Using cognitive developmental science to align educational standards, curricula, & assessments

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Overview

- What Tower of Babble?
- Dynamic skill theory
- Measuring cognitive development
- Applications to leadership
  - describing the development of leadership skills
  - devising assessments of these skills
  - designing & evaluating curricula
  - describing the task demands of jobs
  - setting standards
What Tower of Babble?

- Many languages for describing cognitive development
- Not as bad as it sounds
  - many cognitive developmental theories
  - several converge on a similar scale
- Worse than it sounds
  - much work has been done that shows how useful a good developmental scale can be
  - little has been done to put it to work in real-world contexts
Dynamic skill theory

• Kurt W. Fischer (1980, 2006)
• Dynamic skill scale
  • 5 tiers (reflexes, actions, representations, abstractions, principles
  • 4 (3) levels per tier (single elements, mappings, systems, systems of systems/single elements)
Skill levels are orders of hierarchical complexity

- Each level represents a new order of hierarchical complexity—a new level of elaboration and integration
- This can be observed in the logical structure of statements and concepts.
  - Directly observable in statement structure
  - Indirectly observable in the meanings of concepts
The developmental spiral

Sensorimotor Actions
The developmental spiral

Sensorimotor Actions

Representations

Abstractions

SSmS  SR

SmS

6

6

9 10

11

9

8

7

Sunday, November 4, 2007
What is a good leader?

A good leader is in front.
A good leader is in front, so she can show you the way.
What is a good leader?

A good leader will show you how is fun to have because she knows where to go and knows what to do and will show you how.
What is a good leader?

A good leader

- is good with people
- is fun
- is helpful
- is friendly
What is a good leader?

A good leader is in front

so

she can show you the way

A good leader is good with people

which makes them trust her intentions
What is a good leader?

A good leader will show you how

is fun to have

because she knows where to go and knows what to do and will show you how

A good leader is

inspiring if she is competent and trustworthy without appearing arrogant
What is a good leader?

- A good leader is good with people.
  - is fun
  - is helpful
  - is friendly

- A good leader is a highly competent servant to her organization.
  - inspiring
  - visionary
  - deeply committed

Sunday, November 4, 2007
### Some relatives of the dynamic skill scale

<table>
<thead>
<tr>
<th>Skill levels (Fischer)</th>
<th>GMHC (Commons)</th>
<th>Moral (Kohlberg)</th>
<th>Good (Armon)</th>
<th>RJ (Kitchener &amp; King)</th>
<th>SOI (Kegan)</th>
<th>LM (Piaget)</th>
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<tr>
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<td>stage 5</td>
<td>stage 5</td>
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Measuring cognitive development
The beauty of the dynamic skill scale

- Its level definitions
  - describe a latent, content and context independent dimension, and
  - suggest a basis for an assessment system.
The Lectical Assessment System (LAS)

• Using this system, analysts determine a performance’s
  • *explicit* logical structure, and
  • *implicit* conceptual structure.
• Taken together, they make it possible to accurately determine its level.
A good leader is competent, inspiring, trustworthy, and without appearing arrogant.

- A good leader will show you how is fun to have because she knows where to go and knows what to do.
- If she is trustworthy and inspiring, she is competent without appearing arrogant.
Validity and reliability

- Construct validity
  - Comparison with scoring systems designed by Armon, Kohlberg, Perry, and Kitchener & King
  - Modeling studies showing evidence of hierarchical integration

- Reliability
  - Over several studies, statistical reliabilities consistently in the range of .85 to .95
  - Inter-rater agreement rates at or above 85% within 1/3 of a level.
What psychometric models tell us

- For domain specific systems that have been validated longitudinally, skill level explains approximately 85%–95% of the variance in score distribution.
- There is more noise in domain specific systems than in the LAS.
- Lectical™ levels act more like progressions that involve state changes.
The LAS behaves like a “ruler”

- Scoring is content & context independent
- Scoring criteria are always the same no matter what kind of conceptual content one is looking at
- Content and context independent measures allow us to distinguish between “is” questions and “ought” questions
Content independence
Why is this ruler-like quality important?

