Educators' Beliefs about Teaching Science and Social Studies in K-3

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Background

Research has shown that little time and emphasis have been placed on science and social studies in the early elementary grades. For example, an observational study of third-grade classrooms in the 1999-2000 and 2000-2001 school years found that around 5% of classroom time was devoted to science and social studies each, compared with 48% and 28% of time devoted to English language arts and mathematics, respectively.[1] National surveys have shown similar results over many years.[2]

Spending more time teaching science and social studies in K-3 can have at least four potential benefits:

1. **Increased learning in these subjects is likely to improve students' reading comprehension in later grades.** That is because reading comprehension depends not only on the student's ability to decode words, but also on the student having the vocabulary and background knowledge that the writer assumes for the typical reader.[3] This applies not only to reading comprehension in science and social studies classes, but also in other situations where understanding a passage requires knowledge from either of those subject areas.
2. **Introducing students to science and social studies in the early grades is likely to better prepare them for learning those subjects in later grades.** Learning is cumulative, and students' ability to understand and remember new information is conditioned on their prior knowledge.[4] This knowledge-building process can begin early, as students in the early grades are developmentally and intellectually capable of engaging with and understanding important ideas in science and social studies.[5]
3. **An early introduction to science and social studies can also help students develop interests in those subjects.** Young children are often impressionable and open to new ideas; thus, it should not be surprising that two studies found that the majority of college or graduate students with interest in science or STEM reported that they first acquired their interest in preschool or the elementary grades.[6]
4. **Introducing students to knowledge in the early grades can reduce the pressure on educators to cram too many topics into too short a time in the later grades.** This will help encourage educators to follow up in greater depth on topics that were

introduced earlier.[7] In general, spreading content learning out over more grades reduces the severity of the tradeoff between breadth and depth of learning.[8]

With these considerations in mind, we surveyed teachers, school leaders, and district leaders in two states, Arkansas and Kentucky, on the teaching of science and social studies in kindergarten through third grade.[9] We asked about their beliefs about the value of teaching those subjects and the time and emphasis that were devoted to each subject. We also asked about the perceived barriers to teaching each of the two subjects; about the integration of the two subjects into the English language arts and mathematics curriculum; and the availability of professional development, coaching, and district-wide assessment for each subject. We conclude with recommendations for district leaders and policymakers on ways to support the teaching of science and social studies in the early grades.

The reader should be aware of limitations in this study: Our survey sample consisted of K-3 teachers and school and district leaders in two states, and our response rate was not high enough to make confident generalizations about all of the early-grades educators in those two states.[10]

