Academic Learning Time: The Most Important Educational Concept You've Never Heard Of

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LEARNING WITH THE SPEED AND ENERGY OF LIGHT

Academic learning time: The most important
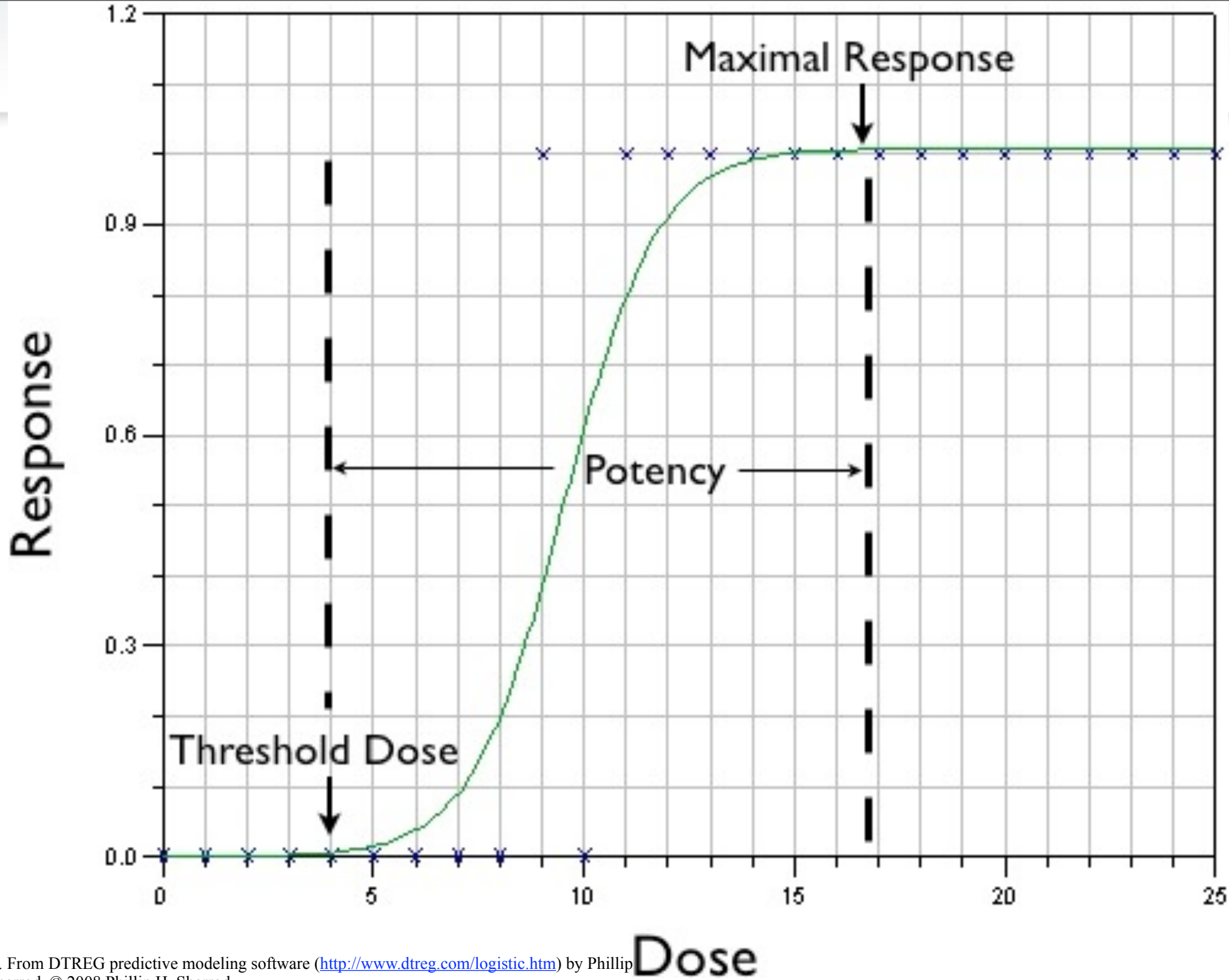educational concept you've never heard of

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Carroll's Model of Learning

- **John B. Carroll, "A model of school learning", 1963**

- **Learning is intrinsically related to time spent learning**

$$\textit{Degree of Learning} = f \left[\frac{\textit{Time Spent Learning}}{\textit{Time Needed to Learn}} \right]$$

- **Suggests that time is effectively a dose variable**

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Nuances of Carroll's Model

- "[o]ne of the bolder hypotheses implicit in the model is that the degree of learning, other things being equal, is a simple function of the amount of time during which the pupil engages actively in learning" (p. 732).

