PlanWise™ by ETS®

The *PlanWise*™ Tool Theory of Action

Meeting Teachers Where They Are With Targeted Formative Assessment Practices and Strategies Right When They Need Them

There are three goals for this document:

- briefly describe what we mean by formative assessment;
- illustrate in a logic model claims about how the *PlanWise*™ tool is intended to improve student learning by supporting teachers to incorporate formative assessment practices into their lesson plans; and
- provide research support for those claims.

What Is Formative Assessment?

Formative assessment is a critical, classroom-based practice in which the teacher and students work cooperatively — adapting to the changing learning needs of students. Formative assessment occurs while student understanding is developing with the explicit purpose of eliciting evidence that can be used to adjust teaching and learning opportunities to help students progress. Adjustments may not always be visible to an observer since they sometimes happen within a lesson, or at other times, between lessons.

The PlanWise tool is designed for teachers to use as they develop lesson plans. It provides them with targeted recommendations for formative assessment practices that can be added directly into their lesson plans as they create them.

Teacher actions based on formative assessment evidence can range from the introduction of a new learning experience to address a concept that students are struggling with, to helping students articulate why a concept was difficult. Responding to evidence of learning can also include providing peer or teacher feedback that supports student learning.

Self-assessment is also part of formative assessment. It allows students to clarify learning goals, identify areas of understanding or confusion and receive the kind of help that they might need to move forward.

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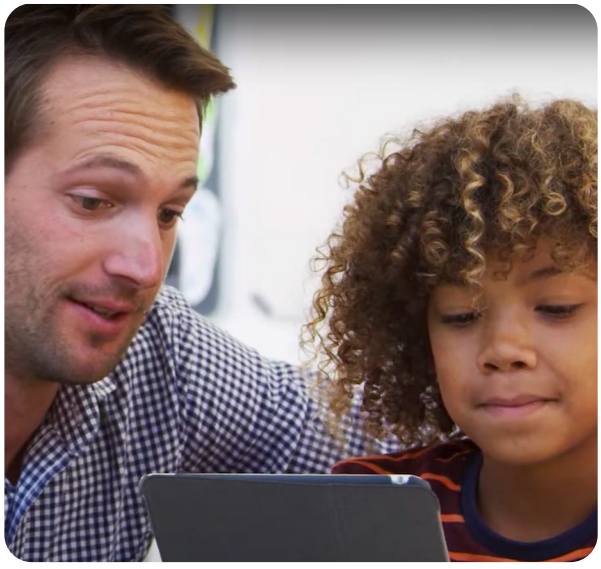
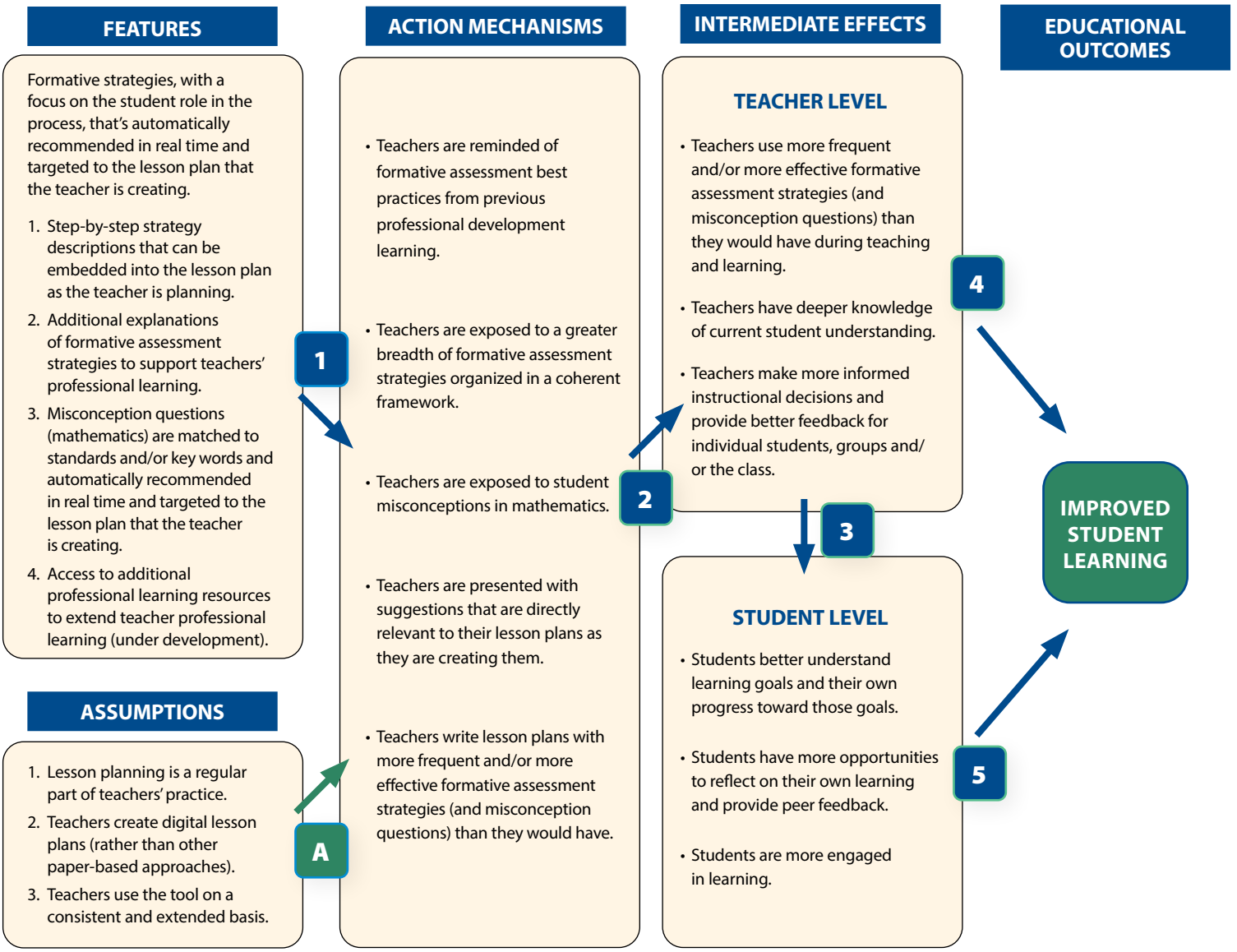
The **logic model** on page 3 should be read left to right. On the left are critical features of the PlanWise tool, along with assumptions that we make about its use. The box to the right of the Features section identifies the action mechanisms through which we anticipate change in practice can occur. The boxes on the far right describe the intermediate and final outcomes for teachers and students that we expect as a result of sustained tool usage.



