The effective use of concept maps in the context of problem based learning

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'CONCEPT' OF A CONFERENCE
Introductions and expectations
OBJECTIVES

• The theory behind concept mapping – scientific basis
• Types of maps and differences between them
• Concept maps – rules and principles
• How to use maps practically
I don't need Google
my wife knows EVERYTHING
Exercise 1 : The use of maps in education
• Organize/Summarize
• Integrate
• Assessment
• Clarify/ Understand/ Analyze /Memorize

• ‘Metacognition’
• Concept maps
• Mind maps
• Argument maps
• Flowcharts/ algorithms/ organizational charts
What is a concept?

A mental representation, which the brain uses to denote a class of things which can be grouped together
• Love is blind

• Marriage opens your eyes
So is there evidence that concept maps help in education/PBL?
PBL

Do students exposed to PBL have more knowledge?
The generic skills of PBL
PBL

• The 3 C’s - constructive, collaborative, contextual
• Active learning
• Deep learning
Rote learning vs meaningful learning
Normal cognitive structure

- Hierarchical
- Progressively differentiated
- Integrative reconciliation
People generally remember...
(learning activities)

10% of what they read
20% of what they hear
30% of what they see
50% of what they see and hear
70% of what they say and write
90% of what they do

Passive Learning

People are able to...
(learning outcomes)

Define
Describe
List
Explain

Demonstrate
Apply
Practice

Analyze
Define
Create
Evaluate

Active Learning
Cognitive Load Theory

What is it and why should I care?
A Picture is worth A thousand words.

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<table>
<thead>
<tr>
<th></th>
<th>A</th>
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<td></td>
<td>There are three figures together. On the right extreme is a z like shape. On the extreme left next to a square is the circle slightly elevated from the baseline compared to the other figures. In the center there is a rectangle which is divided into three rectangles with the smallest rectangle at the top. Circle is on the 5.00 clock position compared to the other figures.</td>
<td>There are three figures together. On the left is a z shape. On the extreme right is the circle slightly elevated from the baseline compared to the other figures. In the center there is a square which is divided into three unequal rectangles with the smallest rectangle at the top. The circle on the extreme right is at the 2.00 clock.</td>
<td>There are three figures together. On the left extreme is a z shape. On the extreme right is the circle slightly elevated from the baseline compared to the other figures. In the center there is a square which is divided into three unequal rectangles with the smallest rectangle at the top. The circle on the extreme right is at the 7.00 clock.</td>
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To cut a long story short

• -If students can represent complex set of relationships in a diagram, they are more likely to understand, remember and analyze those components
• -Deep learning
• -Active learning
Is there actual scientific evidence that concept maps work?
Joseph D Novak
• Definition of concept maps
• ‘A schematic device for representing a set of concept meanings in a framework of propositions’
Rules??
• Rhein II - by Andreas Gursky (1999)
• Sold for $4.3 million - the most expensive photograph ever sold
The most important rule in conventional artistic photography...

THERE ARE NO RULES!
General steps in making a concept map

• Tries to answer a “focus question”
• Identify general concepts
• Identify lower order concepts and place them below the higher level concepts (‘Subsumption’)
• Add linking words (‘progressive differentiation’)
• Integrate concepts across the map (‘integrative reconciliation’)
• Give examples for concepts
QUALITY

FACULTY TRAINING

Improves

Linking words/sentences

SEMANTIC UNIT/PROPOSITION

CONCEPT

CONCEPT
Linking words

• The most difficult part of the concept map

• Differentiates from other types of mapping
IHMC Cmap tools
http://cmap.ihmc.us/download/
Revise and reflect !!!
So how can you use concept maps practically?

- Summarizing
- Encourage students to make/complete maps (in lectures/small groups)
- Collaborative learning/ PBL
- Curriculum/ lesson plan planning/route mapping
- Assessment
Summarizing sessions
How do you explain the symptoms of urticaria?
Ask students to make/complete concept maps
The parking lot

- Antigen (trigger)
- Histamine
- Bronchoconstriction
- Dyspnea
- Vasodilation
- Fluid leakage
- Weals
- IgE Cross linking
- Mast cell degranulation
- Stimulate C fibers
- Itching
- Mast cells
The expert skeleton
Curriculum development/ making lesson plans
HOW CAN YOU USE CONCEPT MAPS FOR ASSESSMENT?

