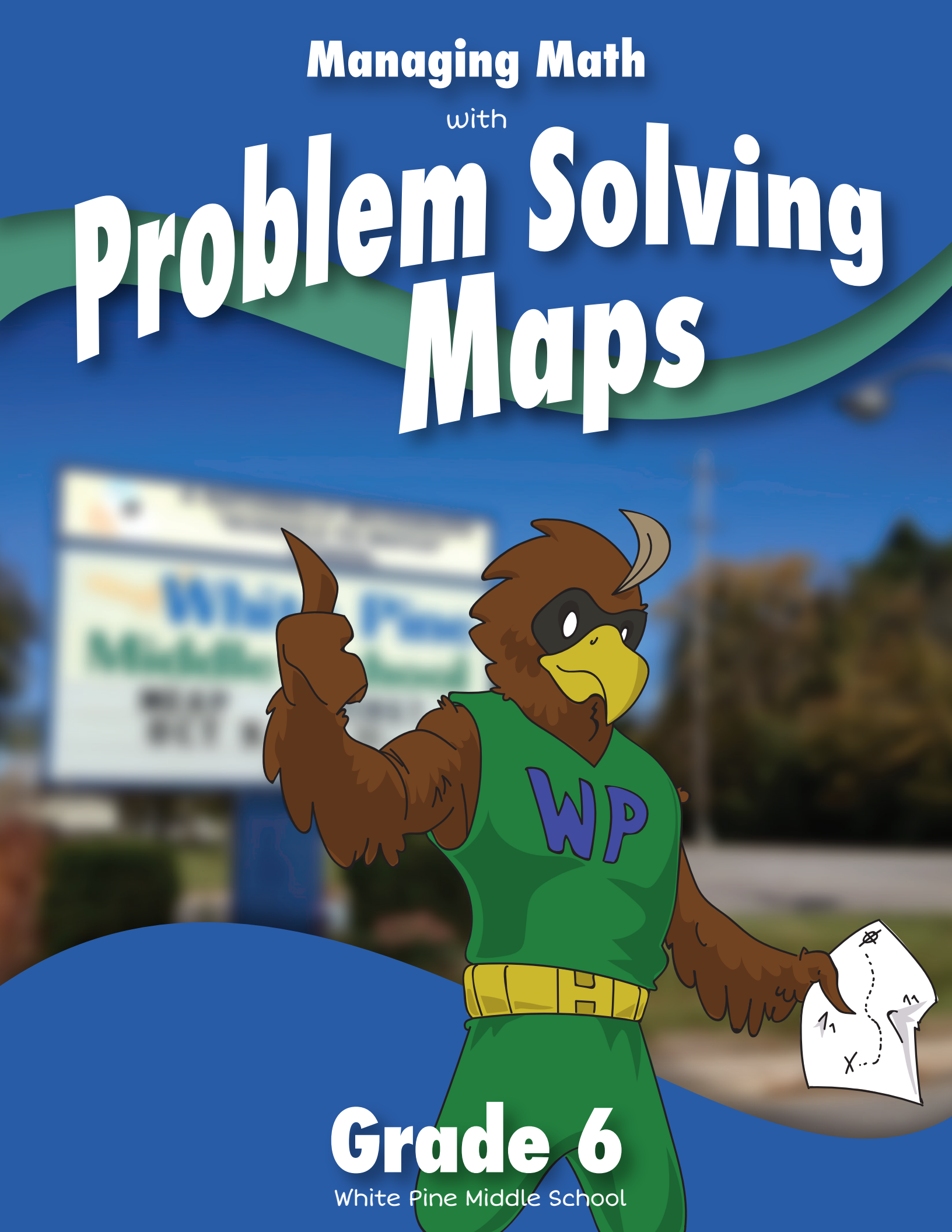
Managing Math

with

Problem Solving Maps



Grade 6

White Pine Middle School

Foreword from the Creator of Problem Solving Maps

The need for a better math education is clear. With the ever increasing advancement in technology and the tighter integration of the global economy, relevant social and business problems have become more complex. Industries which require technology and science-based solutions are becoming the engine fueling countries' growth. Math offers a rigorous and systematic process to improve problem-solving skills, which are useful not only for the highly complex but also for many daily life decisions.

