Key Ideas Underlying Concept Maps And How They Can Be Used

Joseph D. Novak
Cornell University
&
Institute for Human and Machine Cognition
University of West Florida
Jnovak@ai.uwf.edu
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Based on:

- A Theory of Knowledge
- A Theory of Learning
All knowledge is built up from Concepts and Propositions
Concept:

A *perceived* regularity in events or objects, or records of events or objects, designated by a label.
A Theory of Knowledge

Proposition:
Two or more concepts combined to form a statement about something: a unit of meaning
A Theory of Knowledge

Concept Maps:
A tool to represent the Structure of knowledge
A concept map/flow chart hybrid

**Constructing Good CMaps**

- **Procedures**
  - i.e. begin with
  - 1. Open CMap Tools
  - 2. Go to My CMaps, or a folder under Places
  - 3. Go to File
  - 3a. Select: New folder
  - 3b. Name folder and give ID
  - 3c. Select: New Map
  - 4. Begin Cmap Construction by double click at top.

- **Constructing a Good Focus Question (F.Q.)**
  - involves
  - for which

- **Suggest Relevant Concepts**
  - used to
  - these are
  - Concepts Needed

- **Make a List of 15-25 Concepts**
  - ask yourself
  - What events of objects need to be considered?
  - Perceived regularities in events or objects designated by a label

- **Rank Order**
  - remember the definition
  - consider
  - periodically consider

- **Begin Map with 1-4 Most General Concepts**
  - then
  - consider

- **Continue building concept hierarchy**
  - search for
  - that show

- **Possible Crosslinks**
  - then
  - when "finished"

- **Reposition and refine map structure**
  - may lead to

- **Addition of arrows:**
  - Click edit, style, stroke, & select

- **Relationships between concepts in two different map sections**
  - Creative insights

- **The Concept Map Shows Knowledge to Answer the F.Q.**
  - to answer or revise

- **You may "dress up" the map clicking:**
  - edit, style, color, font, etc.
  - Consider that adding color adds to file size.
New epistemological thinking

Toward:
Constructivist epistemology holds that knowledge is a human construction and evolves over time.

Away from:
Positivist epistemology holds that knowledge derives from empirical observation and is “unfettered” by varying human ideas over time.
Key idea:

Each person must construct her/his own meanings for concepts and propositions from experiences over time, building her/his knowledge structure.
Traditional Model of Instruction
Key Memory Systems of the Brain

Information Input

- Short-Term Memory
- Affective System
- Working Memory
- Motor System
- Long-Term Memory
Table 1
Seven Principles of Learning (NAS, 2002)

1. Learning with understanding is facilitated when new and existing knowledge is structured around the major concepts and principles of the discipline.
2. Learners use what they know to construct new understandings.
3. Learning is facilitated through the use of metacognitive strategies that identify, monitor and regulate cognitive processes.
4. Learners have different strategies, approaches, patterns of abilities and learning styles that are a function of their heredity and their prior experiences.
5. Learners motivation to learn and sense of self affects what is learned, how much is learned and how much effort will be put into the learning process.
6. The practices and activities in which people engage while learning shape what is learned.
7. Learning is enhanced through socially supported interactions.
David Ausubel’s Theory of Learning

- Distinction between *rote* and *meaningful* learning
- Idea of *subsumption* of new concepts and propositions into existing, more general concepts and propositions.
- Idea of *progressive differentiation* of meanings over time
- Idea of *integrative reconciliation* of meanings over time
- Idea of *superordinate learning* of more general, more inclusive concepts
Meaningful Learning

Requires:
1. Well organized, relevant knowledge structures
2. Emotional commitment to integrate new with existing knowledge

A Continuum

Rote Learning

Results from:
1. Little or no relevant knowledge
2. No emotional commitment to relate new with existing relevant knowledge
Working memory is limited to about 7 “chunks”

Concept maps can aid working memory
Paul
Grade 2

Some things
made of
tiny chunks
as in
sugar
will
picked up

smell
is
is made of
oxygen or something

air
is
everywhere

can
freeze

can
melt
when

hot

cement
hard

break up
into

by

by

water

you cannot see

tiny chunks

that
Martha, a rote learner, has more misconceptions in grade 12 than she had in grade 2.
A college student’s beginning knowledge of cells
The same student’s knowledge of cells at the semester’s end
A concept map prepared by an expert on why we have seasons, in temperate zones, that can serve as a "scaffold" for student learning.
Concept maps in a complex domain

