## Reconnecting Theory and Hands-On Material Estimating

You may have heard construction workers, students, and even some technical trade educators say that the construction industry is mostly a hands-on industry. I find that this statement is rooted in misunderstanding. Surely "hands-on" tasks play an important role in our industry, but it is understanding theory that demonstrates how well you've mastered each hands-on task. Imagine having a job site team where every employee of the team is knowledgeable and understands the entire scope of the project from start to finish. It's possible if we can teach students to marry theory and hands-on skills to accomplish a project's outcomes!

### Innovative Strategy: Converting Feet to Inches

Many students entering into technical trades think they only need to develop measuring and cutting skills, but not their mathematic skills. In my research, I've discovered some reasons why some students have difficulties solving numeric equations. One is due to what is called "traditional inverted process." This issue stems from the fact that we were taught to read math questions from left to right, but to solve them from right to left.

The most basic, yet common, conversion in construction is feet to inches. Though we tend to rely on calculators to help us solve conversions, we might not always have one handy. Simply multiplying any length in feet by 12 converts the length into inches, but 12 times 12 is the largest multiplication problem most of us are taught memorize. If I task my students to take a large number, such as 34', and multiply it by 12", they immediately reach for their calculators. To easily solve a large multiplication problem without the use of a calculator, I like to use a strategy called "reverse learning order." This strategy helps students understand the entire length conversion process and also makes solving large multiplication easier because it teaches students how to read and solve math problems from left to right.

### *Beyond 12 x 12 = 144*

In order to determine how many inches are in 34', first have students close their eyes and visualize the equation 12 times 12. Then tell them the first 12 represents the length of something in feet that they need to convert into inches, represented by the second 12. Using reverse learning order to break down the answer, 144, shows students how to easily solve multiplication problems beyond 12 times 12 in order to convert feet into inches.

Add the first digit of the length in feet you are solving for to itself. In this case, we are solving for 12' so the first digit is 1. $1 + 1 = 2$.

Next, add that answer to the length in feet you are solving for, in this case 12. ($12 + 2 = 14$). The sum represents the first digit(s) of your converted length in inches.

Finally, add the second digit of the length in feet you are solving for to itself. In this case, we are solving for 12' so the second digit is 2. $2 + 2 = 4$. The sum represents the last digit(s) of your converted length in inches.
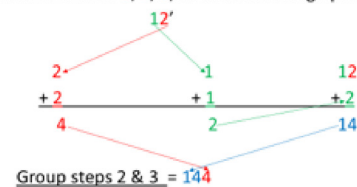
The end result is **144**.



*Figure 1.* Use colors and arrows during lesson demonstration

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