The Biophysicist

Reaching Behind the Black Screen

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Shira Passentin is a MSc student in the Department of Science Teaching at the Weizmann Institute of Science. She also is a teacher of science and technology in a middle school (junior high school) in Israel. In this article, she describes a simple biophysical activity, performed by her students at home during coronavirus disease 2019 (COVID-19) lockdowns, which explicates the meaning and importance of surface area in a biologic context.

When was the last time you spent 1 or 2 h speaking to black squares on your computer screen? Many teachers and lecturers experience this daily since the COVID-19 pandemic entered our lives, as educational institutions switched from face-to-face to distance teaching.

After presenting virtual lessons for a while now, I do not feel that this method of teaching is very effective. It is difficult to tell how attentive the students are, how much they understand, and what they remember from the lesson. Not to mention trying to guess what they are doing while I am "teaching" them: texting with friends, playing on the computer, reading a book, sleeping, or actually making every effort to learn something new.

I have always tried to keep my students involved, active, and engaged, so they enjoy the lessons. I strive to create personal connections with the students by making them feel that they are an important part of the class and can approach me whenever needed and that I care about them.

However, distance teaching challenges these very values. Even the simple act of creating eye contact is impossible. Overcoming these deficiencies requires a fair amount of creative pedagogy. One of the things I do to make some kind of personal connection is to text students that did not attend class and ask them if everything is all right. I also do the same with students that were not noticeably active during the lesson.

To help my students remain involved and engaged in these complex and complicated times, I use activities and experiments that rouse students' interest and can be done at home. An example of a lesson that engaged my students was one that involved the digestive system. The topic was a description of the structure and function of the villi in the small intestine and the importance of surface properties. My purpose was to help the students understand the meaning of the scientific concept, surface area, and its importance in the effective absorption of nutrients in the small intestine.

I instructed them to take 2 slices of bread and their favorite sandwich spread and then cut 1 of the bread slices into 10 smaller pieces. They were then to take 2 equal amounts of sandwich spread and apply one amount on the whole slice of bread and the other

Fig 1. Sandwich spread on small bread pieces and whole slice.

amount on the 10 smaller pieces. I specified that all surfaces (top, bottom, and all the sides) must be covered by the spread (Fig 1).

The conclusion I wanted the students to reach was that more spread was needed to cover the 10 smaller pieces than the whole slice. I wanted, through this experience, to demonstrate that for a fixed total volume, the object's shape determines the surface area.

The lesson was a great success. The students were very active and cooperative, and even students who seldom communicated in class followed the instructions, asked clarification questions, and sent photos.

After the activity, a short explanation, and discussion comparing the bread with the villi in the small intestine, I ran a poll with questions to assess the degree of comprehension. A total of 87% of the students understood the scientific concept of surface area and its relevance to the structure and function of the digestive system.

This activity has some specific features that make it suitable for distance teaching. It's fun and breaks up the typical teaching routine, allowing instructors to reach the students even through the black screen. It's not complicated and is even easier to do at home than at school because students have access to all necessary items in their own kitchens. They don't have to remember to bring things to school, and the school doesn't have to purchase the ingredients. Above all, this is a lesson they will remember and should help them recall the scientific concept.