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The Association between Teachers' Use of Formative Assessment Practices and Students' Use of Self-Regulated Learning Strategies

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The Association between Teachers' Use of Formative Assessment Practices and Students' Use of Self-Regulated Learning Strategies

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Three Arizona school districts surveyed teachers and students in grades 3–12 in spring 2019 to better understand the association between teachers' use of formative assessment practices and students' use of self-regulated learning strategies and to help shape related teacher development efforts moving forward. Formative assessment is a set of practices that enable teachers and students to examine how learning is progressing throughout a lesson or related series of lessons, so that teaching and learning activities can be adjusted as needed. Self-regulated learning is a proactive process in which students select an appropriate learning strategy to advance their learning goals. The survey results indicated that responding teachers frequently gave students feedback but less frequently provided occasions for students to provide feedback to one another, while responding students frequently tracked their own progress but less frequently solicited feedback from their teacher or peers. Only a small positive association was found between the frequency of teachers' formative assessment practices and the average number of self-regulated learning strategies that their students used. The correlation was stronger in elementary school than in secondary school and stronger in science, technology, engineering, and math (STEM) classrooms than in non-STEM classrooms. Some of teachers' least frequently used formative assessment practices—facilitating student peer feedback and self-assessment—had stronger positive associations with the average number of self-regulated learning strategies that their students used than other, more frequently used practices. The more frequently that teachers reported using these practices, the more self-regulated learning strategies their students reported using.

Why this study?

Many schools and teachers are striving to create more dynamic classroom learning environments that encourage students to think critically and manage their own learning in preparation for college and careers. Some observers view formative assessment as a means to this end (see, for example, Popham, 2008). Formative assessment is a set of practices that enable teachers and students to examine how learning is progressing throughout a lesson or related series of lessons, so that teaching and learning activities can be adjusted as needed (Bailey & Heritage, 2018; Black & Wiliam, 1998). A recent review of the literature on formative assessment in the elementary school grades by the Regional Educational Laboratory (REL) Central concluded that formative assessment had a positive effect on students' academic achievement (Klute et al., 2017). These findings led practitioners in REL Central's Formative Assessment Research Alliance to focus their professional development efforts on formative assessment practices that promote learning by more actively involving students in their own learning.

Formative assessment practices can prompt students to take an active role in their learning, for example, by encouraging them to take corrective action if they notice a discrepancy between where they are in understanding a lesson and where they need to be. One type of corrective action is self-regulated learning, a proactive process in which students draw on self-motivation and goal setting to use an appropriate learning strategy (Artelt et al., 2003). Learning strategies can include getting feedback from the teacher or from peers, reorganizing

For additional information, including analysis methods and supporting analyses, access the report appendixes at https://go.usa.gov/x7NnK.

information, trying to make new connections to prior learning, and doing more research (Bailey & Heritage, 2018; Butler & Winne, 1995; Hadwin et al., 2011; Zimmerman & Schunk, 2011).

Working with a group of instructional leaders from more than a dozen states since 2006,[1] the Council of Chief State School Officers (CCSSO) has defined the dimensions of formative assessment practices (Wylie & Lyon, 2016) and developed a theory of action that outlines the inputs required to yield improvement at both the teacher and student levels (Formative Assessment for Students and Teachers State Collaborative on Assessment and Student Standards, 2018). In recent years Arizona Department of Education officials, building on Arizona's longstanding membership in this CCSSO collaborative, established a statewide community of practice consisting of more than 200 volunteering teachers and school and district leaders dedicated to improving, expanding, and sustaining formative assessment practices in classrooms.

Drawing on those efforts, REL West and three Arizona school districts that have identified inquiry into formative assessment and student self-regulated learning as a strategic priority collaborated on this descriptive study of the association between these constructs. In recent years a group of volunteering teachers in each collaborating district has participated in professional learning opportunities focused on applying multiple dimensions of formative assessment practices—as recently defined by CCSSO in the Formative Assessment Rubrics, Reflection and Observation Protocol (Wylie & Lyon, 2016)—to increase self-regulated learning among students.[2] The three districts are Chandler Unified School District in Phoenix, Flagstaff Unified School District, and Sunnyside Unified School District in Tucson (table 1).

