



**PPIC**

PUBLIC POLICY  
INSTITUTE OF CALIFORNIA

# Implementing the Next Generation Science Standards

## Early Evidence from California

### Technical Appendices

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# Appendix A. PPIC NGSS Survey

## Survey Timeline

The NGSS survey was developed by researchers at PPIC. After conducting literature reviews and talking to science educators in 10 diverse school districts, we identified a potential list of topics to be included in the survey. The draft survey was sent to multiple stakeholders including the California Department of Education, the California Science Teacher Association, the California County Superintendents Educational Services Association Curriculum and Instruction Steering Committee science subcommittee, district administrators, and science teachers, who gave us constructive feedback. The revised survey was field tested in February 2017 and formally launched in March 2017. See Appendix E for the survey instrument.

We obtained district and school contact information from the California Department of Education, which publishes public schools and district data files on a regular basis. The online survey was sent to all unified and high school districts in mid-March. The email was addressed to district superintendents; however, superintendents could forward the email to district staff. For this reason, we included in our survey a question asking the respondent’s position in the district. Several stakeholders – CDE, CSTA, Children Now, the K–12 Alliance at WestEd –provided invaluable assistance in disseminating the survey.

## Defining District Types

Large districts are defined to be those at the top 25<sup>th</sup> percentile of the enrollment distribution (total enrollment  $\geq 14,000$ ). Small districts are those at the bottom 25<sup>th</sup> percentile of the enrollment distribution (total enrollment  $\leq 2000$ ).

Districts’ urbanicity status is coded based on the locality variable from the Common Core of Data (2014–15) maintained by the National Center for Education Statistics. The 12 urban-centric code categories are:

**TABLE 1**

Identification of rural and urban districts, Common Core of Data, 2014–15

| Urban Centric Code | Urban | Rural |
|--------------------|-------|-------|
| City, large        | Y     | N     |
| City, Midsize      | Y     | N     |
| City, small        | Y     | N     |
| Suburb, large      | N     | N     |
| Suburb, midsize    | N     | N     |
| Suburb, small      | N     | N     |
| Town, fringe       | N     | N     |
| Town, distant      | N     | N     |
| Town, remote       | N     | N     |
| Rural, fringe      | N     | Y     |
| Rural, distant     | N     | Y     |
| Rural, remote      | N     | Y     |

Urban districts include those in the top three categories (city, large, midsize, and small), and rural districts include those in the bottom three buckets (rural, fringe, distant, and remote). Statewide, 80 (19%) unified and high school districts are urban and 87 (21%) are considered rural. High performance districts are districts at the top 25<sup>th</sup> percentile of student participation in advanced placement (AP) exams. Low-performance districts are districts at the bottom 25<sup>th</sup> percentile of student participation in AP exams. High-need districts are districts with at least 55 percent of students classified as low-income, English Learners, and/or foster youth.

## Survey Respondent Analysis

In our initial sample, large, urban, affluent, and high performing districts were more likely to respond to our survey (not shown here). To address this selection bias, we targeted small, rural, high poverty and low-performing districts during the follow-up. This included sending multiple emails (and in certain cases, phone calls) to district administrators, school administrators, and science teachers in these districts. After two rounds of follow-ups, district enrollment size is the only factor predicting districts' response (Table A1).

The base model (column 1) includes district size, geographic location and district type (e.g., unified versus high school districts) only. To tease out the effect of student characteristics, in column (2) we add districts' share of minority students, English learners, and low-income students. Some of these student characteristics have quite large effects on districts' probability of responding to our survey. In model (3) we replace these multiple student characteristics with one single measure: share of high-need students, which in the new school finance system includes low-income, English learners and/or foster youth. The point estimate, however, is not significant at any conventional level. In model (4) we add in student performance measure: % 10<sup>th</sup>–12<sup>th</sup> graders taking at least one advanced placement exam, which is not significant. In a separate regression not shown here, student characteristics that were significant in model (2) are no longer significant after the inclusion of performance measures. In model (5) we add in an alternative performance measure: average test score in CST science and similar to AP participation, this one is not significant at any conventional level. In model (6) we test whether districts having more experienced and credentialed teachers would be more likely to respond. To do so we add teacher characteristics, which are not significant. In model (7) we further add neighborhood characteristics such as % with a bachelor's degree or higher, and in model (8), which is our preferred model specification, we add in county fixed effects to account for the fact that some county offices of education are more active in sharing our survey with their districts. District size is the only significant predictor. Last, we exclude extremely large districts (enrollment  $\geq$  50,000), which does not change the conclusion that school size seems to be the only significant variable affecting districts' probability of responding to the survey.

**TABLE A1**

Marginal effects of student, teacher, district, and neighborhood characteristics on survey response

