

The “DLOK” Assessment Process

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Abstract

This paper proposes an instructional strategy designed to assess a student’s knowledge and preparation for a mastery examination. Assessing a student’s discussion level of knowledge (DLOK) is a complex-performance assessment with multiple benefits. It considers a wide variety of outcomes, including subject matter knowledge and expertise, reasoning, skills and competencies, attitudes, and integration of concepts and principles. Conducted in a short answer verbal response format, the DLOK exercise uses short response questions to cover a large area of knowledge in a relatively short period of time. Several instruments are planned to evaluate instructional effectiveness.

Introduction

This structured method of assessing a student’s knowledge is a technique used by one of the authors in the private sector in training and preparing professionals for certification as project management professionals. Adapted to apply to the academic environment, the discussion level of knowledge (DLOK) exercise serves as a student assessment technique conducted in the classroom with two primary purposes. First, the students receive almost instant feedback on their learning and an understanding of what areas they need to relearn before an exam. Second, this assessment identifies for the instructor what learning has taken place individually and corporately in the classroom. Based on student feedback from a prototype DLOK exercise, the adaptation of this technique is presented.

A structured methodology is applied to take students with a minimal amount of subject knowledge and prepare them for a major criterion-referenced examination. Attaining a discussion level of knowledge by the end of the semester is one goal of the junior Dynamics course at The Citadel. The steps necessary to develop this level of knowledge are presented to the students early in the semester and formally accepted. During the semester, a step-wise process of learning is applied, beginning with fundamental concepts, followed by periods of review and practical application, self-assessment and determination of strong and weak areas, correction of voids or weak areas, and finally an intense exercise of short verbal answers demonstrating a DLOK of the material. The learning effort involved with the DLOK method is structured to transfer a significant amount of knowledge to a student in a manner that builds on learned material, while encouraging long-term retention and confidence building, thereby enabling the student to confidently take and pass a rigorous final exam and a nationally recognized criterion-referenced examination, the Fundamental of Engineering (FE) exam.

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Background

This paper proposes a classroom assessment technique that begins with the “end in mind” and works toward that end throughout the semester or period of instruction and learning. Students begin the semester determining the body of knowledge necessary to take and pass a major criterion reference examination. Next, they work for a majority of the semester developing that body of knowledge, while assessing their learning periodically prior to each major exam. The mutually beneficial nature of the assessment comes from immediate feedback to the students which alerts them to the concepts and principles that they do not understand and signals them that they need to relearn these elements. In addition, the instructor obtains an assessment of the corporate knowledge of the class and a general sense of the learning that has taken place.

This body of knowledge can be outlined or illustrated in a framework whereby the students can chart their knowledge of particular topics and principles by using the course outline, table of contents from the textbook, or similar breakdown of the body of knowledge to be covered during the course. By charting knowledge acquisition, students are encouraged to build upon previous knowledge and tackle new assignments through any means possible, including self-study, problem solving, and exploration. Also, the instructor has another tool to relate the current learning to the overall body of knowledge, while maintaining the pace and progression of the course.

For the working professional, the knowledge gained through a course of instruction applies to their chosen occupation and very often has “next day” application. For the student, the knowledge enables him or her to master the subject matter, do well in the course and eventually graduate. Both working professionals and active learning students are considered to be effective, self-directed learners, who possess a desire to learn and to apply newly acquired knowledge to current and future situations. For example, a working professional who recognizes an educational need will often initiate a personal program of study or seek out a continuing education course or workshop to meet that need. Very often, the professional will soon find an application for the newly acquired knowledge, maintaining in this way the incentive to acquire “just-in-time” education for professional development needs. Similarly, self-directed students take the initiative in the learning process as they complete courses toward graduation.