Logic Model for the PlanWise Tool



Based on existing research evidence that supports the logical nature of each of the claims (numbered arrows in the diagram), we anticipate that the PlanWise tool will remind teachers of a broad range of relevant formative assessment strategies[1] that they can use and increase the amount of formative assessment that they plan to use (Claim 1). As a result of routinely incorporating formative assessment practices into their instruction, teachers better understand the current status of student understanding and are able to adjust teaching and learning opportunities as a result (Claim 2).

[1] The PlanWise tool currently includes misconception questions for mathematics. All other strategies apply across grades and content areas.

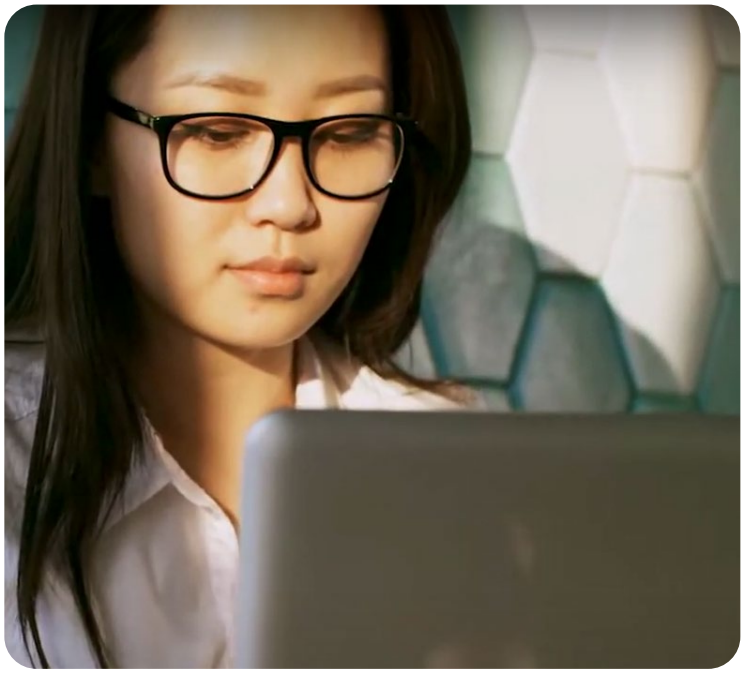
When teachers make sustained use of formative assessment over time, students have a better understanding of learning goals and where they are in relation to those goals, and student engagement in learning increases (Claim 3). When teachers facilitate instruction based on student understanding and students are aware of their own needs, student learning improves (Claims 4 and 5). The arrow labeled A indicates the assumptions (teachers routinely develop lessons plans on a digital platform and use the PlanWise tool on a regular basis) that are necessary for the action mechanisms to occur.