|  | (1)       | (2)       | (3)       | (4)       | (5)       | (6)       | (7)       | (8)       | (9)       |
|--|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| District enrollment (000)                    | 0.0184*** | 0.0495*** | 0.0563*** | 0.0552*** | 0.0559*** | 0.0575*** | 0.0534*** | 0.0662*** | 0.0659*** |
|  | [0.0033]  | [0.0111]  | [0.0114]  | [0.0114]  | [0.0115]  | [0.0129]  | [0.0113]  | [0.0153]  | [0.0156]  |
| Rural districts                              | -0.0811   | -0.0712   | -0.2176   | -0.1615   | -0.1022   | -0.1906   | -0.2104   | -0.1377   | -0.139    |
|  | [0.0596]  | [0.1981]  | [0.1825]  | [0.1889]  | [0.1879]  | [0.1899]  | [0.1913]  | [0.2220]  | [0.2223]  |
| Urban Districts                              | 0.0716    | 0.1847    | 0.191     | 0.1891    | 0.1957    | 0.1807    | 0.1609    | 0.1309    | 0.1313    |
|  | [0.0677]  | [0.2040]  | [0.2069]  | [0.2065]  | [0.2079]  | [0.2099]  | [0.2103]  | [0.2353]  | [0.2355]  |
| High school districts                        | -0.006    | -0.1195   | -0.0549   | -0.0609   | -0.0584   | -0.04     | -0.0409   | 0.0188    | 0.0188    |
|  | [0.0563]  | [0.1835]  | [0.1742]  | [0.1744]  | [0.1774]  | [0.1763]  | [0.1806]  | [0.1850]  | [0.1849]  |
| Share of high-need students                  |           |           | -0.4297   | -0.3553   | -0.1192   | -0.3817   | -0.4146   | -0.3933   | -0.394    |
|  |           |           | [0.2961]  | [0.3608]  | [0.5068]  | [0.3683]  | [0.4796]  | [0.4304]  | [0.4313]  |
| Share 10–12th graders taking AP              |           |           |           | 0.4002    |           | 0.697     | 0.4932    | 0.9998    | 0.9987    |
|  |           |           |           | [0.7362]  |           | [0.7979]  | [0.7865]  | [0.8868]  | [0.8876]  |
| Share white students                         |           | -1.2249** |           |           |           |           |           |           |           |
|  |           | [0.5027]  |           |           |           |           |           |           |           |
| Share free/reduced price lunch               |           | -0.9087** |           |           |           |           |           |           |           |
|  |           | [0.3960]  |           |           |           |           |           |           |           |
| Share w/ limited English proficiency         |           | -0.6368   |           |           |           |           |           |           |           |
|  |           | [0.8161]  |           |           |           |           |           |           |           |
| Average CST science score                    |           |           |           |           | 0.0036    |           |           |           |           |
|  |           |           |           |           | [0.0048]  |           |           |           |           |
| Share teachers w/ Master degree (or higher)  |           |           |           |           |           | -0.488    |           |           |           |
|  |           |           |           |           |           | [0.5275]  |           |           |           |
| Average years of teaching experience         |           |           |           |           |           | -0.0071   |           |           |           |
|  |           |           |           |           |           | [0.0294]  |           |           |           |
| % bachelor's or higher (neighborhood)        |           |           |           |           |           |           | -0.001    |           |           |
|  |           |           |           |           |           |           | [0.0068]  |           |           |
| County Fixed Effects                         |           |           |           |           |           |           |           | X         | X         |
| Exclude extremely large districts (outliers) |           |           |           |           |           |           |           |           | X         |

SOURCES: PPIC NGSS Survey, 2017; California Department of Education, various years; American Community Survey, 2011–15, 5 year estimates; National Center for Education Statistics, 2013–14.

NOTES: 1. Standard errors in brackets and adjusted for clustering at county level. 2. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

Our final sample includes 204 unified and high school districts, representing an overall response rate of 49 percent. An additional 49 elementary school districts responded to our survey, and since they are not the focus of our report, we excluded them from the analysis. We weight each response by their inverse probability of response

(calculated based on model 8 in Table 1), and summary statistics for our respondents and for the census of unified and high school districts are included in Table 2.

**TABLE A2**

Summary statistics of respondents

| Variable   | Respondent (raw) | Respondent (weighted) | Population |
|--|------------------|-----------------------|------------|
| Urban  | 29%              | 22%                   | 19%        |
| Neighborhood educational attainment: % with a BA or higher | 28%              | 26%                   | 26%        |
| Neighborhood median household income                       | \$62,914         | \$52,876              | \$53,698   |
| High-need student share                                    | 57%              | 59%                   | 59%        |
| Total enrollment (in 000)                                  | 19               | 13                    | 12         |
| % Asian Pacific Islander                                   | 13%              | 11%                   | 9%         |
| % Hispanic   | 48%              | 51%                   | 48%        |
| % Black  | 4%               | 4%                    | 4%         |
| % White  | 29%              | 29%                   | 34%        |
| Percent EL   | 18%              | 20%                   | 18%        |
| Percent A–G  | 43%              | 41%                   | 40%        |
| Percent free/ reduced lunch                                | 53%              | 55%                   | 55%        |
| Percent AP participation                                   | 23%              | 23%                   | 21%        |
| CST science score  | 350              | 348                   | 348        |
| Teacher education (percent with master's degree or higher) | 44%              | 42%                   | 42%        |
| Teacher experience (percent novice teachers)               | 18%              | 18%                   | 19%        |
| Teacher experience (years of teaching)                     | 14               | 14                    | 14         |
| N districts  | 204              | 204                   | 420        |

SOURCES: PPIC NGSS Survey, 2017; California Department of Education, various years; American Community Survey, 2011–15, 5 year estimates; National Center for Education Statistics, 2013–14.

## Appendix B. Additional Analyses of the NGSS Survey

For each survey question, we perform a regression analysis that includes district size, geographic location, share of high-need students, student performance and Table B1 summarizes the results. In Figure 1–4, Figure 7 –10, and Table 2, we report the break-down (e.g., large versus small) if applicable variable (e.g., enrollment) is significant.

