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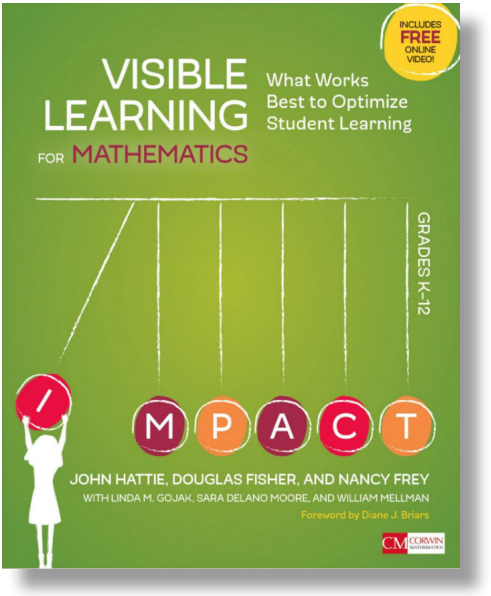
John Hattie, Douglas Fisher and Nancy Frey, *Visible Learning for Mathematics: Grades K-12: What Works Best to Optimize Student Learning*, Corwin Mathematics: 2017; 269 pp.: ISBN: 9781506362946

Reviewed by Monika Zupančič[1]



This book is devoted to the question of how mathematics teachers can make learning visible (evident) to students and to themselves. The content is divided into seven chapters and is supported throughout the book by practical examples that can be applied to mathematics teaching. In addition, each chapter includes QR codes that link to online videos (23 in total, throughout the book). The videos are a mixture of clips from real mathematics lessons and comments from teachers about the structure of the lessons or the methods used. In the videos, we meet seven teachers who teach mathematics from kindergarten through twelfth grade. In addition to the videos, readers have access to some online materials ('reproducibles') consisting of templates, checklists, rubrics, and similar, that teachers can use in their lessons. Each of the seven chapters concludes with a summary, while questions for reflection and discussion guide readers to focus on the key concepts described in each chapter for their teaching.

The first chapter forms the basis for all the following chapters. One of the main themes in this book is 'knowing *what* strategies to implement *when* for maximum impact' (p. 26). The authors call this *precision teaching*. Based on 800 meta-analyses involving more than 250 million students, the co-author of this book John Hattie in his books *Visible Learning* (2009) and *Visible Learning*

1 Faculty of Education, University of Ljubljana, Slovenia; monika.zupancic@pef.uni-lj.si.

for Teachers (2012) studied the effect size of 150 'influences (instructional strategies, ideas, or tools) that we use in school' (p. 20). He found that most (95%) of the influences studied have a positive effect. He defines an effect value of .40 as a key point: the influences studied that have a value greater than .40 fall into the so-called *zone of desired effects*, and it is these on which this book focuses. The chapter concludes with a categorisation of three types of learning: surface, deep, and transfer, and with a brief description of each type and an explanation of the relationship between them. Claiming that *surface learning* (understanding of concepts, skills, and vocabulary) builds on prior knowledge, the linking of multiple concepts, and the application of these links to procedural skills leads to the level of *deep learning*, which serves as an important foundation for *transfer learning* when understanding of concepts and acquired procedural skills are applied to new contexts. Each of the phases of learning is discussed later in separate chapters. In reading this book, the reader may recall a similar (but in some respects different) classification by Brown (1978).

In the second chapter, the authors assert that visible learning begins with *teacher clarity*. They spend most of their time explaining how teachers can achieve this by setting learning intentions ('what students are expected to learn') and success criteria ('what success looks like when the learning goal is reached') (p. 39). When explaining why learning intentions are important and how to set them, they mention that it is also important to communicate them to students. Then they highlight an interesting idea: teachers take the part about communicating learning intentions more seriously when it is presented as 'students have a right to know what they're supposed to learn, and why they're supposed to learn it' (p. 43). This is an interesting and potential pointer to further debate. The chapter continues with a section on how learning intentions should be linked to prior knowledge and how they can be formulated to invite students to engage in the learning process. Special attention is given to two types of learning intentions: language and social. The reader will later notice that these two topics are well represented in this book as the authors write about communication, mathematical language, collaboration, and related topics. They point out that there are fewer and more appropriate ways to frame the statements for the success criteria. Success criteria that are too general, such as 'I work hard' or 'I can do math', do not have much impact. Instead, the authors suggest that statements should be specific and focus on an achievement in the near future. To this end, they offer some advice and examples of good success criteria and suggest that teachers involve students in the process of establishing these criteria.

The third chapter focuses on guiding the learning process through a mathematical task and a conversation. These two themes are also found in

Chapters Four through Six when applied specifically to each phase of learning. In the first part of the chapter, the authors emphasise that teachers need to be careful about what kind of tasks they choose and when they present them to students to help them move from surface to deep learning and then to transfer learning. They distinguish between exercises and problems, advocate spaced practice over massed practice, and stress the importance of introducing real-world problems at the beginning of the learning process rather than at the end. Believing that increasing the quantity of student work cannot be as beneficial as preparing high-quality and varied tasks, they help teachers distinguish between complexity and difficulty. Thus, they present task types that address student fluency (low-difficulty, low-complexity tasks), strategic thinking (low-difficulty, high-complexity tasks), stamina (high-difficulty, low-complexity tasks), and expertise (high-difficulty, high-complexity tasks). The second part, devoted to mathematical talk, begins with a discussion of classroom discourse and how it can be supported. The authors devote considerable attention to asking questions, noting the importance of framing questions in a way that leaves room for students' thinking and allows them to do the cognitive work. They conclude the subchapter on questions with the suggestion to help students ask themselves questions when they get stuck, as this helps them become more independent.