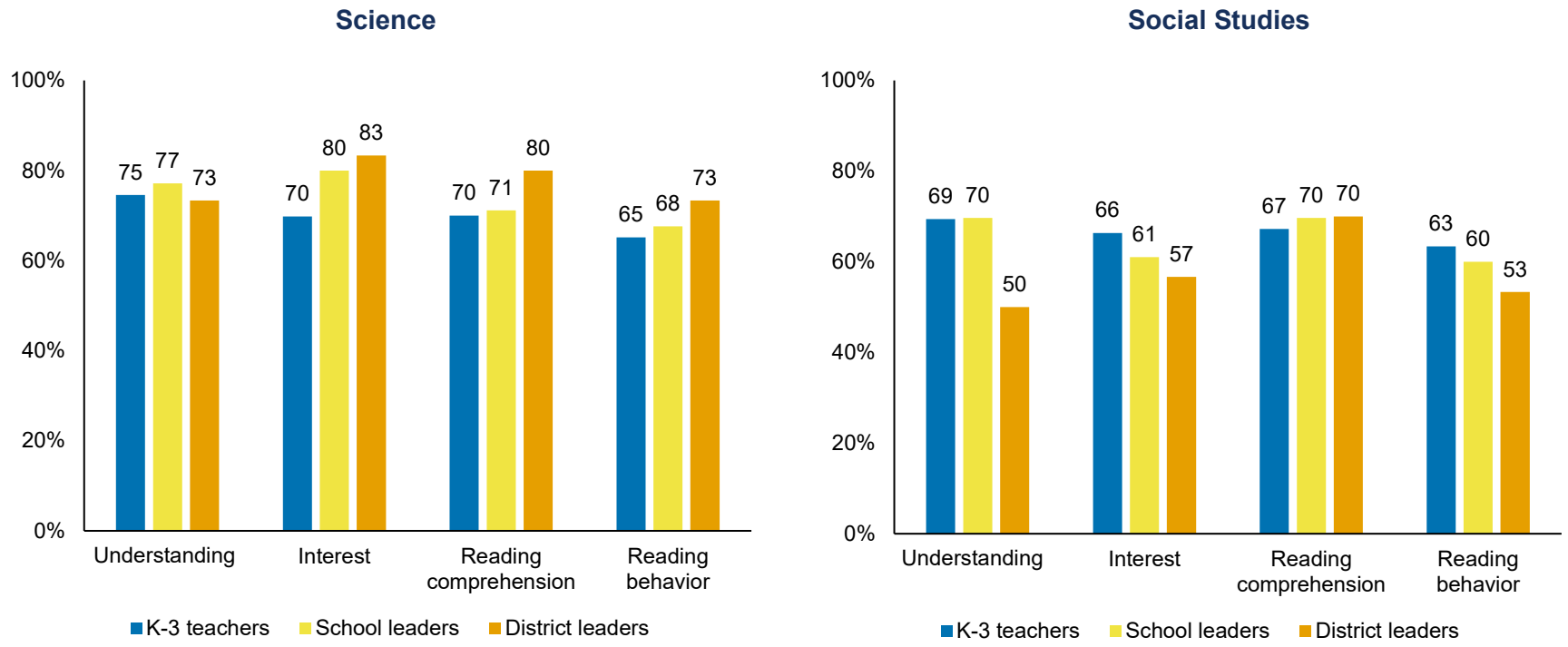
Findings

Beliefs about Teaching Science and Social Studies in K-3

In most cases, sizeable majorities of teachers, school leaders, and district leaders agreed that teaching science and social studies in K-3 often has large effects on desirable future student outcomes, such as better understanding of concepts in the same subject area, improved reading comprehension, increased student interest in the subject, and increased motivation to read about the subject (Figure 1). These beliefs about future value were generally stronger for science than for social studies, a pattern that may have been influenced by the content of the curricula taught in the two subjects.[11]

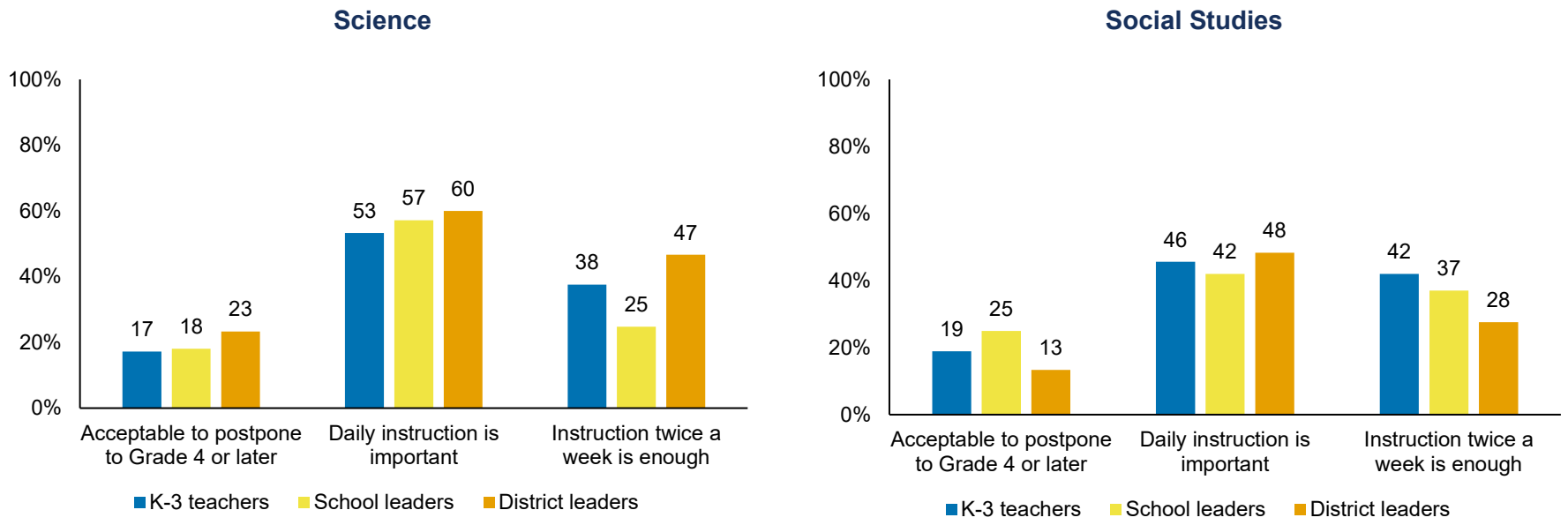
Correspondingly, relatively few teachers or school and district leaders believed that it was acceptable to postpone teaching science and social studies to grade 4 or later (Figure 2). In most cases, educators were more likely to agree that daily instruction in each subject is important than to agree that twice-a-week instruction is enough, though not all educators may have viewed these options as mutually exclusive.[12] For example, some educators may believe that daily instruction is preferable but that it is acceptable to settle for instruction twice a week.

Figure 1. Percentage Agreeing with Beliefs about the Later Impact of Teaching Science and Social Studies in K-3



