Is There a Problem with How We Teach Math?

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Constructivist approaches have dominated math classrooms for nearly two decades. Yet a growing body of evidence suggests this model may be far less effective than advertised. Rather than letting students struggle to discover mathematical concepts on their own, what if we gave them clear, explicit guidance from the start? Here is a look at where constructivist math instruction falls short, what scientific research actually reveals about how we learn math, and why explicit instruction consistently comes out on top.

So, What Is Constructivist Teaching?

According to John Hattie (2022), constructivist teaching "involves providing students with learner-centered, active instruction, where students explore ideas, propositions, explanations, solutions, and take subsequent actions." The theoretical roots of this approach are most often traced to Jean Piaget (1964), who argued that learning occurs through the gradual construction—or scaffolding—of understanding as learners interact with new information. Constructivist theory has been particularly influential in mathematics instruction (University at Buffalo, n.d.).

The University at Buffalo (n.d.) identifies four core principles commonly associated with constructivist teaching:

Create cognitive dissonance: Students are given problems or tasks that challenge existing understanding. Knowledge is constructed as learners encounter novel situations and revise prior schemas while working through these challenges.

Apply knowledge with feedback: Students are encouraged to evaluate new information and adjust their existing knowledge accordingly. Instructional activities often involve comparing prior understanding with new contexts through discussions, presentations, or formative assessments.

Reflect on learning: Students are provided opportunities to demonstrate what they have learned to both themselves and others. Common activities include presentations, reflective writing, or creating step-by-step explanations for peers.

Elicit prior knowledge: New learning is explicitly connected to what learners already know. Instruction therefore begins by activating relevant prior knowledge through pretests, informal questioning, or collaborative warm-up activities.

Understanding Constructivist Teaching in Practice

Importantly, constructivism was not originally conceived as a method of instruction, but as a theory of learning (Piaget, 1964). Traditional educational models tended to view learning as a largely linear process directed by an instructor (Xie, Wang & Hu, 2018). In contrast, proponents of Piaget's work emphasized the learner's active role in constructing knowledge based on personal relevance and experience.

This theoretical shift did not produce a single instructional model, but rather a wide array of approaches commonly grouped under the umbrella of *constructivist teaching*. These include, but are not limited to, discovery-based learning, inquiry-based learning, and problem-based learning (Xie, Wang & Hu, 2018). Additionally, a number of other instructional practices—such as cooperative learning and teaching to learning

styles—are often associated with constructivist theory, even if that connection is more indirect or more loosely defined.

Constructivist teaching, however, represents more than a set of pedagogical techniques. It is frequently framed as a philosophical rejection of traditional and explicit instruction, which some constructivists characterize as inherently authoritarian or disengaging (Small, 2008). This philosophical dimension complicates efforts to evaluate constructivist teaching, both rhetorically and scientifically.

From a rhetorical standpoint, critique is difficult because there is little consensus on what, precisely, constitutes constructivist teaching. As a result, critiques risk being dismissed as mischaracterizations or strawman arguments. To address this challenge, I distinguish between components of constructivist teaching that are clearly defined in the literature and those that are more loosely described or observed in practice.

Evaluating constructivism as a whole risks oversimplification and the loss of important nuance. The ineffectiveness of one constructivist approach does not imply that all such approaches are ineffective. Conversely, evaluating individual methods in isolation constrains the scope of the evidence, limits generalizability, and ignores the interconnected theoretical foundations from which these practices emerge.

Rather than forcing the analysis into this binary, I will attempt to examine both the broader body of evidence related to constructivist theory and the specific instructional practices derived from it. This approach allows for a more accurate and meaningful evaluation of constructivist teaching as it is actually implemented in classrooms.

The Practical Limitations of Constructivist Teaching:

To understand the theoretical challenges associated with constructivist teaching, it is first necessary to consider what a constructivist mathematics lesson actually looks like in practice. As I have already alluded to several times, this is not a straightforward task. There is no single, agreed-upon definition of a constructivist mathematics lesson, and critiques of any particular instantiation are often dismissed as strawman arguments.

Given this ambiguity, I will ground the discussion in anecdotes, drawing on my own experiences as a classroom teacher. While anecdotal evidence cannot substitute for empirical research, it can help illustrate how constructivist principles are commonly interpreted and implemented in real classrooms. Attempting to base this discussion on others' experiences—or on a single representative study—would be equally problematic, as no single paper can adequately capture the wide range of instructional practices that fall under the constructivist umbrella. It is also worth acknowledging that constructivist teaching exists along a spectrum, with some implementations far more extreme than others.

In my experience, many constructivist mathematics lessons center on large, situational word problems. The underlying assumption appears to be that application is the primary goal of mathematics instruction. Much like constructivist approaches to literacy, which often emphasize comprehension over fluency or accuracy, constructivist mathematics instruction tends to prioritize application over procedural fluency (Hansford, Dueker, et al., 2026).

By way of contrast, consider a traditional multiplication lesson. In such a lesson, a teacher might explicitly explain and model a Math algorithm and then assign students a substantial number of practice problems—sometimes dozens—depending on the instructional context. In a constructivist lesson, students might instead be given four or five complex word problems. These problems are typically designed to be "authentic," to involve multiple operations, and to connect indirectly to other mathematical concepts.

