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BOOK REVIEW

Building Thinking Classrooms in Mathematics, Grades K-12: 14 Teaching Practices for Enhancing Learning[*] by Peter Liljedahl (2020)

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Abstract

Building Thinking Classrooms in Mathematics, Grades K-12: 14 Teaching Practices for Enhancing Learning is Liljedahl's latest book that cumulated his long-term research project. He provides concrete advice on each of 14 research-based teaching practices, along with answers to frequently asked questions and suggestions for getting started, which will help you build your thinking classroom.

Keywords Teaching practices, Student learning

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I. INTRODUCTION

When most teachers think of teaching math lessons, they think of reciting formulas, taking notes from the board, and working from textbooks. That is, after all, how most mathematical learnings took place for many years; however, with a shift from passive to active learning in schools, many teachers are seeking more ways to engage students in math. They no longer accept that someone is "bad" at the subject—instead, they try to help students to enjoy the subject and to promote students' mathematical thinking and understanding. But is it possible, or is it an unrealistic theory? How can teachers develop their students' thinking skills whilst covering a vast curriculum and accommodating students' different abilities and needs, all within a constricted time frame?

It was to answer questions like these that Peter Liljedahl embarked on a research project to investigate mathematical teaching and learning in schools. His research across over forty different schools showed most teachers (even the "good" ones) were planning their lessons on the assumption that students could not—or would not—think for themselves, and so were not providing tasks that would encourage them to do so (Liljedahl & Allen, 2013; Liljedahl, 2016, 2017).

Liljedahl's long-term research project culminated in his latest book, *Building Thinking Classrooms in Mathematics, Grades K-12: 14 Teaching Practices for Enhancing Learning*. His work provides an insight into how most teachers currently teach math, how students respond to this, and how teachers can change it for the better by developing "thinking classrooms" (Liljedahl, 2020). His basic premise is that learning doesn't happen without thinking, but much of what teachers do in schools promotes non-thinking. This is a big claim, and he takes it in two parts: students spend a lot of time not thinking in school, and much of what is typical in schools promotes non-thinking.

II. 14 TEACHING PRACTICES AND 4 SEQUENTIAL TOOLKITS

The book was organized around 14 chapters/core teaching practices to build thinking classroom: 1. What are the types of tasks we use?; 2. How we form collaborative groups; 3. Where students work; 4. How we arrange the furniture in our classroom; 5. How we answer questions; 6. When, where, and how tasks are given; 7. What homework looks like; 8. How we foster student autonomy; 9. How we use hints and extensions; 10. How we consolidate a lesson; 11. How we give notes; 12. What we choose to evaluate; 13. How we use formative assessment; 14. How we grade. Each chapter starts with a teacher's likely goals and a comparison to student goals and ends with a summary of the main points in the form of macro and micro moves and a series of questions to think about. Throughout the chapters, I found myself in the narrative of each giving me insight into my teaching. For example, if teachers want their students to think, they need to give them something to think about — something that will not only require thinking but also encourage thinking. In mathematics, this comes in the form of a task, and having the right task is important.

Liljedahl brings these into some alignment in Chapter 1. When first starting to build a thinking classroom, it is important that thinking tasks are highly engaging non-curricular tasks. As the culture of thinking begins to develop, teachers transition to using curriculum tasks. The goal of thinking classrooms is not to get students to think about engaging with non-curricular tasks day in and day out — that turns out to be rather easy. Rather, the goal is to get more students thinking, and thinking for longer periods, within the context of the curriculum, which leads to longer and deeper learning.

