

# SOTL – INTEGRATING CONSTRUCTIVE ALIGNMENT AND SANDWICH METHODS IN PLENARY LECTURES ON BIOANALYTICAL STRATEGIES.

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## PROBLEM OBSERVATION

- Get students actively involved in plenary lectures.
- Make sure the presented principles and methods are understood, which is difficult when only 1 or 2 hours are available to present complex concepts to beginners.

## HYPOTHESES

- Integrate more interactive tools to keep the students active and involved.
- Use polls at the beginning and end of the lecture to check previous knowledge and the understanding of the lecture. Results would be used as feedback to improve the course content and fill the gaps or improve the understanding if necessary.
- Add take home messages to make sure the key points are clearly given and remembered (e.g., using summary inserts, or multiple choice questions with peer-instruction).

## PLANNING

### Learning goals:

- PART I**
  - Understand the goal, scope, and basic principles of bioanalytics.
  - Remember the key parameters of bioanalytical validation and understand their importance.
  - Understand liquid chromatography and mass spectrometry principles.
- PART II**
  - Remember protein structure and how to use it for bioanalytics.
  - Compare molecular data to select the most suitable surrogate peptide
- I + II**
  - Appraise the most adapted analytical strategy for each specific project to get reliable bioanalytical data.
  - Get an insight into the research work in a clinical analytical laboratory.

### Lecture plan:

Course is split in two lectures: Bioanalytics I – Principles and methods and Bioanalytics II – Mass spectrometry (MS)-based bioanalysis of biopharmaceuticals. Both will be organized the same way, (i) entry based on theme centered interaction and (ii) sandwich method for the course structure, alternating between frontal lecture for the introduction of fundamental principles and learning quizzes, before closing with a graphical summary.

## IMPLEMENTATION

### Course activities:

- Poll at the beginning of the course to assess previous knowledge and adapt explanations accordingly. All required technical details are given on the slides, so depending on the previous knowledge of the students, some part could be viewed more rapidly leaving more time for teaching-learning activities.
- Include “take-home” messages to ensure the key points are remembered: using color inserts with key definitions.
- Case study using quizzes and peer-instruction method to let students work on a concrete method development example and develop critical thinking.
- Poll at the end to assess how well the principles were understood according to the students, including one or two questions to get feedback on the course.

### Evaluation of the improvements:

- Number of right answers to the “take-home” messages polls.
- Involvement of the students in the teaching-learning activities.
- Multiple-choice questions at the beginning of the second lecture as checking and reminder of principles and concepts learned during the previous lecture.
- Final feedbacks on the course: how well the students have understood the key points? How did they perceive the course structure?
- Comparison of tests results of the previous years and of this year with the improvements: Have the students better grades?

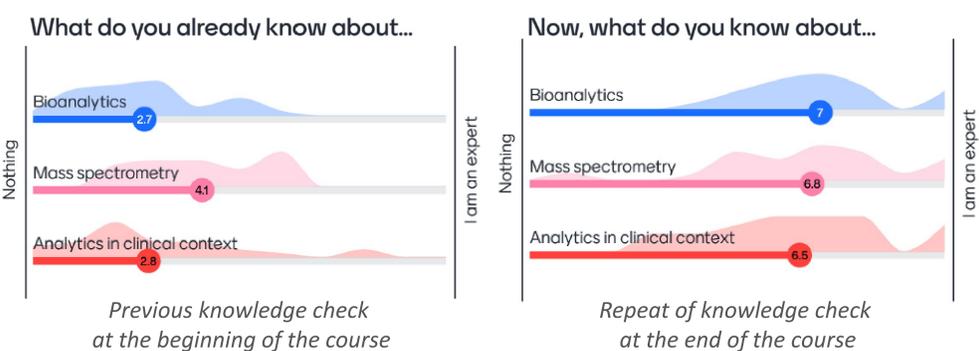
## RESULTS

### Course structure was supporting the defined learning goals:

Preparing the course with Mentimeter gave me a different perspective on the lecture and helped me restructure it in a more logical way to really give an insight of the research project in the analytical laboratory while giving all principles and methods needed for the course, and getting the students to participate in method development as it is done in the laboratory.

### Mentimeter helped controlling the learning process:

Polls at the beginning of the courses filled two purposes. 1. Evaluation of previous knowledge on the main aspects of the coming lecture (Figure). 2. For the second lecture: knowledge control and reminder from previous lecture on MS principles and methods. Polls during the course also gave reminder and knowledge check on previously seen principles, and evolution of answers throughout the course gave an estimation of the understanding of the students. At the end, the repetition of the knowledge check on the main aspect of the lecture allowed to compare with the beginning of the course and make sure the learning process was satisfying (Figure).



## DISCUSSION

### Time management using Mentimeter:

First time using Mentimeter in a lecture makes it sometimes difficult to manage. Going back and forth between Power Point and Mentimeter was not always easy to manage. Practice should allow to find the most optimal way to navigate between the two without losing time or clarity.

### Active learning and constructive alignment:

- Mentimeter was very useful to check previous knowledge or give reminders, as well as to initiate critical thinking using peer-instruction quizzes. However, the number of questions should be better optimized to let the time for explanations on more technical aspects, and answer choices should not be unknown concepts to the students: they need to understand the term and possibly know the technique/principle.
- Alternative learning activities could also be used for the case study, such as Think-Pair-Share or work in small groups: each group work on one step of the case study and present its results to the full class.
- The different quizzes and polls were constructed according to the learning goals and gave a first insight into the type of questions that could be expected for the final exam.

### Dynamic interaction throughout the course:

A dynamic interaction with the students was maintained by adapting the explanation or the method for peer-instruction according to the rate of right answers allowing to make sure all key aspects were understood.

### GENERAL SUMMARY ON THE IMPLEMENTATION OF THE NEW METHODS:

Students seemed well activated and motivated. The use of Mentimeter helped getting the students involved in a plenary lecture. Most of them answered the questions and it created dialog to discuss about the results, especially when using peer-instruction principle.