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COVID-19

A case-based learning approach to online biochemistry labs during COVID-19

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Abstract

With biochemistry forced to transition to remote-teaching online, the cooperative active learning and problem-solving normally in labs have been limited. With little ability to perform experiments with laboratory equipment, determining how to mimic the qualities integral to these labs in an online environment is necessary. We propose one possible solution to provide online labs: short case-based learning activities.

KEYWORDS

biochemistry, case-based learning, COVID-19, online teaching, remote-teaching

Case-based learning (CBL) has shown successful results in improving student achievement, facilitating retention of information, and increasing positive perception towards biochemistry courses.[1–3] Though creation of biochemistry cases has been discussed in a step-by-step guide before, instructions on how to translate cases to online-only instruction is necessary. One must begin first with a learning objective in mind, keep cases concise to only one or a few paragraphs, and encourage student cooperation for cases to work effectively.[4] We suggest using current online conference tools which separate students into groups. These small groups can communicate via voice chat and text with the teacher attached to monitor their work. Students in each group can work on cases using a shared document online which the instructor has access to, making cooperative learning possible. This shared document can then be turned in via a web link.

One example case idea for biochemistry is described in the next paragraph, where students are trying to figure out the identity of unknown amino acids. Instructors may ask each group to identify possible amino acids for every band and what evidence they have to support their hypothesis. Note that the case study is written to promote inquiry, a vital component of case studies, in that the five unknown amino acids cannot be identified without synthesizing the information from the three experiments described (e.g. multiple amino acids have similar isoelectric points, similar molecular weights and similar properties).

Biochemistry case: Three students test a mixture of five unknown amino acids using different biochemistry laboratory techniques to figure out what is in the mixture. Student 1 performed isoelectric focusing by placing the mixture at pH 7 and waited for changes. Four bands appeared with the following isoelectric points: Band 1: 11, Band 2: 9.5; Band 3: 5, Band 4: 3. Student 2 performed a native gel. Using the location of the bands, molecular weight per mole was determined. These g/mole results are as follows: Band 5: 240, Band 6: 174, Band 7: 147, Band 8: 146, Band 9: 133. Student 3 performed sodium dodecyl sulfate–polyacrylamide gel electrophoresis (SDS–PAGE). This student obtained similar results to Student 2; however, the student observed the band at 240 disappear, instead seeing a thicker band much further down the gel. See Figure 1 for how to approach creating a CBL activity.

After personally using a CBL biochemistry curriculum online, it is important that instructors know that it was a challenge initially but became easier with experience. Groups of five students seem to work best online and approximately 10 questions should be given. Questions should ideally apply concepts to real-world situations and slowly develop from simple to complex.

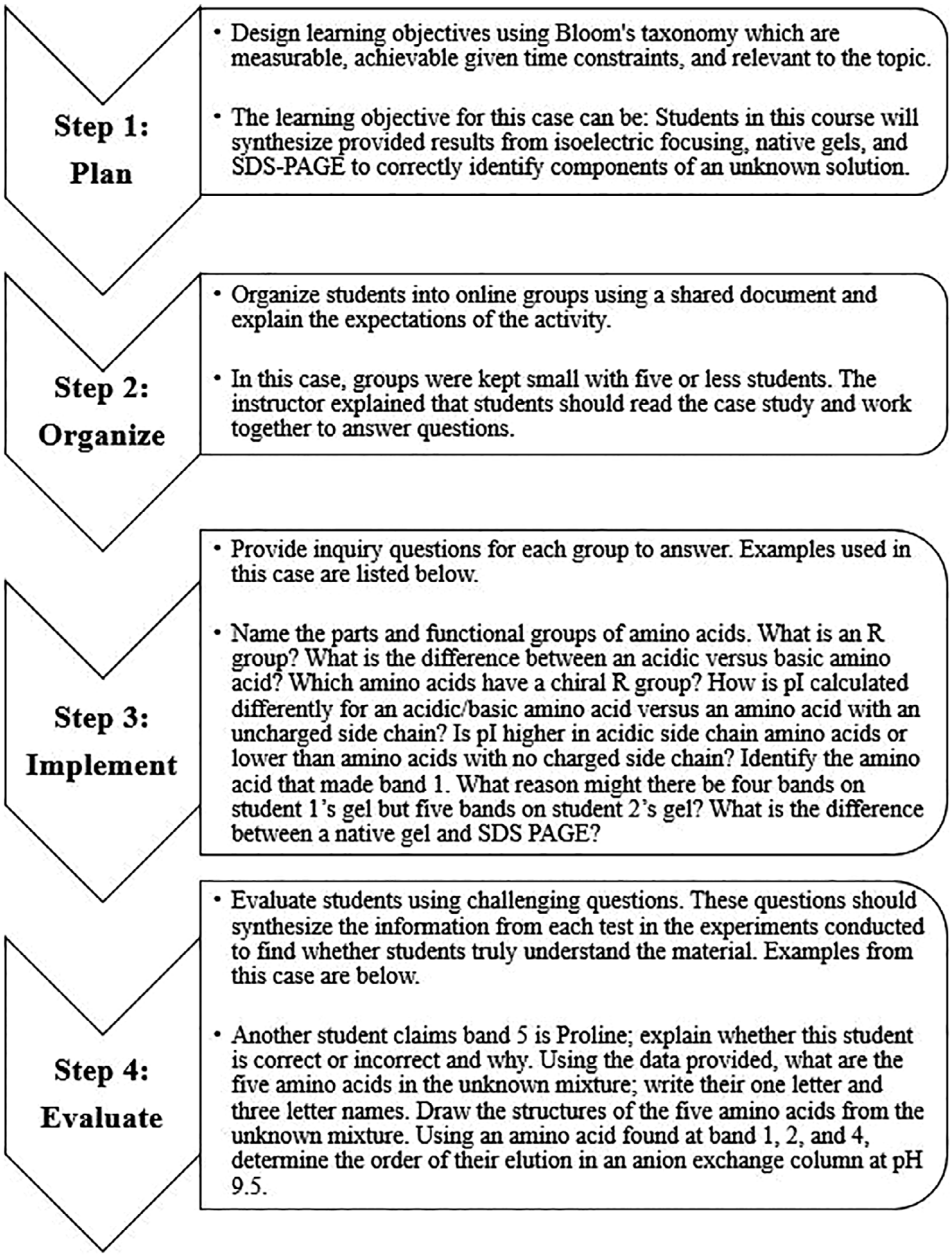

FIGURE 1 Scheme for how to approach creating a case-based learning (CBL) activity

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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