For example, students might be presented with a problem such as: *Michael and Joey go fishing. Michael can hold three fish in his net and fills it four times. Joey can hold five fish in his net and fills it three times. How many fish did they catch altogether? Who caught more fish?* The logic behind such a task is that it is more

"authentic" than an abstract worksheet, requires multiple steps, and allows for what is often described as "rich discussion."

If I were teaching this lesson, I would begin by explicitly demonstrating the relevant operations using a similar example and explaining how to arrive at the correct solution. In many constructivist classrooms, however, providing such instruction at the outset is discouraged. Instead, students are given manipulatives, asked to work in groups, and encouraged to discover solution strategies independently. Any formal explanation typically occurs at the end of the lesson. This instructional sequence is often justified under the banner of "productive struggle" (NCTM, 2014).

In my view, this approach has several significant drawbacks. First, it is highly inefficient. Rather than practicing many examples within a lesson, students engage with only a small number of problems. Instead of front-loading the knowledge required for success, most students are allowed—indeed, expected—to struggle without sufficient guidance, on the assumption that this will make learning more meaningful. In practice, this often results in many students disengaging, while a small number of stronger mathematics students effectively solve the problems on behalf of their peers.

Moreover, these lessons are heavily language dependent. Students with language deficits, learning disabilities, or limited vocabulary can find such tasks inaccessible, even when they understand the underlying mathematics. Ironically, this model is frequently promoted as a way to reduce mathematics anxiety (Ashcraft, 2002). Based on my experience, it often has the opposite effect, reinforcing the belief among many students that they are "not good at math."

To be clear, this is not the only way constructivist principles are implemented. In some school boards where I have worked, complex word problems were used at the end of lessons as a form of consolidation following explicit instruction. In my opinion, this is a far more effective way to incorporate problem-based learning. At the other end of the spectrum, however, I have encountered environments where teachers were actively discouraged from teaching mathematical formulas at all. In one instance, a principal advised that formulas should never be taught directly, while an instructional coach suggested that formulas should only be introduced at the end of a unit, often several weeks long, after students had "played with the numbers."

This approach strikes me as deeply unproductive. Many mathematical formulas were developed by mathematicians after years of study, struggle, and formal reasoning. Expecting students to rediscover such formulas independently is unrealistic and, in my view, more likely to foster frustration and anxiety than understanding. While some students may succeed under these conditions, I can say with confidence that I would not have. As a student who struggled with mathematics, I required explicit instruction and substantial, structured practice in order to be successful.

Another constructivist-influenced approach I have encountered involves so-called "language-free" word problems. These tasks typically present students with an image related to a mathematical concept and ask them to identify patterns, relationships, or relevant mathematical ideas. Such problems often intentionally allow for multiple interpretations in the hope of generating richer discussion. Numbers are sometimes removed altogether to create what are described as "low-floor, high-ceiling" tasks, activities intended to be accessible to all students while still allowing for advanced thinking.

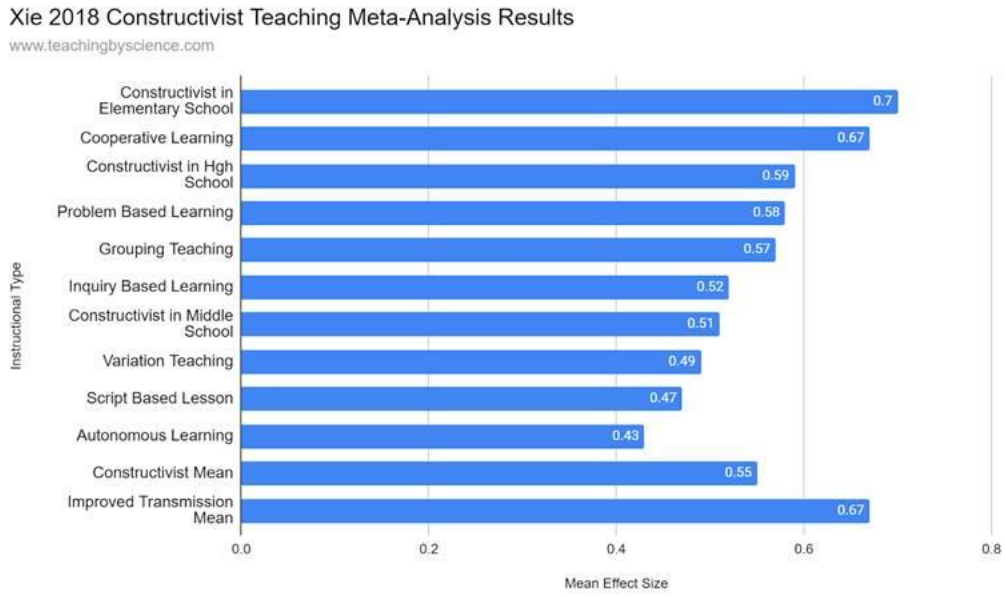
I recently observed such an activity at a mathematics conference. Participants were shown an image of a Ferris wheel and asked to write down all the types of mathematics that they could identify in the image. After five minutes of individual work, this was followed by a twenty-minute group discussion. While the intentions behind this activity were clearly well-meaning, its instructional value was questionable. If we accept that students learn mathematics through explanation and consolidate that understanding through repeated practice, then the primary goal of a mathematics lesson should be to maximize meaningful repetition of mathematical processes. This activity, by contrast, involved no numerical computation, no procedural practice, and no repetition of mathematical skills.

