

---

# Recent Research on Online Teaching and Learning: Implications for Practice

---

Cathy Cavanaugh: Mathematics—An Overview

Susan Lowes: Online Discussions—A Case Study

Meredith DiPietro, Eric Black, Rick Ferdig: Data-Driven  
Decision Making—An Overview

Donna Scribner: Student Motivation and Engagement—  
A Case Study

---

# Research on Mathematics: Implications for Practice--An Overview

---

Cathy Cavanaugh  
University of Florida

[Cathycavanaugh@coe.ufl.edu](mailto:Cathycavanaugh@coe.ufl.edu)

---

# The Nature of Online Mathematics

A US Department of Education survey (Setzer & Lewis, 2005) showed that 15% of public school distance education enrollments were in mathematics courses.

Advanced high school math courses focus on teaching abstract concepts and problem-solving.

Symbolic representations of mathematical concepts can be made more concrete for students in online courses through the use of virtual manipulatives.

---

---

# Virtual Manipulatives

A study of online Algebra classes at the Florida Virtual School compared the performance on graphing linear equations of students who used online graphing tools to students who did not (Cavanaugh, Bosnick, Hess, Scott, & Gillan, 2005).

Students using the tools showed larger gains between pretest and posttest scores, but the differences were not significant.

---

---

# Visualizing Abstract Concepts

Baker (2003) supports whiteboard usage and states that using synchronous feedback for online courses simulates the feedback available to students in face-to-face courses, creating a learning experience more typical of what students are used to.

Teachers may tutor students individually or as a group in this environment. The whiteboard allows the math teacher to change colors and give immediate feedback to student responses.

---

---

# Diagnosing Conceptual Gaps

Hwang's (2005) study of data mining for diagnosing student learning problems in science and math shows that the teacher's work can be streamlined when the intelligent testing and diagnosis system identifies poorly-learned and well-learned concepts.

The system compares the students' concept-effect relationships to the teacher's representation of the concept, and then provides learning suggestions for each student in about half the time than without the system.

---

---

# Teacher Professional Development

Student perceptions of teacher support and feelings of cohesiveness in their online math class were increased for teachers who had more hours of professional development in math content and teaching with technology.

(Hughes, McLeod, Brown, Maeda & Choi, 2005)

---

---

# Co-teaching and Facilitation

The frequency with which on-site math tutors worked with groups of students and monitored student work related positively to student achievement in an online math course taken in a school. Further, when the on-site tutor and the online teacher collaborated frequently on planning, students had larger achievement gains.

(Kleiman, Carey, Bonifaz, Haisted & O'Dwyer. 2005)

---

---

# Practices of Effective Math Teachers

Successful math teachers use online strategies such as:

- Establishing clear communication with students and parents
- Monitoring student performance on a regular basis
- Providing specific feedback with praise as quickly as possible
- Scheduling tutoring at regular intervals
- Arranging asynchronous assessments and periodic synchronous skill and comprehension checks
- Building a sense of community within the online environment

(Reeves, Vangalis, Vevera, Jensen & Gillan, 2008)

---

---

# Bibliography

- Baker, R., (2003). A framework for design and evaluation of internet-based distance learning courses phase one - framework justification, design and evaluation. *Online Journal of Distance Learning Administration*. Volume 6, Number 2, Summer, 2003.
- Cavanaugh, C., Bosnick, J., Hess, M., Scott, H., & Gillan, K. J. (In press). Effectiveness of interactive algebra learning tools. *Journal of Educational Computing Research*.
- Hughes, J., McLeod, S., Brown, R., Maeda, Y., & Choi, J. (2005). Staff development and student perception of the learning environment in virtual and traditional secondary schools. Unpublished manuscript.
- Hwang, G. (2005). A data mining approach to diagnosing student learning problems in science courses. *International Journal of Distance Education Technologies*, 3(4), 35–50.
- Kleiman, G., Carey, R., Bonifaz, A., Haistead, E., & O'Dwyer, L. (2005). A study of the effectiveness of the Louisiana Algebra I Online Project. Unpublished manuscript.
- Reeves, S., Vangalis, M., Vevera, L., Jensen, V. & Gillan, K. (2007). What works in teaching and learning mathematics online. In Cavanaugh, C. & Blomeyer, R. (Eds.) *What Works in K-12 Online Learning*. Eugene, OR: International Society for Technology in Education.
- Setzer, J. C., & Lewis, L. (2005). Distance education courses for public elementary and secondary school students: 2002-03. (NCES 2005-010). Washington, DC: U. S. Department of Education, National Center for Education Statistics.
-

