The 5E Instructional Model: An Evidence Gap Map Analysis

The Engagement, Exploration, Explanation, Elaboration, and Evaluation (5E) instructional model was introduced in 1990 (Bybee & Landes, 1990) and educators use it extensively (Bybee et al., 2006). Researchers also developed two variants of the 5E model: the 3E model, which includes only the Explore, Explain, and Elaborate phases, and the 7E model, which includes the 5E plus Elicit and Extend phases. We completed a comprehensive, rigorous systematic review and meta-analysis of randomized controlled trials (RCTs) that tested the effects of the 3E, 5E, and 7E curricular interventions in K–12 school settings on science, math, and motivation outcomes (Austin et al., 2023).

Across the 61 studies (representing 156 effect sizes) identified, we found the 3E/5E/7E models were effective at increasing students' science achievement (average effect size [*g*] = 0.87 standard deviation units), math achievement (*g* = 0.70) and motivation (*g* = 0.24). Translating these effect sizes to the What Works Clearinghouse's Improvement Index, a member of the control group who received 3E/5E/7E instruction could expect to improve their science domain percentile rank by 29 percentile points and could expect to improve in math and motivation by 26 points and 10 points, respectively.

The purpose of this brief is to illustrate the number and focus of the evaluations conducted to date on the 3E/5E/7E instructional models using evidence gap maps (EGMs). An EGM is a visual representation of the studies included in a systematic review, typically displayed as a grid (Polanin et al., 2023). We used a freely available browser-based shiny app to create the initial EGMs (MOSAIC, 2022).

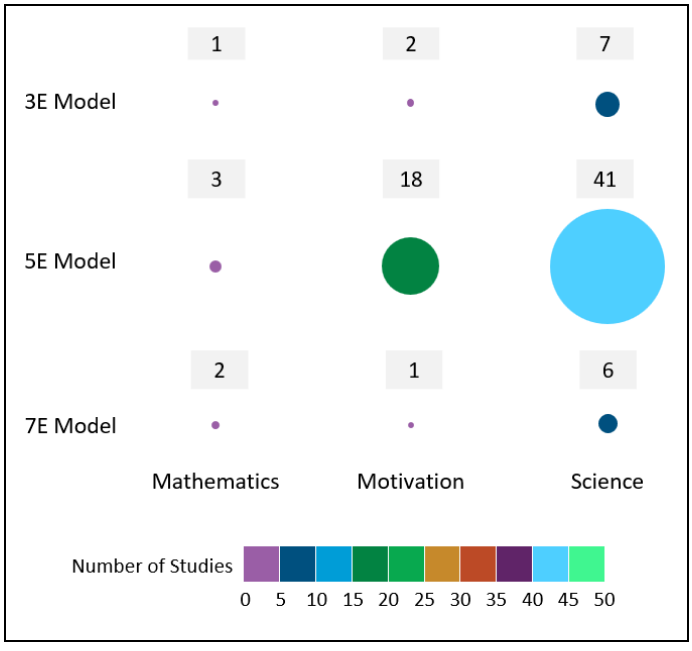

Figure 1. EGM of Instructional Model by Outcome

Evidence Gap Map Analysis

The EGM in Figure 1 depicts the number of studies of 3E, 5E, and 7E models that have been conducted focusing on each outcome domain. Most RCTs have tested outcomes of the 5E model in the science domain: 54 of our 61 identified RCT studies examined science outcomes; among those, 41 (76%) tested the 5E model. Of the 21 RCTs that measured motivation and six RCTs that measured mathematics outcomes, most tested the 5E model (84% and 50%, respectively).[1]

Figure 2 presents an EGM of the evidence in each outcome domain by the country in which the study took place. More than half (52%) of

[1] Some studies examined outcomes in more than one domain, so the numbers in Figures 1 and 2 total more than 61.

the 54 evaluations that examined science outcomes took place in Turkey (k = 28); countries other than the United States or Turkey provided nearly one third of the studies in the science outcome domain (31%). Most studies that examined motivation also took place in Turkey. Notably, no studies from the United States or Turkey tested the 3E/5E/7E models on mathematics outcomes.