PlanWise Features: Formative Assessment

The tool is built upon research that supports and targets the use of formative assessment. Effective use of formative assessment is a driver of and involves several categories of practices (Leahy et al. 2005). They are:

Sharing learning expectations. Research studies have demonstrated that when teachers share learning expectations with students (through the provision of student-friendly learning goals, criteria and expectations or rubrics), students are more accountable for their learning and better able to monitor their own progress (Hattie & Donoghue, 2016; Tell, Bodone, & Addie, 2000; White & Frederiksen, 1998).

Eliciting evidence of learning. Research studies have shown that teachers are better able to plan instruction based upon the current understanding of students when they use questions and discussions to collect evidence of student thinking, their misunderstandings or partial understandings, as well as purposively engage all students in deeper classroom discussions (Carpenter, Fennema, Peterson, Chiang, & Loef, 1989; Graham, Milanowski, & Miller, 2012; Mevarech, 1983, National Council of Teachers of Mathematics, 2000; Tobin, 1987, Wylie & Ciofalo, 2006; Wylie & Ciofalo, 2009).



Structuring opportunities for self-assessment. Research has accumulated evidence of a wide variety of benefits when students have opportunities to analyze their own learning and thinking processes. The potential benefits include the development of internal attributions, feelings of empowerment, improved self-efficacy, a sense of autonomy and improved student learning outcomes (Andrade, Wang, Du, & Akawi, 2009; Brookhart, Andolina, Zuza, & Furman, 2004; Cohen, Raudenbush, & Ball, 2003; McDonald & Boud, 2003; White & Frederiksen, 1998).

Structuring opportunities for peer assessment. Research studies have demonstrated that when students are provided with opportunities to provide feedback to peers with appropriate scaffolds, guidance and routines, they can engage in meaningful collaborations and provide feedback which improves the quality of work — with benefits to both the giver and the receiver of feedback (Lu & Law, 2012; Mercer et al., 2004; van Popta et al., 2016).

Providing actionable formative feedback. For feedback to be formative and support student learning, research studies have identified three conditions that must be met: feedback must help students understand the gaps between the learning expectations and their present status; feedback must provide actionable suggestions for how to address the gap; and students must have an opportunity to engage with and apply the feedback (Black & Wiliam, 1998; Ramaprasad, 1983; Sadler, 1989; Shute, 2008).

Evidence from the PlanWise Pilots to Support Action Mechanisms and the Impact on Teachers

Feedback from a pilot of the initial prototype revealed that the formative assessment information we provided teachers was valuable; however, the delivery mechanism was not. To better understand teacher needs and their preferences in order to inform the features of a delivery system, 10 teachers[2] participated in two half-day workshops. These workshops focused on eliciting a deep understanding of the lesson and unit planning practices used by teachers. The results from these workshops informed the development of three iterative prototypes and rounds of pilot tests that examined how teachers could effectively access and use suggestions for formative assessment strategies as part of their lesson planning process. Over 100 teachers[3] participated across the three pilots, increasing fidelity over each iterative cycle used to create the PlanWise tool.

Participating teachers provided feedback about their experiences with the prototypes. The Teacher Feedback sidebar on this page illustrates how teachers' reactions align with the action mechanisms proposed in the theory of action.