**TABLE B1**

Effects of district characteristics on districts' response

|   | Dependent variable     |                      |                          |                           |                        |
|---|------------------------|----------------------|--------------------------|---------------------------|------------------------|
|   | Familiarity with NGSS  | Implementing NGSS    | MS Sequence - integrated | MS Sequence - discipline  | HS sequence - 3 course |
| District enrollment (000)                 | 0.0037<br>[0.0036]     | 0.0012<br>[0.0021]   | 0.0007<br>[0.0043]       | 0.004<br>[0.0026]         | 0.003<br>[0.0023]      |
| Rural                                     | -0.037<br>[0.1064]     | 0.0624<br>[0.1078]   | -0.2248<br>[0.1595]      | 0.2379***<br>[0.0775]     | 0.6094***<br>[0.2053]  |
| Urban                                     | 0.0981<br>[0.0704]     | 0.2088**<br>[0.0869] | 0.1503*<br>[0.0816]      | -0.1575*<br>[0.0895]      | 0.35<br>[0.2704]       |
| High school district                      | -0.0488<br>[0.0660]    | 0.1052<br>[0.0862]   |                          |                           | 0.2747*<br>[0.1598]    |
| Share high-need students                  | -0.022<br>[0.1256]     | -0.1872<br>[0.1490]  | -0.2549<br>[0.2239]      | -0.1172<br>[0.1469]       | -0.212<br>[0.2490]     |
| Share taking AP exam                      | 0.6175***<br>[0.2293]  | -0.4188<br>[0.3473]  | -0.0793<br>[0.5410]      | -0.3226<br>[0.3334]       | 0.2478<br>[0.4975]     |
| Respondent position: school administrator | -0.2424***<br>[0.0573] |                      |                          |                           |                        |
| Respondent position: science teacher      | 0.0658<br>[0.0573]     |                      |                          |                           |                        |
| Familiarity with NGSS                     |                        | 0.0592<br>[0.0553]   | 0.1308**<br>[0.0664]     | -0.0812**<br>[0.0396]     | -0.011<br>[0.0839]     |
| Having enough teacher                     |                        |                      |                          |                           |                        |
| Model                                     | Ordered Logit          | Probit               | Multinomial logit        | Multinomial logit         | Multinomial logit      |
| Base outcome (if applicable)              |                        |                      | Not decided              | Not decided               | Not decided            |
| Predicted outcome (if applicable)         | Very familiar          |                      | Integrated model         | Discipline specific model | 3 course model         |

|   | Dependent Variable           |                         |                              |   |                     |
|---|------------------------------|-------------------------|------------------------------|---|---------------------|
|   | HS sequence - 4 course model | HS sequence - own model | Offering accelerated pathway | Accelerated pathway: open enrollment policy | Sufficient labs     |
| District enrollment (000)                 | -0.0018<br>[0.0036]          | -0.0037<br>[0.0024]     | -0.0007<br>[0.0005]          | 0.0059<br>[0.0037]                          | 0.0002<br>[0.0001]  |
| Rural                                     | 0.1681*<br>[0.0963]          | -0.8868***<br>[0.2762]  | -0.0732<br>[0.1050]          | 0.1301<br>[0.1395]                          | -0.1253<br>[0.0768] |
| Urban                                     | 0.014<br>[0.1277]            | 0.0717**<br>[0.0350]    | -0.1202<br>[0.0797]          | 0.0021<br>[0.0778]                          | -0.0183<br>[0.0440] |
| High school district                      | 0.1519**<br>[0.0600]         | 0.0647*<br>[0.0372]     | -0.0726<br>[0.0970]          | 0.1886*<br>[0.1070]                         | 0.0119<br>[0.0527]  |
| Share high-need students                  | 0.1437<br>[0.1255]           | -0.0012<br>[0.1131]     | -0.217<br>[0.1840]           | 0.2139<br>[0.1983]                          | -0.0158<br>[0.1041] |
| Share taking AP exam                      | -0.0369<br>[0.3131]          | -0.1737<br>[0.2191]     | 0.4588<br>[0.4614]           | 0.1056<br>[0.4597]                          | -0.2917<br>[0.2118] |
| Respondent position: school administrator |                              |                         |                              |   |                     |
| Respondent position: science teacher      |                              |                         |                              |   |                     |
| Familiarity with NGSS                     | -0.053<br>[0.0467]           | 0.104<br>[0.0635]       |                              |   |                     |
| Having enough teacher                     |                              |                         |                              |   |                     |
| Model                                     | Multinomial Logit            | Multinomial Logit       | Probit                       | Probit                                      | Ordered Logit       |
| Base outcome (if applicable)              | Not decided                  | Not decided             |                              |   |                     |
| Predicted outcome (if applicable)         | 4 course model               | Own model               |                              |   | big issue           |

|   | Labs modern enough   | Sufficient equipment  | Having enough science teachers | Teachers prepared for NGSS | Difficulty in teacher hiring |
|---|----------------------|-----------------------|--------------------------------|----------------------------|------------------------------|
| District enrollment (000)                 | 0.0036*<br>[0.0019]  | 0.0029<br>[0.0019]    | 0.0005<br>[0.0004]             | -0.0002***<br>[0.0001]     | -0.0009***<br>[0.0002]       |
| Rural                                     | -0.0717<br>[0.0995]  | -0.084<br>[0.0965]    | 0.0304<br>[0.1354]             | 0.0266<br>[0.0476]         | 0.0305<br>[0.1155]           |
| Urban                                     | -0.1138*<br>[0.0635] | -0.0548<br>[0.0649]   | -0.0324<br>[0.0847]            | -0.0351<br>[0.0290]        | -0.0197<br>[0.0534]          |
| High school district                      | 0.0674<br>[0.0713]   | -0.0437<br>[0.0456]   | 0.0359<br>[0.0969]             | -0.0261<br>[0.0342]        | -0.0068<br>[0.0699]          |
| Share high-need students                  | 0.0594<br>[0.1715]   | -0.1125<br>[0.1473]   | -0.1914<br>[0.2077]            | 0.0662<br>[0.0637]         | 0.2923<br>[0.1812]           |
| Share taking AP exam                      | -0.5222<br>[0.3844]  | -0.6582**<br>[0.2700] | 0.3973<br>[0.5281]             | -0.1379<br>[0.1740]        | -0.0796<br>[0.4272]          |
| Respondent position: school administrator |                      |                       |                                |                            |                              |

|                                      | Labs modern enough | Sufficient equipment | Having enough science teachers | Teachers prepared for NGSS | Difficulty in teacher hiring |
|--------------------------------------|--------------------|----------------------|--------------------------------|----------------------------|------------------------------|
| Respondent position: science teacher |                    |                      |                                |                            |                              |
| Familiarity with NGSS                |                    |                      |                                |                            |                              |
| Having enough teacher                |                    |                      |                                | 0.0599<br>[0.0403]         |                              |
| Model                                | Ordered Logit      | Ordered Logit        | Probit                         | Ordered Logit              | Ordered Logit                |
| Base outcome (if applicable)         |                    |                      |                                |                            |                              |
| Predicted outcome (if applicable)    | big issue          | big issue            |                                | Very prepared              | Very difficult               |

