Enterprise Modeling at ETS: Highways and Byways

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Abstract

Educational Testing Service, the world leader in standardized educational testing, has begun a transition from paper-and-pencil testing to computer-based testing. This transition is a complex undertaking affecting the entire organization, and will require several years to complete. An integrated enterprise model has been developed to assess financial impacts of the transition and to look for better ways to manage it. Smaller side models have also been developed for exploring a few key issues individually in greater depth and with more elaboration than the large model would allow. Such a mixed "highways and byways" approach to modeling allows one to achieve a solid final product while providing useful, engaging insights along the way.

ETS Business Context

Transition from paper and pencil (P&P) to computer-based testing (CBT):
- Touches every part of the organization
- Not just a change in technology, but in service delivery and cost structure
- Has potential to affect business alliances, market dynamics, and competition

Antecedents and groundwork for system dynamics modeling:
- Growing ETS interest in modeling, and Fred's interest in Systems Thinking
- Two in-house SD workshops coupled with software purchases
- Earlier year-long efforts to identify activity flows and gather volumetric data
- Increasing pressure to get a fix on the costs of transition to CBT

Model expectations:
- Focus on internal operations, leaving market and competition outside boundary
- Focus on three transitioning programs: GRE, GMAT, TOEFL
- Estimate impacts on profit margins and corporate overhead rates

Emerging Concept of Highways and Byways

Dynamic modeling projects fall into three categories:
1. Chronic dysfunction or roadblock -- Understand loops and fix problems
2. Future dysfunctions or roadblocks -- Anticipate loops and prevent problems
3. Ramifications of change -- Spell out the details of transition
   --> Emphasis on visual mapping and quantification

Projects of Type 3 offer opportunities of Type 2:
Look for red flags, follow the bumpy detours --
Capture the detail of the big picture (Highway), but also focus in on
the feedback dynamics of a few potential trouble spots (Byways)

The ETS Highway: A Study in Detail Complexity

Activities:
Create test --> Publish materials --> Distribute products
Register candidates --> Administer test --> Score test and report results
Cost centers:
Test development / Test production services / Statistical analysis
Test administration services / Test security office
Initial processing services / General services division / Publications
Customer service center
Outside contracts:
External test item writers
Test center staff (supervisors and proctors)
CBT administration (Sylvan Learning Systems, plus college-based CBT labs)
Publication printing and shipping
Market uncertainties and ETS decisions:
Test registrations and rate of transition to CBT
Rate of test item turnover due to item exposure (esp. overseas)
Reduced demand for paper registration bulletins (available on Internet)
Frequency of P&P and CBT test dates

Test Development: A Key Byway

Computer testing requires much larger inventory of test items:

    Weekly test packets rather than just a few times a year (exposure issue)

    "CAT" (computer adaptive testing) requires more difficult items per test packet

Stages of item development: writing --> review --> pretest (incl. statistical analysis) -->
        assembly (operationalization)

Reasons for item retirement: exposure, obsolescence, disclosure

For GRE General Test, looking to increase total items 5x and difficult items 8x by 2000:

    Approach to date -- have allocated additional resources, increased outsourcing, and
        reengineered much of process

    Possible stumbling blocks -- staff time, pretesting, writing difficult items, item
        turnover

Tentative model findings:

    By 2000, can get the desired increase in total items but not in difficult items

    Should highlight efforts to raise difficult proportion of items written

    Pretesting limitation prolongs the required time to target by at least a year

    When goal is neared, development moves from "growth" to "maintenance mode" --
        get unexpected large and steep drop in required staff hours

What We Have and Where We're Headed: A Client's Perspective

Payoffs to date:

    Some answers, some insights, corroboration and validation of some (but not all)
    prior suppositions, a useful tool, a useful technology, new mental models (and hard
    copy, too), expanded vocabularies, new ways of thinking, and learning

Steps ahead:

    Avoid the "silver bullet" syndrome

    Manage demand without alienating potential customers

    Pick the right follow-on projects ("What do you do for an encore?")

    Develop internal modeling capability: sizing, staffing, and placing

Successful Enterprise Modeling: A Modeler's Perspective

Generate early support for dynamic modeling, ex. with pre-project workshops
Enterprise modeling should build upon a good existing data/knowledge base
Define the boundary carefully -- focus on the client's main concerns
Get early agreement to Highway/Byways approach -- comprehensive visual mapping
    supplemented by feedback analysis of a few key areas
Find the key byways early -- probe for "red flags", and create modules for discussion
Make sure all important constituencies are involved -- especially in byway modeling
Maintain the momentum -- schedule frequent meetings, work patiently with client to find
    right level of detail considering time available and project objectives
Project sponsor should work the organization -- allowing modeler to concentrate on the
    model without too many distractions