11.839
C-3	Pre handwriting	7	3.50	5.14	5.511
C-5	Forms (copying)	7	3.00	5.14	4.192
	Speech and Language Skills				
E-6	Personal data response	7	2.29	4.71	4.524
E-7	Verbal directions	7	1.79	4.43	8.866
E-8.1	Picture vocabulary (receptive)	7	1.50	4.43	7.638
E-8.2	Picture vocabulary (expressive)	5	1.10	5.60	11.869
	General Knowledge and Comprehension				
F-2a	Body parts recognition (receptive)	7	1.71	4.36	4.838
F-3.2	Color recognition (receptive)	7	2.14	5.00	3.618
F-5	Quantitative concepts	7	3.43	5.86	7.661
F-6	Directional/positional concepts	7	2.29	5.71	2.983
F-9	Knows use of objects	5	2.20	4.60	3.748
F-10	Knows function of community helpers	7	1.50	6.68	6.072

	School Readiness				
H-1a	Visual discriminate forms and uppercase letters	7	1.05	5.65	4.727
H-1b	Visual discriminate lowercase letters and words	7	0.00	3.93	2.825
	Basic Reading Skills				
I-5	Reads common signs	7	0.89	6.61	5.862
	Manuscript Writing				
J-1	Prints personal data	7	1.50	5.68	5.023
	Basic Math				
K-1	Number concepts	7	2.07	5.00	4.518
K-4	Numeral comprehension	7	3.63	6.54	2.452
K-5	Ordinal positions	7	3.89	6.07	2.751
K-11a	Recognition of money (U.S.)	7	2.00	4.86	4.826
Note: Where $N = 7$, $t > 2.447$ indicates statistical significance ($\alpha = .05$). Where $N = 5$, $t > 2.776$ indicates statistical significance ($\alpha = .05$).					

Only one score set, F-3.3 expressive color identification, did not meet the test for significance where $\alpha = .05$; $t > 2.447$. The difference between means for set F-3.3 ($t = 2.324$) did, however, meet the test for significance where $\alpha = .10$; $t > 1.943$. Given the strength of these results, we can conclude that academic intervention produced a net gain in learning among this sample of adult students with severe cognitive impairment.

Popular Science

Popular interpretations of neuroscience are conflated with the reported cost benefit of early childhood programs, creating a belief in "critical periods" during which certain skills must be learned or else the opportunity is lost forever (Abbott, 1997; Boston, 2003; City of Denver, 2007; Halfon, 2001; Hall, 2007; Katz, 2003; Wasserman, 2007). Bruer (1999) identified "Three Neurobiological Strands" in the early childhood conversation: 1) rapid growth of the brain mass in physical size; 2) critical periods for animal vision development and imprinting; and 3) the effect of enriched versus deprived environments on animal brain development.

Educators and policy makers equate the rapid physical growth of the brain in early childhood with a *loss* of cognitive potential after age five: “Almost 80 percent of brain development occurs before the age of five. It is critical that our children grasp basic and fundamental abilities early so they are prepared to learn when they enter kindergarten” (City of Denver, 2007). It is true that during the first few years of life humans experience a period of neural “exuberance” during which the brain actually overproduces cells (Abbott, 1997; Eliot, 1999; Knudsen, 2008). However, that widely cited fact may be a source of confusion in understanding the difference between physical growth and cognitive development.

Neural exuberance is followed by a period of dendrite pruning and neuron myelination that typically continues into an individual’s mid to late twenties (Eliot, 1999). Dendrite pruning is primarily influenced by what information the individual’s brain happens to find necessary or interesting (Abbott, 1997). Pruning is absolutely essential to the development of an individual’s ability to selectively process information (Knudsen, 2008). But education professionals sometimes erroneously describe pruning in negative terms, as if the loss of those cells makes children’s learning a race against time:

> Everything a child sees, hears, thinks, and touches transfers into an electrical activity that is stored into the synapses within the brain. Each time the brain is stimulated, the experience rewires the brain. Information is carried to the brain in synapses. Each day thousands of synapses die off. … Children can lose over 20 billion synapses per day from early childhood through middle childhood and adolescence. (Wasserman, 2007, p. 415)

Neuroscience

In reality, critical or sensitive periods of development are much more complicated, and dependent upon more than the production and death of neurons. Functions controlled by different brain regions are not fully developed, or fully controlled by the individual, until most or all of the neurons in that region have been myelinated. Myelin, the conductive neural coating, must form before messages can move efficiently across brain cells. Areas of the brain related to infant reflexes, like sucking, are fully myelinated at birth. Other regions related to social and emotional intelligence myelinate next, over the course of several years. The last area of the brain to myelinate is the frontal lobe, which is the region that controls decision-making, risk assessment, planning, and higher order cognition:

> Since the myelination process isn't completed in the human brain until the mid to late twenties, it is accurate to say that the brains of our adolescent learners are not yet fully developed. The skills and abilities that are controlled by fully-functional frontal lobes create a laundry list of behaviors that are typically difficult for children, adolescents, and even some young adults. (Eliot, 1999, p. 397).