Although such tasks may be engaging and may "feel" productive, they do not meaningfully advance mathematical understanding. At best, they may serve as brief warm-ups or lesson hooks. When they occupy the majority of instructional time, however, they risk substituting the appearance of mathematics instruction for mathematics instruction itself.

Understanding the Efficacy of Constructivist Teaching

To the best of my knowledge, there has only been one meta-analysis that specifically looked at the overall impact of constructivist teaching on Math achievement (Xie, Wang & Hu, 2018). This meta-analysis was specifically on constructivism instruction in mathematics within mainland China. The meta-analysis included eighty-nine experimental or quasi-experimental studies. All studies compared a constructivist approach to a traditional approach to teaching. The meta-analysis also looked at twenty-five studies that compared a nontraditional, non-constructivist approach to traditional education (which they defined as *transmission instruction*). The inclusion criteria for this study were very rigorous. Figure 5.1 shows the results of this study—the impact of constructivist teaching in mainland China.

Figure 5.1: Constructivist teaching meta-analysis results.



Source: (Xie, Wang, & Hu, 2018)

In their meta-analysis, Xie et al. (2018) used categories not normally referred to within Western education literature. To aid in understanding the results of this study, I have provided an explanation of some of these strategies, such as *variation teaching*, *grouping teaching (ability grouping)*, *autonomous learning*, and *improved transmission*.

Variation teaching: Providing multiple scaffolded examples of problems and how to solve them

Grouping teaching (ability grouping): Grouping students according to their ability level

Script-based learning: Is a Direct Instructional teaching methodology, in which teachers follow a script for all lessons.

Autonomous Learning: Having students choose their own learning goals, monitor their own learning, and evaluate their own progress. In Western education, this model might be referred to as *discovery-based learning*.

Improved transmission: In order to distinguish between traditional and newly-developed models of instruction, this meta-analysis names them *traditional transmission model* and *improved transmission model*, respectively. The former is the traditional method of teaching, as defined earlier in this article. The latter still satisfies the definition of the transmission instructional model and has some new characteristics. Within this label of improved transmission, one could include grouping teaching and variation teaching (Xie et al., 2018).

Overall (Xie et al., 2018) showed that Chinese students benefited from constructivist teaching methods. However, the form of constructivist teaching with the highest effect size was improved transmission, in which students received more explicit guidance. To put it more simply, students benefited from inquiry methods more when they were coupled with more explicit instruction. It is also worth noting that this meta-analysis has some unique limitations.

First, the meta-analysis did not base its inclusion criteria on its definition of constructivist teaching but rather looked at studies on topics *related to* constructivist teaching. For this reason, I would argue that this is not actually a meta-analysis on constructivist teaching, but rather on cooperative learning, inquiry-based learning, problem-based learning, variation teaching, and ability grouping. Of course, this is part of the problem with evaluating the efficacy of constructivist teaching; it's not one pedagogy but a philosophical approach that includes many different pedagogies and concepts.

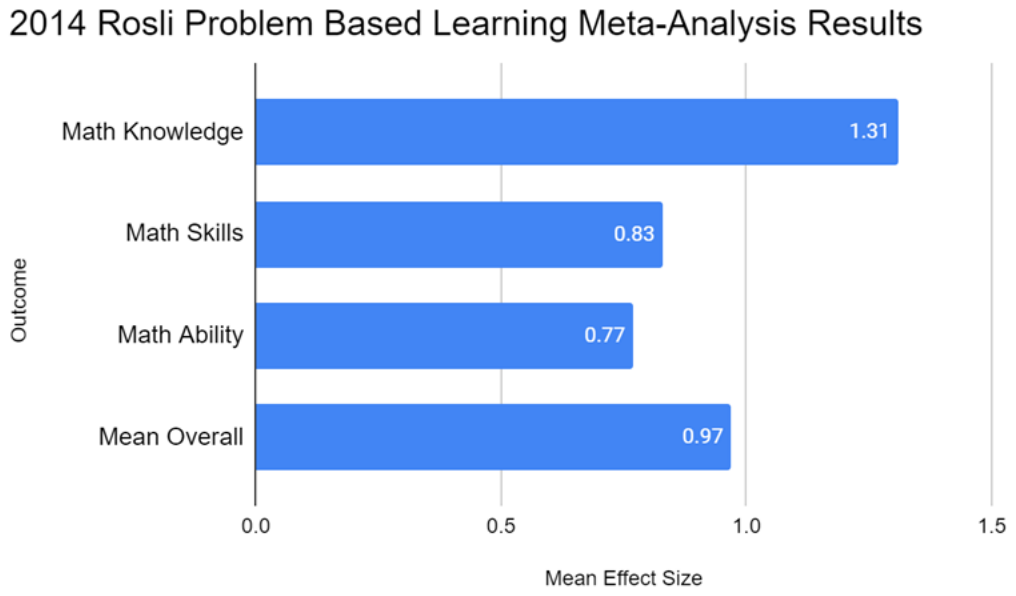
Second, the fact that this meta-analysis was conducted on Chinese studies only is another convoluting factor. China consistently has the highest mathematics PISA scores in the world (OECD, 2018a). And, as Xie et al. (2018) point out, the Chinese education system typically uses a more traditional mathematics education focusing on mathematics fluency taught via explicit and systematic instruction. Considering that China has the best mathematics student results in the world, it makes sense that some element of their transmission instruction model is working. Additionally, did the constructivist teaching work in this study (Xie et al., 2018) because it was better, because it was novel, or because the students already had strong mathematics fluency skills and could, therefore, benefit from the more open-ended curriculum?

