EDITOR’S NOTE
Early-childhood learning can help prepare students for better academic engagement. This Spotlight will help you discover how coding exercises can enhance preschooler’s academic skills; learn how to support young students’ language growth; understand the gaps in preschooler’s language development since the pandemic; examine the impact of early education programs on high school performance; investigate challenges facing school readiness; and evaluate Pre-K programs from multiple lenses.

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Using age-appropriate coding toys has a significant, positive impact on preschoolers’ math abilities, according to the findings of a pilot study that will be discussed at the 2022 International Society for Technology in Education conference.

Because much of the existing research on the benefits of coding on children’s development were focused on elementary-age kids, Eastern Connecticut State University professor Sudha Swaminathan decided to look into how coding impacts younger children’s development.

The small pilot study was structured as a pre- and post-assessment with coding activities as intervention. Six 4- and 5-year-olds who attend the university’s Center for Early Childhood Education played with a Bee-Bot, a robotic toy shaped like a bumblebee with forward, backward, left, and right arrow buttons, as well as “go” and “clear” buttons, on its back.

The children worked in pairs during four coding sessions with the Bee-Bot. The first coding session was an introduction to the robot so they could play around with it and see what it does, along with some guided demonstration. In the next sessions, the play time became more intentional. First, the preschoolers had to get the Bee-Bot from point A to point B in a straight line. After that, preschoolers were introduced to turns, and then they had to get the Bee-Bot from point A to point B with obstacles in the way.

Swaminathan found that after doing just these four coding sessions, there was a statistically significant increase in the youngsters’ math abilities overall. The post-assessment found that coding exercises challenged and enhanced the preschoolers’ problem-solving skills, creativity, and determination.

The assessment had a total of 13 items, with one point for each correct answer. At the pre-assessment, the average score across all children was 7. At the post-assessment, the average increased to 9.56, which Swaminathan said is statistically significant. The children showed gains in comparing quantities, comparing lengths, copying and finishing patterns, and building shapes.

“There’s not a lot of research in preschoolers, and my study is showing that there is value in developmentally appropriate coding exercises in preschool,” she said. “Even four sessions are really increasing children’s math abilities.”

Another important aspect of the study is that it uses “unplugged” technology, Swaminathan said. Toys like Bee-Bot stand alone and don’t need to be used with any kind of online software. Other researchers have used computer programming in their studies, but Swaminathan’s study found that unplugged technology is also effective in enhancing children’s computational thinking.

So people who want to teach kids coding skills but are worried about excessive screen time have other options, she said. She added that using coding toys like Bee-Bot doesn’t require a lot of professional development for teachers.

“Sometimes, people tend to worry about the use of smart toys and how that might take the thinking away from the child,” Swaminathan said. “But something like Bee-Bot, these unplugged things, they don’t do anything unless the child thinks it through and implements it. The child does all the thinking.”

The pilot study was finished in fall 2019 and the full study was supposed to start spring 2020, but the coronavirus pandemic halted those plans. Swaminathan said the full study will start spring 2023.
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To avoid widespread school readiness gaps, experts say teachers and parents need to give children born since the pandemic an immediate language infusion.

Already, studies find a third of children who started school during the pandemic need “intensive” reading help, and the need may become even more widespread for children born in the last few years. Researchers find many of these infants and toddlers have had less exposure to rich language environments and show slower language development.

“It seems like a lot of our kids now are not where other kids have been. They’re not cooing and they’re not doing the things that I have witnessed in the past,” said Brittany Ferguson, an Early Head Start teacher in Longmont, Colo.

“I feel like patience is going to need to be a big thing,” she added. “In the next years, as these kids are coming into school, it is going to be challenging because of just how different things have been.”

Education Week spoke to preschool teachers about the new research findings and practical solutions for building young students’ language skills. One was Ferguson and the other was Brigitte Willis, owner and teacher of A Better Day childcare in Grovetown, Ga. Willis worked with a coach from the LENA Grow program, which provides professional development around child language development, for eight weeks in 2020 to measure and increase how often she spoke with and encouraged vocal responses from her five students ages 7 months to nearly 3 years.