Teacher Feedback on the PlanWise Tool

"Having the formative assessment strategies right at my fingertips saved me time looking for resources and prompted me to include more formative assessments in my lesson plans."

"I liked that I got suggestions as I was typing up lessons. It kept the idea of formative assessment up front and I integrated it more than I used to. It used to be more of an afterthought than part of everyday lesson design."

"Having the formative assessment strategies pop up while lesson planning made me think more deeply about what my learning objective was and how I was going to work with students to make sure they mastered the concept."

"[The prototype] made me realize the misconceptions students may have and really brought my attention to addressing those issues."

[2] The teachers came from three states within driving distance of the ETS Princeton office in New Jersey and had elementary, middle and high school experience in a variety of urban, suburban and rural school districts. Their experience ranged from relatively recent teaching to more than 20 years of teaching. Two teachers were in self-contained classrooms where they taught all subjects, one taught both mathematics and science, and one taught English language arts (ELA) and social studies. Three, two and one teacher(s) specialized in mathematics, ELA and science, respectively.

[3] The teachers came from urban, suburban and rural districts across the United States. They primarily taught grade three to high school in the mathematics, science, ELA and social studies subject areas.

Based on feedback from the pilot of the final prototype, 86% of teachers indicated that including formative assessment strategies in their lesson plans would increase the likelihood that they would implement them during class, 79% reported that if available they would use the PlanWise tool on a regular basis and 97% said that they would recommend it to a colleague. While the pilot data provide preliminary evidence of the likelihood that the PlanWise tool will encourage the effects identified in the logic model, more systematic evidence will be collected as it is used more.

Anticipated Impacts on Students

We have not yet collected research evidence about the impact of teachers' use of the PlanWise tool on student learning. However, existing research on formative assessment had demonstrated positive impacts on students, as explained below:

When teachers use more formative assessment practices, students have more opportunities to develop a better understanding of learning goals, to understand how activities in class connect to those learning goals, and to reflect on their own learning and that of their peers. As a result, students' metacognitive thinking — an important 21st-century skill — *is strengthened.*

Formative assessment, student engagement and metacognition. Formative assessment strategies for eliciting evidence of student understanding (e.g., higher-order questions, wait time, all student response systems) have been demonstrated as effective for increasing student engagement (Tobin & Capie, 1982). Engagement, in turn, is positively related to better learning outcomes (e.g., Hecht, 1978; Samuels & Turnure, 1974).

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Formative assessment and student learning. Formative assessment can have a significant impact on student learning when used consistently and systematically (Black & Wiliam, 1998; Brookhart, 2005; Hattie, 2009a; Hattie & Timperley, 2007) with effect sizes ranging from 0.4 to 0.7, "which are larger than most of those found for educational interventions" (Black & Wiliam, 1998, p. 141). A meta-analysis found that both formative assessment and feedback are one of the top 10 strategies (out of the 138 factors examined) that have the greatest impact on student learning outcomes (Hattie, 2009b).

References

Andrade, H. L., Wang, X., Du, Y., & Akawi, R. L. (2009). Rubric-referenced self-assessment and self-efficacy for writing. *The Journal of Educational Research*, *102*(4), 287–302.

Black, P., & Wiliam, D. (1998). Assessment and classroom learning. *Assessment in Education: Principles, Policy & Practice*, *5*(1), 7–74.

Brookhart, S. M. (2005). *Research on formative classroom assessment*. Paper presented at the annual meeting of the American Educational Research Association, Montreal, Canada.

Brookhart, S. M., Andolina, M., Zuza, M., & Furman, R. (2004). Minute math: An action research study of student self-assessment. *Educational Studies in Mathematics*, *57*(2), 213–227.

Brookhart, S., Moss, C., & Long, B. (2009). Promoting student ownership of learning through high-impact formative assessment practices.

Journal of MultiDisciplinary Evaluation, *6*(12), 52–67.

Carpenter, T. P., Fennema, E., Petereson, P. L., Chiang, C.-P., & Loef, M. (1989). Using knowledge of children's mathematics thinking in classroom teaching: An experimental study. *American Educational Research Journal*, *26*(4), 499–531.