With the digital revolution in place, we are not experiencing a lack of information, but quite the opposite. With a simple click, teachers have access to a variety of free resources, including teaching materials, instructional videos, learning software and tutoring services. Large book publishers continuously push new textbooks and supporting materials, along with training programs and standardized testing aids. In academia, researchers spend a considerable amount of time searching for better approaches to teaching math. Yet, in spite of an abundance of teaching and learning resources, success is still very limited.

During my years as a teacher, I have heard students repeatedly express the same reservations and problems about learning quantitative subjects. Common obstacles usually mentioned include: "these problems look so overwhelming, I don't even know where to start," "there are so many variables and formulas and I don't know how all these things relate," "I'm not good at math" and "when the teacher does it on the board, it looks so easy but when I try I get confused."

I kept advising students that an effective method to improve their problem-solving skills is to focus on working one step at a time. Otherwise, problems seem insurmountable and confusing. The advice seldom resulted in any tangible improvements, which made it clear that new learning tools were needed.

That changed in 2001. In my business statistics class, I started drawing diagrams on the board, depicting each step in independent boxes with brief instructions and spaces to work on. Steps were then connected using arrows. Boxes without any arrows coming into them represent data you need to find in order to start solving the problem. Once the initial data have been determined, the rest of the boxes are steps to complete the problem.

That simple process brought several advantages. The diagrams broke down math problems into manageable parts so students can focus on solving portions of a procedure, rather than getting overwhelmed with the whole problem. Being able to solve a small portion of the problem gave students self-confidence to go to the next step and so on. In addition, I could use the diagrams to diagnose students' weaknesses. Since problems are broken down into steps, I was able to pinpoint where students were having difficulties understanding the material. Finally, students have much better notes. After completing one diagram, students have a clear example of how a problem is to be worked and can easily refer back to it.

I was curious to see if the process could be used for other math subjects so I started helping my two daughters, Denise and Jessica, which at that

time were in elementary school. I quickly realized that the type of diagram from my statistics class was insufficient to learning the foundation of math. Building on the knowledge from my class and through trial and error with my daughters and other teachers, I incorporated two more diagrams. The complete set includes: 1) Example-Conclusion Map, (2) Multi-Rule Map and 3) Math-Breaker Map.

In 2010, I presented the final system, which I named Problem Solving Maps (PSM), in a conference in Peru. The reason I called them maps is because they provide a pathway towards finding a solution. After my presentation, I was approached by the principal of a private school in Mexico who wanted me to train all her teachers. I did that via Skype and that became the first school using PSM. After that, many other teachers have been trained in Poland, Philippines, Netherlands, Nicaragua, Mexico, Peru and the USA and the list keep growing.

After all these years, I have the hypothesis that by learning a large variety of math topics with the same set of Maps, students eventually see the patterns and use the same process to learn and solve other math problems. In other words, students will develop important thinking processes. With the Example-Conclusion Map, students develop inductive thinking abilities which will allow them to eventually see a generic pattern in how to solve complete problems. The Multi-Rule Map promotes deductive thinking by looking at how to apply generic rules to specific problems. The Math-Breaker Map teaches students to analyze problems by systematically breaking it down into steps, a skill that is important for math and for any projects students embark in their life.

What is interesting is that the PSM methodology is not very sophisticated. It does not require purchasing fancy software or taking a long training program. It is not a new curriculum with changes in the material teachers currently used to teach their classes. In fact, the process is very simple but requires viewing the purpose of learning math in a different light. It is not about what to teach but HOW to teach math. PSM is generic enough that it can be used to teach a large variety of math topics. Hope you enjoy this workbook created by teachers in White Pine Middle School.

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P.S. Denise is currently doing a Ph.D. in Molecular and Cellular Biology at Harvard University and Jessica is studying Industrial and Operations Engineering at the University of Michigan.