• Formative
• Summative
• Global assessment - does the map convey the key concepts in a clear and simple manner?
Rubric – Bartel’s

• Concepts and Terminology
  • 3 points Shows an understanding of the topic’s concepts and principles and uses appropriate terminology and notations
  • 2 points Makes some mistakes in terminology or shows a few misunderstandings of concepts
  • 1 point Makes many mistakes in terminology and shows a lack of understanding of many concepts
  • 0 points Shows no understanding of the topic’s concepts and principles

• Knowledge of the Relationships among Concepts
  • 3 points Identifies all the important concepts and shows an understanding of the relationships among them
  • 2 points Identifies important concepts but makes some incorrect connections
  • 1 point Makes many incorrect connections
  • 0 points Fails to use any appropriate concepts or appropriate connections

Ability to Communicate through Concept Maps
3 points Constructs an appropriate and complete concept map and includes examples; places concepts in an appropriate hierarchy and places linking words on all connections; produces a concept map that is easy to interpret
2 points Places almost all concepts in an appropriate hierarchy and assigns linking words to most connections; produces a concept map that is easy to interpret
1 point Places only a few concepts in an appropriate hierarchy or uses only a few linking words; produces a concept map that is difficult to interpret
0 points Produces a final product that is not a concept map
Objective method _ Novak and Gowin

1. Meaningful connections – each connection – 1 point
2. Heirarchy- 5 points for each valid level of hierarchy
3. Cross links – 10 points for one which is valid and significant
4. Examples – 1 point each
   • N: Can express as percentage of an ideal map
• So are students who use more complex maps ‘better’ and more knowledgeable?
• A map is a very personal thing
• Each person uses it in their own way
• A good student might need only a simple map to understand/remember complex concepts
Disadvantages/ criticisms of concept maps

• Too rigid rules – both teachers and students take time to understand
• Does not encourage creativity / Not useful for brainstorming
• Assessment??
Practice

• Let us make a concept map on concept maps!
The concept of brainstorming

LET A THOUSAND FLOWERS BLOOM AND WE'LL SEE WHAT FLOURISHES.

Clara Hemphill
Exercise

• Let’s brainstorm on *scientific publications*
Mind maps
Study of Body Systems

The Body's Major Systems

1. Cardiovascular
2. Respiratory
3. Digestive
4. EXcretory
5. Nervous
6. SENSory
7. Muscular
8. Skeletal
9. Reproductive
10. Endocrine
Mind maps

• Helps to organize ideas and broad concepts
• Build ideas
• Creativity
• Memorization of larger topics
Maps

- Mind maps
  - More creative
  - No need to establish relation
  - Helps in brainstorming
- Concept maps
- Composite maps
  - More creative
  - No need to establish relation
  - Helps in brainstorming
- Argument maps
  - Higher order thinking
  - One complete sentence per box
  - Reasons to be added to next box
  - Tries to support or rebut conclusion with reasoning
  - Starts with conclusion
- Flowcharts
  - Represents processes
  - Rules
  - No rules!!!

Thick lines reduce as it spreads outwards

Can add images

Starts with a central node and moves outward
Software

- https://www.mindmup.com/
- https://www.canva.com/graphs/mind-maps/
- https://bubbl.us/
Females are better drivers as compared to males
• Argument mapping is a way to visually show the logical structure of arguments.
BLOOM’S REVISED TAXONOMY

- **Creating**
  - Generating new ideas, products, or ways of viewing things
  - Designing, constructing, planning, producing, inventing.

- **Evaluating**
  - Justifying a decision or course of action
  - Checking, hypothesising, critiquing, experimenting, judging

- **Analysing**
  - Breaking information into parts to explore understandings and relationships
  - Comparing, organising, deconstructing, interrogating, finding

- **Applying**
  - Using information in another familiar situation
  - Implementing, carrying out, using, executing

- **Understanding**
  - Explaining ideas or concepts
  - Interpreting, summarising, paraphrasing, classifying, explaining

- **Remembering**
  - Recalling information
  - Recognising, listing, describing, retrieving, naming, finding

- **Higher-order thinking**
X is good

X is like A

A is good
The Syntax of an Argument Map

Conclusion

Reason 1
- premise A
- premise B

Reason 2

Reason 3

Reason 4

Objection

Rebuttal
Main claim
We should use public transport more than we do

is supported by

Reason
Public transport is good for the environment
is supported by

Reason
Buses and trains reduce pollution
is grounded by

G Expert opinion

is contradicted by

Objection!
We should use transport that gets us around efficiently
is supported by

Objection!
Public transport does not always get us around efficiently

is contradicted by

Objection!
Efficiency must be balanced by sustainability
is supported by

Reason!
My trip to work is faster by car
Females are better drivers than males

- Females are more careful
- Females are less likely to text while driving
- Females text more

- Females are more likely to follow traffic rules
- Females avoid risk taking behavior

Common Belief
The claim is widely believed.
Flowcharts/algorithms/organizational charts
FLOWCHART

- Usually for processes or protocols
- Step by step, diagram of how a process takes place or how it should take place.
How husbands repair stuff

Flowchart:

- **DOES IT MOVE?**
  - No
    - Should it?
      - No
        - No
          - No Problem
      - Yes
        - No Problem
  - Yes
    - Should it?
      - Yes
        - No
          - No Problem
How to argue with your wife
Organizational /hierarchy charts
The future

• 3D/collaborative concept/mind maps

• https://www.thortspace.com
There is strong theoretical background and evidence for the effectiveness of mapping in education in general and PBL.

There are different kinds of maps - concept maps, mind maps, argument maps, flow charts and combinations.

Maps are very personal - the only rule is 'there are no rules'.

Maps can be used for both teaching and learning - organizing information, summarizing, analysing, collaborative learning and assessment.

TAKE HOME MESSAGES
QUESTIONS??
Thank you