

# DMT INSIGHTS

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## PRETEACHING: PREPARING STUDENTS FOR MATHEMATICAL THINKING

*What research suggests about prior knowledge, instructional preparation, and student learning*

### Introduction

Preteaching involves introducing selected concepts, mathematical language, or prior knowledge before students encounter them in the main lesson. It helps students connect what they already understand to the mathematical ideas they will develop.

In mathematics, preteaching should focus on the relationships students will need for upcoming instruction. By examining these ideas before the main lesson, teachers can address gaps in prior knowledge before they interfere with students' participation and reasoning. This may involve examining a familiar quantity, identifying the unit, composing or decomposing numbers, interpreting a representation, or connecting mathematical language to an existing idea.

This DMT Insight examines evidence related to preteaching, including its effects on student achievement, prior knowledge, cognitive demands, motivation, and participation. It also compares preteaching with reteaching and notes remaining research limitations.

### Effectiveness of Preteaching

Research on preteaching has examined whether providing selected information before instruction can improve students' preparation for upcoming instruction. Lalley and Miller (2006) compared preteaching and reteaching with third-grade students who had low achievement in mathematics. Both approaches improved mathematics achievement, with no difference between the groups. However, students who received preteaching also showed a significant improvement in academic self-concept, a result not found for the reteaching group, although the difference between the two groups was not statistically significant. This finding suggests that pre-teaching may offer benefits beyond achievement alone. Because the study involved a specific group of students and a specific mathematical content area, its findings should not be generalized to all classrooms.

The findings of preteaching studies depend on the subject, student population, instructional approach, and outcomes measured. Evidence from studies of prior knowledge and instructional guidance also helps explain why pre-lesson preparation may be useful (Ausubel, 1960; Kirschner et al., 2006). However, findings from general cognitive research should be distinguished from studies that directly evaluate preteaching in mathematics.

More research is needed to determine which preteaching approaches are most effective for specific mathematical topics, grade levels, and student needs.

## Prior Knowledge, Cognitive Demands, and Motivation

Prior knowledge plays an important role in how students interpret new information. When students can connect an unfamiliar idea to a relationship they already understand, they have more information available for reasoning and problem solving. Ausubel (1960) proposed that introducing organizing ideas before new material can help learners relate it to what they already know.

Sweller's (1988) work on cognitive load offers one explanation for why preparation before instruction may help. Students have limited working-memory resources, and unfamiliar terminology or representations may add demands that interfere with their attention to the mathematics. Preteaching selected ideas may reduce some of these demands, although cognitive load theory does not, by itself, establish the effectiveness of a particular preteaching intervention.

In mathematics, the purpose is to help students attend to the quantities, units, and relationships that will be important during the lesson. Mathematical language develops meaning when students connect it to quantities, units, and relationships. For example, before a lesson on adding  $\frac{1}{3}$  and  $\frac{1}{4}$ , students might partition the same unit of 1 into three and four equal parts and compare the sizes of the fractional units.

Students' experiences with preteaching may also influence their willingness to participate. Lalley and Miller (2006) reported that students who received preteaching gained academic self-concept. Additional research is needed to determine how preteaching influences students' participation, persistence, and attitudes toward mathematics.

**Key Idea • Preteaching connects the upcoming mathematics to relationships students already understand. It prepares students for the lesson without teaching the lesson in advance.**

## Comparison of Preteaching and Reteaching

Preteaching and reteaching serve different instructional purposes. Preteaching occurs before the main lesson and focuses on the knowledge or relationships students need to engage with the upcoming mathematics. Reteaching occurs after instruction or assessment reveals difficulty and requires teachers to examine students' reasoning before deciding what instruction should follow (see DMT Insight 28).

Preteaching can be more effective than reteaching because it addresses key mathematical ideas before students encounter difficulties during the main lesson. Students can connect prior knowledge to new relationships, become familiar with mathematical language, and participate in the lesson with a stronger understanding of the mathematics being developed.

In Lalley and Miller's (2006) study, both preteaching and reteaching improved mathematics achievement, but only the preteaching group showed a significant improvement in academic self-concept. This finding supports examining the benefits of preparing students before instruction rather than relying primarily on reteaching after difficulties occur.