---

# Research on Discussion Forums: Implications for Practice--A Case Study

---

Susan Lowes  
Teachers College/Columbia University  
lowes@tc.edu

---

# Study site: common situation

- **Four-week** fully online professional development course
  - Multiple sessions offered; **two different facilitators**
  - Approximately **20 participants** in each session
  - Participants were experienced middle- and high-school **teachers** from around the country
  - **Discussion forum** was central locus of activity
  - Will focus on **two sessions**, with different facilitators
-

---

# Research questions

- A lot of analysis of discussion forums focuses on counts: number of contributions, length of threads
  - What can we learn about successful discussion forums by focusing instead on their...
    - Overall structure: network analysis
    - Content: content analysis
    - Flow: sequential analysis
  - How do these correlate with satisfaction?
-

# Post-course satisfaction ratings

	<b>Session 1</b>	<b>Session 4</b>
<b>Enjoyment of discussion forums (range 1 – 3)</b>	<b>2.43</b>	<b>2.60</b>
<b>Quality of facilitation (range 1 – 5)</b>	<b>3.67</b>	<b>4.20</b>
<b>Quality of participants' contributions (range 1 – 5)</b>	<b>4.05</b>	<b>4.13</b>

	<b>Session 1</b>	<b>Session 4</b>
<b>Would you take another online course? (Yes, definitely)</b>	<b>24%</b>	<b>60%</b>

---

# Social network analysis:

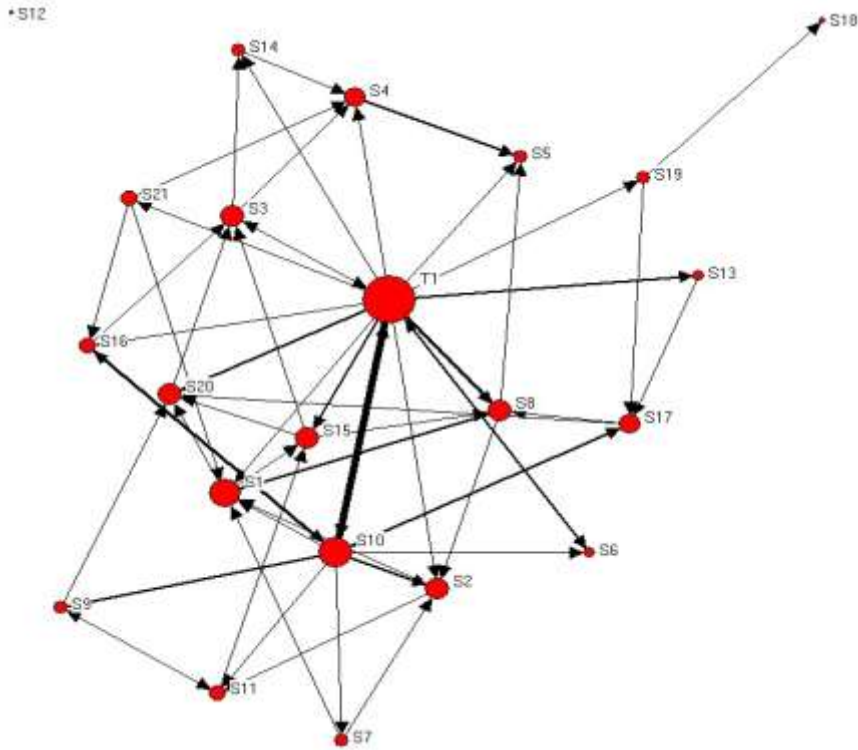
Who interacted with whom, how often?