The DLOK method is considered to be formative assessment. As described by Johnson and Johnson (2002), formative assessments are conducted periodically throughout a course or instructional unit to monitor progress and provide feedback concerning progress toward learning goals. Based on the feedback, the students can plan what to do to advance their knowledge. Also, formative assessments provide teachers with feedback on their ability to provide effective instruction. A key element of formative assessments is that they are not used to evaluate either the student or the teacher.

In both the professional and the academic environments, the DLOK method treats knowledge acquisition as a learner-centered process, similar in many respects to a production process where a basic framework of required knowledge is specified at the beginning of the semester and becomes known and tested over time. As explained by Weimer (2002), shifting the content focus from what knowledge the instructor thinks is important, to what the students realize that they will need in order to master the subject matter and pass the course has many advantages. These advantages include students accepting responsibility for their own learning and developing maturity.

Adapting the DLOK exercise to the academic classroom is a process requiring thoughtful preparation and implementation. With the students, the semester begins with establishing the prerequisite body of knowledge, a framework for assessing progress, and periods of review and assessment. By the end of the semester, one of the objectives of the course is for the students to

have acquired sufficient knowledge to speak intelligently about a myriad of topics and be able to integrate those topics across the body of knowledge.

General Principles of Assessment

The DLOK exercise conforms to principles of good practice for continuously improving student learning. According to Angelo and Cross (1993), to improve learning, students need to receive appropriate and focused feedback early and often, and they need to assess their own learning. The DLOK exercise provides both feedback to the student and assessment of student performance to the instructor.

Gronlund (2003) defines performance assessment as “requiring students to demonstrate their achievement of understanding and skills by actually performing a task or set of tasks.” With assessment as a basic component of the instructional process, it is important to define several terms. Linn and Gronlund (2000), provide the following definitions:

- Assessment is any of a variety of procedures used to obtain information about student performance. Assessment includes traditional paper-and-pencil tests as well as extended responses (e.g. essays) and performances of authentic tasks (e.g. laboratory experiments). Assessment answers the question, “How well does the individual perform?”
- A test is an instrument of a systematic procedure for measuring a sample of behavior by posing a set of questions in a uniform manner. Because a test is a form of assessment, tests also answer the question, “How well does the individual perform – either in comparison to others or in comparison with domain of performance tasks?”
- Measurement is the process of obtaining a numerical description of the degree to which an individual possesses a particular characteristic. Measurement answers the question, “How much?”

With these terms defined, a summary of the process of assessment provides insight into the connection between the nature of student learning and development. By integrating assessment with development, the learning experience is enhanced and possibly expanded. According to Linn and Gronlund (2000), assessment is an integrated process for determining the nature and extent of student learning and development. This process will be most effective when the following principles are taken into consideration:

- Clearly specifying what is to be assessed has priority in the assessment process.
- An assessment procedure should be selected because of its relevance to the characteristics or performance to be measured.
- Comprehensive assessment requires a variety of procedures.
- Proper use of assessment procedures requires an awareness of their limitations.
- Assessment is a means to an end, not an end in itself.

Another aspect of developing assessments is the role other students play in the process. Johnson and Johnson (2002) present a model for managing assessments:

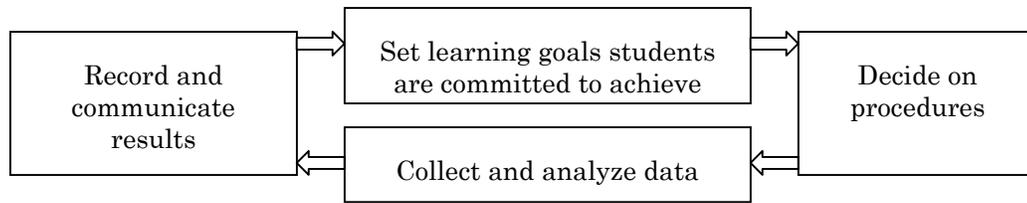


Figure 1. Process of Assessment

Methodology

Orienting the Course

Many engineering students face the same problem – taking and passing the FE examination during their senior year. As noted from the NCESS website (2002), the FE examination is based on subject matter from courses taught in a typical EAC/ABET accredited baccalaureate program and covers a comprehensive range of subjects in engineering. As a comprehensive or mastery test, the FE exam provides a quantitative assessment tool for many engineering programs, especially under the ABET program objective (a) ability to apply knowledge of mathematics, science and engineering.

