Leverage Points: Places to Intervene in a System

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Leveraging Power or Ideas
Positional advantage; power to act effectively

SCHOOL SYSTEMS

Uses understanding of system structure to identify possible leverage actions

T/L INNOVATIONS
ITSI-SU Project
Innovative Technology in Science Inquiry Scale Up

- ITEST (NSF), Concord Consortium
- Alaska, Iowa, Virginia, Kansas state cohorts >250 teachers Year 3/5
- Web-based science simulations, probeware, modeling for gr. K-12 students
- Teacher online community
- Online assessment systems
My fuzzy logic model: ITSI-SU
Systems Levers
Small Movement: Large Effects

12 Systems Levers: Donella Meadows

- Numbers
- Buffers
- Stock and Flow Structures
- Delays
- Balancing Feedback Loops
- Reinforcing Feedback Loops
- Information Flows
- Rules, Incentives
- Self-Organization
- Goals/Purpose of system
- Paradigms
- Transcending paradigms
Lever: Delays

- Delays are critical relative to the rate of change in the stocks the feedback loop is controlling: You’re looking for oscillations, as any system will have
- Too short a delay: overreaction
- Too long a delay: sustained or exploding oscillations
Delays: Too Short

- Too short a delay: overreaction
- Example: all the kids are doing online science and using probes immediately, their test scores rise immediately) what’s wrong with this data?
Delays: Too Long

- Too long a delay: sustained or exploding oscillations
- Feedback that is irrelevant or useless
- Example: typically school system feedback occurs only as a function of standardized test results; is there anything the intervention can do to shift this focus?
Student content knowledge: Teachers have students take online assessments pre/post before each unit. For the research purposes of the grant, sent back to CC.

Not analyzed until after several months, then reported to PI, or following year.

Leverage point: If feedback were immediate (within days), teachers would refine instruction and implementation designs the next time (e.g. INK-12 immediate laptop response 4th grade math)
ITSI Delay: Regional

- Local/regional adoption: In a district, the response and feedback of implementation e.g. Anchorage: (how many teacher Yr 1, Yr 2, Yr 3) grows; as a function of hearing about earlier cohorts.

- Hypothetical: district adoption into a pay-service model; they want to see results in their language: standardized science exam scores, but by the time these will be analyzed, reported, and tied to ITSI classroom activities (2-10 contact days/year), will be irrelevant, too late after project funding.

- Leverage point: difficult to enact b/c funding timeline, needs several years of repeated practice.
Lever: Reinforcing Feedback Loops

- A reinforcing feedback loop is self-reinforcing: the more it works, the more it gains power to work some more, driving system behavior in one direction, either positively or negatively.
- More people have flu, the more will get infected, more will get the flu and infect more.
- The more money you have, the more you’ll make, you invest more, you make more.
- More the polar ice cap melts, the less reflected albedo decreases, less radiant energy reflected back, more heat retained, more ice melts.
ITSI: Reinforcing Feedback Loop

- ITSI: teachers online course: 5 consecutive weeks Fall & Spring
- Required participation, includes assignments, readings, peer review of lessons. Lesson plan posting and blog area for discussion/response

- Required 2 posts/week, some participate more than others

- More they blog, the more they’ll receive a peer response, the more they’ll blog/contribute, inevitably positioning them to implement better; the less they participate, the least likely they are to engage fully, build community, they are then left out, implement poorly
ITSI: Reinforcing Feedback Loop

ITSI: teachers online course: 5 consecutive weeks Fall & Spring

Relationship of Frequency of blog posts to:

- Student engagement
- Frequency of ITSI activities
- likelihood to continue

![Graph showing relationship between blog posts, student engagement, frequency, and likelihood to continue.](image)
ITSI: Reinforcing Feedback Loop

- Blog frequency: class dimension means
ITSI: Reinforcing Feedback Loop

☐ How is this useful?
☐ By encouraging teachers simply to post (anything, even trivial), their overall performance might improve as a result of increased support ➔ sense of community ➔ increased motivation ➔ improved classroom experiences with program ➔ increased likelihood to continue
Lever: Information Flows

- The structure of who does and does not have access to information
- Missing information flows are one of the biggest causes of system malfunction
ITSI: Information Flows

- Technical—online access, getting computer lab to work (IT/tech director or school firewall, etc.)
- Fundamental computer comfort; this knowledge or lack of will considerably impede project advance
- Case of school with poor access, took months, until CC visited, got online between programmer at CC and IT person; things fixed in ½ hour; Understanding this information flow helps design issues
The Tough Levers: Paradigms

- Highly valued lever of Paradigms: how not realized or observed yet. What that might look like
- Why deep change
- Why not seen yet
- What it might look like
- Is it ok as an evaluator to expect to see this?