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Contribution ID: 295

Type: **Oral Presentation**

Probing students' problem-solving ability in physics – a possible role for a typology of errors

Wednesday, 11 July 2012 10:55 (20 minutes)

Abstract content
 (Max 300 words)

For some years we have investigated students' ability to solve problems. We consider now the possible usefulness of an 'error typology', both as a route to better assessment and as an additional data gathering tool in this study. Detailed analysis of test and examination results has enabled us to gauge average student performance in each of several types of assessment task in a typology which is under development.

The typology is based on what the student is actually doing while answering the question - the underlying rationale being that tasks can be divided into two basic modes – algorithmic and heuristic. In the former, a known algorithm is a pre-requisite to the process and is normally supplied to the learner by an instructor. In the latter, the solver has to invent the algorithm as part of the problem-solving process. Of these, only the heuristic mode is truly 'problem solving'. Data collected thus far seems to support the following:

- Students are generally poor problem solvers despite the widely acknowledged importance of problem solving. Performance in non-algorithmic tasks is consistently lower than for algorithmic tasks.
- Explicit teaching of heuristic problem solving is rarely encountered at either high school or first year level. More common is the exposition of content, and teaching of ready-made algorithms.

Also possibly useful is to be able to say exactly what an individual student has done wrong when answering a test question. This goes beyond being able to say what kind of question the student was attempting to answer and what average mark was achieved for that particular question. Instead it looks at what mistakes the student might have made in attempting to produce the answer. With this in mind, a typology of errors is here proposed and will be presented and discussed at the conference.

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Session Classification: Education

Track Classification: Track E - Physics Education