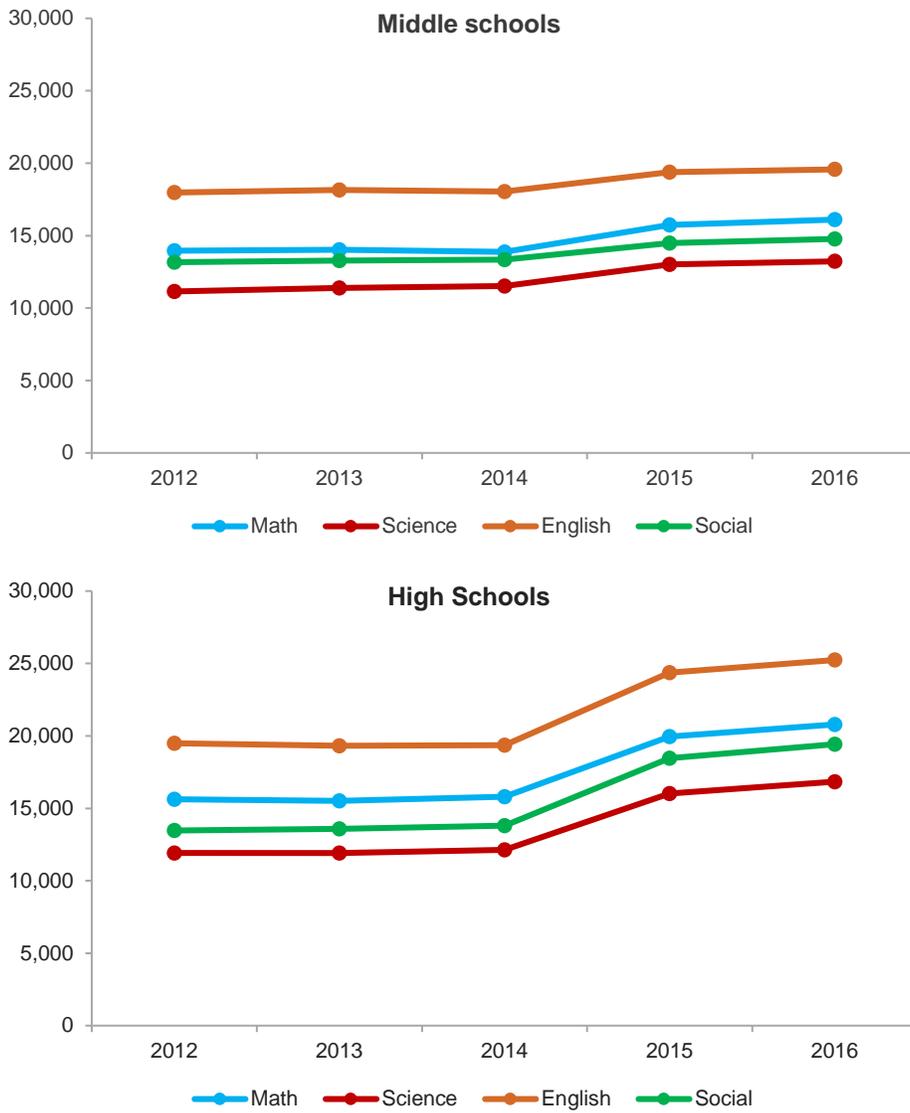
|                                   | Dependent Variable              |  |                       |                                  |                      |
|-----------------------------------|---------------------------------|--|-----------------------|----------------------------------|----------------------|
|                                   | Difficulty in teacher retention | HS graduation: 3 years of science or more<br>(Q12) | Science is a priority | Science exposure in early grades | NGSS efficacy        |
| District enrollment (000)         | 0.0001**<br>[0.0001]            | -0.0028<br>[0.0024]                                | -0.0002*<br>[0.0001]  | 0.0052*<br>[0.0031]              | 0.0027<br>[0.0045]   |
| Rural                             | -0.001<br>[0.0207]              | 0.0016<br>[0.0997]                                 | 0.1347**<br>[0.0642]  | -0.1934<br>[0.1248]              | 0.0112<br>[0.1300]   |
| Urban                             | -0.0061<br>[0.0112]             | -0.1183*<br>[0.0625]                               | -0.0008<br>[0.0397]   | -0.0302<br>[0.0736]              | -0.1477<br>[0.0966]  |
| High school district              | -0.0229<br>[0.0164]             | -0.1229<br>[0.0941]                                | -0.0262<br>[0.0501]   | 0.1398*<br>[0.0842]              | -0.1054<br>[0.1255]  |
| Share high-need students          | 0.0155<br>[0.0300]              | -0.124<br>[0.1682]                                 | -0.2198*<br>[0.1255]  | 0.4795***<br>[0.1113]            | 0.5264**<br>[0.2366] |
| Share taking AP exam              | -0.0639<br>[0.0779]             | -0.4087<br>[0.3446]                                | 0.397<br>[0.2802]     | -0.2058<br>[0.2385]              | 0.6664<br>[0.5070]   |
| Model                             | Ordered Logit                   |  | Ordered Logit         | Ordered Logit                    | Ordered Logit        |
| Base outcome (if applicable)      |                                 |  |                       |                                  |                      |
| Predicted outcome (if applicable) | Very difficult                  |  | Strongly agree        | Strongly agree                   | Very likely          |

SOURCES: District response: PPIC NGSS Survey, 2017; District enrollment, type, high-need student share: California Department of Education, 2016–17; AP participation: California Department of Education, 2015–16; District geographic location: National Center for Education Statistics, 2013–14

NOTES: 1. Standard errors in brackets and adjusted for clustering at the county level. 2. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

**FIGURE B1**

Number of teachers in each subject areas, 2012–2016



SOURCE: California Department of Education, Course Enrollment Data, Staff Assignment Data, 2012–2016.

NOTE: Data not reliable for earlier years (e.g., 2000–2011).