Table 1. Descriptive information about the Arizona study districts, 2016/17 or 2018/19

School district	Number of schools (2018/19)	Number of full-time equivalent teachers (2016/17)	Number of K–12 students (2018/19)	Percent of students eligible for the national school lunch program (2018/19)	Percent of English learner students (2018/19)
Chandler Unified (Phoenix)	43	2,277	45,848	25.4	2.7
Flagstaff Unified	16	573	9,633	50.7	4.2
Sunnyside Unified (Tucson)	22	767	16,115	81.1	14.5
Total	81	3,617	71,596	30.8	5.5

Source: Number of K–12 students is from U.S. Department of Education, Institute of Education Sciences National Center for Education Statistics, Common Core of Data, Elementary/Secondary Information System for 2019 (https://nces.ed.gov/ccd/elsi/). All other data are from Arizona Department of Education, Accountability & Research Division for 2019 (http://www.azed.gov/accountability-research/data/).

The study examined the association between teachers' formative assessment practices and participation in formative assessment trainings and students' use of self-regulation strategies. It explored a key hypothesis in CCSSO's new formative assessment theory of action: that such practices can increase student independence and self-direction in the classroom (Formative Assessment for Students and Teachers State Collaborative on Assessment and Student Standards, 2018). The study findings can help school district leaders in Arizona and elsewhere decide how to systematically roll out formative assessment–centered professional learning opportunities for teachers. The findings could also inform decisions on whether certain formative assessment practices might be more or less emphasized in research or support efforts moving forward—for example, guiding teachers in

1. This multistate Council of Chief State School Officers group is known as the Formative Assessment for Students and Teachers State Collaborative on Assessment and Student Standards (FAST SCASS).
2. These formative assessment-focused learning opportunities tended to be self-selected by teachers and were not generally adopted school- or district-wide. Delivery formats varied, ranging from formal coursework from an external provider to trainings led by local instructional coaches and to less formal peer teacher collaborations involving mentoring, classroom observations, or professional learning communities.

different grade spans or subject areas toward different formative assessment practices or implementing related trainings schoolwide.

Research questions

To examine the association between formative assessment practices and self-regulated learning strategies, the three study districts incorporated parallel sets of questions into their existing teacher and student surveys in grades 3–12 in spring 2019 (box 1).[3] The current study analyzed the survey data to answer the research questions below. The first three questions focus on the reported types and levels of student self-regulated learning, teacher formative assessment practices, and teacher participation in trainings. The last two questions address the associations between teachers' formative assessment practices and training and their students' self-regulated learning strategies. In addition, the study team examined the extent to which the findings for each question varied by teaching context—grade span (elementary or secondary school classrooms) and subject areas (science, technology, engineering, and math [STEM] classrooms or non-STEM classrooms)—noting any statistically significant differences. (See box 2 for a description of the study data, sample, and methods and appendix A for additional details.)

Based on survey responses by students and teachers:

1. What self-regulated learning strategies do students report using in the classroom?

2. What formative assessment practices do teachers report using in the classroom?

3. What types of formative assessment training did teachers report participating in?

4. Are the amounts and types of teachers' training associated with their formative assessment practices and their students' use of self-regulated learning strategies?

5. Are students' self-regulated learning strategies associated with their teachers' formative assessment practices?

Box 1. Questions added to the study districts' existing student and teacher surveys in spring 2019

Student survey questions

How often do the following things happen during a normal week for you? Please be honest. There are no right or wrong answers.
<Response scale: 1-Never, 2-Rarely, 3-About half the time, 4-Most of the time, 5-Always>

1. I set goals for myself to guide my learning in class.
2. In class I ask for feedback from the teacher to check my understanding.
3. I try to connect what I'm learning to things I already know.
4. In class I ask myself questions to help me understand what I'm learning.
5. In class I get feedback from other students to improve my work.
6. In class I keep track of my own progress.
7. In class I identify different ways to improve my work.

3. The study's teacher survey focused on a subset of the dimensions of formative assessment identified in Wylie and Lyon (2016)—specifically, Learning goals, Criteria for success, Descriptive feedback, Peer (student) feedback, and Self-assessment—which the study districts identified as priorities for investigation among their teachers.

Teacher survey questions

Training: Please indicate the formative assessment–related trainings/supports you have participated in to date. (Check all that apply.)

1. Formative Assessment Insights (FAI) coursework.
2. Student Agency in Assessment & Learning (SAAL) coursework.
3. Student Agency in Learning (SAIL) program (inquiry groups).
4. Mentoring from peer teacher(s) on formative assessment.
5. Formative assessment-focused classroom observation(s) and feedback.
6. Dedicated time for teachers to collaborate around formative assessment.
7. Other formative assessment-focused support at my school site (please describe briefly).
8. None.