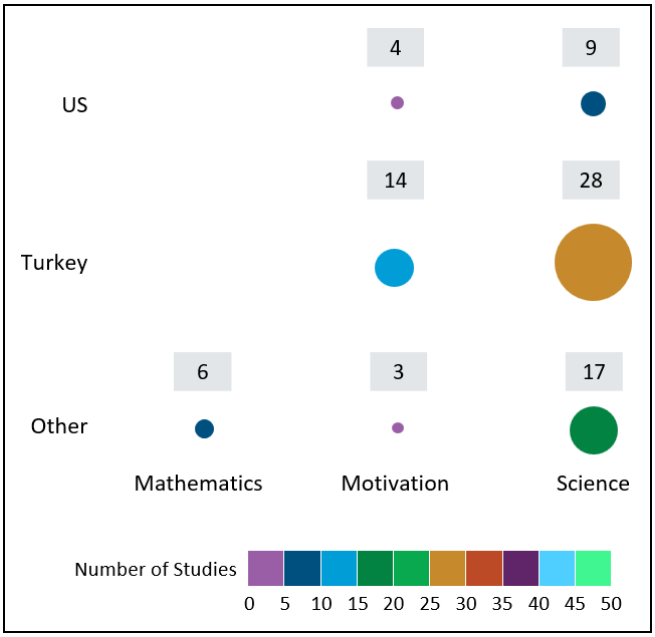

Figure 2. EGM of Country by Outcome Domain

Our final EGM (Figure 3) presents evidence on specific measures within the science outcome domain—critical thinking, general achievement, life science, and physical science—by the grade level studied (K–5, 6–8, or 9–12).[2] Of the 54 RCTs of 3E/5E/7E models in the science outcome domain, 30 examined physical science outcomes; of those, 20 (67%) tested the model with students in Grades 9–12. No RCTs have tested the effect of the 3E/5E/7E instructional models on general science achievement in Grades 9–12.

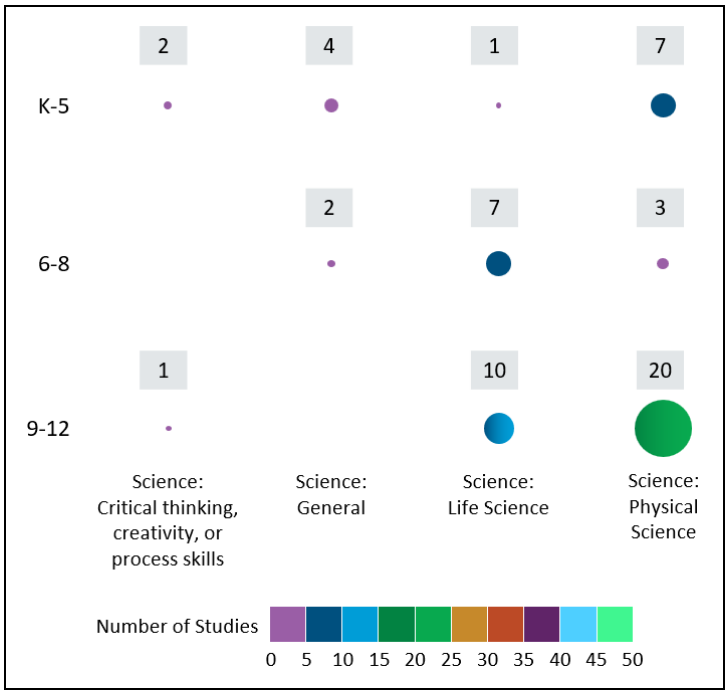

Figure 3. EGM of Grade Level by Science Outcome Measure

Conclusion

Moving forward, researchers should seek to expand the countries, grade levels, and STEM domains in which they test the 3E/5E/7E instructional models. Specifically, researchers should conduct more RCTs focused on science in countries outside the United States and Turkey, as well as with students in Grades K–8 and students studying life or general science. Researchers should also examine science critical thinking and applications of the 3E/5E/7E models in other STEM domains, including mathematics.

[2] We do not display detailed motivation and mathematics outcome domains because most studies in those domains (71% and 50%, respectively) were in Grades 9–12.

References

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