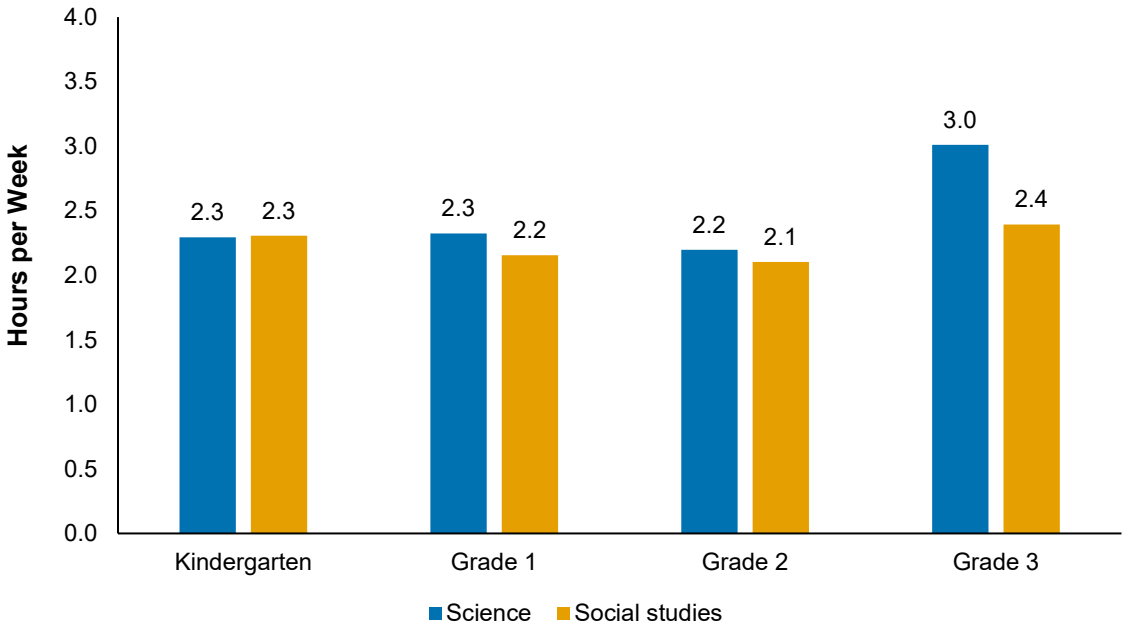
Note: The percentages shown are those who "strongly agreed" or "moderately agreed" with these statements (substitute "history/social studies" for "science" for the social studies questions): 1) Students' science learning in K-3 often has a large effect on their understanding of science concepts taught in later grades; 2) Students' science learning in K-3 often has a large effect on whether they are interested in science in later grades; and 3) Students' science learning often has a large effect on their reading comprehension of science-related books, magazines, and web-based content in later grades; and 4) Students' science learning in K-3 often has a large effect on whether they choose to read science-related books, magazines, and web-based content in later grades.

Figure 2. Percentage Agreeing with Beliefs about Teaching Science and Social Studies in K-3



Note: The percentages shown are those who "strongly agreed" or "moderately agreed" with these statements (substitute "history/social studies" for "science" for the social studies questions): 1) Students need to learn science, but it is acceptable to delay science learning to grade 4 or later as long as the early grades reading and mathematics programs are strong; 2) It is important that K-3 students receive daily instruction in science; and 3) Receiving science instruction at least twice a week is sufficient for students in K-3.

Figure 3. Average Hours Per Week Teaching Science and Social Studies in K-3



Time Spent Teaching Science and Social Studies in K-3

Despite educators' reported beliefs in the value of science and social studies in the early grades, they reported spending relatively little time teaching those subjects. Teachers in our survey reported averaging between 2 and 2 1/3 hours a week teaching science and social studies in kindergarten through second grade (Figure 3). This is an average of 24-28 minutes a day on each subject. In third grade, the average weekly time devoted to science rose to three hours, a pattern that showed up in Arkansas but not in Kentucky. This pattern may be due to the fact that Arkansas but not Kentucky tested science in third grade in the 2015-16 and 2016-17 school years. The absence of a similar pattern in third-grade social studies, tested in neither state, is also suggestive that the Arkansas testing system may have influenced the amount of time devoted to third-grade science in that state.

Perceived Barriers to Teaching Science and Social Studies in K-3

The survey asked teachers and school and district leaders to indicate whether each of the following represents a major barrier, minor barrier, or not a barrier at all to their teaching science (substitute "history/social studies" for "science" for the social studies questions):

1. The need to prepare students for state-mandated standardized tests in reading and mathematics
2. Limitations in teachers' time to prepare lessons in multiple subjects
3. Limitations in the availability of training and curriculum materials
4. Difficulty integrating science into the K-3 English language arts (ELA) program

5. Belief by teachers or educational administrators in your community that teaching science in K-3 is not a high priority

6. Belief by people in your community who are not teachers or educational administrators that teaching science in K-3 is not a high priority

7. Limited emphasis on science in state content standards

Majorities or near-majorities of each group perceived that test preparation pressure is a major barrier for teaching each subject in K-3, while fewer saw the lack of educator or community support or de-emphasis in state standards as a major barrier (Figure 4). However, the perceptions of teachers diverged from those of school and district leaders on barriers related to curriculum, preparation time, and instructional training and materials. For example, teachers were more likely than school and district leaders to see lack of preparation time and training and materials as major barriers to teaching science, and teachers and school leaders were more likely than district leaders to see limited training and materials and difficulties with curriculum integration as major barriers in social studies (Figure 5).

Most of these perceptions were uncorrelated with the amount of time spent on the two subjects. The main exception was that teachers who perceived difficulty with integrating science or social studies into the K-3 ELA program spent an average of about a half hour a week less teaching the subject.