Practice: Please indicate how regularly you engage in the following formative assessment practices in your classroom during the average week. <Response scale: 1-Never, 2-Rarely, 3-About half the time, 4-Most of the time, 5-Always>

1. At some point in the lesson, I communicate the learning goal and success criteria (i.e., what quality work looks like) for the lesson to my students.
2. I help my students understand what meeting the goal and criteria means for the lesson.
3. I provide feedback to students that helps them take steps for improvement.
4. I model for students how to give constructive feedback to their peers.
5. I provide structured occasions for students to provide feedback to one another.
6. My students assess their own learning and think about next steps in class.

Box 2. Data sources, sample, and methods

Data sources and sample. The data for this study were provided to the Regional Educational Laboratory West by Chandler Unified School District, Flagstaff Unified School District, and Sunnyside Unified School District. Each district administered surveys in spring 2019 to all of its teachers and to students in grades 3–12 (see box 1). Although more than 1,200 teachers and 24,000 students across the three school districts submitted surveys in spring 2019 as part of this study, far from everyone did: the response rate was 38 percent for teachers and 47 percent for students (see table). Thus, these findings may not reflect the full populations of teachers and students in these districts but more likely represent teachers with some awareness of formative assessment practices (and their students). A different sample of survey respondents might have yielded different results.

Survey response rates among teachers and students in grades 3–12 in Chandler Unified School District, Flagstaff Unified School District, and Sunnyside Unified School District, spring 2019

Group	Number surveyed	Number of respondents	Response rate (percent)
Teachers	3,228	1,239	38.4
Students	51,868	24,480	47.2

Source: Chandler Unified School District, Flagstaff Unified School District, and Sunnyside Unified School District data for 2019.

Methods. The initial analyses for the study tabulated how often (from 1-Never to 5-Always) the responding teachers and students reported using the listed formative assessment practices and self-regulated learning strategies (see box 1) weekly in the classroom. A frequency index was also calculated for teachers and students (the total of each respondent's 1–5 ratings across all questions), and then associations were calculated between these frequencies for surveyed teachers and their surveyed students. The report presents and discusses associations and group differences that are statistically significant at the .05 level, even for differences that are small.

Findings

The findings reported here are based on the responses of 1,239 teachers (of the 3,228 teachers surveyed) and 24,480 students (of the 51,868 students surveyed) across the three school districts in spring 2019.

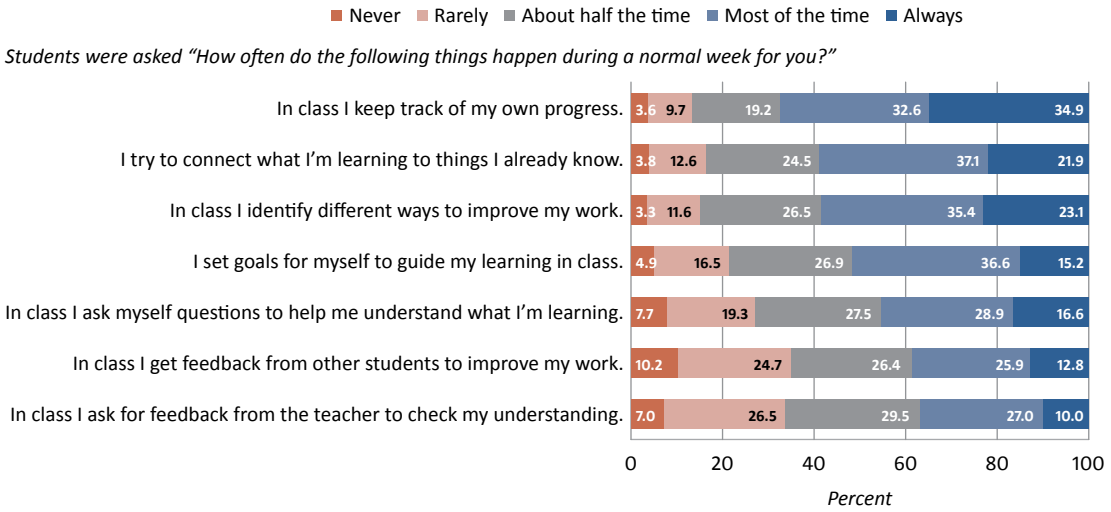
Two-thirds of responding students reported frequently tracking their own progress, but fewer than 40 percent reported frequently soliciting feedback from the teacher or peers

Among the self-regulated learning strategies that students were asked about, responding students reported that they most often "keep track of my own progress" (figure 1). About 67 percent said they do this frequently (most of the time or always) during a normal week. Students reported using other strategies less often. About 37 percent of students reported that they "ask for feedback from the teacher to check my understanding" frequently, while about 39 percent reported that they "get feedback from other students to improve my work" frequently. The frequency of student use of self-regulated learning strategies was similar across grade spans.