Eliot's description of myelination is congruent with Piaget's (1952) well known observations of children's cognitive development occurring in progressive stages—with concrete, then abstract reasoning being the last skills developed during late adolescence and early adulthood.

Similar to Vygotzy's (1978a, 1978b) theories about zones of proximal development, neuroscientist Eric Knudsen (2008) explains that sensitive periods for cognitive development cannot even open until the corresponding area of the brain has matured enough to process the signals. Experiences before then can do little or nothing to shape that domain (p. 529). This assertion is supported by Liston and Kagan's (2002) study of infant memory retrieval. The ability of infants/toddlers under the age of 28 months to recall directions for novel tasks was tested after delays of one day, one week, one month and four months. Success in all tasks could be directly correlated to later ages, with significant differences among those approaching 28 months.

Knudsen also concurs with earlier studies which have demonstrated critical periods in developing vision, filial imprinting, and social/emotional behavior (see, for example, Hubel & Wiesel, 1963; Sherman, 1974). A critical/sensitive period ends after an organism has experienced enough sensory information to pattern a response to a set of stimuli. Sensitive or critical periods can be prolonged by sensory deprivation (e.g., rearing in complete darkness).

Evidence suggests that some sensitive periods can be delayed to adulthood, “sensitive periods in infancy have simply been investigated most often. Exceptions show that sensitive periods can also arise late in development” (Bornstein, 1989). Some sensitive/critical periods may actually *recur* in adulthood (Fischer, Aleem, Zhou, & Pham, 2007). Fischer, et al. found that adult cats were able to regain visual acuity after having undergone eye suturing for the duration of the known critical period for vision in kittens. The original rat-brain study, conducted by Bennett, Diamond, Krech, and Rosenzweig (1964), has been cited in the literature more than 500 times as evidence that enriched environments produce smarter children. However, Bennet, et al. did not intend their work to be applied directly to intelligence, or specifically to children. They hoped to demonstrate that environmental factors can have a measurable impact on the brain’s physical and chemical structure “in *adult* as well as young animals” (emphasis mine, p. 618).

The Myth

Popular notions about neuroscience and early childhood lead most people to believe that before middle childhood a child’s cognitive fate is sealed. Journal articles with titles like “Critical Periods of Brain Growth and Cognitive Function in Children” (Gale, et al., 2004), grab the attention of news groups that filter information to educators and other non-scientists. A summary of Gale et al.'s 2004 article (originally published in *Brain*), was reproduced at least eight times in various trade magazines under the headline, "Infancy and Early Childhood are Critical Periods for Cognitive Development" (Biotech Weekly, 2004; Cognition, 2004; Drug Weekly, 2004; Health & Medicine, 2004; Mental Health, 2004; OBGYN, 2004; Pain & Central Nervous, 2004; Women's Health, 2004). This summary was then summarized and reproduced online at wikis, blogs, and sites like *Infant Encyclopedia* (2007), where it became part of the common knowledge about brain development. Educators and other laypersons vaguely refer to all of these sources as overwhelming proof that children's early years are a ticking time bomb (Katz, 2003; City of Denver, 2007; Georgia, 2003; Hall, 2007).

The myth comes full circle when the inverse of cultural assumptions about children's learning are applied as negative preconceptions about the learning potential of adolescents and adults. Currie and Thomas (2000) use this inverse assumption to explain, "Part of the appeal of early intervention is that interventions aimed at improving the skills of teens and young adults generally have limited effects (see, for example, Grossman 1992; Heckman 1995)" (p. 756). Currie and Thomas' statement about adolescent and adult learning leads the reader down-the-rabbit-hole in search of these examples. The article cited for Heckman (1995) has this to say about adult learning:

> Similar interventions for adults for whom ability and motivation are more stable characteristics are much less effective. For low-ability adults and adults with serious motivational problems, there is little evidence that educational investments are economically justified. Wage subsidies may be a better strategy for integrating such groups into society (Phelps 1994). (p. 1112)

In looking for the article cited by Heckman, we find that though Phelps does promote the use of wage subsidies, he never mentions adult or teen education or intervention.

Heckman (2000) sends us back down the rabbit-hole: "What is known about cognitive ability is that it is formed relatively early in life and becomes less malleable as children age. By age 14, basic academic ability seems to be fairly well set (see the evidence summarized in Heckman, 1995)" (p. 17). To prove his 2000 stance on adolescent and adult programs, he cites his own 1995 article, which in turn had cited Phelps (1994), who never mentioned adolescent/adult education, training programs, or intervention. Heckman reified an uneducated guess.