Using the FE exam as an assessment tool of the engineering program offers logical justification for using student preparation as an outcome objective of the junior Dynamics course at The Citadel. By providing specifications for the subject, the NCESS website (2002) identifies the topic and applicable percentage of the questions for the morning session that is common to all engineering disciplines. In the morning session, Dynamics combines with other subjects like Chemistry, Computers, and Mechanics of Materials, to form the test material. According to the NCESS (2002), the specifications for the morning session indicate that Dynamics composes seven percent of the questions.

With the FE exam as an assessment tool and recognizing Dynamics as the specific subject matter, quizzes, major exams, and the final exam should reflect, in some part, the FE content and format. Also, student commitment to the course may be obtained by using the FE focus throughout the semester, by encouraging students to review information about the FE exam, and with other course materials. The students are encouraged to use this review to evaluate relevant FE subjects, principles, concepts and problem types. This focus is maintained as a derivative objective of having the students approach the end of the semester possessing the requisite knowledge to take and pass the Dynamics questions on the FE exam, as well as the final exam for the course.

The DLOK assessment can be used to confirm or to provide evidence of any shortfalls in the prerequisite knowledge to take and pass any exam. Throughout the semester, the students receive major tests and weekly quizzes that cover material most recently taught. Altogether, the course progresses normally until a review period in the form of a DLOK exercise.

Purpose of the DLOK Assessment

The purpose of the DLOK assessment is to identify the following:

- Personal strengths and weaknesses;
- Areas for improvement;

- An improvement plan and actions to implement it; and
- Additional preparation for taking and passing the final examination and the FE examination.

There are benefits of the DLOK assessment that are not so obvious, but considered by the authors to be valuable as an assessment of what the students are learning in class and as feedback to improve their performance. It is anticipated that the students will emerge from the DLOK exercise with improved self-confidence that they can take and pass the final examination and the FE exam.

The DLOK Assessment Process

The DLOK assessment is a complex performance assessment where the students engage in a group verbal drill facilitated by the instructor. The assessment is structured in a round robin format where the students are called upon to answer the next question in a set of questions. Optimally, the students sit facing each other, with a white board clearly visible at the front of the room. Each student is provided with a handout and instructed on the DLOK process. The handout contains a set of short-answer questions that address specific topics, principles or knowledge area applications.

Each student in sequence is asked to answer a specific question. That student is given a short period of time to present the answer and provide supporting information. In practice, the period of time ranges from thirty seconds to one minute and students are not allowed to answer the question with the statement, "I don't know." After providing their answer, the question is opened for comment by other students. Together, the students are asked to present a complete answer to the question within a two or three minute timeframe. This drill is repeated until the end of the class period or the questions are exhausted.

The role of the instructor is to facilitate the questions and answers, while stopping on occasion to summarize basic points. By developing a complete answer, the group, or at least those who helped answer the question, will be able to take notes and to develop an integrated understanding of the principles and concepts involved.

The procedures for administering the DLOK assessment are as follows:

1. Arrange the seats;
2. Hand out the set of DLOK questions;
3. Introduce the exercise by reading the instructions and noting the value and importance of self-assessment;
4. Conduct the DLOK exercise;
5. Stop periodically to summarize specific points; and
6. Conclude the exercise with a summary of the activity.