Approximately 60 percent of responding students reported always using one or more self-regulated learning strategies during a normal week

Most students (60 percent) reported always using one or more self-regulated learning strategies during a normal week (table 2). Specifically, 24 percent of students reported always using one self-regulated learning strategy during a normal week, 16 percent reported always using two, and 20 percent reported always using three or more. On the other hand, 40 percent of students reported not using any self-regulated learning strategies "always" in a normal week. On average, elementary school students reported always using more self-regulated learning strategies than secondary school students did.[4]

Figure 1. Students in the three Arizona study districts frequently tracked their own progress but less often solicited feedback from the teacher or peers, 2019



Note: *n* = 24,480 students. "Frequently" encompasses the responses "most of the time" and "always." The distributions of responses differed significantly across the seven questions ($p < .01$). Percentages may not sum to 100 because of rounding.

Source: Chandler Unified School District, Flagstaff Unified School District, and Sunnyside Unified School District data for 2019.

4. The difference between elementary school students and secondary school students in the average number of weekly self-regulated learning strategies reportedly always used was 0.17 standard deviation units ($p < .01$).

Table 2. Approximately 60 percent of students in the three Arizona study districts reported always using one or more self-regulated learning strategies during a normal week, 2019 (percent)

Number of self-regulated learning strategies always used weekly	Elementary school students (n = 5,177)	Secondary school students (n = 19,303)	All students (n = 24,480)
0	31.6	42.7	40.4
1	25.5	24.1	24.4
2	18.9	14.5	15.5
3	12.3	8.8	9.5
4	6.9	4.9	5.3
5	3.2	2.2	2.4
6	1.0	1.2	1.2
7	0.7	1.5	1.4
1 or more	68.4	57.3	59.6
3 or more	24.1	18.6	19.8

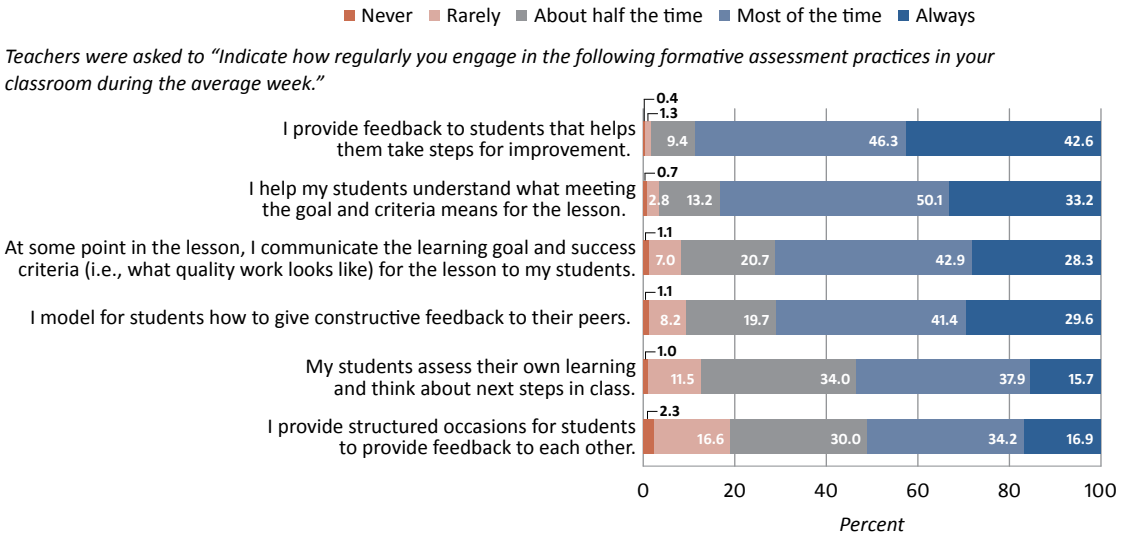
Note: On average, elementary school students reported always using more self-regulated learning strategies weekly than did secondary students (p < .01).

