

# Using Brain Teasers to Develop Confidence and Identity in Mathematics

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## **EXECUTIVE SUMMARY**

*This chapter describes an informal strategy—using brain teasers on a regular basis—that helps mathematics teachers motivate their students to solve problems. In addition, the use of brain teasers has been shown to develop students’ confidence in their mathematical abilities. It is a strategy that supports student critical thinking, persistence, and engagement, and it does not require a great amount of time and effort on the part of the teacher. In addition, brain teasers can be effectively used with students of all ages (pre-K through college graduates) and all ability levels. Once students believe in their mathematical abilities, they’ll be more likely to continue their studies in the important fields of mathematics and science.*

## **CASE DESCRIPTION**

This is a report of activities that have been conducted over a period of more than 40 years, which have been developed into an informal case study. I first began using brain teasers on a daily basis in my classes at the middle school level in a traditional public school district. When I began, they were used for extra credit; however, as I moved into higher grade levels, I found that I needed to make brain teasers more meaningful to students. At the university level, each semester I have made the brain teasers a graded component of the class. This will be explained in more detail later in the chapter. Initially, my reasons for using brain teasers were

to add fun to my classes. As time went on, I began to use them to develop skills in problem solving and creative and critical thinking. Now, I have discovered that the use of brain teasers can increase students' confidence (Williams & Ollerton, 2021) and mathematical identity along with being fun. Most recently, I can see that the way I have used brain teasers has also embedded mathematical affirmations and microaffirmations (D'Angelo et al., 2020) into my lessons.

This chapter is particularly important now because the use of brain teasers has not been studied in an educational setting. A few studies can be found where brain teasers were part of another program such as a summer camp (Gecu-Parmaksiz & Hughes, 2024) or as extra-curricular activities (Chuang et al., 2021), but none have been completed where the singular use of brain teasers was the topic of the research. While it's possible to find a few relevant studies in psychology, business, and medicine, no research studies have been done specifically on the use of brain teasers in education. After many years of using brain teasers, I have seen the power and benefits they hold, and I feel it's important to begin to formally study this strategy. In the United States the recent focus on mathematical identity, and inclusion (Hegedus & Penuel, 2008), along with the current focus on STEM research and mathematics confidence continue to point out the possibilities of mathematical progress if brain teasers are used. Unfortunately, many teachers don't use brain teasers in the classroom for a variety of reasons. This chapter is designed to suggest future research at the same time it tries to break down these teacher concerns about brain teasers and their use.

## **Settings and Context**

I began the use of brain teasers in middle school math classes in a suburban public school district in a large Midwestern city. Over the years, as I assumed different roles in that school district, I used brain teasers at almost all grades 3-12, as well as with gifted students. During those years, the district also changed, first to a suburban/urban district and then to an urban/suburban district. It is now considered an urban ring district. When I moved to the university setting, I continued to use brain teasers in mathematics and education classes at both the undergraduate and graduate levels. My university is an urban-serving university in the heart of the same Midwest city which means I have used brain teasers in diverse settings with diverse students. At the middle school level, I used brain teasers with 8<sup>th</sup> grade remedial and regular classes. At the high school level, I used them when teaching Algebra I and II, Consumer Math, and AP Calculus. At the university level, I used brain teasers in both mathematics and education classes at the undergraduate, graduate, and doctoral levels. In each setting I used brain teasers in a supplemental fashion.

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