- Looks at the number of connections among participants: **density**
  - Looks at the strength of connections among participants: **reciprocity**
  - Looks at centers of interaction: **centrality**
  - Theoretically, a successful discussion forum will be:
    - Dense
    - Reciprocal
    - De-centralized
-

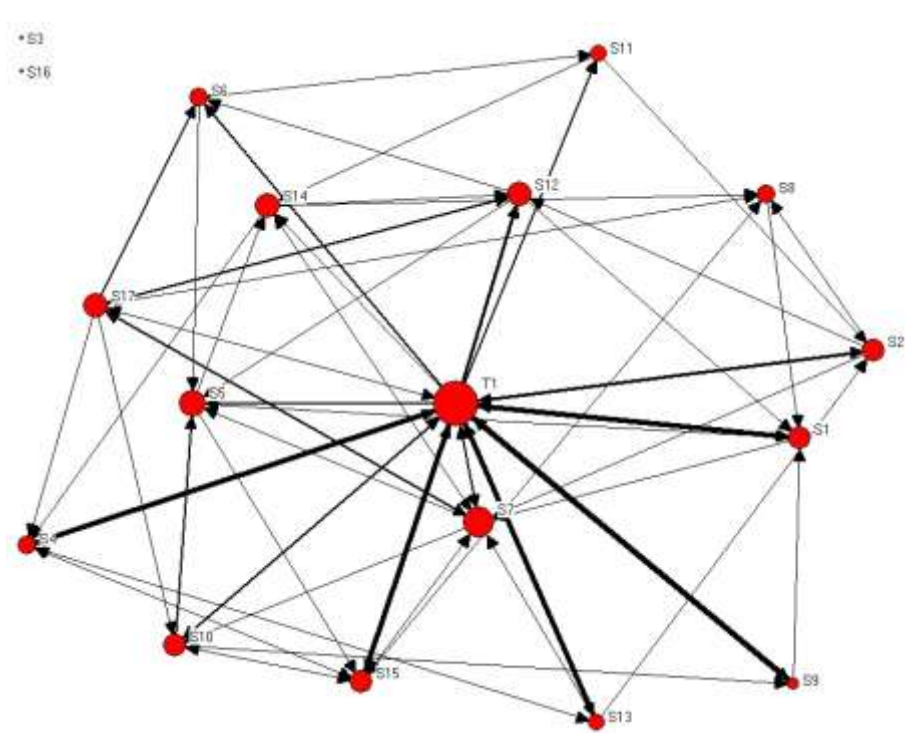
# Matrix example: sender to receiver

		Receiver																			
		T	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	S17	S18	
Se nd er	T		4	1	3	2	3			1	1	2		1	1	3	1		5	4	
	S1						1	1													
	S2				1		1					1								1	1
	S3	1																			
	S4	2					2									2			1	1	2
	S5		1	1		1						1		1	1						
	S6						1														
	S7			1												1					
	S8	2							1	1						1					1
	S9	1	1			2													2	1	
	S10			1														1			
	S11																				
	S12					1	1													1	
	S13	1	1			1	1												1		3
	S14	1																			
	S15								1	1										2	1
	S16					1				1	1					1					
	S17	1				1	2	1								1	1	2	1		2
	S18	2			1	1			1	1						1			1	1	
	S19																				
	S20	1				2					2		1							1	
	S21																				
	S22							1													1
	S23	1	2					1							1						1
S24																2					

# Network diagrams, Sessions 1 and 4



Session 1



Session 4

# Network measures

Measure	Session 1	Session 4
Density	18%	35%
Reciprocity	36%	89%
Network centralization	15%	40%
Facilitator share	18%	24%
Highest participant share	15%	7%

# Content analysis: What was the content of the interactions?

Participants

Code	Session 1	Session 4
1: Cheerleading	54%	12%
2: New information	13%	40%
3: Questioning/challenging	13%	4%
4: Cheerleading + new information	13%	37%
5: Challenging + any others	7%	7%
Participant total	100%	100%