Source: Chandler Unified School District, Flagstaff Unified School District, and Sunnyside Unified School District data for 2019.

Nearly 90 percent of responding teachers reported frequently giving students feedback, but only half of teachers reported frequently providing occasions for students to give feedback to one another

Of the practices listed in the survey, a high percentage of responding teachers (89 percent) reported that they "provide feedback to students that helps them take steps for improvement" frequently (most of the time or always) during the average week (figure 2). By contrast, a smaller percentage of teachers (54 percent) reported frequently having "students assess their own learning and think about next steps in class." Similarly, 51 percent of teachers reported that they frequently "provide structured occasions for students to provide feedback to one another." Overall, though, a majority of teachers reported frequently applying each of the formative assessment practices that they were asked about on the survey.

Figure 2. Responding teachers in the three Arizona study districts frequently gave students feedback but less frequently provided occasions for students to provide feedback to one another, 2019



Note: n = 1,239 teachers. "Frequently" encompasses the responses "most of the time" and "always." The distributions of responses differed significantly across the six practices (p < .01). Percentages may not sum to 100 because of rounding.

Source: Chandler Unified School District, Flagstaff Unified School District, and Sunnyside Unified School District data for 2019.

More than 60 percent of responding teachers reported always using one or more formative assessment practices during the average week

Nearly two-thirds (64 percent) of teachers reported always using one or more formative assessment practices during an average week, and about 15 percent reported always using four or more practices (table 3). The average number of formative assessment practices that teachers reported always using varied little by grade span. However, responding STEM teachers across grade levels reported using fewer formative assessment practices always during an average week than did teachers of other subjects; these differences were small but statistically significant (at $p < .01$).

Table 3. More than 60 percent of responding teachers in the Arizona study districts reported always using one or more formative assessment practices during the average week, 2019 (percent)

Number of formative assessment practices always used weekly	All teachers (*n* = 1,239)	Elementary school teachers (*n* = 521)	Secondary school teachers (*n* = 633)	STEM teachers (*n* = 304)	Non-STEM teachers (*n* = 935)
0	36.2	35.7	35.9	39.1	35.3
1	19.1	19.2	19.6	20.4	18.6
2	15.3	15.6	14.7	16.5	14.9
3	14.0	14.4	14.7	14.5	13.9
4	7.2	6.5	7.1	4.9	7.9
5	3.6	3.8	3.5	2.0	4.2
6	4.6	4.8	4.6	2.6	5.2
1 or more	63.8	64.3	64.1	60.9	64.7
4 or more	15.4	15.1	15.2	9.5	17.3

STEM is science, technology, engineering, and math.

Note: The 85 teachers who taught the same number of elementary school grades (grades 3–5) as secondary school grades (grades 6–12) were excluded from the grade-level subgroup analysis; 83 teachers taught both grades 5 and 6 and 2 teachers taught both grades 5 and 7.

Source: Chandler Unified School District, Flagstaff Unified School District, and Sunnyside Unified School District data for 2019.

Responding teachers participating in formative assessment training reported using more of these practices weekly than responding teachers who reported no formative assessment training

Nearly 90 percent of teachers reported participating in some kind of formative assessment training or support. The many different types of voluntary formative assessment trainings and support activities included formal coursework from an external professional learning organization; formal coursework led by the district's instructional coaches; and less formal peer teacher collaborations involving mentoring, classroom observations, and professional learning communities. Informal training without coursework was the most common type of reported support overall, across grade levels, and for both STEM and non-STEM teachers (table 4). A higher proportion of elementary school teachers (26 percent) than of secondary school teachers (18 percent) reported participating in official formative assessment–focused coursework only (provided externally or by the district), while a higher proportion of secondary school teachers (54 percent) than of elementary school teachers (44 percent) reported participating in less formal formative assessment–focused peer collaborations without coursework.[5]

Compared with teachers in the study who reported no formative assessment training, teachers with any relevant training reported using formative assessment practices more frequently in their classrooms during an average week, although the average difference was small (0.25 more practices always used each week; table 5). Teachers who participated only in formal formative assessment coursework reported engaging in formative assessment practices less frequently during an average week than other responding teachers (who may have had a different

5. Both of these grade-span differences were statistically significant (at p < .01).

understanding of the practices involved). The association between teachers' type of training and their reported frequency of weekly formative assessment practices did not vary by grade span or subject area.

