2013-05-15

Collaborative Learning in Problem Solving

Wismath, Shelly

1st Annual Collaborating for Learning Conference, May, 15-16, 2013, University of Calgary, Calgary, Alberta.

University of Lethbridge

Collaborative Learning in Problem Solving

U of C Collaboration for Learning Conference, May 2013

Collaborative Learning in Problem Solving

Shelly Wismath
Doug Orr

University of Lethbridge

University of Lethbridge

PUZZLES

Logic Puzzle

Chain Link Puzzle

Alphametics

Weighing Puzzle

Feedback on Working on the Puzzles:

University of Lethbridge

-- Emotions?

-- Skills?

-- Solo or Collaborative?

Liberal Education 2200
Problems and Puzzles

University of Lethbridge

Teaching problem solving via puzzles

Developing 21st century skills:

- problem solving
- critical thinking
- communication
- collaboration

Liberal Education 2200
The Students

University of Lethbridge

- 135 students over 3 course offerings

- Roughly half male, half female

- Diverse reasons for enrolment, majors, faculties, learning-styles, thinking-styles, personal motivations, goals, …

The Class …

Primarily non-lecture, hands-on, interactive:

- Present a problem
- Students work individually or collaboratively
- Instructors & TAs circulate to discuss, prompt, question, encourage
- Whole class “debrief” to share challenges, interpretations, strategies, and solutions

What We Did:

- not so much “teaching” skills as developing and empowering skills.

- teacher as facilitator and collaborator, but not expert;

- class as community of inquiry

- change in student relationship to us over the semester.

-teachers learned from the students.

Overarching Research Questions

1. What are problem-solving skills?
2. How can they be learned?
3. How can they best be taught (developed)?
4. How can they be measured?

Do the students know?

Data Collected

- Student demographics and attributes
  - Thinking-Styles (Gregorc, 1979)
  - Learning-Styles (Barsch, 1991 / VARK, 1992)
- Self-Perceptions Survey
- Student Reflection Assignments
- Focus-Group discussion session

Approx. 110 study participants over 3 years

University of Lethbridge

Results to Date

- significant increases in confidence and self-efficacy ($p<0.001$)

- striking gender differences in confidence ($p<0.001$)

- students perceive transfer to academic and real world skills

- stages in development of skills

- patterns of collaborative work

University of Lethbridge

THEORY:

- “Piece-meal Groupwork”
- Collaborative Learning (structure, goal)
- Co-operative Learning
- Community of Inquiry

Collaborative Patterns

CYCLES:

Solo ----> Joint ---> Solo ---> Joint

Pattern consistent over 3 years!

University of Lethbridge

Factors

- Thinking and learning style
- Interaction of styles
- Nature of puzzles
- Competition, thrill, reward
- Stage in puzzle

Thinking/Learning Styles

-Abstract Random: social

- Abstract Sequential: solo

University of Lethbridge

Interactions of Styles

Pros and Cons of working with others of similar vs. different styles:

-- similar style: comfortable, but all stuck in same way.

-- different style: more viewpoints and approaches, but frustrating.

-- note increase in communication skills from explaining to others.

University of Lethbridge

Why Work Alone?

- sense of competition

- desire to be first to solve

- satisfaction of solving on one's own

- "the joy of discovery"

- intrinsic reward

When do Solo Workers Share?

University of Lethbridge

- to get help in understanding a problem at the start;

- to get help when stuck;

- to share solutions at the end;

- to see alternate solutions.

University of Lethbridge

Nature of Puzzles

Some puzzles lend themselves more to collaborative or solo work.

Example: logic puzzles were more often done alone; creative puzzles were often done with others.

University of Lethbridge

Stages in Working on a Puzzle

Connection to Polya's Method?

University of Lethbridge

Polya's Method

1. Understand the problem fully.
2. Devise plans of attack, and choose one.
3. Carry out the plan.
4. Reflect, evaluate, re-do as needed.

Connection to solo/joint cycles?

Collaborative Models

- Fast Thinking
- Overview
- Intuitive
- Extrovert

- Slow Thinking
- Depth
- Logical
- Introvert

- Collaborative

- Solo

University of Lethbridge

Our conclusions

-cycles of solo/joint work may relate to Polya's method.

- students develop own rhythm for solo/joint work.

- optimal collaboration is contextual.

-Implications…

University of Lethbridge

Collaborative Learning in Problem Solving

Thank you

Results and publications at

www.cs.uleth.ca/~wismaths/pandppage

Solution for Neighbours

House Num.	1	2	3	4	5
Last Name	Brown	White	Green	Black	Grey
Male Name	Ralph	Sam	Peter	Tom	Ned
Female Name	Ida	Grace	Helen	Jane	Fran