A 2016 meta-analysis by Ard Lazonder and Ruth Harmsen looked at the effect of inquiry-based learning in Western countries on Math achievement. Interestingly, they also found that inquiry-based learning that included additional guidance or more explicit instruction outperformed traditional inquiry-based learning. They looked at only 5 rigorous Math studies and found a statistically insignificant effect size of .28, for inquiry-based learning. A 2016 meta-analysis by Toraman and Demir looked at not Math achievement, but Math motivation. They looked at 43 rigorous studies and found a statistically significant mean effect size of .72.

None of these meta-analyses on inquiry-based learning directly compared the effect of inquiry-based learning with direct instruction. Matthew Burns, Florence Bason, Concepcion Moncada-Cummings, & Gabriella Arfaras published a meta-analysis in 2026, in the journal of Remedial and Special Education. They directly compared Direct Instruction with inquiry-based learning. Their meta-analysis found a negative effect size for inquiry-based learning of .32, suggesting that inquiry-based approaches only showed positive effects when the comparison group also used less explicit methods, but underperformed when contrasted with more explicit instruction.

Roslinda Rosli, Mary Margaret Capraro, and Robert Capraro (2014) conducted a meta-analysis on the effect of problem-based learning on mathematics outcomes. The results of this study are shown in figure 5.2. However, this meta-analysis only contained thirteen studies, which is a small number for a meta-analysis. While these studies examined grades 3-12, the inclusion criteria were strict, which improves confidence in their results, at least for these thirteen studies.

Figure 5.2: Problem-based learning meta-analysis results.



Source: Rosli et al., 2014.

In 2015, Kimberly Jensen conducted a meta-analysis of problem-based learning. However, only one of the studies looked at mathematics and only one looked at reading. The reading effect size was 0.11 (statistically insignificant), and the mathematics effect size was 0.34. The meta-analysis was not peer reviewed and was, therefore, of lower reliability. Dağyar and Demirel (2016) also conducted a meta-analysis on problem-based learning and found a mean effect size of .86 for mathematics instruction across fifteen rigorously conducted studies. One convoluting factor for this meta-analysis is the fact that most studies were conducted on high school and university students. This is problematic, because problem-based learning makes more sense in these age brackets, as students should have already developed their basic procedural and computational fluency. Yet, we often see problem-based learning recommended for younger students.

Overall, these studies suggest that there is very strong evidence for the use of problem-based learning in mathematics instruction. However, the vast majority of this research is on secondary and university students. I think it might be problematic to use this evidence as justification for the extensive use of problem-based learning in the elementary grades before students have developed their procedural and computational fluency.

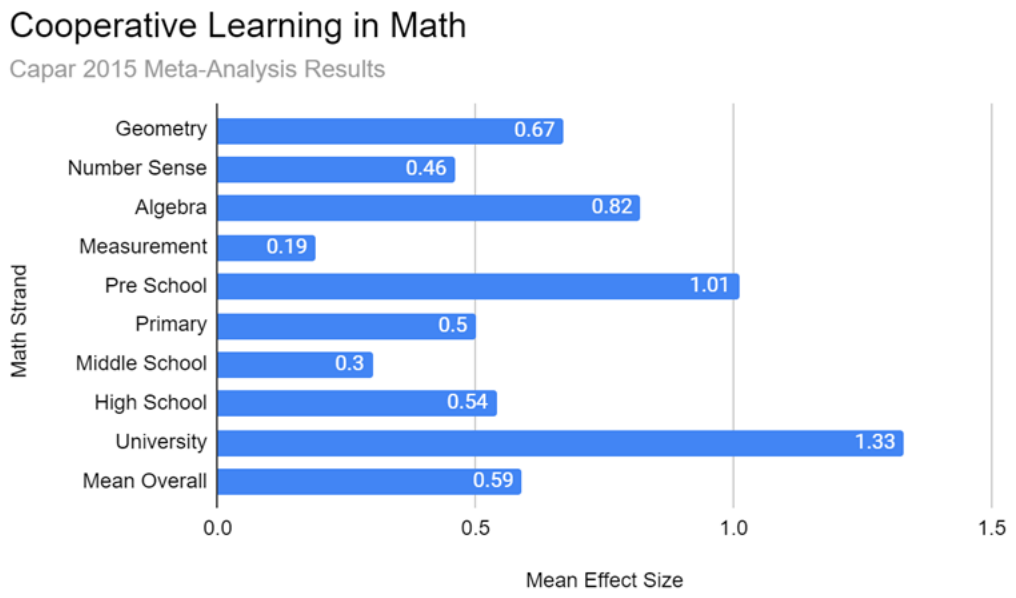
Discovery-Based Learning

To the best of my knowledge, only one peer-reviewed meta-analysis exists on the topic of discovery-based learning. In 2011, Louis Alfieri, Patricia Brooks, Naomi Aldrich, and Harriet Tenenbaum conducted a meta-analysis on discovery-based learning. Their meta-analysis included 164 studies and used strict inclusion criteria. However, it did not specifically control for any subject. The study found a mean negative effect size of –0.30 for discovery-based learning and a mean effect size of 0.30 for combining discovery-based learning and direct instruction. This said, it appears that the current evidence suggests that the use of discovery-based learning lowers academic achievement.