Bruer (1999) accurately predicted the inherent problem of an all-or-nothing approach to early childhood education: "We might question the prudence of decreasing expenditures for adult education or special education on the grounds that a person's intellectual and emotional course is firmly set during the early years" (p. 26). A reasonable body of literature suggests adolescents and adults continue to have sufficient cognitive plasticity for learning (Bruer, 1999; Fischer et al., 2007; Sticht, 2000), and that programs for adolescent/adult learners can produce positive cost-benefit results (Benard, 2010; Hahn et al., 2000; Hattie, 2010; Lalonde, 1995; Sticht, 1996). But education intervention programs for adults and adolescents are not widely covered in popular media, because adult and adolescent programs do not immediately resonate with cultural notions about future-building and learning potential.

Implications, Limitations and Conclusions

Implications

The positive results of this study provide evidence to support the efficacy of academic intervention for older students with cognitive impairment. It is even likely that for some individuals with developmental disabilities, critical or sensitive periods for cognitive development occur or recur in early adulthood (Bruer, 1999; Fischer, Aleem, Zhou, & Pham, 2007). Yet, securing funding for and safeguarding the educational rights of older students is an ongoing challenge.

Currently, the state of Michigan is the only state that extends the offer of a free and appropriate public education (FAPE) to students with disabilities through the age of 26 (Michigan Department of Education, 2013). Six states provide special services through age 22. Thirty-five states discontinue special education services at the age of 21, or at the age of 22 if the student was 21 at the beginning of the year. Five states cutoff special education services at age 20. Maine offers services only to the age of 19, and Montana ends services at age 18 (National Center for Educational Statistics, 2012). The "child find" aspect of the federal Individuals with Disabilities Education Act provides a vague requirement that all states have policies in place to "identify" children with disabilities from ages 3 to 21. However, states that do not require the education of nondisabled (general education) students aged 3 to 5 and 18 to 21, are *not* obligated to provide educational services for students with disabilities ages 3 to 5 and 18 to 21 (Individuals With Disabilities Education Act, 2004; Yell, 2006).

Some states have tried to exercise a kind of loophole in these requirements by offering optional services to nondisabled adult students without offering analogous programs or special education services to adult students with disabilities. In 2010, Hawaii passed Act 163, which prohibited both general education and special education students from attending traditional public schools after the end of the school year in which they turned 20. The state then established "Community Schools" in which students over 18 could finish their diploma requirements or earn GEDs, but special education accommodations and related services were specifically excluded from these tax-funded adult education centers (Walsh, 2013). Suit was brought against the Hawaii school district. In 2013, the U.S. Court of Appeals for the 9th Circuit ruled that Act 163 did violate IDEA (*E.R.K. v. State of Hawaii Department of Education*). But the attempt to restrict access to adult education to nondisabled students only is a telling indicator of how the learning of adults with disabilities is devalued.

Limitations

The allocation of funds for public education is a volatile cause of anxiety and argument over thinly stretched resources. On the surface, it may resonate most easily with policymakers to spend money primarily on the youngest students, because "a stitch in time saves nine." But we may need to rethink the level of emphasis placed on early childhood and lower elementary intervention if it leads to the elimination of future supports for older students with disabilities.

This particular study only demonstrates the positive treatment effect of continued instruction for one set of adult students. It does not address the economic benefit of such intervention. The societal savings and economic value associated with acquiring these skills in adulthood would be the subject of separate cost benefit analysis. Further research is necessary to determine whether academic intervention among older students with significant disabilities can produce lasting positive effects that may translate to improved independence, self-concept, and community participation.

Further research is also needed to address and assess the extent of the bias against the learning potential of older students. While the extant literature suggests that this bias exists, it has not been concretely explored. Instead, it is often presented as self-evident fact that it is simply too late for students after a certain age (Heckman, 2000). Additional studies should include teacher and administrator perception surveys to determine what specific biases about age and student learning exist, and what outside factors (teacher preparation programs, district policies, popular culture, etc.) influence those perceptions.

Conclusions

This study describes the statistically significant improvement of one group of adult students with severe disabilities over the course of one school year in several measured academic skills. Students were supported in attaining this improvement primarily through the implementation of evidence-based practices commonly used in general education classrooms, and adapted as needed to meet the needs of these particular learners. Based upon the results of this study, it is important that educators continue to maintain high expectations for students' learning potential beyond middle childhood and into early adulthood.

Future studies should include projected cost-benefits for successful academic interventions that target young adults with severe disabilities. But remembering the joy of one student's mother as she watched her 22 year-old son write out his name for the first time, I cannot imagine an appropriate monetary value assigned to the skill "prints personal data."

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