The fourth chapter is devoted to equipping teachers with information, techniques, and examples to promote *surface learning* in their mathematics classrooms. They point out that the word surface might evoke a negative connotation in some people, and attempt to distinguish this from the meaning of *surface learning*, which is a fundamental part of learning as it equips learners with tools for future action and learning. The rest of the chapter is divided into two larger parts. In the first part, the authors introduce four different types of mathematical talk (number talk, guided questions, worked examples, and direct instruction) that are helpful for students in the *surface learning* phase. All sections presenting the four types of mathematical talk include an example of an activity or a QR code to an online video on the topic (sometimes both). This adds immeasurably to the value of this book by giving readers the knowledge, illustration, and motivation to apply the practices presented in their classrooms. In the second part of the chapter, they describe several effective teaching practices that promote *surface learning*, such as vocabulary instruction, manipulatives for *surface learning*, spaced practice with feedback, and mnemonics. The authors devote most of their writing to teaching practices, which include vocabulary instruction. They encourage readers to be intentional about helping their students build their academic language.

Chapter Five is, in our opinion, the most comprehensive of all. Its content relates to the *deep learning* phase. The authors write about the nature of *deep learning* and highlight the core meaning of *deep learning* – making connections between ideas. They emphasise the importance of discourse (which is more than just discussion) as it provides an opportunity to express agreement or disagreement in different ways. As in Chapter Four, the authors give advice on choosing a mathematical task that will challenge students in the *deep learning* phase. They emphasise the importance of students' *surface learning* to the success of this learning phase, but they do not stop there. They argue that successful *deep learning* requires more than just offering students the right task. One of the ways to support student learning in the *deep learning* phase is through accountable talk – 'a set of expectations for students that is supported through the use of language frames that scaffold the use of language to explore a topic' (p. 144). They provide insight into how accountable talk is achieved by using pre-established language frames that teachers and students can use to ask for clarification, request justification, challenge misconceptions, and similar The authors provide advice on how teachers can motivate their students to use accountable talk in their communication in mathematics classrooms but point out that the responsibility lies first with the teachers themselves, who must practice accountable talk in their communication with students. Next, the chapter looks at the use of accountable talk in small groups and in the whole class. The chapter continues with a debate about when to put students in a small group to organise their work together, how to group them, how to support collaborative learning in groups on the one hand, and how to promote student accountability on the other. It continues with a section on whole-class collaboration that focuses on whole-class discourse when to use it and how to support it.

The sixth chapter is devoted to *transfer learning*. The authors point out that the goal of teaching should be that students can transfer their knowledge to new contexts and eventually become independent learners. They further argue that if teachers are to achieve this goal, they must provide students with tools to assist them in this process. They suggest that helping students develop their metacognitive skills would impact their independence as they begin to monitor and regulate their learning process. They develop this idea further in two sub-chapters, discussing why self-questioning and self-reflection are critical metacognitive techniques and how to help students develop them. The chapter concludes with a description of how to help students transfer and connect their mathematical understanding. One suggested way for students to develop connections in their understanding is to tutor younger students. They argue that

tutors need to organise and understand their own thinking when explaining, which helps them improve as learners.

The final chapter focuses on properly using formative and summative evaluation to provide feedback to students and teachers. The authors present several ways teachers can check students' understanding and provide feedback that can vary in timing, amount, type, and audience, and encourage teachers to cultivate a positive attitude toward student errors. Next, the authors highlight the importance of differentiation as a way teachers can address the needs of individuals. They describe three ways teachers can differentiate instruction (adjusting content, process, or product) but advise adjusting only one area at a time. They also present the RTI (Response to Intervention) model in detail, as it has been shown to have one of the most significant effect sizes (1.07). It ranks third out of 150 influences measured. One of the interesting emphases in this section is that teachers should provide interventions for high-achieving students because they sometimes have difficulty justifying why their answer is correct or because they tend to get bored. Although the authors highlight influences throughout the book that have a positive impact on student learning, they do not disappoint and also present some that do not work as well, such as grouping students by their ability or teaching students how to take a test. The book concludes with 'ten teacher mind frames that together summarize a great deal of the "what works" literature' (p. 199) which encourage teachers to collaborate with their colleagues and acknowledge learning as hard work (Hattie, 2012).

This book is relevant to target readers (mathematics teachers) both in terms of the topic chosen and the way it is written. It contains some very interesting ideas and themes (e.g., categorising learning into three phases, effect sizes for 150 influences, highlighting the importance of communication and mathematical talk) that offer the possibility to be elaborated upon at the college level, as professors of didactics could include them in their didactics courses for pre-service teachers.

We conclude that the book covers many different topics, supported with practical examples in the text or content from online videos that encourage the reader to reflect on them and put them into practice. There is a common theme throughout the book: how making learning visible can help students transfer their mathematical knowledge to new contexts and help them become independent as learners. One theme that we believe makes an essential contribution to the value of this book is the importance of using mathematical language in the process of teaching and learning mathematics. The content of this book, through teachers' reflection, represents a great opportunity to strengthen teachers' didactic knowledge and contribute to the quality of their teaching.

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