

## **Mathematical learning theory (R. C. Atkinson)**

### **Overview:**

Mathematical learning theory is an attempt to describe and explain behavior in quantitative terms. A number of psychologists have attempted to develop such theories (e.g., Hull; Estes; Restle & Greeno, 1970). The work of R. C. Atkinson is particularly interesting because he applied mathematical learning theory to the design of a language arts curriculum.

Atkinson (1972) discusses the problem of optimizing instruction. He outlined four possible strategies: (1) maximize the mean performance of the whole class, (2) minimize the variance in performance for the whole class, (3) maximize the number of students who score at grade level, or (4) maximize the mean performance for each individual. Atkinson shows that while alternative (1) produces the largest gain scores, it also produces the greatest variance since it increases the spread between the most and least successful students. Alternative (4) produces an overall gain but without increased variability. This is accomplished by giving each student variable amounts of time depending upon performance.

### **Scope/Application:**

Atkinson's research has primarily focused on simple [language learning](#) in the context of computer based instruction. Atkinson & Shiffrin (1968) discuss a model of memory based upon quantitative principles.

### **Example:**

Atkinson (1972) reports the results of an experiment in which college students learned German vocabulary via (1) random presentation of words, (2) learner selection of words, or (3) response-sensitive presentation based upon student performance. The response-sensitive strategy resulted in the best scores on a delayed test. The response-sensitive strategy was based upon a mathematical model that predicted the changes from one state of memory to another.

### **Principles:**

1. It is possible to develop an optimal instructional strategy for a given individual provided that a detailed model of the learning process is available.
2. Optimal learning performance can be achieved by giving each individual sufficient time to learn.

### **References:**

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Restle, F. & Greeno, J. (1970). Introduction to Mathematical Psychology. Reading, MA: Addison-Wesley.

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