Development over time

Year of testing

2          4           6           8        10       12       14

Critical thinking
Decision making
Strategic thinking
Ethical reasoning

Critical thinking
Decision making
Strategic thinking
Ethical reasoning

Year of testing

2          4           6           8        10       12       14

Sunday, November 4, 2007
Developmental pathways and institutional demands
# Workplace demands vs. performance

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<tr>
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<th>Management levels</th>
<th>Development over time</th>
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Applications
Describing the development of leadership skills

- Over 200 interviews of managers’ and students’
- Scored with the LAS
- Analyzed for their conceptual content
  - Coding
  - Identifying themes
- Reintegrated skill level and content within thematic strands
Results

• Identified 8 themes: emotion, cognition, communication, social skills, personality, ethics, style, and skills (other)
• Constructed descriptions of 4 phases per theme: 10:2-10:3, 10:4-11:1, 11:2-11:3, 11:4-12:1, corresponding to estimated task demands of 4 management levels (L0-L3).
## Example: Communication, concepts

<table>
<thead>
<tr>
<th>Concept</th>
<th>L0</th>
<th>L1</th>
<th>L2</th>
<th>L3</th>
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<tbody>
<tr>
<td>communicating well</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>answering questions</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>soliciting feedback</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>communicating the vision</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>providing the big picture</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>soliciting counsel</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>adapting to audience</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>handling miscommunication</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>integrating diverse perspectives</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
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<tr>
<td>maintaining open discourse</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
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<tr>
<td>facilitating compromise</td>
<td></td>
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<td>X</td>
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</table>
### Example: Communication, descriptions

<table>
<thead>
<tr>
<th>Phase</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>L0</strong>&lt;br&gt;10:2-10:3</td>
<td>Respondents performing at this level focus on basic, stereotypic communication skills. Skills such the ability to communicate well, answers question, and request input are related to other concepts in a linear manner, forming propositions comprised of a few logically related abstractions. For example, an individual performing at this level might claim that a leader should be clear in both oral and written communication.</td>
</tr>
<tr>
<td><strong>L1</strong>&lt;br&gt;10:4-11:1</td>
<td>Respondents performing at this level focus on a broader set of communication styles such as accessibility or communication skills or the ability to solicit perspectives or feedback, communicate the vision, and summarize information. These are combined into sets, groups, or lists, and most commonly coordinated with other concepts in linear arguments, but may also be observed in unelaborated multivariate structures. For example, an individual performing at this level might assert that if leaders want to communicate the vision they must not only be able to define the task but must also provide the big picture.</td>
</tr>
<tr>
<td><strong>L2</strong>&lt;br&gt;11:2-11:3</td>
<td>The communication styles and skills that are mentioned for the first time at this level tend to be multidimensional and to incorporate psychological and organizational insights. They include concepts like open environment, receiving and soliciting counsel, and handling miscommunication, which are coordinated with other concepts in a structure that specifies multiple relations between the conceptions. This can be seen in the idea that leaders should be able to communicative up and down the chain of command, which involves translating and articulating the definition of tasks differently for different individuals.</td>
</tr>
<tr>
<td><strong>L3</strong>&lt;br&gt;11:4-12:1</td>
<td>Individuals performing at this level often focus on the ways in which the organizational environment fosters or interferes with the development of communication skills. They begin to coordinate systems of abstractions, sometimes in terms of overarching conceptions or general principles. Conceptions such as democratic communicative environments and managing conflicting perspectives subsume systems of abstractions and facilitate their coordination. For example, in conceptualizing the integration of diverse perspectives, individuals performing at this level coordinate variables that are systems of abstractions such as facilitating compromise, a complex notion coordinating other abstract notions like balancing interests, maintaining open discourse, and resolving conflicts.</td>
</tr>
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</table>
Comparing managers’ level of skill to the task demands of their jobs

- Describe the task demands of management positions
- Interview managers about the task demands of their jobs
- Examine job descriptions
- Determine the complexity range of the management-related task demands of each management level
Management hierarchy
Task demands vs. performance

L3 (n=28)
L2 (n=46)
L0 (n=24)

Feelings
Problem-solving
Epistemology
Self as leader
Good leader
Good employee
Designing curricula

• Managerial decision-making
  • study how skills develop within the skill area
  • score and document the content of decision making texts
  • use results to “map” the decision-making domain
  • describe learning goals for 4 broad themes and three levels of management
The decision making domain

- Intersubjective skills
- Decision-maker qualities
- Cognitive skills
- Values
The decision making domain

Decision maker qualities

Psychological capabilities
- focus
- intuition
- tolerance for risk
- tolerance for complexity
- motivation
- initiative

Personality traits
- discipline
- adaptiveness
- creativity
- leadership and character
- vision
- resolve
- responsibility
- self-confidence

Creativity
- intuition
- tolerance for complexity
- motivation
- initiative

Discipline
- focus
- tolerance for risk
- emotional regulation
- initiative

Adaptiveness
- intuition
- tolerance for risk
- emotional regulation
- initiative

Leadership and character
- discipline
- adaptiveness
- creativity
- initiative
Decision making domain breakdown

- Describe the competencies required for L1, L2, & L3
- Describe appropriate learning activities for each level; and
- When possible, link activities to particular texts.