# Appendix C. High School Graduation Requirements

**TABLE C1**

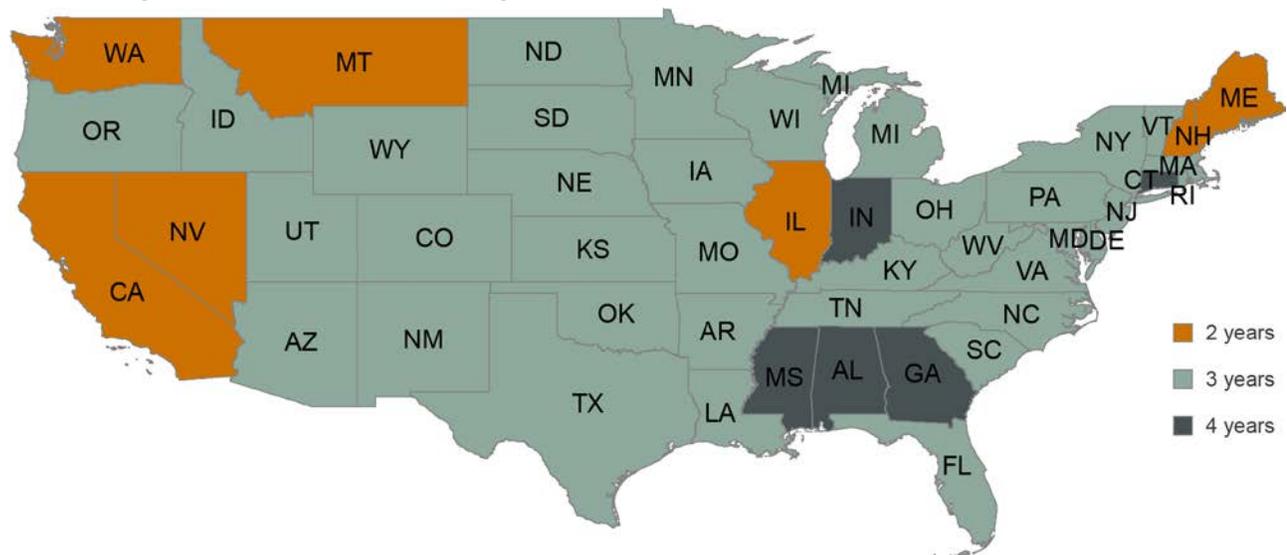
Years of instruction required for high school graduation

| Core subject area | State graduation requirements                        | UC requirements   | CSU requirements   | Rest of US (average) |
|-------------------|--|---|--|----------------------|
| Math              | 2 years:<br>-algebra 1                               | 3 years:<br>-algebra 1<br>-geometry<br>-algebra2          | 3 years:<br>-algebra 1<br>-geometry<br>-algebra 2              | 3 years              |
| Science           | 2 years:<br>-biological science<br>-physical science | 2 years with labs:<br>- biology<br>-chemistry<br>-physics | 2 years with labs:<br>-biological science<br>-physical science | 3                    |
| English           | 3  | 4   | 4  | 4                    |
| Social Science    | 3  | 2   | 2  | 3                    |

SOURCES: California Department of Education, 2017. University of California, 2017. California State University, 2017. States' Departments of Education, 2017.

**FIGURE C1**

California lags behind other states in science graduation requirements



SOURCE: State Departments of Education, 2017.

NOTE: Alaska requires two years of science and Hawaii requires three.

# Appendix D. Analysis of Survey Responses from Elementary School Districts

Similar to Table A1, we examine whether elementary districts that responded to our survey are representative of the state, and the results are summarized in Table D1. Urban, affluent, and large elementary districts are more likely to respond to our survey. These respondents also have considerably more Latino students, more teachers with a master’s degree or higher, and more experienced teachers.

**TABLE D1**  
Survey respondents analysis, elementary school districts only

| Variable   | Respondent (raw) | Population |
|--|------------------|------------|
| Urban  | 35%              | 13%        |
| Neighborhood educational attainment: % with a BA or higher | 29%              | 25%        |
| Neighborhood median household income                       | \$71,404         | \$60,082   |
| High-need student share                                    | 59%              | 59%        |
| Total enrollment   | 8531             | 2367       |
| % Asian Pacific Islander                                   | 7%               | 4%         |
| % Hispanic   | 53%              | 42%        |
| % Black  | 3%               | 2%         |
| % White  | 29%              | 43%        |
| Percent EL   | 26%              | 22%        |
| Percent free/ reduced lunch                                | 54%              | 54%        |
| Teacher education (percent with master's degree or higher) | 43%              | 34%        |
| Teacher experience (percent novice teachers)               | 17%              | 20%        |
| Teacher experience (years of teaching)                     | 14               | 13         |
|  |                  |            |
| N districts  | 49               | 527        |

SOURCES: PPIC NGSS Survey, 2017; California Department of Education, various years; American Community Survey, 2011–15, 5 year estimates; National Center for Education Statistics, 2013–14.

# Appendix E. Survey Instrument

## Next Generation Science Standards Survey

Thank you for taking this survey conducted by the Public Policy Institute of California (PPIC), an independent, objective, nonpartisan research institute ([www.ppic.org](http://www.ppic.org)). The following questions are about your school district's implementation of the Next Generation Science Standards. When you are ready, please click the "Next" button below to start the survey.

Q1. Please select the county where your district is located.



Q2. Please select your district.



*Display This Question: If Please select your district. = Other*

Q3. Please write in the name of your district.

\_\_\_\_\_

Q4. Please select your position in the district.

(Select all that apply)

- District administrator (e.g., superintendent, department of instruction)
- School administrator (e.g., school principal, department heads)
- Science teacher
- Other, please specify \_\_\_\_\_

In this section, we ask about the newly adopted science standards, the California Next Generation Science Standards (CA NGSS).

Q5. In 2013, California adopted the California Next Generation Science Standards (NGSS). How familiar, if at all, are you with the CA NGSS?