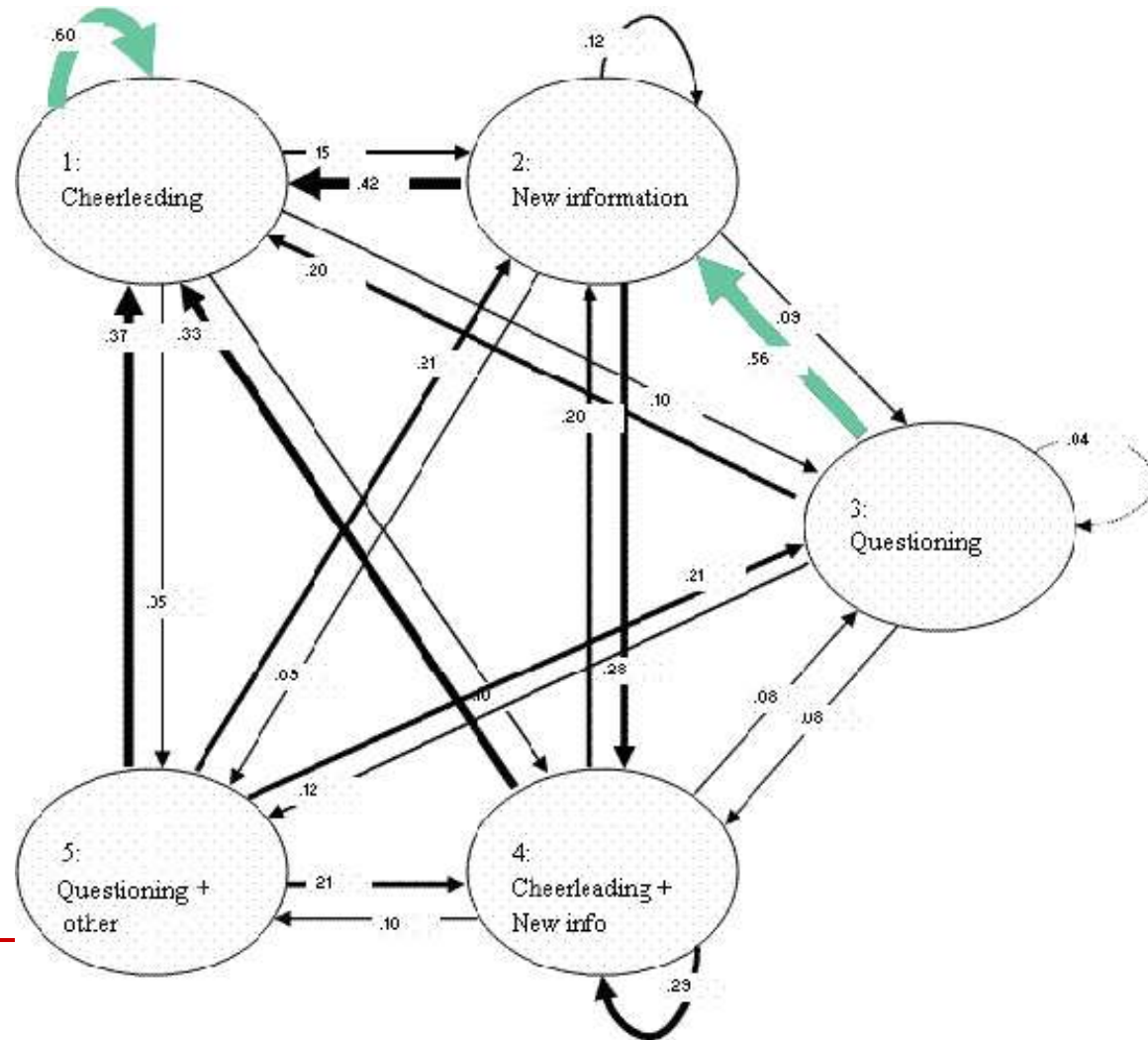
Note: Percent is percent of total codes, not posts.

