Tissue Engineering, 3rd Ed.

CBL Instructors guide

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1. **Introduction**

The application of the chapter’s content is done using challenge-based learning (CBL).

* + - **Independent study**. It is important that groups of 4-5 students can make decisions autonomously and defend their choices while solving CBL modules. Students who have not previously taken part in CBL activities need to learn to take ownership of what they want to learn. CBL modules do not have a unique right answer, but many answers can be accepted as long as they are technically-sound, logic, feasible, and well-supported by evidence.

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| A gradual transition to independent study can be promoted by:   * + - * Early planning the approach to solve the CBL module,       * guiding groups in the technical, medical, and biological analysis of the problem,       * sharing and dividing the activities and responibilities between group members,       * reporting the results. |

* + - **CBL modules do not exist in isolation**. There is meaningful information to solve the CBL module throughout the book and well as in published literature. Students are encouraged to explore the recommended readings and literature to increase their knowledge about the chapter. The students are guided by an experienced instructor(s) who provide(s) supporting instruction and information. It is *highly recommended* to read and understand Chapter 1 of the book. The chapter will teach you the tips and tricks on how to better use the book and how to approach the CBL modules.
    - **This handbook gives an preliminary overview of instructor roles and responsibilities while guiding CBL modules.** The content of this handbook is a work in progress and we appreciate the feedback to [j.d.boer@tue.nl](mailto:j.d.boer@tue.nl) and [j.a.uquillas.paredes@tue.nl](mailto:j.a.uquillas.paredes@tue.nl).

1. **The instructor role**
   * First and foremost, instructors should let the group take the lead and allow the students depend on each other rather than on the expertise and knowledge of the instructor.

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| The instructor should avoid giving a direct answer to a question from a student where possible. It is preferable to counter the student’s question with an instructor’s question to spark the critical thinking process of the group. |

* + The instructor can help in setting up the study activities in the group. Start the discussion with questions based on the challenge’s background, vision, motivation and problem definition.
  + It is *mandatory* that students should study individually or in groups the chapter’s contents before taking part in CBL discussion sessions.
  + Asking the right question at the right moment not only provides probes the group’s knowledge but also helps to avoid situations in which the students get bogged down or go around in circles during their discovery and learning process.
  + Consider and reflect on the role of instructors in the following situations:
    - **Are instructors expected to know before hand the answer of the challenge?** No necessarily, but it is highly recommended that the instructor understands what makes a meaningful and sound CBL answer. The instructor should refrain from solving the CBL module before hand and expect the students to “unveil or discover” the instructor’s answer. Rember that the CBLs are open-ended by nature and many answers can be correct. The group strives to correctly interpret the challenge, design the method to solve it, and define the plan to reach to the solution.
    - **Are instructors expected to be motivators to students?** Yes, instructors can motivate the group to achieve the greatest possible learning benefit from discussion sessions and.

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| **How do the instructors operate?**   * + - * Show interest in the progress of the group. Depending on the situation, instructors either listen or challenge the students by asking questions. Does the group work with a clear agenda, and does everyone keep their commitments? Is everyone active in providing clear contributions to solve the challenge?       * Regularly ask the group about the why and the how of important decisions to solve the challenge. Instructors should encourage creativity and action, and stimulate the groups towards a deeper understanding of the different challenge components.       * Help and guide the group through difficult periods. In complex and cutting-edge challenges like the ones presented in this book, difficulties and moments of uncertainty will appear sooner rather than later. |

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| The process of learning to work together while solving the CBL modules will not always progress smoothly. Cautionary signs are:   * + - * The lack of understanding about the activities that are to be undertaken,       * confusion during the division of tasks,       * unclear work strategy and unclear agreements among group members,       * poor preparation before CBL meetings,       * poorly conducted meetings, and       * the feeling that attending the CBL meetings is not necessary to solve the challenge. |