Cooperative Learning

In 2015, Gulfar Capar and Kamuran Tarim completed a meta-analysis of cooperative learning in mathematics. The inclusion criteria were rigorous and included a total of twenty-six studies. Figure 5.3 shows the results of this meta-analysis.

Figure 5.3: Cooperative learning in mathematics meta-analysis results.



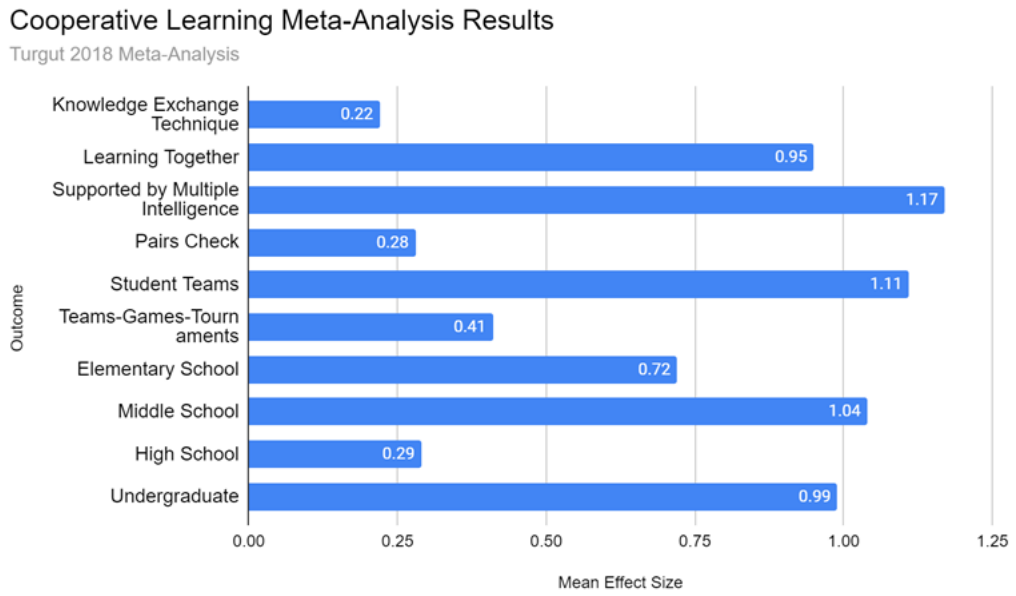
Source: Capar et al., 2015.

In 1993, Francis Burton Spuler conducted a non-peer-reviewed meta-analysis on cooperative learning in mathematics for elementary students. He found a mean effect size of 0.59; however, the meta-analysis only included ten studies. The fact that this meta-analysis had only ten studies and was not peer reviewed makes it less reliable, as typically ten studies within a meta-analysis is a very small sample.

In 2002, Kristen McMaster and Douglas Fuchs conducted a meta-analysis of cooperative learning for students in kindergarten through grade 12. It included fifteen studies total. Their study found a mean effect size of 0.29 for mathematics and reading outcomes. The inclusion criteria were rigorous for the study, which increases my confidence in the results.

In 2018, Sedat Turgut and Ilknur Turgut conducted a meta-analysis of forty-seven experimental or quasi-experimental cooperative learning studies on mathematics. The inclusion criteria were rigorous, and there was a sufficiently high number of studies. The results of this meta-analysis are shown in figure 5.4. Overall, the results of this meta-analysis were high and the studies experimental, which suggests that cooperative learning does benefit students in mathematics.

Figure 5.4: Effects of cooperative learning on mathematics meta-analysis results

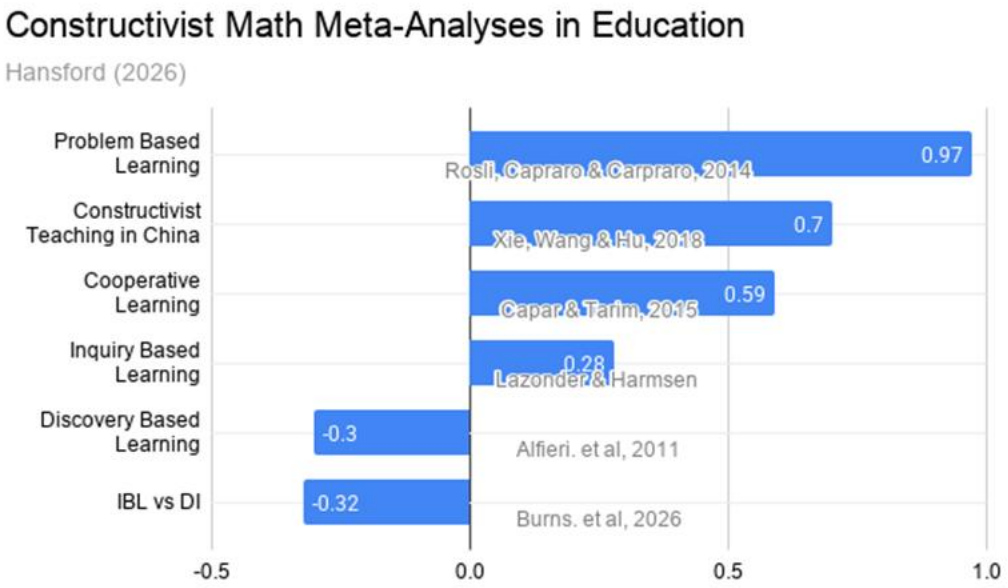


Source: Turgut & Turgut, 2018.

