

Digital Observation of Educational Practice

by Jon Hasenbank and Jennifer Kosiak

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Presented at the 2008 Wisconsin Research Seminar:
“Closing the Gap: Highly Qualified to Highly Effective”
Tuesday, June 17, 2008

Motivation: the Parent Project

- Project: “Professional Development Partnership for Improving Understanding in Algebra”
 - Foundation: the *Framework for Procedural Understanding*

- Project components:
 - One-week institute (13 teachers)
 - 8 algebra, 2 geometry, 1 AP calculus, 1 physical science, 1 special education
 - Academic year follow-up:
 - **Classroom observations**
 - Weekend meetings
 - Online component

Our *Framework for Procedural Understanding*

Objective: To help students develop deep connected knowledge of procedures.

To that end, we ask students:

- 1a) What is the goal of the procedure?
- 1b) What sort of answer should I expect?
- 2a) Can I execute the procedure?
- 2b) What other procedures could I use to complete the task?
- 3) Why does the procedure work?
- 4) How can I verify my answer?
- 5) When is this the “best” procedure to use?
- 6) What else can I use this procedure to do?

Adapted from NCTM's Navigating through Algebra in Grades 9-12
(Burke, Lott, Erickson, & Obert, 2001)

Connecting the Framework:

WMAS for Mathematics

<i>Framework Question</i>	<i>WMAS for Mathematics</i>
1a. What is the goal of the procedure?	“Students need to <u>know...why [skills and knowledge] are being applied.</u> ”
1b. What sort of answer should I expect?	“Students must be able to <u>communicate their thinking</u> to others.”
2a. How do I execute the procedure?	“Students need to know... <u>how to apply skills</u> and knowledge...”
2b. What are some other procedures I could use instead?	“Learning is easier when students <u>see the connections</u> between various concepts and procedures...”
3. Why is the procedure effective and valid?	“Students should be able to <u>provide a reason... why [a] skill works</u> the way it does.”
4. What connections or contextual features could I use to verify my answer?	“Students should habitually check their results and conclusions for their reasonableness; <u>that is, ‘does this make sense?’</u> ”
5. When is this the “best” procedure to use?	“Students should be able to provide a reason <u>why they have chosen to apply a particular skill</u> or concept...”
6. What can I use this procedure to do?	“Important goals for students are... to master specific knowledge necessary for its <u>application to real problems...</u> ”

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Observing Teacher Practice – Pilot

- Pilot study (college algebra, 2005)
 - Study goal: Improve understanding without declines in skill
 - Need: assess fidelity of implementation
 - Observation methods:
 - Pairs of observers
 - Tally marks of desired classroom events
 - Holistic perception on 0 to 6 scale.

Observing Teacher Practice – Pilot

Brief Instructions: An event refers to a classroom episode in which a Framework Objective is addressed. As you observe the lesson, place a tick mark in the appropriate box for each event that you observe.

- An event in which a majority of students are engaged (either through dialog, discussion, or writing) should be marked under the *Active* heading.
- An event in which the instructor is lecturing, having a dialog with just one or two students, or answering his or her own question, should be marked under the *Passive* heading.

Framework Objective	Related Questions	Passive (Q&A / Monolog / Lecture)		Active (Class Discussion / Dialog / Tasks)	
		Emphasis (focus of instructor's lecture / monolog; esp. when written on the board)	Aside (most passive students miss)	Emphasis	Aside
1a. The Overall Goal of the procedure.	1a. "What are we trying to accomplish?"				
1b. Predicting & Estimating.	1b. "What sort of answer should we expect?"				
2a. Performing the procedure.	2a. "How do we carry out this procedure? What are the steps?"				
2b. Alternate Methods / Representations.	2b. "How else could we have done this?"				
3. Why the procedure is Effective & Valid.	3. "Why does this work? Why is it valid?"				
4. Evaluate Results by using context, other procedures, etc.	4. "How can we verify the answer? Does it make sense?"				
5. Assess relative Efficiency & Accuracy.	5. "What is the most efficient method to use?"				
6. Empowerment as a problem solver.	6. "What types of problems can we solve with this?"				