**Working around health and safety measures**

Children under 5 remain the only age group unable to be vaccinated against the coronavirus that causes COVID-19. Both Ferguson and Willis said they were able to continue to teach in-person throughout the pandemic because of mitigation strategies like hygiene, using facial masks, and social distancing, but they said educators have to “do extra” to ensure infants and toddlers still can engage linguistically.

“We’re missing the facial expressions, wearing masks,” Ferguson said. “If you’re feeding a baby a bottle or changing a diaper, or if someone’s crying, they don’t necessarily get to see you smile and talk. And if they are young enough, they might hear you talk across the room [while physically distanced], but they don’t necessarily know it’s directed toward them.”

Ferguson said she has increased the overall amount of reading and singing she does with her infants and toddlers, and has started touching a child whenever she speaks to draw their attention.

“Even though they can’t necessarily see me smile at them, I’m just trying to pull them in as much as I can,” Ferguson said.

Willis agreed, noting that she has tested many kinds of face masks to find ones that muffle her voice as little as possible and “I’m slowing down, trying to enunciate clearly and be as intentional as possible when I speak” to the children.

**Parent engagement can be critical tool**

One recent study found that while parents reported reading with their young children as often during the pandemic as before, they were

A Birmingham, Ala., preschool teacher works with a student wearing a “talk pedometer,” which records child and adult vocalizations, as part of the school-based LENA Grow program. Teachers receive reports on how much talk and interaction each child experiences in a day of recording.

Even though they can’t necessarily see me smile at them, I’m just trying to pull them in as much as I can.”

BRITTANY FERGUSON
Early Head Start teacher, Longmont, Colo.
more distracted, and less likely to read complex books or to have conversations while reading.

But Willis said it’s important for educators not to blame or lecture parents who have had less time to engage their young children verbally.

“Parents are trying to deal with so much, you know, and juggle so many different things,” Willis said. “I try to come from a strength-based approach for parents ... to make sure they have a ton of information and resources [on engagement] ready at their touch.”

Willis also makes parents aware of ways that improving verbal skills can also help toddlers’ behavior. “I won’t say [behavior] isn’t a challenge, but it’s what kids do at this age. They’re trying to figure out the boundaries, their feelings, their emotions in being able to say their words.”

Teachers may also encourage parents who have used more digital books and apps for their toddlers and young children during the pandemic to dedicate more time to reading print books with their children instead. One recent meta-analysis found most commercially available e-books don’t focus a child’s attention as well as adults do when reading a story with a child, such as by asking questions, pointing out story elements, or highlighting chains of events.

A

mid the stress and disruption of the pandemic, parents and caregivers have had less time and energy to engage their babies and toddlers in conversation—and the lack of talk already shows in their language skills.

New studies from Rhode Island Hospital and the nonprofit LENA Foundation find that infants born during the pandemic vocalize significantly less and engage in less verbal “turn-taking” behaviors found to be critical for language development. As those babies grow, experts worry they will need significant supports to be ready for school.

Since 2010, Sean Deoni, the director of the Advanced Baby Imaging Lab at the INSPIRE Center of Rhode Island Hospital, and his colleagues have tracked more than 1,700 Rhode Island families with infants. The researchers conduct regular cognitive and language development tests as well as brain scans as the children grow and monitor how the children are exposed to language in their earliest years of life.

During the pandemic, the lab was able to continue its assessments, but Deoni said he and his colleagues quickly realized their study population was changing.

“We began to notice anecdotally several months into the pandemic that kids seemed to be having a little greater challenge in doing their cognitive tests,” Deoni said. “Children just seemed to be taking a little bit longer to get through their assessments; they maybe weren’t as attentive or not performing as well as we normally had seen. And over time, those individual anecdotal statements became a chorus.”

