Creating A Learning Organization In The Classroom

CLE Conference
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Who we are

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Interviews

- Name
- Professional Experience
- Experience with Systems
- Your Hopes for this Workshop
Behavior Over Time Graphs

- Time is on the horizontal axis
- Decide on time horizon
- Behavior is on vertical axis
- Decide on scale
- The graph is a continuous curve
Efficacy *n.*

- Power or capacity to produce the desired effect
- Ability to achieve results
- Effectiveness
Behavior Over Time Graphs

✓ What is changing?
✓ How is it changing?
✓ Why is it changing?
✓ So what?
“My mother made me a scientist without ever intending to. Every other Jewish mother in Brooklyn would ask her child after school, ‘So? Did you learn anything today?’ But not my mother. ‘Izzy,’ she would say, ‘did you ask a good question today?’ That difference - asking good questions - made me become a scientist.”

Isidor Isaac Rabi
What is a learning organization?

...organizations where people continually expand their capacity to create the results they truly desire, where new and expansive patterns of thinking are nurtured, where collective aspiration is set free, and where people are continually learning to see the whole together. (Senge 1990)
Why Create a Learning Organization?

- In situations of rapid change only those that are flexible, adaptive and productive will excel.
- Being part of a great team is a profoundly meaningful experience.
- Citizenship in Action
How?

- The Five Disciplines
- Pedagogy
- Cooperative Learning
- Content
The Five Disciplines

- Systems Thinking
- Personal Mastery
- Mental Models
- Shared Vision
- Team Learning
Systems Tools

Behavior Over Time Graphs
- Simple
- Show overall behavior

Feedback Diagrams
- Analytical
- Trace causality
- Two basic loops

Stock and Flow Maps and Models
- Operational
- Graphically display accumulations and rates
Pedagogy

- Hands-on
- Constructivist
- Student Centered
- High Expectations
- Accommodation to different Ability Levels
Cooperative Learning

- Positive Interdependence
- Individual and Group Accountability
- Promotive Action
- Teaching Social Skills
- Group Processing
Basic Cooperative Skills

- Uses Quiet Voices
- Takes Turns
- Uses Others’ Names
- Positive About Working In Group
- Willing to Help Others
- Follows Directions
- Shows Courtesy Toward Others
Facilitating Understanding Skills

- Summarizes, Integrates
- Seeks Accuracy
- Relates New Learning to Old
- Helps Group Recall Knowledge
- Checks For Understanding
- Makes Covert Reasoning Overt
Leadership Skills

- Clarifies Goals
- Gives Direction To Group’s Work
- Contributes Ideas, Opinions
- Requests Other’s Ideas, Opinions
- Summarizes, Integrates
- Encourages Other’s Participation
- Supports; Gives Recognition, Praise
- Paraphrases
- Facilitates Communication
- Relieves Tension
Intellectual Challenge Skills

- Criticizes Ideas, Not People
- Differentiates Members’ Ideas
- Ask For Rationale, Justification
- Extend Other’s Reasoning
- Probes, Asks Complex Questions
The Mammoth Game

- Start with 20 dice in a box: this is your herd.
- Each round represents a year in the life of the herd.
- Add or remove dice according to the following rules:
The Mammoth Game

1 = a calf is born

2 = the mammoth is killed by a predator

3 = the mammoth dies of starvation

4 = the mammoth keeps living another year

5 = the mammoth keeps living another year

6 = the mammoth keeps living another year
The Mammoth Game 2

- 1 = a calf is born
- 2 = the mammoth is killed by a predator
- 3 = the mammoth dies of starvation
- 4 = the mammoth is killed by a hunter
- 5 = the mammoth keeps living another year
- 6 = the mammoth keeps living another year
Another reinforcing Loop

Principal

Interest
Easier Balancing Loop

Activity of furnace → Heat in the building

Heat in the building → Activity of furnace
Reinforcing or balancing? You Decide!

Practice

Incentive to practice

Skill

Practice
CONNECTION CIRCLES

1. Draw a large circle.
2. List important elements around the circle.
   - Restrict the number to between five and ten.
   - All elements should be nouns or noun phrases.
   - Elements can increase or decrease.
3. Identify an element that causes another element to increase or decrease.
   - Draw an arrow from the cause to the effect.
   - Make sure that the causal connection is a direct one.
   - Identify polarity of arrow and label at the arrow head.
4. Continue to identify elements with causal connections.
Content Example: Math

Three Aspects of Mathematics:

- Problem Solving and Applications
- Conceptual Understanding
- Acquisition of Skills
Content Example: Math

8-4 The Slope-Intercept Form of a Linear Equation

Objective To use the slope-intercept form of a linear equation.

