

Chapter 8.14

Online Assessment and Instruction Using Learning Maps: A Glimpse into the Future

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ABSTRACT

Online assessment, in its infancy, is likely to facilitate a variety of innovations in both formative and summative assessment. This chapter focuses on the potential of online assessment to accelerate learning via effective links to instruction. A case is made that detailed learning maps of academic progress are especially conducive to effective skill and concept diagnosis and prescriptive learning, contributing construct validity and precision to assessment results and coherence to instructional interventions. Item adaptive testing using learning maps and the paradigm of intelligent agents is discussed in the context of a vision of a seam-

less integration of assessment and instruction. The chapter is primarily speculative rather than technical.

A GLIMPSE INTO THE FUTURE

In this chapter the authors invite the reader to take a step back from the pressures of educational policy and politically driven educational reform movements to consider one possible direction of development of online educational assessment and instruction in the age of the Internet and advancing technology.

Instruction and assessment are closely related, integral aspects of the learning process. Instruction is the process by which learning is facilitated

and guided; assessments are opportunities for learning, as well as feedback mechanisms that inform and have the potential to positively and dynamically affect instruction. It is only when this feedback provides relevant, timely information for enhancing instruction that its full potential can be realized. Online approaches to assessment are ideal for this purpose.

Imagine a classroom where students interact with an online assessment system on a weekly or monthly basis. The assessments are formative in nature (designed to inform the instructional process), as well as diagnostic, describing the specific skills a student has mastered and has yet to master in order to meet a prescribed educational standard. Linked to these diagnostic test results are instructional references and other supports to help the teacher remediate, sustain, or advance the student. With this support, the teacher is better able to meet the specific learning needs of each student and track all students' cumulative progress toward achievement of prescribed educational standards. Now imagine the same teacher delegating the teaching of some skills and concepts in each content area to learning software. As each student interacts with the software program, his or her knowledge state is continually assessed in order to customize the instructional inputs. Imagine further (if you do not mind a wildly speculative leap) an online learning environment, available in this same classroom via subscription, in which the construction of instructional inputs suggested by the ongoing assessment of the student's knowledge state is achieved by automated searches of public domain Web sites.

The argument of this chapter will be that detailed learning maps of academic progress are likely in this and coming decades to play a role in progress toward a vision of closely integrating assessment and instruction—either in the classroom, or in software, or in cyberspace.

It should be stated from the outset that there is no necessary distinction between the data required for sound formative assessment and

sound summative assessment for accountability requirements. The cumulative records of student achievement, based on ongoing, detailed formative assessment, can potentially be aggregated and expressed in periodic summative reports. This chapter focuses, however, on the use of online formative test data as immediate feedback for learning and the design of instruction.

LEARNING MAPS

One of the foundations for online assessment advances may be the representation of academic learning sequences in detailed learning maps of a particular kind, defined here as networks of sequenced learning targets. Compared to other more general methods of ordering content (for example, by grade-level collections of knowledge indicators, by statistical results, or by the definition of emerging general stages of skill and knowledge), the detailed ordering of learning targets in learning maps is especially conducive to effective concept and skill diagnosis and prescriptive learning. Learning targets may be skills, concepts, or any discrete focus for a lesson. In addition to intentional learning targets, learning maps can include transitional knowledge states (errors or partially correct knowledge) that typically occur on the learning path.

Each learning target in a learning map may be represented graphically as a node in a network of nodes. These nodes are ordered in precursor/post-cursor (learning order) relationships, as shown in Figure 1, which represents the learning path to an understanding of the causes of seasons on Earth. Figure 1 is a section of a larger learning map with links to other science strands. This section of the map focuses on the learning targets that need to be mastered in order to understand the causes of seasons on Earth. The shaded nodes are those that have been mastered by the student. This particular student appears to be making the mistake, common among students and the general

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