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

Appendix A. Methods

Appendix B. Supporting analyses

See https://go.usa.gov/x7NnK for the full report.

Appendix A. Methods

Reliability of teacher and student surveys

Instructional leaders in the three districts (Chandler Unified School District, Flagstaff Unified School District, and Sunnyside Unified School District) derived the study's survey items from existing survey instruments in summer 2018. The items examining teachers' core formative assessment practices were drawn from the relevant subscales on the Formative Assessment Rubrics, Reflection and Observation Protocol (Wylie & Lyon, 2016). The items for students were drawn from the self-regulated learning subscales on the Motivated Strategies for Learning Questionnaire (Pintrich & DeGroot, 1990) and the Organisation for Economic Co-operation and Development Programme for International Student Assessment (PISA; Artelt et al., 2003). The reliability (Cronbach's alpha) for the Motivated Strategies for Learning Questionnaire self-regulation subscale was .75 (Ilker et al., 2014), while the reliability of the relevant PISA learning strategies subscale, in its U.S. administration, was .83 (Artelt et al., 2003).

In the current study the scale reliability coefficient (Cronbach's alpha) was .79 for the seven student survey items and .77 for the six teacher survey items.

Frequency calculations and proportional weighting

The initial analyses for the study tabulated how often (from 1-Never to 5-Always) the responding teachers and students reported using these different formative assessment practices and self-regulated learning strategies in the classroom in an average or normal week. Next, the study team calculated a frequency index for each teacher and student that represented the sum of each respondent's 1–5 ratings across all questions and then further explored (through correlations) the association between these frequencies among surveyed teachers and their surveyed students.

A higher proportion of secondary school students than of elementary school students responded to the survey (table A1). In response, the study team adjusted (using proportional weighting) the student survey data so that the responding student sample at every grade level accurately reflected that grade level's proportional representation in each district's student population. For each student survey question, a side-by-side comparison of the raw, unweighted response frequency and its weighted counterpart showed that the weighting had very little impact on the results (table A2). The differences between the mean responses for the weighted and unweighted groups varied by less than .05 standard deviation units for each survey question.

Table A1. Proportions of students among survey respondents and among the study population in the three Arizona study districts, by grade span, 2019 (percent)

Grade span	Respondents (*n* = 24,480)	Study population (*n* = 49,782)
Elementary (grades 3–5)	21.1	29.4
Secondary (grades 6–10)	78.9	70.6

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

Table A2. Comparison of unweighted and weighted frequencies of self-regulated learning strategies used by students in the three Arizona study districts during a normal week, 2019 (percent)

Self-regulated learning strategy	Never		Rarely		About half the time		Most of the time		Always	
	Unweighted	Weighted	Unweighted	Weighted	Unweighted	Weighted	Unweighted	Weighted	Unweighted	Weighted
S1. I set goals for myself to guide my learning in class.	4.9	4.8	16.5	16.3	26.9	26.9	36.6	36.6	15.2	15.4
S2. In class I ask for feedback from the teacher to check my understanding.	7.0	7.1	26.5	26.4	29.5	29.4	27.0	26.9	10.0	10.1
S3. I try to connect what I'm learning to things I already know.	3.8	3.8	12.6	12.5	24.5	24.3	37.1	37.1	21.9	22.2
S4. In class I ask myself questions to help me understand what I'm learning.	7.7	7.7	19.3	19.2	27.5	27.2	28.9	28.8	16.6	17.1
S5. In class I get feedback from other students to improve my work.	10.2	10.6	24.7	25.2	26.4	26.4	25.9	25.3	12.8	12.6
S6. In class I keep track of my own progress.	3.6	3.6	9.7	9.9	19.2	19.4	32.6	32.1	34.9	34.9
S7. In class I identify different ways to improve my work.	3.3	3.3	11.6	11.6	26.5	26.1	35.4	35.3	23.1	23.8

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

References

Artelt, C., Baumert, J., Julius-McElvany, N., & Peschar, J. (2003). *Learners for life: Student approaches to learning: Results from PISA 2000*. Organisation for Economic Co-operation and Development.

Ilker, G. E., Arslan, Y., & Demirhan, G. (2014). A validity and reliability study of the Motivated Strategies for Learning Questionnaire. *Educational Sciences: Theory & Practice, 14*(3), 829–833.

Pintrich, R. R., & DeGroot, E. V. (1990). Motivational and self-regulated learning components of classroom academic performance. *Journal of Educational Psychology*, *82*(1), 33–40.

