

DEVELOPMENT OF A REAL-TIME ASSESSMENT OF
STUDENTS' MENTAL MODELS OF SOUND
PROPAGATION

by

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B.S., University of Split, Croatia, 1998
M.S., Kansas State University, 2002

A DISSERTATION

Submitted in partial fulfillment of the
requirements for the degree

DOCTOR OF PHILOSOPHY

Department of Curriculum and Instruction
College of Education

KANSAS STATE UNIVERSITY
Manhattan, Kansas

2004

Approved by:

Major Professor
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ABSTRACT

Our previous research has identified that in order to describe sound propagation students use two models that are fundamentally different: the Wave Model and the Entity Model (Hrepic, Zollman & Rebello, 2002). All other identified models are hybrid models that share some, but not all of the features of each of the fundamental models.

We have constructed a multiple-choice assessment to elicit the identified models. This research has demonstrated that the test which was developed is a reliable and a valid instrument and can be used as a formative assessment tool at secondary and tertiary educational levels. The full name of the test is “Formative Assessment of Mental Models of Sound Propagation” or for short “FAMM-Sound”. The assessment can be delivered in real time over a classroom response system to identify student’s mental models in a classroom setting. Accompanying software has been developed and made freely available for teacher’s usage in their own instructional setting. Based on the results of the study an instructional approach that effectively addresses students’ mental models of sound propagation has been suggested and described in detail.

The unique approach to testing and to analysis of the test results has been developed to meet the research goals of this study. In this new approach to model analysis, that we call Linked Item Model Analysis (LIMA), the complete meaning of the particular answer choice is determined by answers given in other (sometimes all other) test questions. This testing approach could be applicable for eliciting of mental models in other domains of physics and natural sciences. It might be also utilized for eliciting of other, not necessarily cognitive psychological constructs, thus serving for diagnostic purposes not only in education but in psychology as well.

Hrepic, Z., Zollman, D. & Rebello, S. (2002). Identifying students' models of sound propagation. Paper presented at the 2002 Physics Education Research Conference, Boise ID.

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