By a year into the pandemic, the average cognitive performance of children ages 3 months to 3 years was the lowest it had been since the researchers had begun to measure it in 2010. For toddlers ages 16 months or younger, expressive and receptive language scores fell from about 90 points on a scale of 140 in 2020 to 60 in 2021 on normalized assessments of verbal skills. Moreover, neuroimaging data show babies born during the pandemic have had slower growth in white matter, the communication channels of the brain, compared to infants born in the years before the pandemic.

“It’s not that they start off low and they’ll slowly get back to [normal], but [they] actually seem to be decreasing as time is going on, which means that the cumulative impact of the COVID environment seems to be getting worse,” he said. “And this seems to be across the brain, impacting not just motor systems or later cognitive systems, but almost every neurodevelopmental system. So that’s alarming.”

**Gaps of words and conversation**

Both Deoni’s research and separate research by the LENA Foundation suggest these developmental delays may be sparked by less language engagement.

Thirty years ago, University of Kansas...
Early benefits of preschool participation

By Sarah D. Sparks

The benefits of early-childhood education can take a decade or more to come into focus, but a new study in the journal Child Development suggests preschool may help prepare students for better academic engagement in high school.

Researchers at the nonprofit ChildTrends, Georgetown University, and the University of Wisconsin tracked more than 4,000 children who started kindergarten in Tulsa, Okla., public schools in 2006. Some 44 percent of the students participated in the Sooner State’s universal state-funded preschools, which include partnerships between school districts and early-learning organizations. Another 14 percent of the students had participated in federal Head Start programs, and the rest did not participate in either program.

Early benefits of preschool participation on students’ math and reading scores mostly faded away by the time students reached high school—a common fade-out problem seen for early education. But Amadon and her colleagues found that students who had participated in Tulsa’s state-funded preschool programs were more likely to attend school regularly and take more-challenging courses than those who participated in Head Start or did not receive early-childhood education.

“The fact that students were attending school more days, the fact that they were enrolling in different types of courses indicates some sort of different engagement in and commitment to their education and their schooling,” said Sara Amadon, a senior research scientist for the nonprofit ChildTrends and lead author of the study. “It didn’t translate to GPA or test scores, but, you know, we also know that GPA and test scores are just one part of the puzzle of persistence and engagement through high school. Those behavioral indicators are also really powerful predictors of graduation.”

The results come as the Biden administration continues to press for universal, publicly funded state preschools. But even more importantly, adults help infants build language skills by “conversational turn-taking”—speaking in response to a baby’s coos or cries and then pausing to let the baby or toddler vocalize back to them. Parents often use exchanges like these to answer their children’s needs or encourage their interests.

In the three years before the pandemic, a 2-year-old in the Rhode Island study heard, on average, 100-140 words per hour, and had 35-50 conversational exchanges with the adults around them. By contrast, in 2020 and 2021, a 2-year-old heard about 20-70 words an hour and had 15-25 conversational exchanges per hour. Deoni also found toddlers during the pandemic spent a greater portion of their time watching television. (The American Academy of Pediatrics recommends no media use for children under 2.)

Jill Gilkerson, the LENA Foundation’s language research director, tracks infants’ language environment through a recording device attached to a harness. The infant or toddler wears the harness at home over several days, and the recorder is triggered by verbal sounds made by both the infant and others around her, screening out nonverbal sounds like burps.

Gilkerson found on average, that while vocalizations fell for all infants born after the pandemic, the drop was greatest for the poorest 25 percent of children. The lowest-income babies and toddlers fell from the 50th percentile to the 25th percentile in the frequency of their vocalizations, and from the 45th percentile to the 25th percentile in the number of conversational exchanges they had with caregivers.

Gilkerson said the pandemic stressed families in ways that could reduce their engagement: more harried parents—often with older siblings home—and fewer children in formal day care programs with teachers trained to engage them. Moreover, in many cases early-education teachers used face masks, which were intended to limit the spread of COVID but also made it harder for babies to see teachers’ expressions and hear their responses.

Gilkerson and Deoni both urged education leaders to partner with local early-childhood educators and parents to provide more language enrichment for children born during the pandemic.

For example, in a separate study, Gilkerson found that after families participated in a 10-week program to learn conversational strategies, their infants had an 8 percent increase in vocalizations and a 30 percent increase in conversational turns.