The points with coordinates \((-2, -4), (-1, -2), (0, 0),\)
\((1, 2),\) and \((2, 4)\) are on the graph of the linear equation
\[ y = 2x. \]

The graph, shown at the right, is the straight line that has slope \(\frac{2}{1}\), or 2, and that passes through the origin.

The graph
\[ y = -\frac{1}{3}x, \]
also shown at the right, is a line that has slope \(-\frac{1}{3}\)
and that passes through the origin.

For every real number \(m\), the graph of the equation
\[ y = mx \]
is the line that has slope \(m\) and passes through the origin.
Example 1

Find the slope and y-intercept of \( y = \frac{3}{5}x + 2 \).

For \( y = \frac{3}{5}x + 2 \), we have \( m = \frac{3}{5} \) and \( b = 2 \).

\[ \therefore \text{the slope is } \frac{3}{5} \text{ and the y-intercept is } 2. \]  

Answer

Example 2

Use only the slope and y-intercept to graph \( y = -\frac{3}{4}x + 6 \).

Solution

The slope is \( -\frac{3}{4} \). The y-intercept is 6.

Since the y-intercept is 6, plot (0, 6).

Since the slope is \( -\frac{3}{4} \), move 4 units to the right of (0, 6) and 3 units down to locate a second point.

Draw the line through the two points.

Example 3

Use only the slope and y-intercept to graph \( 2x - 5y = 10 \).

Solution

Solve for \( y \) to transform the equation into the form \( y = mx + b \).

\[
\begin{align*}
2x - 5y &= 10 \\
-5y &= -2x + 10 \\
y &= \frac{2}{5}x - 2 
\end{align*}
\]

The slope is \( \frac{2}{5} \). The y-intercept is \( -2 \).

Since the y-intercept is \( -2 \), plot (0, -2).

Since the slope is \( \frac{2}{5} \), move 5 units to the right of (0, -2) and 2 units up to locate a second point.

Draw the line through the two points.
### Oral Exercises

State the slope and $y$-intercept of each line.

1. $y = 3x + 7$
2. $y = -2x - 1$
3. $y = \frac{1}{2}x + 4$
4. $y = \frac{2}{3}x - 5$
5. $y = 5x$
6. $y = -3x$
7. $y - 6x = 4$
8. $y - 2x = 7$
9. $3x + y = 8$
10. $4x + y = 10$
11. $-2x + y = 7$
12. $-3x + y = 8$

### Written Exercises

Find the slope and $y$-intercept of each line.

**A**

1. $y = 2x + 1$
2. $y = 3x - 4$
3. $y = \frac{1}{2}x - 3$
4. $y = \frac{2}{3}x + 3$
5. $y = -\frac{1}{2}x + 6$
6. $y = -\frac{1}{3}x - 2$
7. $y = 8 - 2x$
8. $y = 9 - 3x$
9. $y = x$
10. $y = -x$
11. $y = -4$
12. $y = 4$

Use only the slope and $y$-intercept to graph each equation. You may wish to verify your graphs on a computer or a graphing calculator.

13. $y = -x + 5$
14. $y = 2x - 3$
15. $y = \frac{2}{3}x + 4$
16. $y = \frac{4}{5}x - 3$
17. $y = -\frac{1}{2}x + 4$
18. $y = -\frac{3}{4}x - 5$
19. $x + y = 8$
20. $2x + y = 6$
21. $3x - y = 6$
22. $2x - y = -4$
23. $3x + y = 9$
24. $2x + y = -4$

**B**

25. $3x - 5y = 10$
26. $4x - 3y = 9$
27. $x + 5y = 5$
28. $6x + 4y = 8$
29. $3x = 2y$
30. $4y = 3$
1. To do a college visit, Wes must make a 240-mile trip by car. The time required to complete the trip depends on the speed at which Wes drives, of course, as the table below shows. Fill in the missing entries, and plot points on the grid provided. Do the quantities time and speed vary directly? It makes sense to connect your plotted points with a continuous graph. Explain why.