Figure 5.4 shows strong support for cooperative learning. While some demographics demonstrate dramatically different effects, there is no linear pattern. For example, middle school results are high, and undergraduate results are high, but high school results are low. This makes me believe that the low effect size for high school students is likely an anomaly in the data. Overall, there is moderate evidence for the use of cooperative learning in mathematics. That said, cooperative learning consistently outperformed other constructivist teaching methods. However, many cooperative learning effects may be better explained by increased opportunities for practice, explanation, and corrective feedback rather than by constructivist knowledge construction per se. Across all these pedagogies and topics, there is strong evidence for the use of constructivist pedagogies in mathematics, but only for more advanced students, with greater previous mathematics fluency instruction. Moreover, where constructivist studies compared less explicit teaching with more explicit teaching, the more explicit teaching group almost always outperformed.

To help make sense of all this research, I compiled the main results of the Math meta-analyses on constructivist teaching in elementary school. This can be seen in figure 5.5.

Figure 5.5: The Impact of Constructivist Teaching on Math Instruction in Elementary School



Source: Original

The graph in figure 5.5 makes it appear that constructivist learning might be effective when it is used with advanced students and focuses on problem-based learning and cooperative teaching. It makes it appear that inquiry-based learning and discovery-based learning might be less effective. However, the Lazonder & Harmsen, (2016), Xie, Wang, & Hu, (2018) and the Alfieri, et al. (2011) studies all found that results went up when additional support and guidance were given to students. Moreover, meta-analyses that compared inquiry methods to more explicit teaching methods, like Alfieri et al. (2011) and Burns et al. (2026) showed negative effect sizes for the less explicit teaching methods. To me, this suggests strong empirical support for the idea that more explicit teaching is more effective than less explicit teaching. Realistically, the best evidence for constructivist teaching in this analysis comes from the (Capar & Tarim, 2015) meta-analysis on cooperative learning. However, of the teaching methods explored in this article, I think cooperative learning is the least directly connected to constructivist learning theories.

Explicit/Direct Instruction

In the previous section, I critiqued constructivist teaching methods as being ineffective for Math instruction. In this section, I will be discussing the philosophical alternatives to constructivist teaching methods: explicit and direct instruction. Similar to how there is no one definition of constructivist teaching, there is no singular definition of explicit instruction that I would feel absolutely defines explicit instruction in all contexts. However, there are comparatively more specific models and commonly understood definitions. It is therefore easier to evaluate the overall efficacy of explicit teaching methods.

Traditional Teaching

According to (Xie, Wang, and Hu, 2018), in *traditional teaching* practices, teachers use the "transmission instructional model [. . .] a teacher-centered teaching and learning model in which the teacher's role is to design lessons aimed at predetermined goals and to present knowledge and skills in a predetermined order, and students' tasks are to passively acquire teacher specified knowledge and skills." To put this in less academic language, transmission scholars believe that learning is linear. In a transmission (or traditional) classroom, a teacher presents a curriculum to the students based on a carefully scaffolded curriculum. It is the teacher's job to teach and the student's job to learn. Teachers are the active providers of knowledge, whereas students are the passive recipients.

Traditional teaching often includes more explicit instruction than has been popularized by modern education theorists (Xie, Wang & Hu, 2018). It should be noted that explicit instruction is often also referred to as direct instruction. Within the scientific literature, two versions of direct instruction are often represented. *Direct Instruction* (capitalized) refers to scripted programs, in which the teacher has an actual script to read from in their lessons. *Direct instruction* (not capitalized) is a strategy in which the teacher explicitly teaches the content but does not follow scripted lessons (National Institute for Direct Instruction, n.d.).

Differences between traditional teaching and modern or constructivist teaching extend beyond the differences between explicit and implicit instruction. However, it is within this difference where there is the greatest debate. The terms *traditional teaching*, *transmission theory*, *explicit instruction*, *direct instruction*, and *Direct Instruction* are often used interchangeably. However, most of these terms refer to slightly different strategies or methodologies. To help build clarity around these terms, see Table 6.1.

Term	Definition
Traditional teaching	Teaching methods popularized prior to the rise of constructivist teaching
Transmission theory	The theory of learning that informs both direct instruction and traditional teaching
Explicit instruction	Instruction in which the teacher directly and fully explains concepts and information to students
Direct instruction	Another term for *explicit instruction*
Direct Instruction	Scripted programs based on the transmission theory that rely on direct instruction

So, What Does the Research Show?

One of the most cited studies on direct instruction is "Project Follow Through." Project Follow Through was a large-scale, federally funded, multi-site comparative evaluation conducted in the United States to examine the effectiveness of competing instructional models serving disadvantaged students in early elementary grades. Implemented across hundreds of sites beginning in the late 1960s, the study compared models such as Direct Instruction, Open Education, and language-experience approaches using common outcome measures in basic skills, cognitive skills, and affective domains. Results consistently showed that Direct Instruction outperformed all other models across all three outcome categories, including measures of basic academic skills, higher-order cognitive performance, and student self-esteem—a pattern that sharply contradicted prevailing pedagogical assumptions at the time (Watkins, 1997). A major strength of Project Follow Through lies in its scale, longitudinal design, and real-world implementation, providing replicated evidence across diverse contexts rather than controlled laboratory conditions. However, limitations include the absence of modern meta-analytic techniques (e.g., effect-size aggregation and variance weighting), uneven implementation fidelity across sites, and political interference that complicated dissemination and interpretation of results. Despite these weaknesses, Project Follow Through remains one of the most consequential bodies of evidence in instructional research, offering unusually robust comparative data demonstrating the effectiveness of explicit, systematic instruction relative to less structured approaches.