- Very familiar
- Somewhat familiar
- Slightly familiar
- Not at all familiar

Q6. Overall, do you think the CA NGSS will increase, decrease or will it make no difference in student preparedness for post-secondary work?

- Increase
- Decrease
- Will make no difference
- Don't know

Q7. Under CA NGSS, districts can choose which science sequence to offer. Please select the option that best describes your district's science sequence for middle school.

- Integrated Model
- Discipline Specific Model (e.g. Earth & Space, Life, and Physical Science)
- A decision has not yet been made
- We developed our own model (please specify) \_\_\_\_\_
- Not applicable (no middle school grades offered)
- Don't know

Q8. Please select the option that best describes your district's science sequence for high school.

- Three-Course Model: Biology, Chemistry, and Physics as three separate courses with Earth and Space Science interwoven into those subjects
- Four-Course Model: Biology, Chemistry, Physics, and Earth and Space Science as four separate courses
- Integrated: Every Science, Every Year
- A decision has not yet been made
- We developed our own model (please specify) \_\_\_\_\_
- Not applicable (no high school grades offered)
- Don't know

Q9. Accelerated pathways allow students to reach advanced level science courses, such as Advanced Placement (AP) courses, earlier than a regular pathway. Does your district offer any accelerated pathways for science?

- Yes
- No
- Don't know

*Display This Question: If Q9 = Yes*

Q10. Does your district have an open enrollment policy for accelerated science pathways?

- Yes
- No
- Don't know

*Display This Question: If Q9 = Yes And Q10 = No*

Q11. How important are each of the following measures in determining student placement into accelerated pathways? If your district does not use the measure, please select "Not used".

|                                     | Very important | Somewhat important | Not very important | Not at all important | Not used |
|-------------------------------------|----------------|--------------------|--------------------|----------------------|----------|
| Previous science course             |                |                    |                    |                      |          |
| Grades in previous science course   |                |                    |                    |                      |          |
| State assessment (e.g. CST)         |                |                    |                    |                      |          |
| Local assessment, please specify    |                |                    |                    |                      |          |
| Science teacher recommendation      |                |                    |                    |                      |          |
| Parents request                     |                |                    |                    |                      |          |
| Student attributes (please specify) |                |                    |                    |                      |          |
| Other (please specify)              |                |                    |                    |                      |          |

*Display This Question: If Q8 != Not applicable (no high school grades offered)*

Q12. In your district, how many years of science are students required to complete for high school graduation?

- Two years/two courses
- Three years/three courses
- Four years/four courses
- Other (please specify) \_\_\_\_\_
- Don't know

*Display This Question: If Q8 != Not applicable (no high school grades offered)*

Q13. Does your district require A–G completion in your high school graduation requirements?

- Yes
- No
- Don't know

*Display This Question: If Q13 = Yes*

Q14. What is the grade requirement for A–G courses?

- A–G course with a grade of C or better
- A–G course with a grade of D or better
- No grade requirement
- Other (please specify) \_\_\_\_\_
- Don't know

*Display This Question: Q13 = No*

Q15. Does your district plan to include A–G in its high school graduation requirements in the next 2 to 3 years?

- Yes
- No
- Don't know

In this section we ask about the conditions at your district while implementing the CA NGSS, including the adequacy of science facilities and preparation of science teachers.

Q16. Is your district currently implementing the CA NGSS?

- Yes
- No
- Don't know

*Skip To: Q38 if Q16 != Yes*

17. Some districts have experienced issues with their **science facilities, equipment, and supplies**. To what extent are the following an issue in your district as you implement the CA NGSS?

|   | Big issue | Somewhat of a big issue | Small issue | Not an issue at all | Don't know |
|---|-----------|-------------------------|-------------|---------------------|------------|
| Having enough science labs and facilities   |           |                         |             |                     |            |
| Having labs modern enough for teachers to adequately teach hands-on science.  |           |                         |             |                     |            |
| Having adequately equipped labs (e.g. calculators, microscopes, beakers) for all students to participate in hands-on science. |           |                         |             |                     |            |
| Having equipment and tools that are in good working order.  |           |                         |             |                     |            |
| Having reliable and sufficient internet for instructional purposes within our schools.  |           |                         |             |                     |            |

Q18. Do you feel your district has enough credentialed science teachers to teach the CA NGSS?

- Yes
- No
- Don't know

*Display This Question: Q18 = No*

Q19. Is your district unable to offer enough advanced science courses (e.g., honor, advanced placement science courses) to meet student demand because of your science teacher shortage?

- Yes
- No
- Don't know

Q20. In your opinion, how prepared or unprepared are the teachers in your district to teach under the CA NGSS?

- Very prepared
- Somewhat prepared
- Somewhat unprepared

- Very unprepared
- Don't know

Q21. Please rate the level of difficulty your district is having in **recruiting** science teachers?

- Very difficult
- Somewhat difficult
- Somewhat easy
- Very easy
- Don't know

Q22. Which of the following has your district used to **recruit** science teachers?

(Select all that apply)

- Financial Incentives (e.g, signing bonus, loan forgiveness)
- Better working conditions (e.g., smaller class sizes, participation in school decisions, more classroom autonomy)
- Teacher learning and supports (e.g., mentors, induction programs, professional development)
- Outreach strategies (e.g., out-of-state recruitment, CalTeach)
- Fringe benefits (e.g., housing subsidies, health insurance, longer maternity leave)
- None of above

*Display This Question: If Q22 = Financial Incentives (e.g., signing bonus, loan forgiveness)*

Q23. Based on your experience in your district, please rate the effectiveness of **financial incentives** to help **recruit** science teachers.

|  | Very effective | Somewhat effective | Not too effective | Not at all effective | Don't know | Not used |
|--|----------------|--------------------|-------------------|----------------------|------------|----------|
| Signing bonus                                  |                |                    |                   |                      |            |          |
| Differential pay by subject                    |                |                    |                   |                      |            |          |
| Bonus for science teachers                     |                |                    |                   |                      |            |          |
| Bonus to teach hard-to-staff schools           |                |                    |                   |                      |            |          |
| Return-to-workforce bonus for retired teachers |                |                    |                   |                      |            |          |
| Loan forgiveness programs for teachers         |                |                    |                   |                      |            |          |