Table 4. More than 90 percent of responding teachers reported participating in some form of formative assessment training in 2019/20 (percent for each type of training)

Type of formative assessment training	All teachers (*n* = 1,215)	Elementary school teachers (*n* = 510)	Secondary school teachers (*n* = 623)	STEM teachers (*n* = 302)	Non-STEM teachers (*n* = 913)
Coursework only (from external provider or district)	20.8	26.1	17.7	20.5	20.9
Coursework plus peer teacher mentoring, classroom observations, or meetings	18.5	19.6	17.8	16.2	19.3
Peer teacher mentoring, classroom observations, or meetings without coursework	50.0	44.3	53.6	53.3	48.9
No formative assessment-focused training to date	10.7	10.0	10.9	9.9	11.0

STEM is science, technology, engineering, and math.

Note: The 106 teachers who did not report a categorizable grade span or a categorizable type of formative assessment training were excluded from this analysis.

Source: Chandler Unified School District, Flagstaff Unified School District, and Sunnyside Unified School District data for 2019.

Table 5. Responding teachers in the three Arizona study districts who participated in formative assessment training reported using formative assessment practices in the classroom more frequently than did teachers who did not participate in formative assessment training, 2019

Difference between trained and untrained teachers in frequency of formative assessment practices used in an average week

Type of formative assessment training	All teachers (*n* = 1,215)	Elementary school teachers (*n* = 510)	Secondary school teachers (*n* = 623)	STEM teachers (*n* = 302)	Non-STEM teachers (*n* = 913)
Coursework only (from external provider or district)	–0.09 (0.06)	+0.04 (0.03)	–0.14 (0.09)	+0.07 (0.04)	–0.15 (0.10)
Any type of formative assessment training or support	+0.25 (0.15)*	+0.17 (0.10)	+0.28 (0.18)	+0.29 (0.18)	+0.25 (0.15)

* Significant at $p < .05$; ** significant at $p < .01$; *** significant at $p < .001$.

STEM is science, technology, engineering, and math.

Note: The 82 teachers who did not report a categorizable grade span were excluded from this analysis. Statistical significance was estimated using independent *t*-tests of the group means. Numbers in parentheses are effect sizes, which represent the difference between group means divided by the pooled standard deviation of the frequency of formative assessment practices teachers reporting using during the average week.

Source: Chandler Unified School District, Flagstaff Unified School District, and Sunnyside Unified School District data for 2019.

Responding students in classrooms with teachers who participated in formative assessment training reported using self-regulated learning strategies more frequently

The students of teachers who participated in any formative assessment training reported using self-regulated learning strategies more frequently during a normal week than the students of teachers with no formative assessment training, although the average difference was small (+0.11, or 0.18 standard deviation units; table 6; see also table B3 in appendix B). The magnitude of the difference varied by grade span and subject, with larger differences between elementary school and secondary school grades and between non-STEM teachers and STEM teachers than between all teachers. Specifically, the association between teachers' training and students' self-regulated learning strategies was stronger among non-STEM teachers; a stronger association was evident for elementary school teachers across all training types, yet the students of secondary school teachers who participated in formative assessment coursework tended to report more frequent use of self-regulated learning strategies during a normal week (see table 6).

Table 6. Responding students in the Arizona study districts with teachers who participated in formative assessment training reported using self-regulated learning strategies more frequently than did students with teachers without such training, 2019

Difference between trained and untrained teachers in frequency of self-regulated learning strategies used by students weekly

Type of formative assessment training	All teachers (*n* = 977)	Elementary school teachers (*n* = 327)	Secondary school teachers (*n* = 571)	STEM teachers (*n* = 284)	Non-STEM teachers (*n* = 693)
Coursework only (from external provider or district)	+0.14**	+0.09	+0.16**	+0.09	+0.16**
Any type of formative assessment support	+0.11*	+0.32**	+0.05	+0.12	+0.21**

* Significant at $p < .05$; ** significant at $p < .01$; *** significant at $p < .001$.

STEM is science, technology, engineering, and math.

Note: This table displays results for teacher respondents whose students also completed surveys. The 79 teachers who did not report a categorizable grade span were excluded from this analysis. Statistical significance was estimated using *t*-tests of group means. See appendix B for additional information, including the sample size and effect size for each cell.

