Importance of prior knowledge (theoretical framework)
The common analogy for education often shows the student as an empty vessel with the teacher filling their minds with knowledge; however, no matter what the student’s age or experience, they will bring prior knowledge and experience to the learning process. What students bring to the table may be perfectly suited for the course, it may be accurate but incomplete, it may be factually correct but just not relevant to the current topic, or it can be inaccurate. Based on this list it can be seen that a student’s prior knowledge can either help or hinder the learning process.

Regardless of the kind of prior knowledge a student has, it is vital that an instructor determine what that knowledge is. Armed with the understanding of a student’s prior knowledge a course or lesson can be tailored for maximum effectiveness. Accurate knowledge can be leveraged to act as a foundation, and inaccurate or inappropriate prior knowledge (misconceptions) can be targeted for correction.

Different levels/kinds of knowledge
Accurate, but insufficient -
In this situation, students have some portion of the knowledge needed for their assigned task, but not enough to support success. Since they recognize portions of the content, this can lead to overconfidence amongst the students (and instructor) about their ability to complete the assigned task. There are two main areas that student’s knowledge can be insufficient: Declarative knowledge (facts & definitions) and Procedural knowledge (how and/or when to do something, in other words using information).

Inappropriate -
Knowledge in this area is based on information that is factually correct, but is incorrect when applied to the current situation. This can often occur in a situation where a term has a particular meaning in common usage or in a specific field, but then has a different meaning in the new context. Another example results from the use of an analogy (or comparison) to explain something complex. In situations where that analogy no longer applies individuals can have difficulty separating from that description.

This misapplication of knowledge can also have considerable negative impacts when interacting with individuals from other cultural backgrounds. Our own cultural experiences and perspectives can often cause us to misinterpret the meaning or role of aspects of other cultures. This kind of inappropriate knowledge can have impacts both inside and outside of the classroom.

Inaccurate -
Whereas the previous two categories included knowledge that was in at least some ways correct, this category includes knowledge that is just flat out wrong. In some cases, individuals hold an isolated fact that is wrong, and these can be relatively easily addressed. A more difficult level of inaccurate knowledge involves misconceptions. This is knowledge that has become integrated into an individual’s worldview and has likely been reinforced over the years based on repeated inaccurate observations. These are not so simply corrected. For example, a common misconception in biology is that the mass of a tree comes from the soil. Students have a hard time breaking this misconception and understanding that so much mass could come from CO2 in the air.

Gauging prior knowledge -
There are a number of potential strategies for gauging a student’s prior knowledge, mostly based around some type of assessment quickly followed by the instructor evaluating the student responses.

1. Experience of others - An important place to begin, especially for new instructors, is to ask colleagues
about their experiences with student’s prior knowledge. This can be in regards to the course you are teaching, other courses at the same level and in prerequisite courses. Some of the following questions can be helpful in these regards: What do students struggle with? What is covered in the course? What are their learning objectives? How do students perform on “final” course assessments? What do students excel at? What do students never seem to get? Any misconceptions that they struggled with?

2. Pre-assessment - Many disciplines publish concept inventories that may help target your pre-assessment in a course, and often times these are designed as multiple choice question sets that could be used as the basis for a pre-test/quiz. An added benefit is that these concept inventories are often specifically designed to ask about common trouble spots and misconceptions. One challenge is that they are often created for a broader application than just a single course, and would need to be appropriately focused for using as a pre-test for a course. If there are particular skills or concepts that are foundational to your course, then that may also form the basis for the creation of a pre-assessment of some sort. It is important to remember that these should be relatively short and low stakes assignments.

3. Student Self-Assessment - It is also possible to have students assess their own knowledge; however, this requires a degree of metacognitive ability that students may not possess at all levels. The self-assessment would be based on a list of concepts or skills that students would then rate their comfort/familiarity. There are also models where students would complete a pre-test that also includes a self-assessment component, such as answering a question and then rating their confidence.

4. Student Brainstorming - In smaller classes, or classes with small group sessions, open-ended questions can be used to determine the student’s knowledge and experience with a topic. For example, “What comes to mind when you think of <blank>?” could be used to start a discussion of a topic. As with any group activity, the very well prepared may “hide” the less well-prepared or quieter students, so it will be important to design and guide the discussion carefully. Additionally, when any inaccuracies or misconceptions come up during the discussion it will be important to address them immediately so that they are not reinforced further.

5. Concept Maps - Similar to the brainstorming, students can be posed a question or topic and asked to write down and connect all that they know as part of a concept map. There are many ways to go about constructing a concept map, so it will be important to give students an idea of how to approach building the map and what aspects you wish to emphasize. If building connections is more important than coming up with the terms, it may be worth providing students with a list of concepts to use in their map. Once maps are built, they should be discussed and gone through with the students to identify gaps and misconceptions. These maps could also be revisited throughout the semester to show students their learning gains and provide a way to connect new knowledge to old.

6. Just keep an eye out - Depending on how the assignments in a course are structured, there are likely numerous opportunities to see how students are progressing. Looking for patterns of errors between students and on the part of a single student can illustrate misconceptions or incomplete understanding. This process can be more difficult in larger multi-section courses, where more than one person is doing that grading. Many large lectures have adopted class response systems (clickers) to gauge class-wise understanding in real time.