*Display This Question: If Q22 = Better working conditions (e.g., smaller class sizes, participation in school decisions, more classroom autonomy)*

Q24. Based on your experience in your district, please rate the effectiveness of **better working conditions** to help **recruit** science teachers.

|  | Very effective | Somewhat effective | Not too effective | Not at all effective | Don't know | Not used |
|--|----------------|--------------------|-------------------|----------------------|------------|----------|
| Smaller class size   |                |                    |                   |                      |            |          |
| More autonomy in the classroom   |                |                    |                   |                      |            |          |
| Participation in schools' decision making process (e.g., discipline policy, establishing curriculum, determining in-service content) |                |                    |                   |                      |            |          |
| Improved school safety   |                |                    |                   |                      |            |          |
| Reduced student absenteeism and tardiness  |                |                    |                   |                      |            |          |
| Improved school leadership   |                |                    |                   |                      |            |          |

*Display This Question: If Q22 = Teacher learning and supports (e.g., mentors, induction programs, professional development)*

Q25. Based on your experience in your district, please rate the effectiveness of **teacher learning and supports** to help **recruit** science teachers.

|   | Very effective | Somewhat effective | Not too effective | Not at all effective | Don't know | Not used |
|---|----------------|--------------------|-------------------|----------------------|------------|----------|
| Beginning teacher support program (e.g. BTSA) |                |                    |                   |                      |            |          |
| Additional prep periods for teachers          |                |                    |                   |                      |            |          |
| Teacher mentors                               |                |                    |                   |                      |            |          |
| Teacher coaching                              |                |                    |                   |                      |            |          |
| Teacher residencies                           |                |                    |                   |                      |            |          |

*Display This Question: If Q22 = Outreach strategies (e.g., out-of-state recruitment, CalTeach)*

Q26. Based on your experience in your district, please rate the effectiveness of **outreach strategies** to help **recruit** science teachers.

|   | Very effective | Somewhat effective | Not too effective | Not at all effective | Don't know | Not used |
|---|----------------|--------------------|-------------------|----------------------|------------|----------|
| Out-of-state recruitment                            |                |                    |                   |                      |            |          |
| CalTeach recruitment centers                        |                |                    |                   |                      |            |          |
| Recruit college students to become science teachers |                |                    |                   |                      |            |          |
| Credential reciprocity with other states            |                |                    |                   |                      |            |          |

*Display This Question: If Q22 = Fringe benefits (e.g., housing subsidies, health insurance, longer maternity leave)*

Q27. Based on your experience in your district, please rate the effectiveness of **fringe benefits** to help **recruit** science teachers.

|  | Very effective | Somewhat effective | Not too effective | Not at all effective | Don't know | Not used |
|--|----------------|--------------------|-------------------|----------------------|------------|----------|
| Longer maternity leave                     |                |                    |                   |                      |            |          |
| Affordable health insurance                |                |                    |                   |                      |            |          |
| Flexible retirement options                |                |                    |                   |                      |            |          |
| Transportation benefits                    |                |                    |                   |                      |            |          |
| Extra credit teacher home purchase program |                |                    |                   |                      |            |          |
| Affordable housing for teachers            |                |                    |                   |                      |            |          |

Q28. Has your district used any other programs to help **recruit** science teachers?

- Yes, please specify \_\_\_\_\_
- No
- Don't know

Q29. Please rate the level of difficulty your district is having in **retaining** science teachers?

- Very difficult
- Somewhat difficult
- Somewhat easy
- Very easy
- Don't know

Q30. Which of the following has your district used to **retain** science teachers?

- Financial Incentives (e.g., performance bonus, loan forgiveness)
- Better working conditions (e.g., smaller class sizes, participation in school decisions, more classroom autonomy)
- Teacher support (e.g., professional development)
- Fringe benefits (i.e., housing subsidies, health insurance, longer maternity leave)
- None of above

*Display This Question: If Q30 = Financial Incentives (e.g., performance bonus, loan forgiveness)*

Q31. Based on your experience in your district, please rate the effectiveness of **financial incentives** to help **retain** science teachers.

|  | Very effective | Somewhat effective | Not too effective | Not at all effective | Don't know | Not used |
|--|----------------|--------------------|-------------------|----------------------|------------|----------|
| Performance bonus                      |                |                    |                   |                      |            |          |
| Differential pay by subject            |                |                    |                   |                      |            |          |
| Bonus for science teachers             |                |                    |                   |                      |            |          |
| Bonus to teach hard-to-staff schools   |                |                    |                   |                      |            |          |
| Loan forgiveness programs for teachers |                |                    |                   |                      |            |          |

*Display This Question: If Q30 = Better working conditions (e.g. smaller class sizes, participation in school decisions, more classroom autonomy)*

Q32. Based on your experience in your district, please rate the effectiveness of **better working conditions** to help **retain** science teachers.

|  | Very effective | Somewhat effective | Not too effective | Not at all effective | Don't know | Not used |
|--|----------------|--------------------|-------------------|----------------------|------------|----------|
| Smaller class size   |                |                    |                   |                      |            |          |
| More autonomy in the classroom   |                |                    |                   |                      |            |          |
| Participation in schools' decision making process (e.g., discipline policy, establishing curriculum, determining in-service content) |                |                    |                   |                      |            |          |
| Improved school safety   |                |                    |                   |                      |            |          |
| Reduced student absenteeism and tardiness  |                |                    |                   |                      |            |          |
| Improved school leadership   |                |                    |                   |                      |            |          |

*Display This Question: If Q30 = Teacher support (e.g., professional development)*

Q33. Based on your experience in your district, please rate the effectiveness of **teacher supports** to help **retain** science teachers.

