

Student Experiment Troubleshooting:

The goal the student experiment is to see what may be subtle differences in the level of amylase in students' saliva. To do this, you need the right experimental conditions. The conditions listed in lesson implementation should work in many cases. However, we have found that differences in temperature and the type of water used in the experiment can change the outcome of the experiment. For example, when the temperature of the room was higher, the enzymatic reaction works faster. This can lead to all the reactions to go to completion (meaning that all the indicator turns from blue to clear) in the time it takes to do the experiment. If all reactions go to completion, it's hard to say which students have more amylase. That is why we recommend that all teachers test their specific classroom conditions (using different concentrations of their own saliva and possibly the saliva of several teachers) before having the students try it. If you find that the experimental conditions fail to allow you to distinguish between different levels of amylase, we suggest that you try tweaking the following experimental parameters to get the experiment to work:

1. **Reaction time:** Under some conditions, the enzymatic reaction proceeds faster. Our student instructions say to let the reaction go for 1 minute. However, if you find that the reaction is going too fast or too slow, you can instruct students to either decrease or increase the duration of the reaction. Keep in mind that the students may have trouble performing the reaction in less than 30 seconds (unless they already know how to pipet). If you find that you need to decrease the reaction time to less than 30 seconds to get it to work, try tweak 2 instead. If that doesn't work, try tweak 3 or 4. If you find that the reaction takes more than 5 minutes to work, try tweak 4 instead.
2. **Amount of indicator:** If the enzymatic reaction proceeds too quickly, you may consider increasing the volume of indicator you add. Be aware that the more indicator you add, the darker your reaction will be. Make sure that the darkness of the indicator does not interfere with your ability to discern differences in the color of the reaction after it is finished.
3. **Type of water:** Distilled water has fewer impurities than tap water and is less variable in quality. If you are having trouble getting consistent results for your reactions, you may consider buying some distilled water to do the experiments.
4. **Amount of Saliva:** If your reaction is going too fast, try decreasing the concentration of saliva used in the reaction. For example, use a 1:4 dilution instead of a 1:3 dilution. Conversely, if your reaction is going too slow, use a higher concentration of saliva, say a 1:2 dilution instead of a 1:3 dilution. Do not use pure saliva in the reactions. We found that it is very difficult to pipet and

small pieces of food in saliva it sticks to the indicator, making the interpretation of results much more complicated. If your reaction is still going too slow after using a 1:2 saliva dilution, try decreasing the amount of indicator.

5. **Amount of starch:** In general, we found that this was the least effective tweak, so we recommend trying the other tweaks before trying this one.

6. **Amount of vinegar:** If you find that the reaction does not stop after adding vinegar, you should try increasing the amount of vinegar you add to the reactions. For example, add 750 microliters instead of 500 microliters. Make sure that adding the vinegar does not cause the indicator to be diluted too much, so you can still easily see the color of the indicator after the reaction has been stopped.