# Content analysis

Facilitator

Code	Session 1	Session 4
1: Cheerleading	46%	38%
2: New information	12%	11%
3: Questioning/challenging	8%	13%
4: Cheerleading + new information	22%	13%
5: Challenging + any others	12%	25%
Facilitator total	100%	100%

# Sequential analysis: What content leads to what response?



---

# Implications for practice

- It is not just the **amount** of participation that is important but the **structure of the discussion**, its **content**, and the **flow or sequence**
  - These are highly correlated with satisfaction
  - Without doing a complicated analysis, you can watch for patterns that indicate trouble
-

---

# More implications

- If you want a vibrant discussion:
    - Stop cheerleading in its tracks
    - Make participants challenge each other
    - Do not let one or two people dominate
    - Do not let one or two people get into back-and-forth between themselves
    - Facilitator role is important, but it is not so much the number of interventions as the content
    - Keep participants on a schedule so no orphan posts (threads die)
-

---

# Bibliographical notes

The research on which this presentation is based will be published in the Winter 2007 issue of the Journal of Interactive Online Learning:

<http://www.ncolr.org/default.htm>



---

# Data-Driven Decision Making: Implications for Practice—An Overview

---

Meredith DiPietro  
Erik Black  
Richard E. Ferdig

University of Florida

---

# Online Teacher Training and Online Instructor Professional Development

## Finding:

- Data was collected from five courses in this study. In two of those courses, Geometry and PFM, online students had higher final course grades

## Implication:

- Virtual school teachers need to make considerations regarding the instructional practices they use to ensure they are a 'best fit' for the content being delivered.
-

---

# Student Retention

## Finding:

- Survey instruments, such as the ESPRI, can be valuable for predicting students success in a virtual school course.

## Implication:

- Virtual school teachers can use data collected through these instruments to help accommodate the deficiencies in student skill that can impact their success in the course.
-

---

# Course Quality, Course Design and Curriculum Development

## Finding:

- The results of this study indicate a relationship between course content, student achievement, and the medium of content delivery.

## Implication:

- The instructional designers of a virtual school course should carefully select the various tools and web-based resources they integrate into the course to facilitate students learning of content.
-

---

# Evaluation for Data-Driven Decision Making

There is an increasing need for assessment and evaluation tools to enable decision-driven decision-making in a variety of important areas within K-12 virtual schooling.

- Mixed methodologies
  - Validation is key
  - Incorporation of successful instruments from other domains
  - Move towards interventions for change
-

# Categories of Analysis

<b>Cavanaugh et al. (2004)'s success factors</b>	<b>Corresponding assessment category</b>
Abilities and disabilities of the student	Student Assessment
Quality of the teacher	Teacher Assessment
Demands of the content	Content/Curriculum Assessment
Design of the distance learning system	Technology Assessment
<i>(not specifically addressed)</i>	Course Instance Assessments
<i>(not specifically addressed)</i>	Other Assessments

# Examples -

Name	Description	Metric	When	Research	Type
<b>Diagnostic Algebra Assessment</b>	Designed to identify whether student achievement in algebra is being hindered by algebraic misconceptions	Algebraic achievement	Mid-course, Post-hoc	None available	Student Assessment
<b>North Carolina Online Test of Computer Skills</b>	Measures computer proficiency in middle school students	Computer literacy	Pre-Coursework	Public Schools Of North Carolina, 2006	Technology Assessment
<b>SOM: School Observation Measure</b>	Measures classroom practice at a whole school level	24 different classroom practices	Pre, Mid, Post-hoc	Ross, Smith & Alberg (1998)	Teacher Assessment
<b>Chico State ROI: Rubric for Online Instruction</b>	Evaluation tool for existing online courses	Curriculum and instruction	Post-hoc	Distance Education Report, 2003	Content/ Curriculum Assessment

---

# Opportunities and Threats

## Threat – Survey Fatigue

- The development of new instruments has the potential to be an invasive process

## Opportunity – LMS Log Analysis

- Time to think outside of the box
  - Data collection can be a passive process
-

---

# Communities of Practice

Researchers and educators need to have continuous, open discussions about evaluation instruments.