“The stark reality is we are going to have a generation of children who are going to start school less ready for school,” Gilkerson said. “Kids are resilient and we know a lot of them can see a bounce back, but we want to start as early as possible. I worry about the children whose parents have fewer resources. It’s going to be harder to get that bounce back.”

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funded preschool for all 3- and 4-year-olds. Earlier this month, President Joe Biden signed a $1.5 trillion spending bill for fiscal 2022 that included more than $584 million in additional support for child care and early learning programs, including Head Start, Early Head Start, and the Child Care and Development Block Grants. However, the new study suggests state-supported programs may have more-stable benefits than Head Start in the long term.

Overall, students showed no significant differences in cumulative grade point averages or scores on ACT or SAT college placement exams, regardless of whether or not they participated in preschool. There were two exceptions: Native American students performed better in English/language arts on college placement exams, and Hispanic students had higher GPAs, if they attended preschool than if they had not.

Moreover, compared with children who had not attended early education, alumni of Tulsa’s universal preschools challenged themselves more academically: They were significantly more likely to take an Advanced Placement or International Baccalaureate class, and less likely to fail a high school course in general, than students who had not attended preschool. (By contrast, there was no significant difference academically for students who had participated in Head Start or no early education.)

Better attendance habits later on for preschool participants

In part, this could be because students who attended Tulsa’s universal preschools developed better attendance habits early—and kept them throughout their academic careers.

Students who had attended Tulsa’s preschools were significantly less likely to be chronically absent in high school—defined as missing 10 percent of school days or more—than their classmates who had not attended preschool. On average, preschool alumni missed 1.5 fewer days a year than those who hadn’t attended.

On average, students who had attended Head Start programs instead were also slightly less likely to miss school, but showed no other academic or engagement advantages.

Students of color who had attended preschool were particularly likely to be more engaged in school later on. For example, Hispanic students who had attended preschool attended 2.8 more school days on average in high school compared with Hispanic students who had not attended preschool or who had attended Head Start.

Amadon said the study also highlights the need for educators and school leaders to plan for additional supports for students entering school during the pandemic, who may have had less access to early-childhood education.

“When we think about the upcoming pre-K classes, [education leaders should] make sure they are giving that extra push to ensure that all students are accessing pre-K ... doing a little more outreach, especially to the neighborhoods and communities that you know have families that were hard hit by the pandemic or struggled to find child care” and early education, she said.

The study is part of an ongoing research project tracking the long-term effects of early-childhood education. The next study in the project will focus on differences in college-going among these students.
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Preschool Enrollment Has Plunged: What That Means for School Readiness

By Sarah D. Sparks

Amid the pandemic, the number of young children attending preschool has dropped to its lowest level in more than a quarter century. The decline threatens to derail decades of improvements in school readiness, particularly for the most-vulnerable children.

New Census data show only 40 percent of 3- and 4-year-olds enrolled in school in 2020, a 14 percentage-point drop from 2019 and the first time since 1996 that fewer than half of U.S. children in that age group attended preschool. (Those data back up Education Week’s own analysis of state enrollment data this summer, which found declines in kindergarten in every state and in preschool in every state that collects preschool data.)

The National Institute for Early Education Research found the top three reasons parents pulled their young children from preschool included fears of health risks, cuts to state and other preschool programs and a dearth of in-school preschool options for working parents.

In fact, the Census data show young children of working moms were particularly hard hit; their preschool enrollment fell 35 percent in 2020, compared to only 10 percent of 3- to 4-year-olds whose mothers did not work.

While most preschool programs have returned to in-person instruction, NIEER also found families continue to be concerned that sending young children to nursery school could expose them—and by extension, other vulnerable family members—to COVID-19. While a vaccine is expected to be approved for 5- to 12-year-olds in days or weeks, there is no timeline yet for COVID-19 vaccines for younger children, and studies have found students in the earliest grades are more likely than older children to infect other family members if they bring home the coronavirus.