Curriculum Integration Methods in K-3 Science and Social Studies

Anticipating a possible relationship between curriculum integration and time spent on science and social studies, we asked teachers whether they mostly teach these subjects as separate subjects or as integrated into other content areas. Four response options were provided (substitute “history/social studies” for “science” for the social studies questions):

1. Science is mostly taught as a separate subject

2. Science is mostly part of a scope and sequence that integrates with other content areas

3. Science is mostly integrated with other content areas but is not part of a scope and sequence;

4. Science is rarely taught

With the exception of third-grade science, which the majority of teachers reported teaching mostly as a separate subject, the majority of teachers reported teaching science and social studies mostly by integrating the subjects into the other content areas (Figure 6). Teachers who integrated science or social studies using a scope and sequence reported spending about the same amount of time on each subject as did teachers who taught the subject separately. However, teachers who tried to integrate science or social studies without a scope and sequence spent about a half hour less on each subject.

Figure 4. Perceived Major Barriers to Teaching Science and Social Studies in K-3: Test Preparation, Educator and Community Priorities, and Emphasis in State Standards

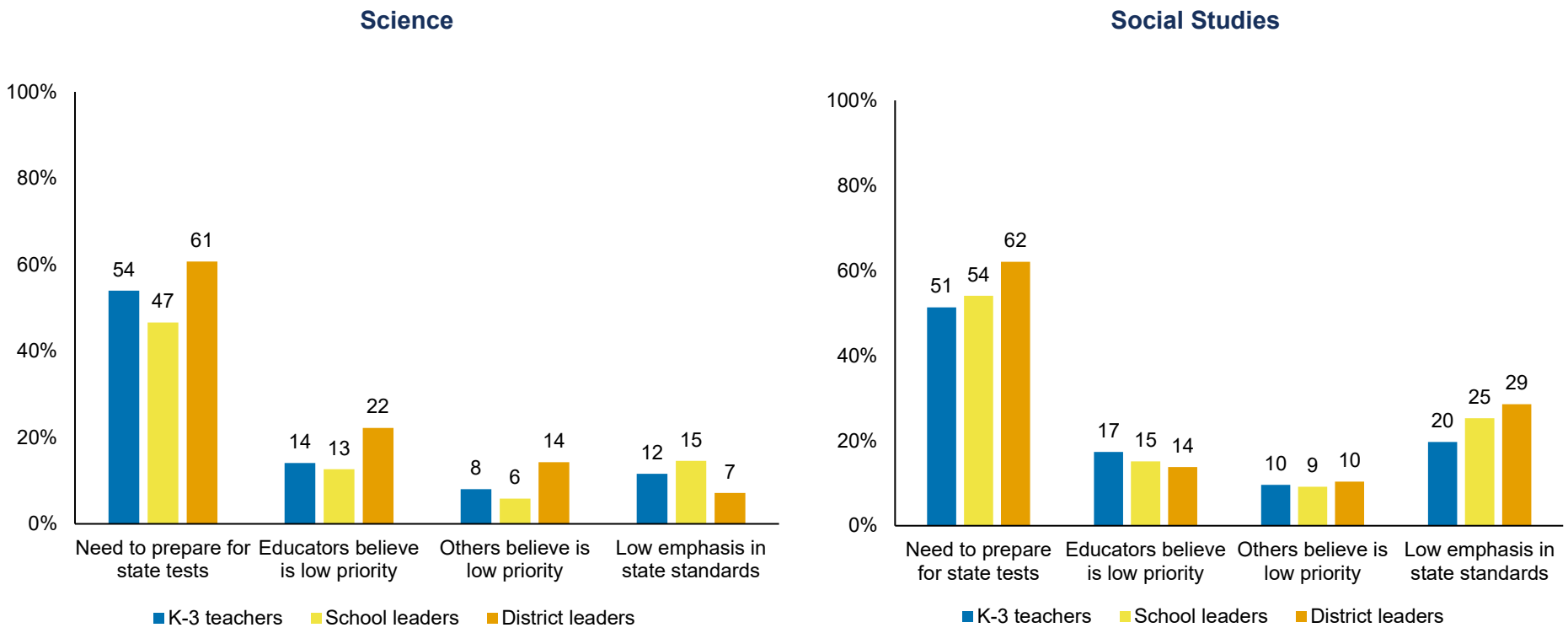


Figure 5. Perceived Major Barriers to Teaching Science and Social Studies in K-3: Curriculum, Preparation Time, Training, and Instructional Materials