Cohen, D. K., Raudenbush, S. W., & Ball, D. L. (2003). Resources, instruction, and research. *Educational Evaluation and Policy Analysis*, *25*(2), 119–142.

Graham, M., Milanowski, A., & Miller, J. (2012). Measuring and Promoting Inter-Rater Agreement of Teacher and Principal Performance Ratings. *Online Submission*.

Hattie, J. (2009a). The black box of tertiary assessment: An impending revolution. T*ertiary assessment & higher education student outcomes: Policy, practice & research*, 259–275.

Hattie, J. (2009b). *Visible learning: A synthesis of over 800 meta-analyses relating to achievement*. New York, NY: Routledge.

Hattie, J. A., & Donoghue, G. M. (2016). Learning strategies: A synthesis and conceptual model. *Science of Learning*, *1*(1), 1–13.

Hattie, J., & Timperley, H. (2007). The power of feedback. Review of educational research, *77*(1), 81–112.

Hecht, L. W. (1978). Measuring student behavior during group instruction. *Journal of Educational Research*, *78*(5), 283–290.

King, A. (1992). Facilitating elaborative learning through guided student-generated questioning. *Educational Psychologist*, *27*(1), 111–126.

Leahy, S., Lyon, C. J., Thompson, M., & Wiliam, D. (2005). Classroom assessment: Minute by minute, day by day. *Educational Assessment*, *63*(3).

Lu, J., & Law, N. (2012). Online peer assessment: Effects of cognitive and affective feedback. *Instructional Science*, *40*(2), 257–275.

McDonald, B., & Boud, D. (2003). The impact of self-assessment on achievement: the effects of self-assessment training on performance in external examinations. *Assessment in Education: Principles, Policy & Practice*, *10*(2), 209–20.

Mercer, N., Dawes, L., Wegerif, R., & Sams, C. (2004). Reasoning as a scientist: Ways of helping children to use language to learn science. *British Educational Research Journal*, *30*(3), 359–377.

Mercer, N., Wegerif, R., & Dawes, L. (1999). Children's talk and the development of reasoning in the classroom. *British Educational Research Journal*, *25*(1), 95–111.

Mevarech, Z. R. (1983). A deep structure model of students' statistical misconceptions. *Educational Studies in Mathematics*, *14*(4), 415–429.

National Council of Teachers of Mathematics. (2000). *Principles and standards for school mathematics.* Reston, VA: NCTM.

National Research Council. (2012). *Education for life and work: Developing transferable knowledge and skills in the 21st century*. Washington, DC: The National Academies Press.

Ramaprasad, A. (1983). On the definition of feedback. *Behavioral Science*, *28*, 4–13.

Sadler, D. R. (1989). Formative assessment and the design of instructional systems. *Instructional Science*, 18, 119–144.

Samuels, S. J. & Turnure (1974). Attention and reading achievement in first-grade boys and girls. *Journal of Educational Psychology*, *66*(1), 29–32.

Shute, V. J. (2008). Focus on formative feedback. *Review of Educational Research*, *78*(1), 153–189.

Tell, C. A., Bodone, F. M., & Addie, K. L. (2000). *A framework of teacher knowledge and skills necessary in a standards-based system: Lessons from high school and university faculty.* Paper presented at the annual meeting of the American Educational Research Association, New Orleans, LA.

Tobin, K. (1987). The role of wait time in higher cognitive level learning. *Review of Educational Research*, *57*(1), 69–95.

van Popta, E., Kral, M., & Camp, G. (2016). Exploring the value of peer feedback in online learning for the provider. *Educational research review*, *20*, 24–34.

White, B. Y., & Frederiksen, J. R. (1998). Inquiry, modeling, and metacognition: Making science accessible to all students. *Cognition and instruction*, *16*(1), 3–118.

Wylie, C., & Ciofalo, J. (2006). *One diagnostic item: Then what?* Paper presented at the annual meeting of the American Educational Research Association (AERA) and the National Council on Measurement in Education (NCME) San Francisco, CA.

Wylie, E. C., & Ciofalo, J. (2009). *Diagnostic Items in Math and Science* (Final Report for No. R305K040051). Washington, DC: Institute for Education Sciences.

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