Source: Chandler Unified School District, Flagstaff Unified School District, and Sunnyside Unified School District data for 2019.

Some of responding teachers' least frequently used formative assessment practices—facilitating student peer feedback and self-assessment—had stronger associations with student self-regulated learning than did responding teachers' other, more frequently used formative assessment practices

Among the formative assessment practices explored in the surveys, the reported frequency of several teacher practices (helping students understand the goal and criteria of the lesson, modeling how to provide feedback, providing structured occasions for student feedback, and asking students to assess their own learning) had positive, statistically significant associations with the average frequency of self-regulated learning strategies that their students reported using weekly. This association was found across the overall sample and for elementary school teachers and STEM teachers (table 7; see table B1 in appendix B for the associations between students' frequencies of certain self-regulated learning strategies and their teachers' frequencies of certain formative assessment practices).[6] Although the magnitude of the associations was small, the more frequently that teachers reported using those formative assessment practices, the more self-regulated learning strategies their students reported using. However, as discussed earlier, teachers reported using the formative assessment practices of providing opportunities for peer student feedback and self-assessment least frequently.

The frequency of responding teachers' formative assessment practices had a small positive association with the number of self-regulated learning strategies that their students reported using

Across the study sample there was a small, statistically significant positive association between the frequency of formative assessment practices that teachers reported using and the frequency of self-regulated learning strategies their students reported using in a normal week. The relationship was not linear. Some students whose teachers reported frequently using formative assessment practices did not report using self-regulated learning strategies at all, and vice versa. But on average, across all respondents, more frequent use of formative assessment practices corresponded to more frequent use of self-regulated learning strategies, and the association was stronger in elementary school classrooms than in secondary school classrooms and stronger in STEM classrooms than in non-STEM classrooms (table 8).[7]

6. As with table 7, table B1 in appendix B reveals that teachers' offering structured occasions for students to provide feedback to one another and assess their own learning had a small, statistically significant positive association with the average frequency of each self-regulated learning strategy students reported using in a normal week.
7. According to the literature review by Klute et al. (2017), formative assessment used during math instruction had larger effects, on average, than did formative assessment used during reading and writing instruction.

Table 7. Responding students in the three Arizona study districts reported using self-regulated learning strategies more frequently when their teachers reported using certain formative assessment practices more frequently, 2019

Association between the frequency of teachers' formative assessment practices and the average number of self-regulated learning strategies used by their students in a normal week

Teacher formative assessment practice	All teachers (*n* = 998)	Elementary school teachers (*n* = 336)	Secondary school teachers (*n* = 580)	STEM teachers (*n* = 286)	Non-STEM teachers (*n* = 712)
I provide structured occasions for students to provide feedback to one another.	.13**	.15**	.10*	.26**	.09*
My students assess their own learning and think about next steps in class.	.12**	.18**	.07	.17**	.10**
I model for students how to give constructive feedback to their peers.	.09**	.11*	.07	.16**	.06
I help my students understand what meeting the goal and criteria means for the lesson.	.08*	.18**	-.01	.13*	.05
I provide feedback to students that helps them take steps for improvement.	.07	.07	.04	.11	.05
At some point in the lesson, I communicate the learning goal and success criteria for the lesson to my students.	.03	.10	-.04	.02	.03

* Significant at $p < .05$; ** significant at $p < .01$; *** significant at $p < .001$.

STEM is science, technology, engineering, and math.

Note: This table displays results for teacher respondents whose students also completed the survey. The 82 teachers who did not report a categorizable grade span were excluded from this analysis. The values in the table reflect the strength and consistency of the association between the frequency of the formative assessment practices among teachers and the average number of self-regulated learning strategies reported by their students, as indicated by Spearman (nonparametric) rank-order correlation coefficients (ρ).

Source: Chandler Unified School District, Flagstaff Unified School District, and Sunnyside Unified School District data for 2019.

Table 8. Responding students in the three Arizona study districts reported using self-regulated learning strategies more frequently when their teachers reported using formative assessment practices more frequently, 2019

Group	Number of teachers	Number of students	Correlation coefficient[a]
All	998	10,503	.14**
Elementary school classrooms	336	5,012	.18**
Secondary school classrooms	580	4,359	.09*
STEM classrooms	286	2,133	.25**
Non-STEM classrooms	712	8,370	.09*

* Significant at $p < .05$; ** significant at $p < .01$; *** significant at $p < .001$.