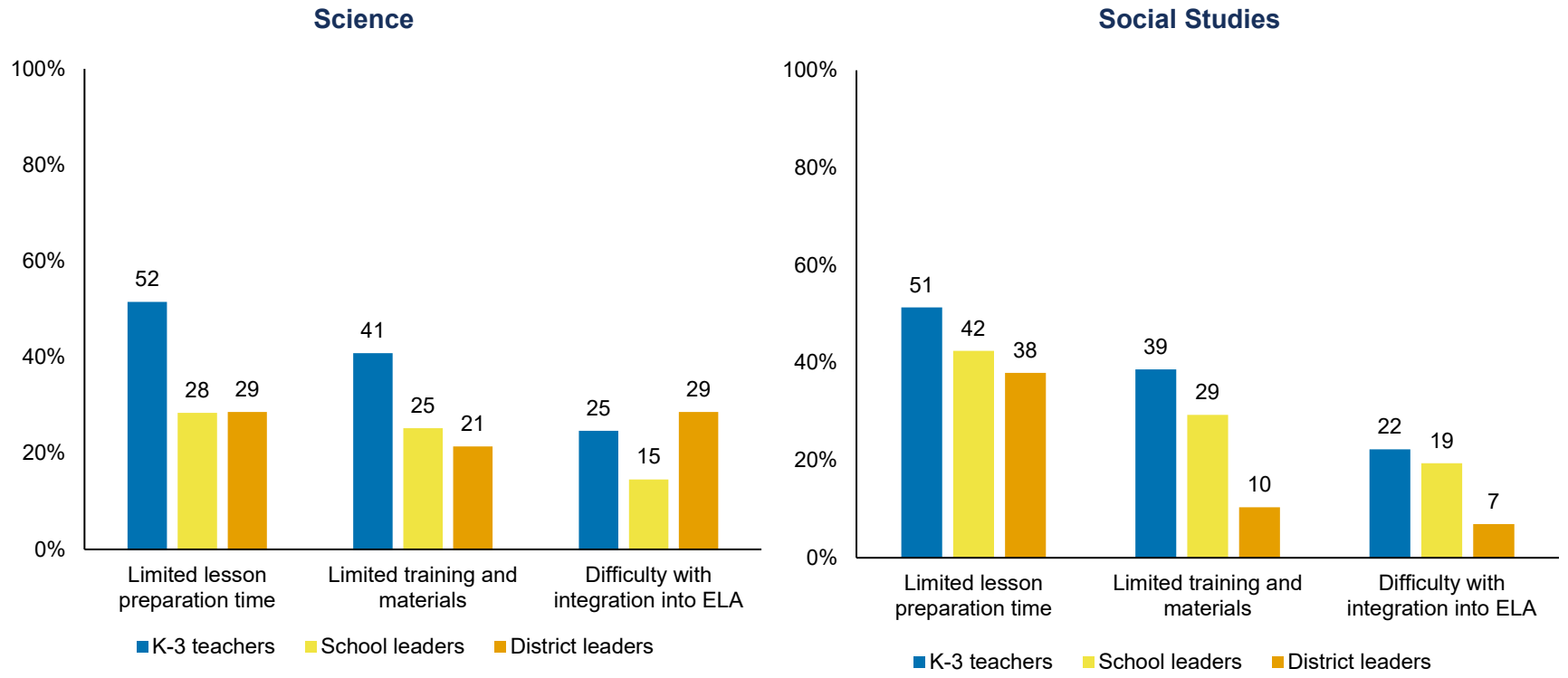
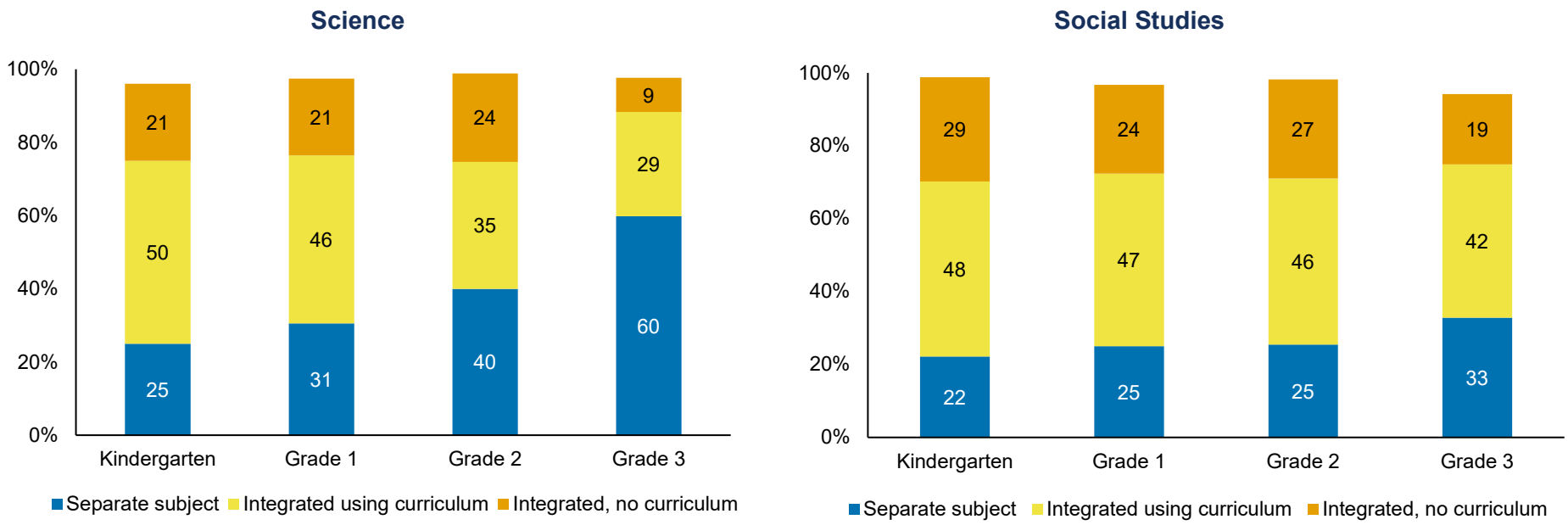


Figure 6. Percentage of Teachers Reporting Each Curriculum Integration Method in Science and Social Studies



Note. Subject area percentages in Figure 6 do not add to 100% because a fourth category, "this subject is rarely taught," was omitted.