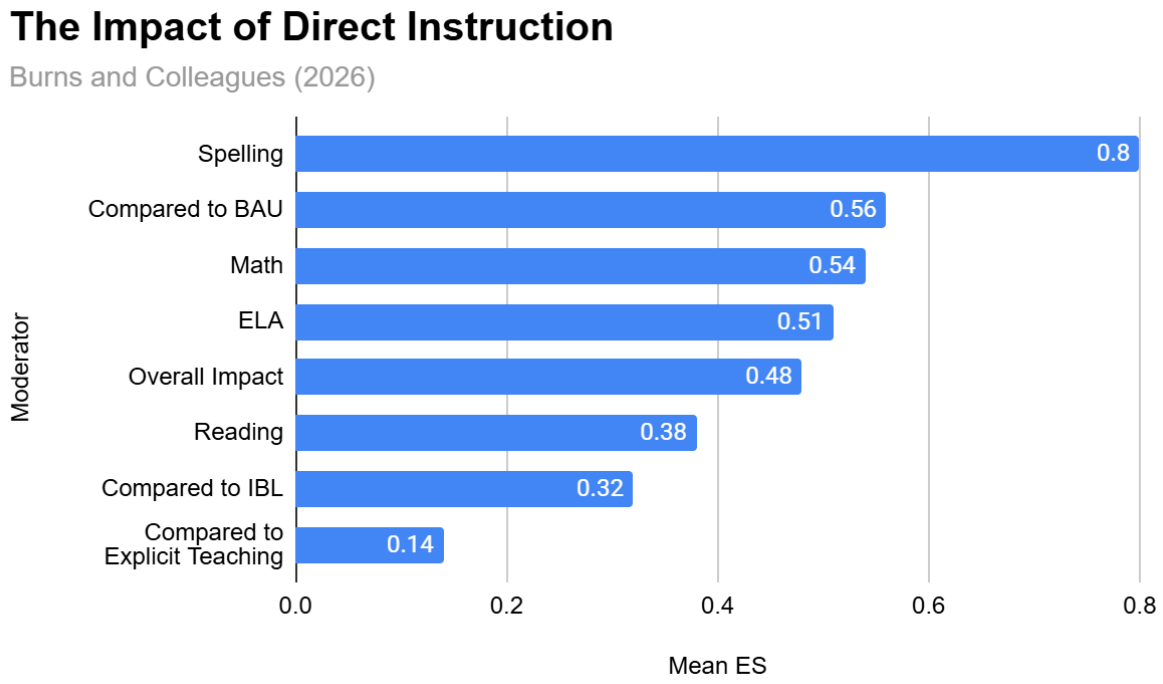
In 2002, Scott Baker conducted a meta-analysis on the impact of explicit instruction for low achieving Math students. He examined 4 rigorous studies and found a mean effect size of .58. In 2009, Russel Gersten, David Chard, Madhavi Jayanth, Scott Baker, Paul Morphy, and Jonathan Flojo conducted a meta-analysis on the

impact of explicit Math instruction for students with learning disabilities. They found a statistically significant mean effect size of 1.22. The meta-analysis included 11 Math studies and had a relatively strict inclusion criterion.

In 2018, Stockard, Jean & Wood, Timothy & Coughlin, Cristy & Khoury, Caitlin conducted a meta-analysis of 70 rigorous studies on the impact of Direct Instruction programs. The study found a mean effect size of .55. Stockard's meta-analysis drew both heavy praise and heavy criticism. It was the largest and most modern meta-analysis of Direct Instruction. However, it included single group studies, which inflates effect sizes (Plonsky & Oswald, 2014). In 2026 Mat Burns, Florence Bason, Concepcion Moncada-Cummings, and Gabriella Arfaras re-analyzed the 2018 Stockard paper and published their results in the Journal of Remedial and Special Education.

The re-analysis removed all single group studies and not only analyzed the overall effect of direct instruction but analyzed it against specific comparators. They found a mean effect size of .48 overall. When Direct Instruction was compared to business-as-usual instruction the effect size increased to .56. When it was compared directly to inquiry-based learning style instruction, the effect size dropped to .32, but was still significant. Direct Instruction also outperformed unscripted explicit instruction overall; however, when broken down into specific subject subsets, those particular comparative findings were not statistically significant for math or reading individually.