STEM is science, technology, engineering, and math.

Note: This table displays results for teacher respondents whose students also completed the survey. The teacher and student counts in each column represent the number of unique people contributing to the calculated correlation for each row group.

a. The statistics in this column reflect the strength and consistency of the association between teachers' total reported formative assessment practices and the average number of self-regulated learning strategies reported by their students, as indicated by Spearman (nonparametric) rank-order correlation coefficients (ρ).

Source: Chandler Unified School District, Flagstaff Unified School District, and Sunnyside Unified School District data for 2019.

Limitations

The analysis of nonresponse patterns in view of the study's low survey response rates (see box 2) was limited by the lack of information available to the study team on the respondent sample and on the characteristics of the districtwide populations. The study team did not have information on the demographic characteristics of the responding teachers and students or on the overall counts or proportions of responding teachers by grade span and subject area. Therefore, it was not possible to ascertain how representative the responses of this sample are of teachers and students in the participating districts as a whole. However, information on student grade levels was available, and differences were evident between the districtwide population and the respondent sample, with a higher proportion of secondary school students than of elementary school students responding to the survey (see table A1 in appendix A). This could be because elementary school students have more difficulty understanding or completing surveys. As a result, the study team adjusted (via weighting) the student survey data so that the responding student sample from every grade span accurately reflected that grade span's proportional representation in the district's student population. Ultimately, as shown in appendix table A2, this weighting had very little impact on the student results. But a different sample of survey respondents might have yielded different results.

At the same time, given the widespread interest in formative assessment and self-regulated learning in Arizona and across the United States, findings from surveys of such large numbers of teachers and students on these topics are still of interest, despite the low response rates. Additional research, perhaps focused on ensuring a representative sample, is recommended to enable a deeper understanding of the issues raised in this study, particularly those related to associations between formative assessment training and variations in formative assessment practices and self-regulated learning strategies in different types of classrooms.

By themselves, the study's findings of an association between teachers' formative assessment practices and students' use of self-regulated learning strategies do not prove that the formative assessment practices cause the use of self-regulated learning strategies. Further research, with a different design, could test the extent to which teachers' formative assessment practices might cause students to use self-regulated learning strategies as well as whether training in formative assessment practices can improve teachers' use of these practices and influence student outcomes. If the research demonstrates causality, it might also shed light on how this occurs.

Implications

The formative assessment practices that were most strongly associated with self-regulated learning—facilitating self-assessment and peer feedback among students—were among those least frequently used by teachers. That is, these practices, though implemented less frequently than others, seemed more closely linked with student self-regulation than the other practices studied. Based on these associations, the training and implementation of these specific formative assessment practices could be a primary focus in systematic monitoring moving forward (while acknowledging that peer feedback among students may run counter to traditional teacher-led classroom norms discouraging students from talking to each other in class).

At the same time, more than a third of teachers reported using zero formative assessment practices in an average week, and about a third of students reported rarely or never soliciting feedback from teachers or peers during a normal week. Schools and districts could, in turn, more directly target self-regulated learning strategies in their messaging to students, or more directly target formative assessment–centered professional development to teachers who have not yet engaged in such training.

Districts might also consider rolling out trainings on formative assessment in a subset of schools and then comparing student self-regulated learning in those schools with that in other schools. Districts could also examine the

effects of teachers' use of formative assessment practices in different grade spans and subject areas. It is possible, for example, that elementary school classrooms or STEM classrooms are fundamentally more or less conducive to particular formative assessment practices (such as communicating the criteria for evaluating student performance) or to certain student self-regulated learning strategies. Districts and schools might want to use the associations identified in this study to begin to target formative assessment trainings (and related research) to teachers in certain types of classrooms.

Finally, although it is true on average that students in classrooms with teachers trained in formative assessment reported using self-regulated learning strategies slightly more frequently during a normal week than students in classrooms with teachers without any formative assessment training, the strength of the association differed by the type of training. The results also suggest the possibility that teachers trained through formal coursework only might have a different understanding of formative assessment than teachers who applied their learning alongside their peers and might engage their students differently in self-regulated learning. It is possible that some types of formative assessment training might produce better outcomes than others, and this possibility could be more systematically evaluated. Full schoolwide rollouts of training might also be considered, as that implementation format showed positive impacts in a recent program evaluation (Speckesser et al., 2018).

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