School and District Professional Support for Teachers in K-3 Science and Social Studies

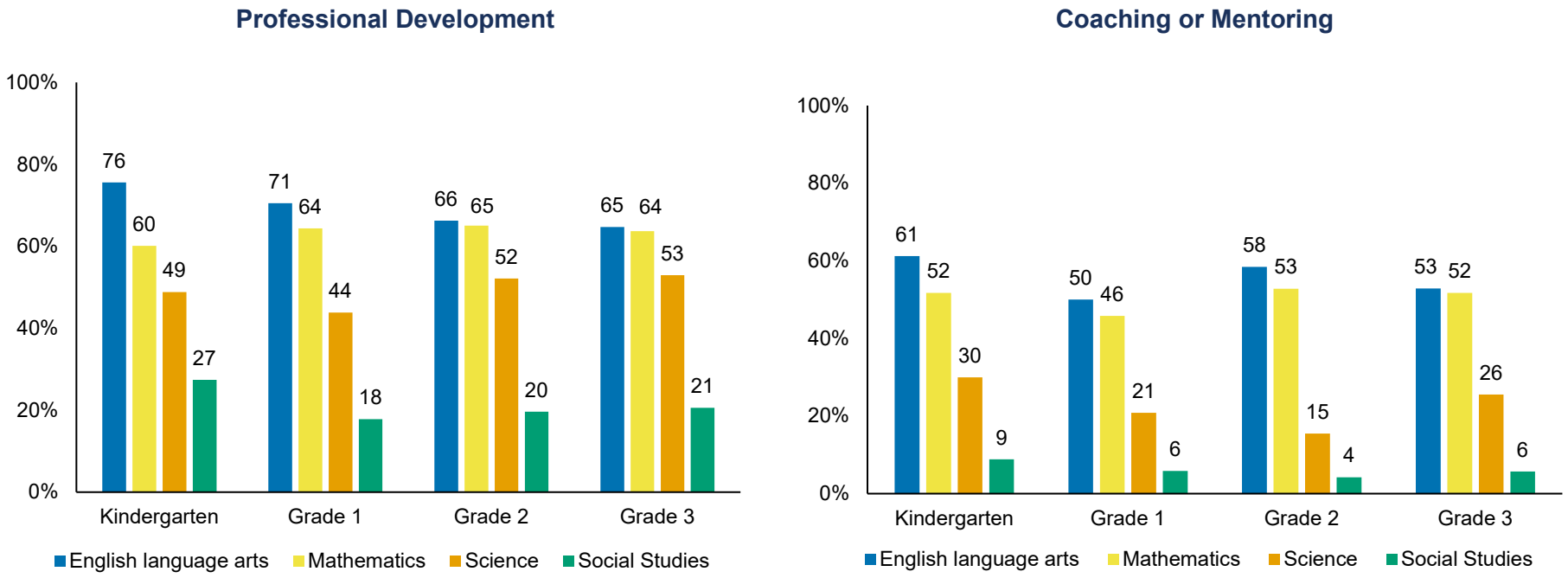
Teachers were asked the following questions about the professional support they had received:

1. In which of the following areas has your district provided you with professional development (e.g., one-day training, multi-day training sessions) this academic year? (Select all that apply.)
2. In which of the following areas has your district provided **academic instructional coaches or mentors** to work with you **one-on-one** this academic year? (Select all that apply.)

- History/Social Studies
- Mathematics
- Reading/English language arts
- Science
- None of the subjects
- Instructional or pedagogical practices that are not content specific
- Don't know/not applicable

Teachers were much more likely to report having received professional development, instructional coaching, or mentoring in reading/English language arts and mathematics than in science or social studies. Coaching or mentoring was less common than professional development training sessions. A low percentage of teachers reported receiving professional support in social studies (Figure 7).

Figure 7. Percentage of Teachers Reporting Receiving Professional Development and Coaching or Mentoring



Recommendations

A significant body of research suggests that teaching science and social studies in the early grades is likely to benefit students. In our study, the majority of teachers and school leaders believed that teaching science and social studies in K-3 is likely to improve students' reading comprehension and subject-area learning and interest in later grades. In addition, we found that these beliefs were positively related to the number of hours spent teaching the two subjects. A descriptive study such as this one cannot identify the direction of causality in this relationship: Perhaps spending more time on a subject changes teachers' understanding of the subject's importance.

Even when K-3 teachers said that they valued science and social studies, they spent relatively few hours on those subjects. Difficulty integrating science and social studies into the curriculum for English language arts, a more highly emphasized subject, was associated with fewer hours teaching science and social studies. In general, curriculum integration did not raise the average instructional time devoted to those subjects beyond the time devoted when the subjects are taught separately.