Wylie, C., & Lyon, C. (2016). *Using the Formative Assessment Rubrics, Reflection and Observation tools to support professional reflection on practice*. Formative Assessment for Students and Teachers State Collaborative on Assessment and Student Standards of the Council of Chief State School Officers.

Appendix B. Supporting analyses

The rank-order correlations between each teacher survey item (formative assessment practice) and each student survey item (self-regulated learning strategy) are listed in table B1. The rank-order correlations provide insight into how the frequency of each formative assessment practice is associated with the frequency of each self-regulated learning strategy. As shown, teachers providing structured occasions for students to provide feedback to one another and assess their own learning had small, statistically significant positive associations with the (average) frequency of each self-regulated learning strategy that their students reported.

Table B1. Students in the three Arizona study districts used self-regulated learning strategies more frequently when their teachers facilitated student peer feedback and self-assessment more frequently, 2019

Association between the average frequency of the teachers' formative assessment practice and the average frequency of the self-regulated learning strategy applied by their students each week

	Student self-regulated learning strategy						
Teacher formative assessment practice	S1. I set goals for myself to guide my learning in class.	S2. In class I ask for feedback from the teacher to check my understanding.	S3. I try to connect what I'm learning to things I already know.	S4. In class I ask myself questions to help me understand what I'm learning.	S5. In class I get feedback from other students to improve my work.	S6. In class I keep track of my own progress.	S7. In class I identify different ways to improve my work.
T1. 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.	–.03	–.04	.05	–.04	–.01	.09**	–.00
T2. I help my students understand what meeting the goal and criteria means for the lesson.	.06	.05	.05	.05	.06	.09**	.06*
T3. I provide feedback to students that helps them take steps for improvement.	.05	.06	.05	.08*	.03	.07*	.05
T4. I model for students how to give constructive feedback to their peers.	.09**	.06	.05	.06	.13**	.08*	.10**
T5. I provide structured occasions for students to provide feedback to one another.	.08*	.08*	.09**	.09**	.16**	.11**	.09**
T6. My students assess their own learning and think about next steps in class.	.09**	.06	.09**	.08*	.11**	.14**	.08*

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

Note: n = 998 teacher respondents whose students also completed a survey. Values in the table reflect the strength and consistency (monotonicity) of the association, 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.

Tables B2 and B3 present additional details about the differences between teachers trained and untrained in formative assessment practices and the self-regulated learning strategies that their students reported using in a normal week (see table 6 in the main report).

Table B2. Students in the three Arizona study districts in classrooms with teachers who participated in any formative assessment coursework reported using self-regulated learning strategies more frequently, 2019

	With formative assessment coursework			Without formative assessment coursework			Statistic		
Teacher/classroom type	Mean	Number of teachers	Number of students	Mean	Number of teachers	Number of students	Difference	Effect size	Pooled standard deviation
Overall	3.58	367	3,316	3.44	610	6,695	0.14**	0.23	0.64
Elementary	3.71	135	1,373	3.61	192	3,348	0.09	0.14	0.68
Secondary	3.53	208	1,654	3.37	363	2,595	0.16**	0.26	0.61
STEM	3.52	104	624	3.43	180	1,509	0.09	0.16	0.57
Non-STEM	3.61	263	2,692	3.44	430	5,186	0.16**	0.25	0.66

* 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 a survey. The teacher and student counts represent the number of unique people contributing to the group mean for each specific row group. Statistical significance was estimated using independent *t*-tests of the group means.
Source: Chandler Unified School District, Flagstaff Unified School District, and Sunnyside Unified School District data for 2019.

Table B3. Students in the three Arizona study districts in classrooms with teachers who participated in any type of formative assessment training reported using self-regulated learning strategies more frequently, 2019

	With any type of formative assessment training			Without formative assessment training			Statistic		
Teacher/classroom type	Mean	Number of teachers	Number of students	Mean	Number of teachers	Number of students	Difference	Effect size	Pooled standard deviation
Overall	3.50	876	9,038	3.39	101	973	0.11 *	0.18	0.64
Elementary	3.68	294	4,088	3.36	33	633	0.32 **	0.48	0.68
Secondary	3.43	514	4,029	3.39	57	220	0.05	0.08	0.61
STEM	3.45	256	1,967	3.57	28	166	–0.12	0.24	0.57
Non-STEM	3.53	620	7,071	3.32	73	807	0.21 **	0.21	0.66

* 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 a survey. The teacher and student counts represent the number of unique people contributing to the group mean for each specific row group. Statistical significance was estimated using independent *t*-tests of the group means.
Source: Chandler Unified School District, Flagstaff Unified School District, and Sunnyside Unified School District data for 2019.