Enrollment in preschools fell by 25 percent from 2019 to 2020, from 4.7 million to 3.5 million, significantly worse than the 9 percent drop in kindergarten enrollment, which brought that number down to 3.7 million, Census data show.

School readiness at risk

Elementary schools are already feeling the fallout of incoming kindergartners who missed early education last year. Studies find young children were exposed to significantly more screen time and had fewer opportunities to develop academic routines.

Erika Forti is the public schools superintendent in East Haven, Conn. While children who attended her district’s preschool program last year have kept up in elementary, she said, those who did not attend last year or who are coming into preschool now need more support with both academics and social-emotional development.

“The preschoolers [in 2020] who transitioned into our kindergarten definitely have a stronger foundation for routine and foundational cognitive and academic skills, but also have more regulation around emotions and executive functioning,” Forti said. “Those who have not necessarily attended preschools due to the pandemic may not have had the kindergarten-readiness skills of the kids who attended preschool ... both academics and [school] routines and, in some instances, the socialization skills.”

Moreover, the district has seen that new grades coming up will need more support. “It’s been really challenging [for] some of our 3- and 4-year-olds,” Forti said. “You know, they were 18 months old when the pandemic hit. So they were in their homes; their opportunity to socialize with others wasn’t as readily available. And so they’re coming to us with some different kinds of behaviors and in a very different place than they have in the past.”

One new study by researchers at George Mason University found children’s school-readiness skills at age 4 still predicted their academic achievement and likelihood of receiving discipline by grade 5, and the American Academy of Pediatrics finds students who attended preschool were less likely later on to show signs of anxiety or be at risk of dropping out of school.

Children who attend preschool have been shown to attend school more regularly once they get to K-12, too, according to Hedy Chang, the founder of Attendance Works, a nonprofit that studies the effects and prevention of chronic absenteeism. Better attendance comes in part, she said, because children develop school routines and become comfortable in organized school settings, and because they’ve strengthened their immune systems from having been around other kids.

Because there are few assessments for
students before grade 3, Chang noted, “one of the challenges is we may not pick up what the impact of all of this is for a little while. ... We’re already going to see some impacts on 3rd grade now, but it’s going to grow over time unless we figure out some other ways to really support our youngest learners.”

East Haven provided in-person, full-day summer preschool programs for the past two years, with a focus on helping students socialize, develop executive skills, and learn hygiene and safety routines related to the pandemic. Forti said the district is doubling down on socialization and academic routine development for children who have been out of school.

“We focus on social-emotional learning and building kids’ executive functioning skills. That’s really, really important to us—to develop that strong foundation,” she said. “We need to make sure we are welcoming our kids back to safe and nurturing environments and building relationships with them.”

Additional Resource

To view the charts that accompany this article, click here.

OPINION

Published May 24, 2022

The Not-So-Certain Science of Pre-K

By Rick Hess

There’s a lot to like about preschool. Over the years, my kids have used several different preschools—from a cheerful church basement to a hard-core Montessori—and had a number of really positive experiences. You don’t need to convince me that good, affordable, reliable, and convenient preschool is something we should value.

But it’s a big leap from there to concluding that preschool “works” or that universal pre-K is a good idea. Now, when I offer such qualifications, preschool aficionados immediately leap to patiently (or not-so-patiently) explain that I’m ignoring the science.

As for that science. Earlier this year, researchers at Vanderbilt University released the outcomes of a new gold-standard study of Tennessee’s statewide pre-K program, launched back in 2009. The study has been touted as the only randomized “thorough, ongoing investigation into the impacts of a statewide pre-K program for economically disadvantaged children.” The findings of the initial 2015 report were regarded as highly disappointing, with the benefits of the pre-K program fading before 1st grade. The follow-up results aren’t any better. The pre-K students fared worse on state assessments than their peers and had worse outcomes “for disciplinary infractions, attendance, and receipt of special education services.”

