Data Mining of both Right and Wrong Answers from a Mathematics and a Science M/C Test given Collectively to 11,228 Students from India [1] in years 4, 6 and 8

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Abstract: Our poster presentation illustrates how to include wrong answers in test analyses using Response Spectrum Evaluation (RSE) procedures to track answer patterns on an answer-by-answer basis.

RSE is a statistical procedure adapted from the multinomial [3] that bypasses the linear dependency problem so that alternative (wrong) answers can be included in data-mining analyses. Thus, the study of the dynamics of learning events can be conducted on an answer-by-answer basis.

Previous investigations [3] using this procedure have revealed:

1. The selection of answers is the result of the way students interpret the test questions.

2. These interpretations are directly inferable from the answers selected (or presented).

3. Selection procedures involve a number of strategies that are characteristic of each student, providing diagnostic information that can inform teaching.

4. This information is of more value to teachers who focus upon teaching how to think and how to learn instead of reproducing course content.

5. Some students show systematic development similar to the sequence described by the clinical observations of Piaget [1], while others show deterioration in the reverse direction.

6. Some students systematically shift from the right answer on the easy questions to particular types of "wrong" answer when their ability breaks out of "all" or "nothing" thinking (without considering other options) into more intellectually flexible mind-sets. RSE is the only procedure with this detection capability.

7. The focus upon the right answers in the psychology of test-taking reinforces closed-minded thinking on the part of students taking the test, meaning that if the objective of teaching is profound understanding, the focus upon "right" answers is psychologically invalid.

8. The dynamics of learning revealed by the RSE procedures are non-linear and multichotomous, meaning that the use of total-correct scores to assess student

performance is mathematically invalid because the normal distribution requires dichotomous data to be utilized.

Our study considers two tests, mathematics and science, given to the same students at three school levels, years 4, 6 and 8. It presents three examples from each test, showing the patterns of answer selection transitions on these items and the interactions among them.

In our study, we draw implications for using RSE to add important diagnostic and interpretive information for teachers. This information can often be derived by direct analysis of each answer to each item. The ways in which these behaviors aggregate, however, requires determining the associations among answers with all answers in the test (both right and wrong), requiring that the analysis bypasses linear dependency.

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References

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