Chapter 14
A Guide to Professional Learning for Secondary Mathematics Teachers

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ABSTRACT
After implementing a professional learning program for mathematics teachers in grades five to twelve with success, this author is providing details as to how it was done and how others can do the same. Included is a literature review of relevant topics such as andragogy, brain research, self-efficacy, growth mindset, distributed leadership, and creating a professional learning community. Quantitative and qualitative research results from the author’s initial professional learning program is used to explain the reason for the suggestions made. The curriculum is divided into five sessions of approximately two hours each.

INTRODUCTION
Mathematics is a difficult subject to learn and to teach. In this researcher’s experiences teaching mathematics for the last forty years, it was found that most general professional development (now called professional learning) provided only bits and pieces that were applicable to mathematics teaching, and fellow secondary mathematics teachers concurred. Borko (2004) adds, “Despite recognition of its importance, the professional development currently available to teachers is woefully inadequate” (p. 3). Many teachers did not believe they gained enough from professional learning compared to all their time and effort. Borko (2004) suggests we remain optimistic, “Research provides evidence that intensive professional development programs can help teachers to increase their knowledge” (p. 5) but also states, “Professional development programs that include an explicit focus on subject matter can help teachers develop these powerful understandings” (p. 5). Graham (2007) concurs, “Results demonstrated that professional learning community activities – that comprised same-subject, same-grade teacher teams – had the potential to achieve significant improvements in teaching effectiveness” (p. 1).

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For this study, participants were involved in a professional learning program that was developed specifically for experienced secondary mathematics teachers and dealt exclusively with topics concerning secondary mathematics. The results from this study were used to develop the guide generated for this chapter and offer a plan for a new professional learning program for secondary mathematics teachers. David Sousa’s (2015) text, *How the Brain Learns Mathematics* offers the common understandings implemented in this chapter, and this training can be used to effectively offer the program either in person or online.

Secondary mathematics teachers have to fight the belief of many students thinking they cannot do mathematics (Boaler, 2016). Therefore, teachers of mathematics have to work hard to give students who struggle to learn mathematics the strategies and coping skills to grow their mindsets (Dweck, 2010). Mathematics teachers can help students who believed they would never be good in mathematics change their thinking. When teaching, “the aim is to get students to learn the skills of teaching themselves – to self-regulate their learning” (Hattie, 2009, p. 245). As students realize they can meet the challenge of figuring out mathematical connections, their mindset will become one of growth, providing them with a willingness to learn more mathematics (Dweck, 2010). An important component for students in learning mathematics is believing in themselves and feeling that they can learn mathematics. If students can convert how they think about learning mathematics into a growth mindset (Dweck, 2010), they will increase their self-efficacy (Bandura, 1997) to learn mathematics (Boaler, 2016). Thinking about how students learn mathematics is an important way to guide secondary mathematics teachers into thinking about more effective ways to help their students. Mathematics teachers understand ideas based on research and are more willing to use them, since that is what they were taught to do when studying mathematics.

The guide developed in this chapter contains two main sections. Section one is an explanation of the methodology used, based on the literature review, for each of three program themes: a. pedagogical theory and practice used, b. results of the research, and c. type of educational leadership needed as the professional learning is implemented. Section two gives suggested details of the curriculum for the new professional learning program, based on five sessions. There are sub-sections written about each of the three program themes and each of the five sessions of the professional learning program.

Based on a review of the literature, effective pedagogical theories and practices are used to describe the ideas behind how effective professional learning should be conducted. More specifically, since the professional learning program is dedicated to the instructional needs of the adult learner, andragogy, the pedagogy of adults, is used as the basis for the learning activities in the professional learning process. In addition, this chapter will explain how we can use information concerning how the brain learns in order to improve mathematics instruction. The results of this study were used to develop *A Guide to Professional Learning for Secondary Mathematics Teachers*, which will hopefully give mathematics teachers and their trainers a more effective professional development system.

The section for the research component includes a literature review of the theories of self-efficacy and growth mindset, explaining how these prompted this researcher to create the professional learning program as it is designed. The findings from the initial professional learning program are described in this chapter, and the feedback and data from participants are used to explain how this plan for a new professional learning program was influenced.

The educational leadership part brings it all together, describing how this research, as well as the work of others, drives the professional learning highlighted in this guide. The educational leadership component includes information obtained concerning making professional learning programs effective and creating a professional learning community as a result. For this professional learning program to instruct secondary mathematics educators, the facilitator (leader) must care about mathematics instruction.