

This column addresses aspects of lifelong learning including continuing education and activities for students and faculty that involve industrial practice and engagement. These topics may be best covered in an anecdotal or editorial presentation instead of a traditional scholarly format. Submit Lifelong Learning papers through journals.fcla.edu/cee, include Lifelong Learning in the title, and specify Lifelong Learning as the article type.

PREPARING STUDENTS FOR LIFELONG LEARNING

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Cognitive activities associated with the lower three levels of Bloom's Taxonomy^[1] (remembering, understanding, and applying) are important intellectual activities, but professionals also operate in the upper levels – analyzing, evaluating, and creating. They no longer learn by going to class, passively receiving another's knowledge, and seeking to memorize instructor-given facts and concepts. Further, their learning is no longer credentialed by test results on teacher-devised exercises.

How can we equip students for lifelong, self-directed, and self-evaluated learning? Here are some techniques that have helped me in this goal:

- A. *Seek to understand the stages of Bloom's Taxonomy, and make sure your course structure addresses its higher levels on a regular basis.*
- B. *Let students know why lifelong learning is important, and how the rules of the game will change after they graduate. Tell stories and ask seminar speakers from industry to tell stories that reveal the students' after-college situation.*
- C. *In seminars or other transition-to-practice courses, explain Bloom's Taxonomy to your students and note how the learning activities they are accustomed to are generally restricted to the lower levels. Help them understand how their learning patterns, shaped for in-school success, will have to change to meet the requirements of their future workplaces.*
- D. *Occasionally, require students to demonstrate techniques for validating problem solutions^[2] and grade their efforts.*
- E. *Periodically, require the students to create their own homework exercises. Give them the topics and the learning and validation objectives to be addressed, and teach them appropriate learning/validation objectives of an exercise. Clearly specify what concepts need to be*

included, what level of complexity is desired, how comprehensive a write-up is expected, and how the exercise will be graded. Of course, such assignments add to your grading burden, but often the burden is balanced by the joy in seeing their creativity and growth. My thanks to Richard Felder for this idea and guidance in its implementation.^[3]

- F. *Share with the students your learning objectives for exercises that you create. Assign them to evaluate the effectiveness of the exercises in meeting those objectives after they complete the exercises. Initially, some may express trivial, obsequious, or angry responses, providing judgment without the specifics that would help you continue to improve. Return feedback on those to let them know how to provide a better evaluation. But, many of the student evaluations will be effective. Return a thank you note on each. Compile the useful feedback and reveal it to the class. Their evaluations will gradually increase in substance and usefulness to you. Take the feedback seriously, and use it to shape subsequent assignments.*

REFERENCES

1. Bloom's Taxonomy https://en.wikipedia.org/wiki/Bloom%27s_taxonomy. Accessed February 13, 2019.
2. Rhinehart RR (2017) How to be your own professor. *CONTROL*, 30(3):69-70.
3. Felder RM (1985) The generic quiz: a device to stimulate creativity and higher-level thinking skills. *Chem. Eng. Ed.* 19(4):176-181, 213-214.

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