An interesting thing about this week's lab is the effect that observing a system ultimately has on the result of a measurement. This is similar to the Heisenberg Principle where there is an inverse relationship between the speed of a particle and its position. The act of measuring the voltage across a resistor can have an impact on the result we get and so we must be critical about how the tools we use interact with the systems we build.

The main idea behind the lab is that given a resistor R and a DMM with internal resistance Rint. Measuring the voltage across the resistor requires the DMM to not just be a passive observer but rather become part of the system. If Rint >> R then Req ≈ R. If, however, the Rint is closer in value to R then Req would be much less.
This has implications when we want to measure systems with resistances greater than the internal resistance of the DMM. If our DMM does not have a large input resistance then our voltage measurements would come out wrong.

With digital multimeters we can get accurate measurements because of their high input impedance of 10 M Ω (or higher) in comparison to the analog counterparts. Analog multimeters on the other hand may have an input impedance of 20kΩ / V. So if in a 20V range then the input impedance would be 400 kΩ. Having a high input impedance minimizes the circuit loading.

Overall when it comes to measuring systems it is important to realize that our measurements are approximations and that having a good understanding of how our tools interact with the systems helps us build better tools and also design better systems.

Sources:

[1]electronics notes, “Analogue vs Digital Multimeter» Electronics Notes,” *Electronics-notes.com*, 2025. https://www.electronics-notes.com/articles/test-methods/meters/analogue-vs-digital-multimeter.php