* + - **Instructors help to ensure that the group members work well together by guiding the meetings.** When necessary, instructors must give technical input about the challenge or a part thereof. Instructors should be aware not to provide too much direction and control on what is decided. Instructors should check whether the group members work together productively and consistently, and include discussions if roadblocks or problems arise in moving the challenge forward. Instructors should encourage stragglers to catch up, helping them back on track.
    - **What is the role of the instructor as an expert/specialist?** In CBL discussions, the instructor should try to avoid explaining and teaching; this is necessary so the group is forced to take an active role and become responsible for what and how they solve the module. This is a clear deviation from traditional learning/ teaching where students sit in a classroom, listen to a lecture, study from a book, and then take an exam. In the CBL module the students define the path they want to follow to move the chellenge forward. In the CBL module, instructors define the starting point but not the endpoint. Therefore, instructors should limit their involvement in clarifying a difficult point in a direct and straightforward manner. If the instructor clears up the point, then the group cannot go through the thinking process to logically and rationally discover the answer. Furthermore, the group will get used to see the instructor as the source of answers to all questions. This situation may put the group in a passive role during the learning process. At the end of the CBL meetings, instructor should draw attention to evident misunderstandings or errors students have to incur while solving the project.

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| As a general note, the group should function as a cohesive unit even in the absence of the instructor. The function of group meetings is to initiate and organize the work to be done. Thus, the instructor have a double role: in addition to guiding the group process, they are also experts. It is important to separate these roles. Instructors should see themselves as project managers with important and relevant technical knowledge. |

1. **Agreements with the group**
   * **Make definite agreements with the group about CBL learning.** Record the agreements in a logbook. This helps to prevent misunderstandings down the road.

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| The agreements can cover, for example:   * + - the subject to be discussed,     - the contribution of each group member, and     - the contributions of the instructor. |

* + **The game plan.** Although it may seem too much to invest much time planning activities and assigning responsibilities, it is a good idea to define a game plan to keep everyone accountable. After all, *if there are no commitments, there is no urge to meet deadlines and generate high-quality output. Having a game plan is useful when difficult times arise*. Group members can always pull out the master plan a review as many times as needed the agreements, responsibilities, and tasks.

1. **Being an instructor during the various phases of the challenge**

Instructors can apply different coaching strategies depending on the various phases of the CBL module. The recommended strategies are as follows.

Before the start of the module

* + - * Study carefully the CBL module. It is annoying for the students if you haven’t seen or know about the module.
      * What must be done to prepare yourself and the group before a TA meeting? For example, have the agenda points and the readings or other materials distributed among the group beforehand.

The first instructor meeting

* Make agreements about the group’s work methods, for example:
  + - * + discuss which points will be included in the meeting minutes,
        + the views of the instructor on the performance of the tasks and the contribution of the group members,
        + the preparations everybody is expected to make for the CBL meetings,
* Make agreements about the problem-solving methods to be used in each meeting, for example:
  + - * how to formulate objectives and self-study assignments,
      * how to explain unclear terms and concepts,
      * how to define the challenge in your own words,
      * how to analyze the challenge, and
      * how to break down the challenge into set of smaller challenges.

1. **How to give and receive feedback?**

What is the purpose of giving feedback?

* + - Help students to explore the context of the situation.
    - Help students to develop critical thinking.
    - Help students to reflect upon their experiences in order to develop their scientific and technical skills.
    - Monitor progress.
    - Challenge students’ thinking to nurture deep learning.
    - Raise issues that need to be considered.
    - Make a connection between issues and problems as a deviation from the challenge’s learning objectives.
    - *Please remember that*: you are not there solely to answer questions!

What are the rules to give feedback?

* + Describe the behavior you observed in neutral words, not as a judgment or interpretation.
  + Focus on specific facts and specific behavior.
  + Limit your feedback to behavior that can be changed.
  + Speak only about recent events.
  + Stay close to yourself and your own perception.
  + Indicate what *effect* a person’s behavior has on the group and the instructor; usually this approach is better than giving suggestions for change
  + Give a judgment and suggestions for change only if necessary.
  + Check whether the receiver understood your feedback.
  + Give room for reactions.
  + Feedback should not only be negative but positive as well.
  + Take care of the timing: is this the proper time and place to give feedback?
  + Is the person ready to receive feedback?
  + Invited feedback is more welcome than uninvited feedback.
  + *Do not overflow*: limit your feedback to the most important aspects.

1. **Communication during CBL discussion meetings**
   * State clearly what the students can expect from you.
     + Make sure that the group is on track.
     + Take the last 5 min to reflect on the group’s performance.
   * Talk about the agreements as a group. Including task division.
     + Define the group’s goals, results, and methods, and expectations.
     + Make sure that everyone arrives on time for the CBL session(s).

*Good luck in guiding the student teams in CBL modules!*