- Time Needed to Learn (TNL) is a function of a variety of variables - quality of instruction, aptitude, etc.

- A critical component of the model is that TNL varies at the level of the individual

Time Is Not Time Is Not Time

- Berliner, "What's all the fuss about instructional time?", 1990

- 4 required attributes of academic learning time (ALT)

  - Must be instructional in nature

  - The student must be engaged across the time period in question

  - The instruction must be appropriate for the student

  - The content must be aligned with outcome measures
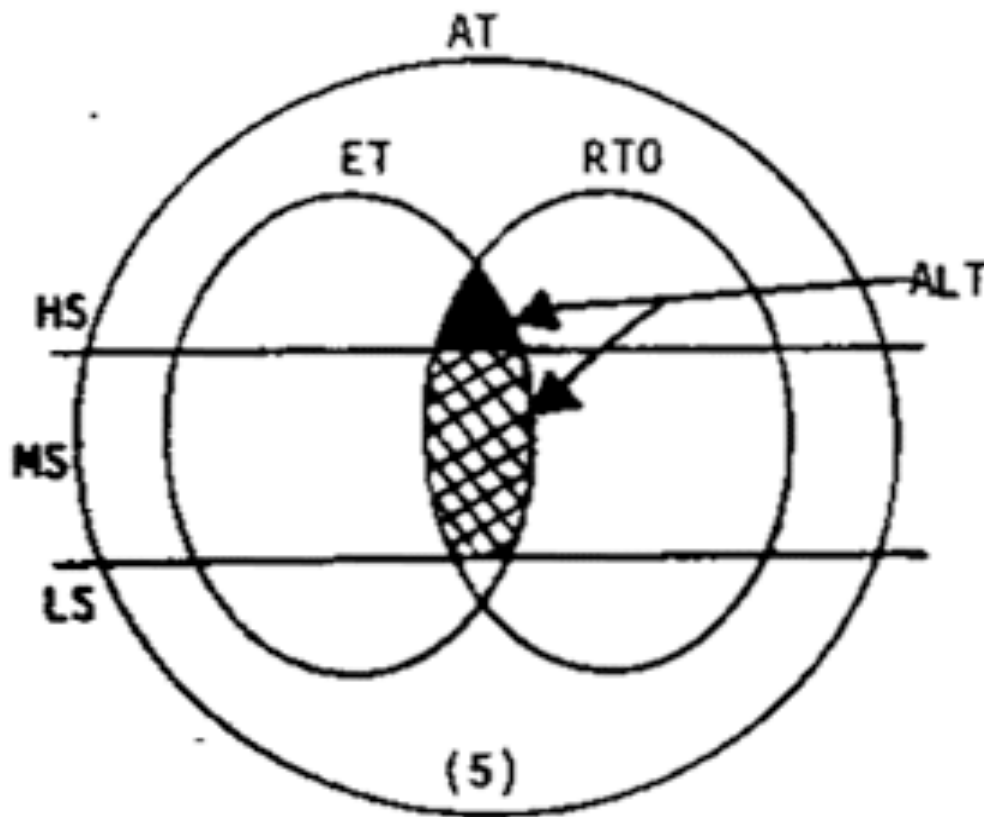
Notes

AT = Allocated time
ET = Engaged time, always a subset of AT
HS = High success experience
MS = Medium success experience
LS = Low success experience
RTO = Time spent on materials or in activities related to outcomes
ALT = Academic Learning Time: That part of (1) allocated time in which students (2) are engaged, (3) are succeeding at what they are doing, and (4) what they are doing is related to outcomes that are desirable. (5) ALT for young children (5th grade and below) is the small dark section; ALT for older students is both the dark and the cross-hatched sections.

Adapted from Berliner, 1990, p. 19

Implications of ALT

- ALT is therefore not just "time on task" it is "time on [the] right tasks" (p. 18)

- "[u]nless ALT is affected in some way, there will be no changes in student achievement at all" (p. 22)

- This suggests that ALT is not just correlational, it is causal

- It is difficult to overstate the fundamental character of this declaration

"I often say that when you can measure what you are speaking about and express it in numbers you know something about it; but when you cannot measure it, when you cannot express it in numbers, your knowledge is of a meagre and unsatisfactory kind: it may be the beginning of knowledge, but you have scarcely, in your thoughts, advanced to the state of science."

– Lord Kelvin

If ALT is so important, why have I never heard of it?

- With the general agreement that time is important there has been an explosion of terms - time on task, opportunity to learn, etc.