The available evidence does not establish that preteaching is always more effective. Its success depends on the mathematics being taught, students' prior knowledge, and the quality of instruction. Reteaching remains necessary when student work reveals relationships that need further development.

## Implementing Preteaching

Preteaching should be connected directly to the mathematics of an upcoming lesson. Teachers need to identify the prior knowledge students will use and determine whether unfamiliar language, representations, or mathematical relationships may interfere with their participation.

Depending on the content and students' needs, preteaching may involve revisiting a known relationship, interpreting a representation, examining a unit, or connecting mathematical language to quantities. It should prepare students to engage with the main lesson without replacing the mathematical reasoning the lesson is intended to develop. Research on productive failure suggests that students benefit from attempting a problem before formal instruction, when the following instruction builds on their attempts (Kapur, 2014). Preteaching that presents a lesson's methods in advance could remove that opportunity.

The duration, group size, and instructional approach should depend on the mathematical content and evidence of student understanding. The cited research does not establish a universal 15–20-minute recommendation or show that classroom-teacher instruction is always more effective than other arrangements.

## Limitations of the Research

Research on preteaching raises several questions that warrant further study. These include whether benefits persist over time, whether students transfer what they learn to new mathematical situations, and how the effects differ across grade levels and mathematical topics.

Studies also need to distinguish the effects of preteaching from those of additional instructional time, individual attention, and other supports. A preteaching group receiving more time may improve for reasons unrelated to instruction timing.

The effectiveness of preteaching depends on the mathematical content, students' prior knowledge, and the quality of instruction.

**Key Idea • Preteaching has the potential to improve learning by addressing important mathematical relationships before students encounter the main lesson. Reteaching remains necessary when student work shows that students need additional instruction.**

## Conclusion

Preteaching allows students to prepare for the mathematical ideas they will encounter during instruction. Its value depends on identifying the relevant prior knowledge and helping students connect familiar relationships to new mathematics.

Research on prior knowledge, cognitive demands, and instructional guidance supports examining preteaching, but direct evidence of its effects in mathematics requires careful evaluation. Teachers must determine what students already understand, what the upcoming lesson requires, and which mathematical relationships need attention.

Preteaching allows teachers to address key mathematical relationships before students struggle with new content. When students can connect prior knowledge, representations, and mathematical language to the upcoming lesson, they may be better prepared to reason, explain, and develop efficient strategies. This is why preteaching deserves consideration as a proactive instructional approach, so that teachers do not rely primarily on reteaching after students struggle.

## References

- Ausubel, D. P. (1960). The use of advance organizers in the learning and retention of meaningful verbal material. *Journal of Educational Psychology*, 51(5), 267–272. <https://doi.org/10.1037/h0046669>
- Kapur, M. (2014). Productive failure in learning math. *Cognitive Science*, 38(5), 1008–1022. <https://doi.org/10.1111/cogs.12107>
- Kirschner, P. A., Sweller, J., & Clark, R. E. (2006). Why minimal guidance during instruction does not work: An analysis of the failure of constructivist, discovery, problem-based, experiential, and inquiry-based teaching. *Educational Psychologist*, 41(2), 75–86. [https://doi.org/10.1207/s15326985ep4102\\_1](https://doi.org/10.1207/s15326985ep4102_1)
- Lalley, J. P., & Miller, R. H. (2006). Effects of pre-teaching and re-teaching on math achievement and academic self-concept of students with low achievement in math. *Education*, 126(4), 747–755.
- Sweller, J. (1988). Cognitive load during problem solving: Effects on learning. *Cognitive Science*, 12(2), 257–285. [https://doi.org/10.1207/s15516709cog1202\\_4](https://doi.org/10.1207/s15516709cog1202_4)

## Social Media

What should students know before a mathematics lesson begins?

Preteaching introduces selected ideas, relationships, or mathematical language before the main lesson. Its value depends on identifying what the upcoming mathematics requires.

Before a lesson on adding  $\frac{1}{3}$  and  $\frac{1}{4}$ , students might partition the same unit of 1 into three and four equal parts and compare the fractional units. The lesson then develops equivalence and addition.

In DMT Insight 27, we review research on preteaching, prior knowledge, cognitive demands, motivation, and how preteaching compares with reteaching.

Read the full Insight at [mathsuccess.io/dmtinsights](https://mathsuccess.io/dmtinsights).