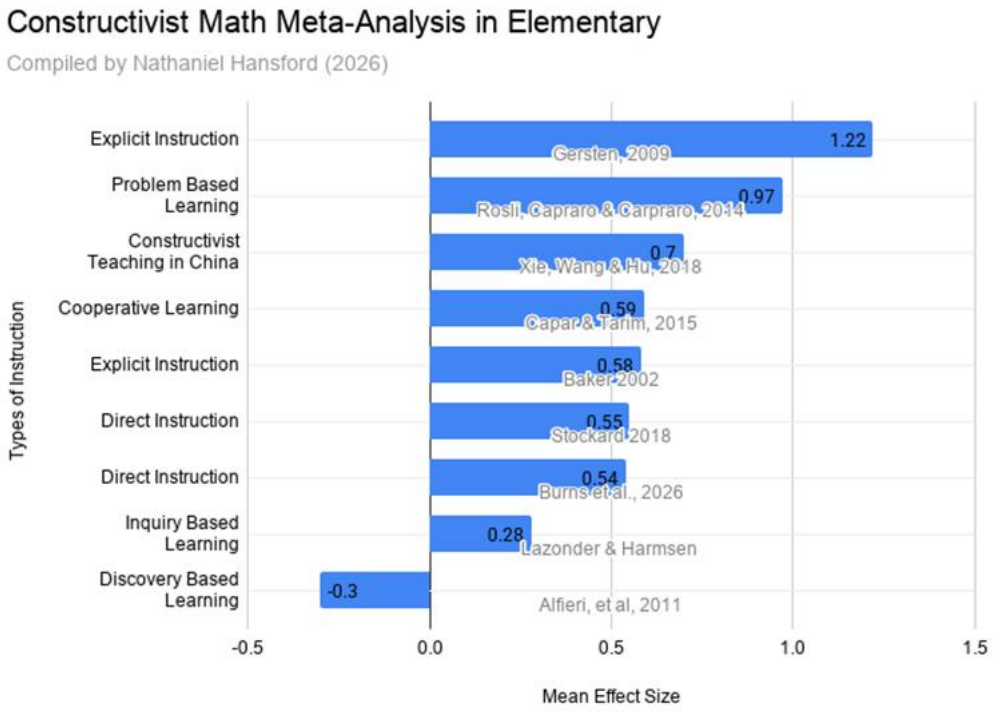
Figure 6.1 Burns and Colleagues Secondary Meta-Analysis Results



In summary, across these four meta-analyses of explicit instruction, the unweighted mean effect size is 0.72 (ranging from 0.48 to 1.22 depending on student population and program type). In comparison, meta-analyses on inquiry-based instruction have shown a mean effect size of 0.28 for math outcomes, and discovery-based instruction yielded a mean effect size of –0.30, as can be seen in Figure 6.2. Comparing the results of Direct and Inquiry Based Instruction, there is clearly a trend where explicit or direct instruction outperforms inquiry-based learning or discovery-based learning. Indeed, while explicit instruction led to the largest effect sizes, inquiry-based learning and discovery-based learning led to the lowest effect sizes. Moreover, while effect sizes were high for problem-based learning, one of these meta-analyses did not exclude case studies (which

dramatically inflates results) and the other was on advanced Chinese Math students. Neither of these meta-analyses should be used to influence primary Math instruction in the United States or Canada. Moreover, as pointed out in the previous article, both Xie, Wang & Hu (2018) and Lazonder & Harmsen (2016) showed that the more explicit instruction was provided within inquiry-based learning, the larger the effect sizes were found. Perhaps most importantly, the only meta-analysis that ever directly compared Direct Instruction with inquiry based methods, showed a statistically significant benefit for direct instruction.

Figure 6.2 Comparing constructivist and explicit instruction meta-analyses



Source: *Original*

Putting this Into Practice:

None of this is to say that there is never a place for discovery or inquiry in a Math class. However, research does consistently show that more explicit instruction outperforms less explicit instruction, especially for students with weak Math skills.

In my experience, constructivist approaches to mathematics instruction have often emphasized large, situational problems while providing minimal explicit scaffolding. The underlying assumption appears to be that open-ended tasks, by their very nature, cultivate critical thinking, creativity, and a genuine enjoyment of mathematics. This logic closely parallels the balanced literacy movement (Pressley et al., 2002), which prioritized comprehension strategies while downplaying the systematic development of reading accuracy and fluency.

The flaw in this reasoning is not the value placed on higher-order thinking, but the assumption that such thinking can be reliably developed without first establishing foundational knowledge and skills. It is akin to arguing that the upper floor of a house is what truly matters, while neglecting to build a solid foundation. Paradoxically, explicitly teaching the component knowledge and procedures required for complex problem solving is far more likely to enhance students' abilities to engage successfully with those problems than simply presenting the end goal and expecting understanding to emerge organically.

I have worked in schools where this constructivist approach was pushed. When the entire focus becomes application questions, without the adequate development of proficient Math fluency, the majority of students ironically become disengaged. Because the problems are too challenging and the scaffolding is not sufficient, often 2-3 students solve the problem for the class, while the rest of the students sit and pretend to work. In my opinion, these forms of more open-ended instruction are far more effective after the foundational knowledge is acquired. The more knowledge of a topic students have, the better equipped they are to solve complex related application questions. And this perspective is supported by the research. As pointed out in the previous article (Xie, Wang & Hu, 2018), studies where inquiry-based learning was effective tend to be for older, more advanced students.

Key Points:

1) Direct Instruction refers to a scripted and explicit teaching method
2) Direct instruction refers to non-scripted explicit teaching
3. All meta-analyses evaluating Direct Instruction and explicit instruction report positive mean effect sizes on student achievement
4. Across comparative studies, instructional models with greater teacher guidance consistently yield higher academic achievement than less explicit or unstructured methods
5) Constructivism is a learning theory, not a pedagogy; however, it has influenced teaching methods
6) Constructivist teaching is most associated with less explicit teaching
7) Most meta-analyses on constructivist teaching methods seem to imply that the less explicit the instruction, the lower the academic achievement
8) Constructivist teaching methods can increase student motivation

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