Decision maker qualities

Psychological capabilities

Adaptiveness

- intuition
- tolerance for risk
- tolerance for complexity

Tolerance for complexity

Psychological capabilities

Tolerance for risk

Tolerance for complexity

Intuition
Evaluating the decision making curriculum

- **Sample**
- **65 managers**
  - Level 1 = 12
  - Level 2 = 15
  - Level 3 = 38 (2 classes)

- **Instrument**
  - Workplace dilemma
  - Solution and defense
  - Map of decision-making process
Results

- Developmental change (in phases)
  - 14 of the 65 students showed no advance;
  - 1 individual advanced 4 phases;
  - 1 advanced three phases;
  - 32 advanced two phases; and
  - 17 advanced one phase.

- Average gains were greater than one phase.
- Average gains for two traditional curricula were 1/4 to 1/2 of a phase.
Example 1: Phases 11:1 and 11:2

Time 1

- Is TD valuable to org?
  - if no...
    - Is TD interested in promotion?
      - if no...
        - if yes...
          - Invest more?
            - if no...
              - Do nothing/ ask to leave
        - if yes...
          - Develop/ provide exposure
          - Made more promotable?
            - if yes...
              - Success!
            - if no...
              - Invest more?

Time 2

- Problem
  - Objectives
    - Define desired outcomes
    - What are the possible courses of action? Be exhaustive. Think creatively.
  - Alternatives
    - How well does each alternative meet the objectives?
  - Consequences
    - Select the right path. If no one path meets all of the objectives, compromise or blend alternatives so as to maximize the degree to which objectives are achieved
  - Tradeoffs
    - Confirm that you are working on the right problem/ understand problem space well

Consider: uncertainties, risk, tolerance, and links between decisions

Keep in mind that this process is usually iterative and not linear
Example 2: Phases 12:1 and 12:2

Time 1

Options and constraints

Decision maker (personal strengths/weaknesses)

Factors to consider

Balance needs of individual with those of the organization

Environment

Organization

People

Influences and considerations

Time 2

Q1

I

Values, beliefs, morals, ethics

Us

K+S+C Behaviors

We

Vision, strategy

Them

Processes, measures

Q2

Subjective

Q3

Objective

Q4

External

Internal

Sunday, November 4, 2007
Setting standards

• Describe 5 levels of competency for 13 manager skills (such as decision-making, leading change, strategic thinking, communication)

• Employ these in the design of developmentally informed curricula and assessments for the National Leadership University
Values Centered Leadership

articulate the vision VC04

communicating the vision as it relates to the IC's mission and values VC04a
connecting the mission and values to workplace realities VA04b

be aware of conflicting obligations VC03

coordinating conflicting interests VC03a
stakeholder perspectives VC03b

move others to action (manage culture) VC05

move others to action that will provide inspiration
as it is informed by the mission and relates to IC core values

inform efforts to inform what it means to
provide content to

act in an ethical manner VC02

inform efforts to

values

as part of efforts to

 identifies and addresses ethical issues VC01

conflict resolution VC01a
emotions of self and others VC01b
core values VC01c

as part of efforts to

supporting responsible action VA05b

rewarding responsible action VA05a

...
Building the next generation of assessments

- Most large-scale assessments
  - examine content knowledge,
  - provide either a percentage correct score or a percentile score, and
  - allow us to compare people with one another.

- They do not tell us
  - how well people think,
  - how an individual has progressed in his or her learning, or
  - what that individual needs to learn next.
Building the next generation of assessments, cont.