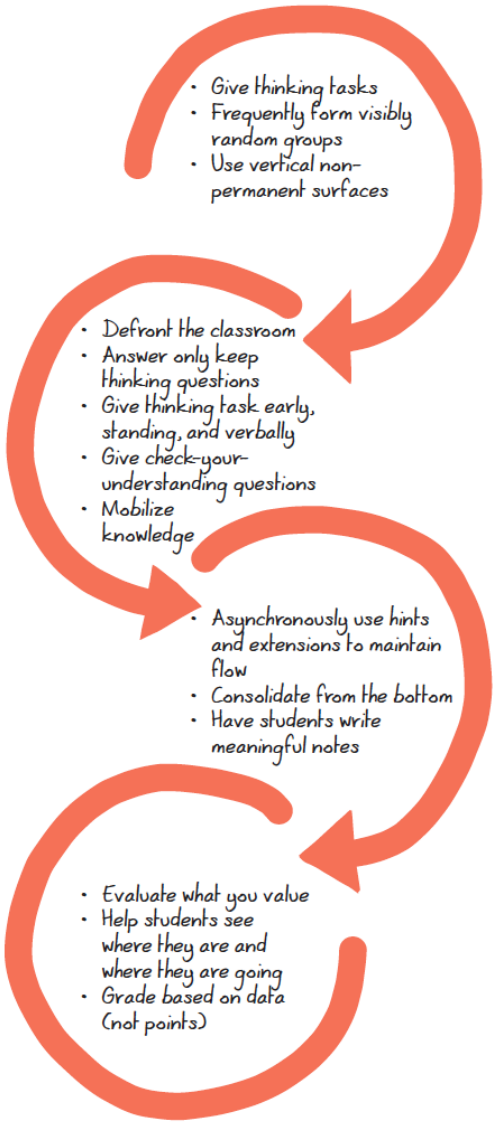

Figure 1. The Building Thinking Classroom Toolkits (Liljedahl, 2020)

Liljedahl grouped the 14 teaching practices into 4 sequential stages. These stages are called toolkits in Chapter 15. Typical day-to-day practice will involve worthwhile tasks, structuring the classroom environment, and formative assessment. These activities comprise the first, three toolkits. The final, fourth toolkit is characterized by practices that bring both teacher and students closer to an assessment of learning.

- Toolkit 1 implementation typically involves the use of worthwhile/rich mathematical tasks, vertical non-permanent surfaces, and visibly random groups.
- Toolkit 2 is comprised of giving verbal instructions, de-fronting the classroom, answering students only with keep-thinking questions, students creating meaningful notes, and building student autonomy.
- Toolkit 3 involves the use of hints and extensions to manage the flow (or state of optimal learning), leveling to the bottom, and students completing check your understanding questions.
- Toolkit 4 involves the teacher communicating where students are in relation to learning goals, evaluating what is being valued, and reporting out on data (as opposed to points).

III. CONCLUSION

To promote students' mathematical thinking, first, students must experience productive struggle to develop mathematical thinking skills and a deeper and more last understanding (Meyer, 2010; Kapur & Bielaczyc, 2012). They must wrestle with exciting problems and persist through challenges. Productive struggle asks students to truly think, to employ mathematical habits of mind (Cuoco, Goldenberg, & Mark, 2010), and not to merely mimic mathematical procedures. My first suggestion is to try to create, adapt, and/or find the daily thinking tasks for lessons, and the goal is always to provide the correct level of challenge so that any struggle would indeed be productive.

Second, Liljedahl's focus is on using problem-solving questions to promote logical reasoning and independent thought. He advocates that students should be able to justify their answers, thereby telling both themselves and the teacher what they already know, and what they have yet to learn. He also emphasizes the importance of teaching students that perfection is not the goal and that failing is a part of thinking and learning that should be celebrated and built upon. My second suggestion is to keep the following quote in their mind:

> "Problem-solving is a messy, non-linear, and idiosyncratic process. Students will get stuck. They will think. And they will get unstuck. And when they do, they will learn—they will learn about mathematics, they will learn about themselves, and they will learn how to think," (Liljedahl, 2020, p. 20).

Last, Liljedahl´s research journey is described in detail in the book, including him discussing the stumbling blocks he encountered along the way. This is incredibly useful in proving to teachers that they, too, can implement "optimal thinking practices" in their own settings, tweaking and adapting the strategies until they find the right fit both for themselves and their students. My last suggestion is to develop teachers' own action research projects. For example, the book offers many "non-curricular thinking tasks", which promote mathematical thinking and engagement, but are not always connected to state content standards. Liljedahl only offers a few examples of "curricular thinking tasks" that directly relate to concepts teachers are required to teach. Teachers could develop a research project that includes "curricular thinking tasks." Here is an example of the research question. *How can teachers use "curricular thinking tasks" to enhance students' mathematical thinking, engagement, and math attitudes?*

Overall, I agree with Liljedahl that thinking classrooms are an essential part of all learning, and are one of the ways forward for education; therefore, I highly recommend every teacher to explore the book, regardless of age group.

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