Given the potential benefits of increased early learning in science and social studies (i.e., improved reading comprehension, better preparation for future learning, increased interest in these subjects, and reduced pressure on educators to overload curricula in later grades), it seems prudent for district leaders to pursue increases in instructional time and student learning in these subjects by taking the following steps:

- **Train teachers and school leaders in the research that explains why "teaching content is teaching reading."** Reading consists of two abilities: the ability to identify the words on the page (decoding), and the ability to understand the passage once the words have been identified (comprehension). While decoding depends on knowledge of letter-sound relationships, comprehension depends heavily on the students' vocabulary and knowledge of the subject the passage is about. Thus, devoting a larger amount of time—including time in the English language arts program—to teaching content subjects such as science and social studies should improve students' reading comprehension.[13] In addition, teachers and school leaders should be aware of the research that shows the appropriateness of teaching this content to young children.[14]
- **Adopt content-rich English language arts curricula that explicitly integrate a coherent sequence of science and social studies topics into the English language arts curriculum.** A number of these curricula have received high ratings in external reviews based on their coherent emphasis on developing students' background knowledge and vocabulary. For example, the curriculum reviewing organization EdReports.org has rated several elementary ELA curricula as content-rich based on its criteria under "Gateway 2: Building Knowledge with Texts, Vocabulary, and Tasks."[15] Teachers and school and district leaders should review these ratings and the criteria behind

them when making curriculum adoption decisions.

- **Institutionalize school and district improvement processes that support consistent and sustained improvement.** Without the right processes in place for identifying, testing, and keeping or discarding changes, improvements in curriculum and instruction often don't survive school and district leadership changes. These processes typically involve the use of diagnostic causal modeling to select the changes to be adopted, the use of short-term continuous improvement cycles, and use of a mix of measures to learn if a change is in fact an improvement.[16]

For their part, state and local policymakers can take the following steps:

- **Encourage public recognition of the importance of getting students on track in the early grades.** Paying too little attention to younger students is like focusing antismoking efforts on 70-year-olds because teenagers rarely get lung cancer or emphysema. Students who are far off track academically by the end of elementary or middle school often have great difficulty catching up to college readiness benchmarks in subsequent years.[17] In addition, student attitudes and interests related to learning are strongly influenced by their early-grades experience.[18]
- **Modify state and local accountability systems to recognize the value of targeting long-term improvement through well-designed improvement processes.** Accountability systems have been designed in large part to create a sense of urgency about improving student outcomes. However, this has often had the undesirable effect of shortening educators' time horizons so that they emphasize changes aimed at improving accountability ratings over the short run. These changes can include narrowing the curriculum to deemphasize subjects not tested in the current grade and spending inordinate amounts of time coaching students on how to answer sample test questions. Accountability systems should be redesigned to encourage improvement processes that focus on a broader mix of short- and long-term student outcomes.

Notes

1. National Institute of Child Health and Human Development (NICHD) Early Child Care Research Network, "A Day in Third Grade: A Large-Scale Study of Classroom Quality and Teacher and Student Behavior," *The Elementary School Journal* 105, no. 3, (January 2005): pp. 305-323.
2. For example, in the 1999-2000 Schools and Staffing Survey (SASS) by the US Department of Education, teachers in grades 1-4 reported devoting 8.9% and 7.4% of classroom time to science and social studies, respectively. These percentages declined to 7.1% and 7.4% in the 2011-12 school year, a reduction that may have been influenced by the emphasis on reading and mathematics test scores under the No Child Left Behind Act of 2002.
3. Kintsch, Walter, *Comprehension: A paradigm for cognition.* (New York, NY: Cambridge University Press, 1988). Hirsch, E. D., "Reading Comprehension Requires Knowledge—of Words and the World," *American Educator 27*, no. 1 (Spring 2003): pp. 10–29, 48. Hirsch, E. D., *The Knowledge Deficit: Closing the Shocking Education Gap for American Children.* (New York, NY: Houghton Mifflin, 2006). Romance, Nancy R. & Michael R. Vitale. (2012). "Expanding the Role of K-5 Science Instruction in Educational Reform: Implications of an Interdisciplinary Model for Integrating Science and Reading," *School Science and Mathematics* 112, no. 8 (December 2012): pp. 506-515. Willingham, Daniel T., T*he Reading Mind: A Cognitive Approach to Understanding How the Mind Reads.* (San Francisco, CA: Jossey-Bass, 2017).
4. Willingham, Daniel T. (2006). "How Knowledge Helps: It Speeds and Strengthens Reading Comprehension, Learning—and Thinking," *American Educator* 30: pp. 30–37.
5. For example, see Akerson, Valarie L. & Lisa A. Donnelly, "Teaching Nature of Science to K-2 Students: What Understandings Can They Attain?" *International Journal of Science Education* 32, no. 1 (January 2010): pp. 1-28.; Akerson, Valarie L., Gayle A. Buck, Lisa A. Donnelly, Vanashri Nargund-Joshi, & Ingrid S. Weiland, "The Importance of Teaching and Learning Nature of Science in the Early Childhood Years, *Journal of Science Education and Technology*, Issue 20, no. 5 (October 2011): 537-549.; Kuhn, Deanna, & Susan Pearsall, "Developmental Origins of Scientific Thinking," *Journal of Cognition and Development* 1, no. 1 (2000): 113-129.; Metz, Kathleen E., "Narrowing the Gulf between the Practices of Science and the Elementary School Science Classroom," *The Elementary School Journal* 109, no. 2 (November 2008): 138-161. Committee on Science Learning, Kindergarten Through Eighth Grade, *Taking Science to School: Learning and Teaching Science in Grades K-8,* eds. Duschl, Richard A., Heidi A. Schweingruber, & Andrew W. Shouse (Washington, DC: The National Academies Press, 2007).
6. Maltese, Adam V., & Robert H. Tai., "Eyeballs in the Fridge: Sources of Early Interest in Science," *International Journal of Science Education* 32, no. 5 (2010): 669–685.; Maltese, Adam V., Christina S. Melki, & Heidi L. Wiebke, "The Nature of Experiences Responsible for the Generation and Maintenance of Interest in STEM," *Science Education* 98, no. 6 (2014): 937-962.