|  | Very effective | Somewhat effective | Not too effective | Not at all effective | Don't know | Not used |
|--|----------------|--------------------|-------------------|----------------------|------------|----------|
| Beginning teacher support program (e.g., BTSA) |                |                    |                   |                      |            |          |
| Additional prep periods for teachers           |                |                    |                   |                      |            |          |
| Teacher mentors                                |                |                    |                   |                      |            |          |
| Teacher coaching                               |                |                    |                   |                      |            |          |

*Display This Question: If Q30 = Fringe benefits (i.e. housing subsidies, health insurance, longer maternity leave)*

Q34. Based on your experience in your district, please rate the effectiveness of **fringe benefits** to help **retain** science teachers.

|  | Very effective | Somewhat effective | Not too effective | Not at all effective | Don't know | Not used in my district |
|--|----------------|--------------------|-------------------|----------------------|------------|-------------------------|
| Longer maternity leave                     |                |                    |                   |                      |            |                         |
| Affordable health insurance                |                |                    |                   |                      |            |                         |
| Flexible retirement options                |                |                    |                   |                      |            |                         |
| Transportation benefits                    |                |                    |                   |                      |            |                         |
| Extra credit teacher home purchase program |                |                    |                   |                      |            |                         |
| Affordable housing for teachers            |                |                    |                   |                      |            |                         |

Q35. Has your district used any other programs not mentioned above to **retain** science teachers?

- Yes, please specify \_\_\_\_\_
- No
- Don't know

Q36. Please write in the biggest challenge(s) your district has had in implementing the CA NGSS.

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Q37. How likely do you think the CA NGSS will improve students' science performance (e.g., test scores)?

- Very likely
- Somewhat likely
- Somewhat unlikely
- Very unlikely
- Don't know

In this section we ask about the current condition of science education in K–12 schools.

Q38. How aware are your district's students about science careers (e.g., geologist, engineers, biologist)?

- Very aware
- Somewhat aware
- Not at all aware
- Don't know

Q39. How motivated are your district’s students in taking science courses?

- Very motivated
- Somewhat motivated
- Not motivated at all
- Don’t know

Q40. To what extent do you agree or disagree with each of the following statements?

|   | Strongly agree | Somewhat agree | Somewhat disagree | Strongly disagree | Don't know |
|---|----------------|----------------|-------------------|-------------------|------------|
| My district does a good job preparing students for science coursework in college (college track). |                |                |                   |                   |            |
| My district does a good job preparing students for science careers (CTE track).                   |                |                |                   |                   |            |
| Science <i><b>should</b></i> be a priority for our schools.                                       |                |                |                   |                   |            |
| Science <i><b>is</b></i> a priority for our schools.  |                |                |                   |                   |            |
| California is doing a good job of teaching science in schools (K–12).                             |                |                |                   |                   |            |
| The U.S. is doing a good job of teaching science in schools (K–12).                               |                |                |                   |                   |            |

Q41. Some districts have encountered challenges related to **student attitude, motivation, and preparation** with science education. Please indicate how much of a challenge each one is at your district.

|  | Big challenge | Somewhat a challenge | Small challenge | Not a challenge at all | Don't know |
|--|---------------|----------------------|-----------------|------------------------|------------|
| Student awareness of the importance of science education             |               |                      |                 |                        |            |
| Student motivation to take science courses                           |               |                      |                 |                        |            |
| Student interest in learning about science                           |               |                      |                 |                        |            |
| Students not exposed to science in earlier grades                    |               |                      |                 |                        |            |
| Students not prepared to advance to the next level of science course |               |                      |                 |                        |            |

Q42. Some districts have encountered challenges related to **facilities and working conditions** with science education. Please indicate how much of a challenge each one is at your district.

|  | Big challenge | Somewhat a challenge | Small challenge | Not a challenge at all | Don't know |
|--|---------------|----------------------|-----------------|------------------------|------------|
| Adequacy of science facilities, equipment and supplies |               |                      |                 |                        |            |
| Large class sizes in science courses                   |               |                      |                 |                        |            |

Q43. Some districts have encountered challenges related to **curriculum and instruction** with science education. Please indicate how much of a challenge each one is at your district.

|   | Big challenge | Somewhat a challenge | Small challenge | Not a challenge at all | Don't know |
|---|---------------|----------------------|-----------------|------------------------|------------|
| Lack of CA NGSS aligned curriculum                  |               |                      |                 |                        |            |
| Lack of CA NGSS aligned instructional materials     |               |                      |                 |                        |            |
| Lack of hands-on science instruction in our schools |               |                      |                 |                        |            |

Q44. Some districts have encountered challenges related to **teacher quality** with science education. Please indicate how much of a challenge each one is at your district.

|  | Big challenge | Somewhat a challenge | Small challenge | Not a challenge at all | Don't know |
|--|---------------|----------------------|-----------------|------------------------|------------|
| The shortage of quality science teachers   |               |                      |                 |                        |            |
| Insufficient training of science teachers so they can teach CA NGSS more effectively                     |               |                      |                 |                        |            |
| Inadequate compensation and professional development to recruit and retain high quality science teachers |               |                      |                 |                        |            |

Q45. Has your district encountered any other challenges with science education?

- Yes, please specify \_\_\_\_\_
- No
- Don't know

*Display This Question: If Q4 = Science teacher*

Q46. Due to teacher shortage, many science teachers in California are assigned to classes for which they lack specialized training. During the 2016–17 school year, were you assigned to science class(es) for which you do not have the proper credentials?

- Yes

- No
- Don't know

*Display This Question: If Q4 = Science teacher*

Q47. How many years have you taught in your current school district?  
Please only use whole numbers (e.g. 1.5 should be 2)

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*Display This Question: If Q5 = Science teacher*

Q48. How long do you plan to remain teaching in this school district?

- As long as I am able
- Until I am eligible for retirement or social security benefits
- Until a more desirable job opportunity comes along
- Plan to leave as soon as I can
- Undecided at this time

*Display This Question: If Q48 = Until a more desirable job opportunity comes along / or / Plan to leave as soon as I can / or /Undecided at this time*

Q49. What would encourage you to stay in your current district?

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