- NACOL Forums
- Virtual School Clearinghouse



---

# Bibliography

- Black, E.W., Ferdig, R.E., DiPietro, M. (2008). An overview of evaluative instrumentation for virtual high schools. *The American Journal of Distance Education, 22*(1).
- Cavanaugh, C., Gillan, K. J., Kromrey, J., Hess, M., and Blomeyer, R. (2004). *The Effects of Distance Education on K-12 Student Outcomes: A Meta-Analysis*. Naperville, IL: Learning Point Associates.
- DiPietro, M., Ferdig, R.E., Preston, M. & Black, E.W. (accepted). Best practices in teaching K-12 online: Lessons learned from Michigan Virtual School teachers. Paper to appear in the *Journal of Interactive Online Learning*.
- Ferdig, R.E., Papanastasiou, E., & DiPietro, M. (2005). *Teaching and learning in collaborative virtual high schools*. Report submitted to the North Central Regional Educational Laboratory as part of the K12 Online Learning Initiative. 65 manuscript pages.
-

---

# Exploring High School Students' Perceptions--Motivation to Engage and Persist in Learning: Implications for Practice—A Case Study

---

Donna Scribner  
Virtual High School  
dscribner@goVHS.org

---

# Questions to be addressed:

- What instructional elements do today's high school students perceive motivates them to *engage* in learning in an asynchronous online classroom?
  - What instructional elements do today's high school students perceive motivates them to *persist* in learning in an asynchronous online classroom?
-

---

# The Study

- Anonymous and voluntary
  - 399 Invited, 202 responses (~51%)
  - Sections on:
    - Grades
    - Content Layout & Material Availability
    - Material Delivery Strategies
    - Social Interactions
    - 4 open-ended
      - Where do I go first
      - When do I get bored
      - When am I interested
      - One most important aspect of an online course which motivates me to learn.....
-

---

# Course Formatting and Content Availability

- Professional looking course is worthy of their attention: 85.4% (Agree or Strongly Agree)
- Images and pictures important to capture their attention: 86.2% (Agree or Strongly Agree)

“having a class that is organized & easy to follow where I will not get mixed up as to what I have to do”

---

---

# Delivery Strategies

- Not just text alone

- 89.3% (agreed or strongly agreed): Learning new material easier when mix of presentation styles

“Doing things hands on and watching videos or something where you can see things visually is sometimes more interesting. Fun activities to mix it up a bit is always more intreretsing (sic) than just reading and writing and doing busy work”

“There are various type of media involved”

---

---

# Delivery Strategies

- Why
  - 90%: Important that they know why they were learning something



---

# Delivery Strategies: Motivated When

“on a subject that i (sic) like”

“I feel like it may benifit me later in life”

“it has to do with things I'm interested in learning”

“it talks about things that I would go through or relate to me”

“i can relate it to something in my life”

“I want to major in this area when I go to college so I want as good of an understanding as possible before I go to college”

---

---

# Delivery Strategies: Not Motivated When

“I have to do things that I have no interest in at all”

“I can see no purpose to the assignment or what they're trying to teach”

“The subject matter is something that I see as being completely unimportant to benefit me”

---

---

# Social Interactions

- Important for sustaining motivation
  - Involved teacher: 89.6%
  - Involved classmates
-

---

# Social Interaction

“everyone including the teacher seems interested in the discussions we all have to participate in”

“the discussion groups where I can see the opinions of others”

“being in a class where everybody is from a different place that I have never heard from. It is awesome to meet new people from different places that are like me”

---

---

# Grades

- Grades are important: 97.6%
  - Of those that agreed or strongly agreed: 92.4% self-reported grade to be A or B
  - Of the 5 students who strongly disagreed: 4 didn't self-report grade and 1 said they were a D student...
-

---

For additional information please contact Donna at:  
dscibner@goVHS.org

978-450-0413

---