7. Li, Junlei, David Klahr, & Stephanie Siler, "What Lies Beneath the Science Achievement Gap: The Challenges of Aligning Science Instruction with Standards and Tests," *Science Educator* 15, no. 1 (2006): 1-12.; Schwartz, Marc S., Philip M. Sadler, Gerhard Sonnert, and Robert H. Tai, "Depth Versus Breadth: How Content Coverage in High School Science Courses Relates to Later Success in College Science Coursework," *Science Education* 93, no. 1 (December 2008): 798-826.
8. Bransford, John D., Ann L. Brown, & Rodney R. Cocking, eds. (2000). *How people learn: Brain, mind, experience, and school*. (Washington, D.C.: National Research Council, National Academy Press, 2000); Committee on Science Learning, Kindergarten Through Eighth Grade, *Taking Science to School: Learning and Teaching Science in Grades K-8,* eds. Duschl, Richard A., Heidi A. Schweingruber, & Andrew W. Shouse (Washington, DC: The National Academies Press, 2007); Wills, J. S., "Putting the squeeze on social studies: Managing teaching dilemmas in subject areas excluded from state testing," *Teachers College Record* 109, no. 8 (2007): 1980-2046.
9. To conduct the survey, we obtained publicly-available data on schools and districts for the 2014-15 school year in these two states and asked educators to participate in an online survey. Superintendents and principals were solicited directly; principals forwarded an email invitation to participate to the teachers in their school. All data collection occurred during a four-week window beginning on January 18th and ended on February 16th, 2017. A total of 722 K-3 teachers, 218 school leaders, and 62 district superintendents participated in this study. The responding teachers came from 12% of the schools in the two states, while the school and district leader participants came from 15% of the schools and 15% of the districts, respectively.
10. See the previous endnote.
11. A number of social studies curricula postpone learning about the world outside the student's family and community until fourth grade and after. This can make for a social studies curriculum that is less interesting to students and teachers and less effective in preparing students for later learning. See Ravitch, Diane, "Tot Sociology: Or What Happened to History in the Grade Schools," American Scholar, 56, no. 3 (Summer 1987); Ravitch, Diane, *Left Back: A Century of Failed School Reforms* (New York, NY: Simon & Schuster, 2000); and Frazee, Brian, & Samuel Ayres, "Garbage In, Garbage Out: Expanding Environments, Constructivism, and Content Knowledge in Social Studies," in *Where Did Social Studies Go Wrong?,* eds. James Leming, Lucien Ellington, & Kathleen Porter-Magee (Washington, DC: Thomas B. Fordham Institute, 2003), 111–123. We did not collect information on the science and social studies curricula taught in the classrooms and schools in the survey.
12. Lower percentages of teachers, school leaders, and district leaders believing that social studies should be taught daily (compared with science) may also be related to the nature of the social studies curriculum that is taught. See the preceding endnote.

13. In addition to the sources cited in notes 3 and 4, see Wexler, Natalie, *The Knowledge Gap: The Hidden Cause of America's Broken Education System – and How to Fix it*, (New York, NY: Penguin Random House, 2019), and Willingham, Daniel, "Teaching Content is Teaching Reading," YouTube video, published Jan 9, 2009, retrieved August 31, 2019 from *https://www.youtube.com/watch?v=RiP-ijdxqEc*.
14. Some of this research is cited in note 5. In addition, common misconceptions about the appropriateness of teaching content to young students are addressed in Willingham, Daniel, "What is Developmentally Appropriate Practice?" *The American Educator*, (Summer 2008): 34-39.
15. EdReports.org. "K-2 ELA Methodology." Edreports.org. Retrieved June 27, 2018 from *https://api.edreports.org/about/our-approach/ela-k-2.html*.; EdReports.org. "3-8 ELA methodology." Edreports.org. Retrieved June 27, 2018 from *https://www.edreports.org/reports/?s=ela;*EdReports.org. (2018c.) ELA reports: Compare K-8 ELA materials. Retrieved June 27, 2018 from *https://www.edreports.org/compare*.
16. Bryk, Tony, Louis Gomez, Alicia Grunow, & Paul LeMahieu, *Learning to Improve: How America's Schools Can Get Better at Getting Better*, (Cambridge, MA: Harvard University Press, 2015).
17. Dougherty, Chrys, "Catching up to College and Career Readiness: The Challenge is Greater for At-Risk Students," (Iowa City, IA: ACT, 2014). An overall summary of the case for focusing on the early grades, even when the outcomes of interest largely materialize in middle and high school, is Dougherty, Chrys, "College and Career Readiness: The Importance of Early Learning," (Iowa City, IA: ACT, 2013).
18. See the sources listed in note 6.

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