Application of the DLOK assessment technique requires students to have a moderate amount of subject knowledge, gained in study groups, prerequisite course(s), or in prior class sessions. Examples of DLOK questions for a Dynamics course would include the following:

- Dynamics deals with Kinematics and Kinetics. What is Kinematics?
- What is Kinetics?
- Describe rectilinear motion?
- What does it take to define a particle in curvilinear motion?
- Describe the work of the force exerted by a spring?
- Why is the work of friction always negative?
- Describe the potential energy of a body with respect to the elastic force of a spring?
- What is meant by the expression “the total momentum of the particles are conserved”?
- What is the first derivative of kinetic energy with respect to time?

Before the DLOK session, each student is encouraged to note their ability to answer each question on a scale from zero to one hundred percent, with one hundred being a perfect, complete answer. After the session they are encouraged to review their percentages and develop a plan to address their lapse of knowledge before sitting for the applicable exam.

Initial Classroom Experience with DLOK

As part of the review for the junior Dynamics final in the fall of 2002, a prototype DLOK exercise was conducted by the one of the authors. The class, which meets three times a week, was introduced to the DLOK concept at the end of Monday’s class and told that Wednesday and Friday would be devoted to the DLOK exercise.

During Wednesday’s class period, a set of DLOK questions was provided to each student and the instructions read. The exercise began with the first few questions, which received varying degrees of response. Awkward at first, some students responded with complete answers, while others provided partial answers or tried to say “I don’t know.” For those who did not have an answer, they soon learned how difficult it was to endure sixty seconds of silence. After one or two instances of silence, the responses came relatively quickly, with attempts at partial or incorrect answers. Also, early in the exercise, a few students expressed some frustration with answering their question, but with some encouragement, most were able to compose a response from previous questions and answers. A few students gave an obviously incorrect answer and encouraged someone else to answer. As the class period progressed, the students appeared to be more relaxed in responding to questions in front of their peers and in contributing to the group answer to the questions. Wednesday’s class period ended with the group answering 25 of 37 questions.

By Friday, the students arrived with a much clearer understanding of the exercise. Several of the students had taken it upon themselves to answer the remaining questions. To initiate the exercise, several questions from the previous class were answered. On this second day, the exercise progressed faster, with an improvement in both the individual and group responses. By the end of the second day, much of the course material had been covered using the DLOK exercise.

As Friday’s class adjourned, several students commented on the value of the exercise. They indicated the benefit of being quizzed on the basic concepts and principles of the course. Several

expressed regret that DLOK exercises had not been conducted prior to each of the four exams, but acknowledged that this exercise prepared them for the final exam. Based on initial student feedback, several changes were proposed:

- A mini-DLOK exercise to be conducted prior to each major test;
- Divide the class into teams and have a team response; and
- Configure the exercise to have more of a competitive atmosphere.

Other Course Elements

Several other course elements are planned to help develop the students' sense of understanding about the body of knowledge to be developed and assessed. The following elements are under consideration for the Dynamics course:

First day of class

- Present how the semester will progress and how assessments will be conducted;
- Ask the students to review a draft syllabus and make inputs based on each student's review of the FE examination content; and
- Receive and discuss student input for incorporation into the syllabus.

During the semester

- Proceed through the subject areas within the defined knowledge area;
- Chart advances in the body of knowledge;
- Develop some tests in a format similar to the FE examination; and
- Ask students to submit test questions on the subject matter covered.

End of the semester

- Develop and give diagnostic exams to help students determine strong and weak areas of knowledge;
- Help the student develop a profile of their knowledge based on the body of knowledge; and
- Conduct review sessions to address weak areas.

Discussion/Recommendations

The objectives of the DLOK assessment are to help the student attain a consistent and thorough knowledge of the subject and demonstrate that knowledge in a facilitated group environment. Demonstration of a discussion level of knowledge should provide an exercise where the students are exposed to the complete body of knowledge and encouraged to integrate concepts and principles in

ways that they have never considered before. In addition, the derivative effects of the assessment are proposed to include a self-assessment by the student and an increase in the student's confidence that they can take and pass the final examination and the FE exam. Both of these derivative effects are considered by the author to be positive and probably in some part measurable through various instruments.

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