Assessment Modality for Biomaterial Education Outreach to Improve Pedagogical Methods

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Statement of Purpose: Students within the 6th-8th grade can be underprepared to understand and retain knowledge in complex fields such as Biomaterials. By properly understanding the student's baseline knowledge and comprehension of biomaterials, we can gauge the effectiveness of educational outreach to middle school students. Using the results of pre and post lesson assessment tools for gauging student knowledge, interest, and understanding we can optimize teaching methods.

Methods: The Herff School of Engineering sponsors Engineering Day where local middle schools can participate in various demos, including our 20 minute hydrogel demo. Our model biomaterial education outreach activity is the crosslinking of sodium alginate (MP Biomedicals) using $CaCl_2$ (Fisher Scientific) solution. This activity involves describing the source of alginate while detailing the common gastronomical and medical uses of these chemicals. Scientific information regarding polymer chemistry is discussed with an aside to biocompatible chemical choices. After the discussion, students will crosslink the alginate by immersing it in $CaCl_2$[2]. Assessment of the activity begins before the presentation of the material by gaining data on the student's knowledge, interest, and known applications of biomaterials through discussion and surveys. Discussion is mediated by an activity known as "Think, Pair, Share" where students write down thoughts, discuss them amongst their peers, and orally share their discussions to the group as a whole[1]. The student's thoughts are written down onto a survey form, using rating scales and open answers before, then after, the activity has completed students are given an identical survey to track the progression of the students' learning, attention, and understanding. The assessment modality is generic to any activity in biomaterials education but is essential in understanding the student perspective. The surveys consisted of three questions which gauged interest in, or knowledge of biomaterial principles. Students will answer questions with a number from 1-7 with 7 representing highest knowledge or interest. The data was compiled and analyzed to show changes in attitude by using scales in the survey. The result tabulations included mean and standard error calculations alongside a paired t-test.

Results: Using this assessment technique, survey scores significantly improved after the lesson (Figure 1). Knowledge ratings increased from 1.9 to 4.1, and interest ratings increased from 3.3 to 5.1. Before the lesson, 89% of students were unable to list any biomaterial applications from prior knowledge. However after the activity 54% of students were able to list at least one application of biomaterials, some of which were unrelated to the presented material. By describing applications and not only repeating stated lesson material students demonstrate an understanding of the material.

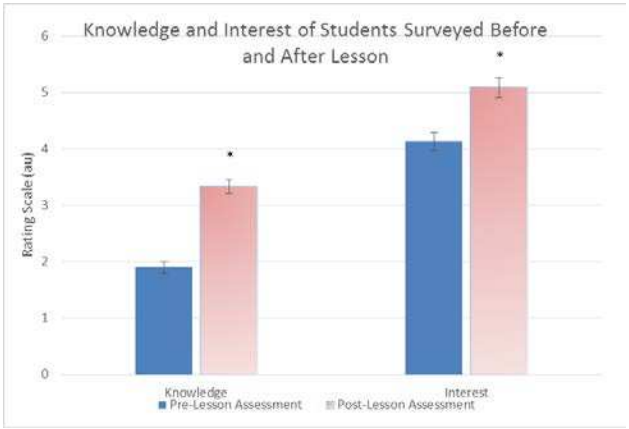

Figure 1. Survey results gauging basic knowledge and interest of biomaterials before and after a 20 minute lesson. Data is presented as mean with standard error of the mean error bars. Asterisks (*) indicate a p-value << 0.001 using a paired t-test.

Conclusions: By assessing the knowledge of the general field beforehand we, as instructors, can understand the prior knowledge of the students to best assess their development after the outreach exercise. Using this assessment it is possible to cue instruction and apply changes to various aspects of the outreach. This innovative assessment of possible faults in pedagogy can curb the interest, understanding, and retention of these students. By utilizing engaging activities, assessed using our novel modality, we can provide feedback to tune our pedagogical methods to optimize student interest and retention of biomaterials. Further research into change in knowledge and interest based on factors such as group size, age range, and length of activity can help to tailor this activity for future outreach activities.

References:

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