- ALT has a complex and nuanced definition

- Exceedingly difficult to quantify in a standard classroom setting - all 4 criteria need to be simultaneously met

Criterion 1: Instructional

- Usually measured via teacher self-reports or direct classroom observation of teachers and students

- Bromme & Hömberg (1990) found that teachers' estimates of overall instructional time were accurate

- However, this breaks down at the student level - teachers noticed only 3% of individual student successes and failures

- "[T]eachers had observed the class as a unit. They perceived the learning progress of the 'collective student,' that is, an abstract subject composed of the various students in the lesson dialogue" (pp. 183-84)

Criterion 2: Engaged

- 'Spending time' means actually spending time on the act of learning. "Time" is therefore not "elapsed time" but the time during which the person is oriented to the learning task and actively engaged in learning. In common parlance, it is the time during which he is 'paying attention' and 'trying to learn.' (Carroll, p. 725)

- Nonobvious how to operationalize this - does the child have to be watching? Not doodling? Not texting?

- There is no consensus in the research community about what qualifies as engagement (Ball & Rowan, 2004; Fredericks, Blumenfeld, & Paris, 2004)

Criterion 3: Appropriate

- Has caught more attention recently - same idea as "Zone of Proximal Development" (Vygotsky, 1978)

- Requires a researcher to know the range of capabilities of each student and to know if the material at hand falls within that range

- Generally demonstrated by feedback - Gettinger & Seibert (2002) specified that ALT requires an 80% success rate for young children

- Does not appear practical, as it would necessitate a minimum of 5 items / student * 30 students / classroom = 150 items to be asked per learning task

Criterion 4: Assessed

- Researcher would need to know what was ultimately going to be assessed at an item level

- Not necessarily a major problem for a given site, but it has disturbing implications for ALT research on a broader scale

- There are 13,924 U.S. Districts, each potentially with its own assessment

- Atomized teaching ethic (Elmore, 2002)

- Large scale ALT research will be hampered until there is more consistency in assessment across instructional settings

ALT Challenges in Summary

- ALT requires analysis at the student level

- All of our traditional tools and methodologies operate at the classroom level

- Teachers (and researchers) think at the classroom level

- This fundamental disconnect suggests that there needs to be a rethinking of how to conduct ALT research

Enter Technology

- Atkinson and Hansen (1966) noted that computer-based instructional (CBI) systems "make it possible to obtain rigorous behavioral measures", with the result that "subject-matter learning can be studied under conditions of greater control and with more precision in response-recording than has ever been possible even in the psychologist's laboratory" (p. 8)

- In instances where instruction is delivered via technology, computer-based ALT potentially can be calculated

Criterion 1: Instructional

- Computers can vary the amount of instructional time they provide with precision

- Computers can handle the amount of information necessary for analysis of achievement at the individual (not just the group or classroom) level

- In addition, the instructional content delivered by the computer is identical every time, so there is no question as to each student's opportunity to learn

- This is not a methodological panacea - ALT is obviously coming from other sources - but it is a vast improvement over the present approach

Criterion 2: Engaged

- Properly designed CBI is interactive, both inviting and requiring active response

- While time on the software cannot directly be equated with ALT, it is a meaningful improvement over "time in class" approaches used today

- In those instances where the software is both highly interactive and engaging, it seems reasonable to assume that time spent learning would asymptotically approach ALT

Criterion 3: Appropriate

- Modern instructional systems can be adaptive in nature, personalizing content for each student without disrupting other students

- Computers can also keep detailed logs on past performance which can be used to inform sequencing and leveling of the content

- Ideally the system ensures that each student gets the amount of time needed to master each concept

- While this approach is still in its infancy, it holds the promise of eventually being able to provide what each student needs at that particular moment

Criterion 4: Assessed

- CB Assessment does not in and of itself guarantee alignment, but alignment can be built in

- One of the major sources of potential error in the assessment of young children comes from individual variation among testers

- CB Assessment does not remove this bias, but it shifts it from a variable to a constant

- As Suppes & Zanotti (1996) pointed out, if the curriculum is properly leveled and sequenced, and all of the items are aligned to the assessment, outcomes can be inferred from position in the curriculum

Limitations of CBI for ALT

- Qualitative differences in instruction

- CBI is more of a tutor as opposed to a group approach

- Pace of change

- Lack of external validity

A Call to Action

- If time (ALT) is as fundamental to learning as both Carroll and Berliner suggest, then it is a research imperative that it be rigorously investigated

- The tools are finally coming into focus

- It is my hope that some of you will join in this important pursuit so that we can finally make a science out of learning

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