Ejection Fraction

Diagnostically Significant
Prognostically Significant

LOW
HIGH

First Pass
Radionuclide
Ventriculogram

Displays
Displays a

Velocity

Ejection Fraction is not
may be
might be
produces

Representation

is a statistical
in terms of

Counts

Heart Wall Motion

Displays

Bolus Ejection

Rate Images

Abnormal Global Function

Normal Global Function

may decrease with

Differentiation Ability
can be

between

Normal LV Function

Severe Left Ventricle Dysfunction

Normal Wall Motion

usually means

DIFFUSE BLUE

Cardiomyopathy

Seizures

Mitral Valve Prolapse

Ischemia

Systolic Decrease Diastolic Increase

ASSYMMETRIC ZONES

BALLERINA FOOT

BULLS EYES

ICE CREAM CONE

BALLERINA FINGERS

BLUE FINGERS

DIFFUSE BLUE

Valve Disease

Mitral Valve

small

inferior

are both signs of

when

Mitral Valve

Mitral Valve Prolapse

are signs of
C-Maps as Navigational Tool
We can work from transcripts of interviews with experts and concept map their expert knowledge.

We can also interview experts and capture their expert knowledge in the form of a concept map in real time. This is, of course, much more efficient. The concept maps can later be “polished” and checked with the expert.

The next slide illustrates an example of such a concept map.
A concept map made by interviewing an expert on management

Focus Question:
How do you manage the workforce effectively?

Effectively Managing the workforce

requires knowledge of

Business Needs

Include

Mission, Goals & Objectives

Raw Materials

Human Resources

Capital

Core Values

demonstrated by

Continuous Improvement

molds

Teamwork

Work-Life Balance

Culture

is characterized by

Working Relationships

Leadership Styles

such as

supervisory/staff relationships

Peer relationships

influences

Productivity

Headcount

influences

Management Actions

Individual Actions

influences

External Entities Actions

include those by

Competitors

Labor Unions

Regulatory Agencies

Performance Management

Benchmarking

Skill Development and Training

Diversity management

Compensation Policies

There is an active group of business professors, consultants and mavericks such as me seeking to find ways to create “intelligent enterprises”. Most of this group is looking to computer applications. I am looking to the need for educating all members of the enterprise.

The next slide shows key ideas I believe are needed to create “Intelligent Enterprises”.

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A Theory of Education

Meaningful learning underlies the constructive integration of thinking, feeling, and acting leading to empowerment for commitment and responsibility.

J. Novak
Meanings

- derive from
- Our Cognitive Frameworks
  - comprised of
  - Concepts
    - combined to form
    - Propositions
  - related to
  - Experiences

Our Actions

Our Emotions

- are
- Personal
  - from our
- Idiosyncratic
Educating/Management

must consider

Five Basic Elements

are

Teacher/Manager
Learner/Employee
Knowledge
Evaluation
Context

all

Interact
to construct

The Meaning of Experience

Undesirable
Desirable

is

Disempowering
Empowering

From J. Novak. Learning, Creating, and Using Knowledge
Effective Teaching/Management

requires

Meaningful Learning
to achieve

Progressive Differentiation of Cognitive Structure
leads to

Enhancement of Learner’s I’m Okay Image
are the primary basis for

Development of Skills
In Summary

• Building expertise requires building complex knowledge structures through meaningful learning.

• Concept maps can be used to capture and represent the knowledge of experts and can facilitate the development of expertise.

• Enterprises can become more intelligent by using education ideas and concept maps.
LEARNING, CREATING, AND USING KNOWLEDGE

Concept Maps™ as Facilitative Tools in Schools and Corporations

JOSEPH D. NOVAK
Defect Free Products

Documented Product Design

Marketing Specifications

Assess Product Quality

Release for Manufacture

Supplier Certification Program

Customer Requirements

Prototype Evaluation Samples

Product Form, Fit & Function

Assess Product Quality

Release for Manufacture

Supplier Certification Program

Customer Requirements

Red links indicate weak or missing communications between sectors, or sectors that need strengthening.
A few references


Institute for Human and Machine Cognition www.coginst.uwf.edu

Joseph D. Novak jnovak@ai.uwf.edu