<table>
<thead>
<tr>
<th>speed</th>
<th>15</th>
<th>20</th>
<th>25</th>
<th>48</th>
<th>60</th>
<th>r</th>
</tr>
</thead>
<tbody>
<tr>
<td>time</td>
<td>12</td>
<td>8</td>
<td>6</td>
<td>4.8</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

2. Pat bought several pens at Walgreen’s, for 60 cents each. Spending the same amount of money at the Bookstore, Pat then bought a few more pens that cost 80 cents each. In all, 42 pens were bought. How many pens did Pat buy at the bookstore?

3. Exeter building code does not permit building a house that is more than 35 feet tall. An architect working on the design shown at right would like the roof to be sloped so that it rises 10 inches for each foot of horizontal run.

(a) Given the other dimensions in the diagram, will the builder be allowed to carry out this plan?

(b) Two vertical supports (shown dotted in the diagram) are to be placed 6 feet from the center of the building. How long should they be?

4. The line through (1, 6) and (0, 3) passes through every quadrant except one. Which one?
1. The rectangle $ABCD$ shown at right has sides that are parallel to the coordinate axes. It is three times as wide as it is tall, and its perimeter is 56 units.
   (a) Find the length and width of $ABCD$.
   (b) Given the information $D = (9, 2)$, find the coordinates for points $A$, $B$, and $C$.

2. A ladder is leaning against the side of a building. Each time I step from one rung to the next, my foot moves 6 inches closer to the building and 8 inches further from the ground. The base of the ladder is 9 ft from the wall. How far up the wall does the ladder reach?

3. Each step of the stairs leading from room 9 to room 107 in the Academy Building has a vertical rise of 7 inches and a horizontal run of 12 inches. Each step of the marble staircase leading to the Assembly Hall has a vertical rise of 5.5 inches and a horizontal run of 13 inches.
   (a) Which flight of stairs do you think is steeper? Why?
   (b) Calculate the ratio rise/run for each flight of stairs, and verify that the greater ratio belongs to the flight you thought to be steeper.

4. (Continuation) The slope of a line is a measure of how steep the line is. It is calculated by dividing the change in $y$-coordinates by the corresponding change in $x$-coordinates between two points on the line: slope $= \frac{\text{change in } y}{\text{change in } x}$. Calculate the slope of the line that goes through the two points (1, 3) and (7, 6). Calculate the slope of the line that goes through the two points (0, 0) and (9, 6). Which line is steeper?
Social attractiveness loop

Loop 1 (Untitled Loop)

City population

attracting people

R

social interactions

individual productivity
Efficiency of resources loop

Loop 2 (Efficiency of resources)

City population

attracting people

resources used

available resources

efficiency

R
Limits to growth loop

Loop 3 (Limits to growth loop)

City population

losing people

negative events

available resources

efficiency

B
When working in a team you need to remember to make sure that everyone explains and you see as many different ways to solve a problem as possible. You can also remember to ask Mr. Quaden for help. Just because he has you work in teams does not mean that he is bad at explaining... In a team that works really well it feels more like a discussion than a class. In a really good team the person presenting isn’t the only one talking. People are listening and asking questions and even sometimes correcting the presenter. This helps both the listened and the explainer to get a better understanding of the problem.

Harriet
When you are part of a team that works well together, there are often intense debates over problems. There may be times when you are right and times when you are wrong and the times that you are wrong are the most educational times. The intense debates in class help people remember what they learn better. It is even more fun when no one in the team got the answer to a problem because generally people have parts of a problem completed and it is fun putting all the parts together and figuring out the answer as a team.

Anonymous
“I really like how we are forced to think about things more thoroughly and discover how to solve things on our own, rather than just being told how to get the answer. This year I’ve actually had to think in class, which is definitely a good thing. I like what we do for homework; although some of the problems can be annoying, they're for the most part interesting and challenging, but aren’t so challenging that you’re are unable to solve them and become frustrated. It’s kind of cool how at some points all the little things you've been doing in different problems come together and you discover some sort of rule, and it suddenly all makes more sense.

I also really like how we get a lot of time to talk with our teams about problems, rather than having to listen to someone at the front of the class for a long time. I like how we have to work together and how we're usually able to help each other understand.”

Anna
Student Feedback after Using Alcohol Model

• It helped show me the effects alcohol would have on certain people based on weight, gender, and other factors.
• I think the best part … was the effect it will have on my future and how I will view drinking as I get older. Thank you!
• [The best part was] being able to put our own situations into the program.
• I never really thought about it too much so it was interesting to see.
• It was also scary to see how much seven hours of drinking can do to someone.
• I learned a lot about … how most drinks do the same to you over an hour.
• The best part was putting my own weight in the program and seeing how alcohol would affect me.