- Assessments of skill level can help fill these gaps
- First, they can tell us how well people think about what they know.
- Second, once developmental pathways in a knowledge area are well-understood, determinations of skill level can be combined with conventional assessments of what people know to help determine what comes next in learning.
LRJA
LECTICAL REFLECTIVE JUDGMENT ASSESSMENT

9:4 is the modal reflective judgment phase for 12-year-olds. As shown in the figure on the right, about 23% of 12-year-olds reason at this level on the LRJA. Assuming that a student has kept up in all of his or her courses, this level of performance is an excellent fit for grade 7, because students performing at level 9:4 have the reasoning skills they will need to learn the early level 10 skills and concepts that are presented in grade 7 classrooms. If a student’s content knowledge, as reflected in GPA or standardized test scores, is not at the grade 6 level, tutoring to bring content knowledge up to grade level may be helpful. If GPA or test scores are considerably above average, immersion in an a good inquiry learning environment should inspire interest and motivation while catalyzing the transition into reflective judgment level 10.

Reflective judgment:
Percentages of 9- to 20-year-olds performing at phase 9:4

In this phase, students understand that people can have different beliefs or opinions, based on the combination of specific things they know. They are likely to assert that the truth about something can be found, but only if a person has all of the facts. Facts are thought of as bits of information that have been proven or directly observed. Truth is viewed as something that exists, but may be hard to find. When pressed, students performing at this level will usually acknowledge that there are some things people just can’t agree about, such as religion, the right rules for teen behavior, or who is the best looking girl or guy in the class. These things are often regarded as matters of opinion. Although they have many of the concepts that are required to make logical inferences about the relations between belief & opinion and facts & truth, they do not make these connections without support. This ability emerges at phase 10:1.

*All lectical assessments are assessments of performances, not people. All individuals function in a developmental range, and a single assessment cannot represent that range. Further, our assessments are discipline-specific. Individuals generally function at different levels in different disciplines. Consequently, performance on an assessment in any one domain cannot be taken as a general assessment of cognitive ability.
Beliefs about learning, inquiry, certainty of knowledge, and relativism

• primarily thinks of learning as the acquisition of facts, although there is some appreciation that learning also involves thinking about and applying ideas
• thinks it is a good idea to consult several sources of information when trying to solve a problem or answer a question
• primarily views knowledge as uncertain—difficult to “prove”—but believes there is some knowledge that can be verified
• views some knowledge as relative to particular persons or situations, whereas other knowledge is viewed as absolute

The major strengths in this performance are reflected in the student’s ability to:

• understand that people can’t be sure about their predictions until after they have observed an outcome—“what really happens”
• understand that the truth can be hard to agree upon because people can come to different conclusions if they have different information
• understand that the honesty of a source can have an impact on his or her conclusions, a precursor notion for a level 10 understanding of bias
• think of reality as something that is observable and truth and facts as subject to verification in the form of “proof”
The next areas for growth in this students’ reflective judgment skills are:

• considering what is special about the way scientists think and solve problems, especially what makes the scientific method a good way to learn about the world

• exploring how people come to believe something is true or false in different disciplines, such as science and history

• getting more specific about what it means to prove that something is true and what it would take to prove that something is not true

• learning about factors, in addition to honesty, that can have an impact on the quality of one’s own and other people’s conclusions

In light of these results, we suggest the following learning activities.

• This student is right on the verge of making an important developmental transition, during which thinking becomes more complex and he or she will be able to solve more difficult problems. It’s a good time to learn more about the scientific method—in particular, the steps required to design, carry out, and report about experiments. Good web sites with information about scientific thinking are Kidipede.com, dmoz.org, and nyelabs.com.

• From a developmental perspective, this is a good time for students to begin to learn about how their minds work, especially how the way we think affects the kind of decisions we make. There are some great psychology sites for tweens and teens, including epsych.msstate.edu, beautycheck.de, brainexplorer.org, and thinkquest.org.
Find this presentation at:
Example: Good leadership

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<td>• give &amp; take</td>
<td>• balancing mission &amp; employees</td>
</tr>
<tr>
<td>• building trust</td>
<td>• modeling &amp; expecting integrity</td>
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<tr>
<td>• two-way communication</td>
<td>• articulating the vision</td>
</tr>
<tr>
<td>• motivation</td>
<td>• leading vs. managing</td>
</tr>
<tr>
<td>• positive feedback</td>
<td>• transparency</td>
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<tr>
<td>• positive attitude</td>
<td>• cultivating resilience</td>
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<tr>
<td>• availability</td>
<td>• visibility</td>
</tr>
<tr>
<td>• teamwork</td>
<td>• group dynamics</td>
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</table>