Readers who regularly hear that pre-K “works” might be surprised. They shouldn’t be. The truth is, an analysis of the 10 best-known, widely cited pre-K programs makes clear that the research around these programs shows not “that ‘pre-K works’” but that “some early childhood programs yield particular outcomes, sometimes, for some children.” Indeed, the most credible research has made clear that “the most meaningful, far-reaching effects are the product of ‘carefully designed, well-implemented programs’”—not sweeping mandates.

And even the studies that do indicate pre-K efforts were beneficial don’t necessarily point at a clear path forward for policies on pre-K. Consider the famed Perry Preschool project, a small pilot preschool and home-visiting program for 3- and 4-year-olds that ran from 1962 to 1967 in Ypsilanti, Michigan. The program provided 38 low-income Black children with two years of a research-based preschool curriculum and weekly home visits. It was found to have positive impacts on participants’ educational and life outcomes, reducing teenage pregnancy, and increasing lifetime earnings. All good stuff. But we’re talking about less than 60 students, in an intensive boutique pilot program, more than a half-century ago. The notion that Perry offers a clear blueprint for broad public policies is just fantastic.

And yet, some years back, Nobel Prize-winning economist James Heckman savaged a newspaper columnist for even questioning the benefits of expanded pre-K. Heckman insisted that it clearly works. How did he know this? Heckman pointed to his “evidence-based analysis of more than 30 years of data” from the Perry Preschool project. “It is as good a trial for effectiveness as those we currently rely on to evaluate prescription and over-the-counter drugs,” he wrote.

While Heckman is a very smart guy, he
was wrong here. There’s a difference between a medical therapeutic and a public-policy response. Unlike a preschool program, the ingredients of an over-the-counter drug can be replicated exactly and administered to new patients with precise directions. In the case of Perry, it’s not especially clear just what it means to replicate the program. Was the intervention simply attending a preschool? Doubtful. Was it attending a “high quality” preschool? OK, but just what made Perry “high quality”? Was it the student-teacher ratio? Home visits? The curriculum? All of the above? How exactly does one know?

Unless we know, it’s tough to be confident that policies will deliver the desired results. Worse, the bigger the policy, the bigger the risk that getting things wrong will have adverse consequences. And yet much of the support for universal preschool proceeds with a blind assurance that leaves all such difficult questions aside. For instance, last fall, the Biden administration’s Build Back Better proposal for universal preschool contained sweeping new federal requirements that would’ve governed preschool education standards, credentials, and pay. There was little evidence behind any of this and actually more cause to fear the ways in which it might bureaucratize early-childhood education, squelch small church-based and neighborhood providers, drive up costs, and aggravate staffing challenges. We would’ve been far better served not by assertions of “the science says” but by serious discussions of uncertainty, trade-offs, and sensible compromise.

Helping ensure that families have access to reliable, trusted child-care options is a good idea. But the claims made about preschool—and especially about universal pre-K—tend to be overstated, the benefits are far from certain, and fail to consider that massive new programs can cause real harm. We should keep working to expand access to reliable, convenient, trusted preschool. But we should do so guided by good judgment, not by overreliance on not-so-certain science.

Rick Hess is a resident scholar at the American Enterprise Institute and the director of the think tank’s Education Policy Studies.
### Checklist for Choosing the Best Adaptive Program

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<th>IMPORTANT FACTORS TO CONSIDER</th>
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<tr>
<td><strong>Is the program validated by third-party research?</strong></td>
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<td>Explore both the product’s own case studies and third-party independent studies.</td>
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<td><strong>Will the solution fill short-term and long-term needs?</strong></td>
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<td>Consider your school district’s goals over the next few months, as well as the next few years.</td>
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<td><strong>Is it truly mastery based?</strong></td>
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<td>The resource should include hundreds of personalized pathways that adapt with every response through evidence-based design.</td>
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<td><strong>Does the program sustain student engagement long enough to be effective?</strong></td>
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<tr>
<td>Look for colorful, three-dimensional digital worlds that spark excitement and motivate students to keep playing.</td>
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<td><strong>Is the program easy to implement and use?</strong></td>
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<td>Students should be able to log on independently, and data should be accessed in real time on a user-friendly dashboard.</td>
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