Classroom Observations – Overall Emphasis on Procedural Understanding

Brief Instructions:

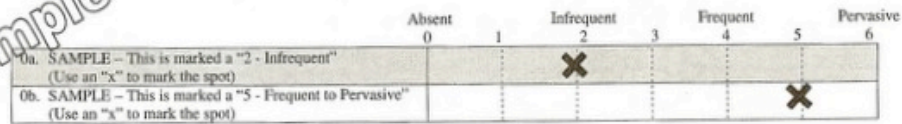
- Complete this section **immediately after** you have observed the lesson.
- Base your responses on your **overall impression** of the lesson, **guided by** the events you recorded on the checklist.
- Remember that "infrequent" and "frequent" should also reflect the duration of the events you observed.
- See the sample below to note how to mark your response. **Please use whole numbers (0 – 6) only.**

Your Initials: LT

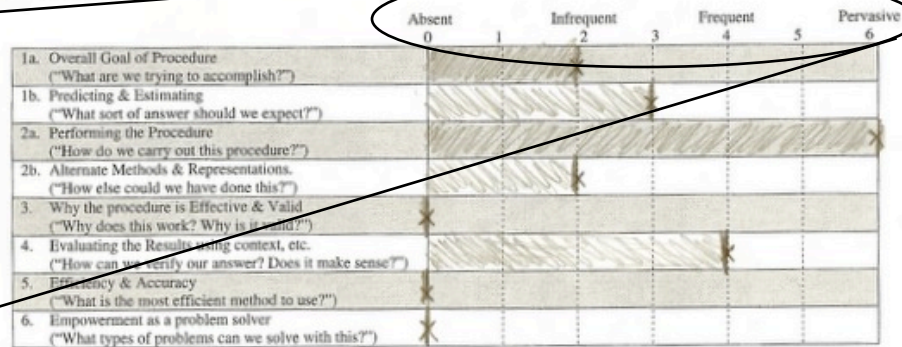
Week Number? (circle one)
2 6 **10**

Class Observed? (circle one)

McGoff8 Katz9 Erlich10
Lauriski10 Hayes11 Sporleder12



Mark the locations on each of the 8 continua below that correspond to **your independent evaluation** of the extent to which each Framework Objective was addressed during the lesson.



0 = "Absent"

2 = "Infrequent"

4 = "Frequent"

6 = "Pervasive"

Observing Teacher Practice – Pilot

■ Primary Limitations:

- No record of *sequencing* of events
- No record of *time* spent in each category
 - (Cannot say, “Instructors devoted 15% of class time to...”)

■ Additional limitations

- Holistic score was subjective
- Holistic score could mask disagreements between observers about specific events

Observing Teacher Practice – Round 2

■ Vision:

- Digital checklist would keep track of sequencing and duration of desired events.
- Observer selects category (with optional notes); computer keeps record of the changes.

■ Benefits:

- Record of sequencing of events.
- Precisely measures time spent in each category.

Observing Teacher Practice – Round 2

(format similar to Praxis III checklist)

1	A	B	C	D	E	F	G	H	I	J
2	Time	Duration	Pri. Cat.	Sec. Cat.	Comments (optional)	Press "CTRL+O" ("oh") to start Observation				
3	10:39:11	0:00:02	0	2		Version:	5/29/2008	Web Tutorial:	Click here	
4	10:39:13	0:00:07	3	2		Copyright:	2008 (Jon F. Hasenbank; hasenban.jon@uwla.edu)			
5	10:39:20	0:00:08	3	2	Answering homework questions	All rights reserved; Not for distribution.				
6	10:39:28	0:00:12	5	2						
7	10:39:40	0:00:01	5	2	Student asks why the procedure works.					

Classroom Observation Form

Framework Literacies

- 1a - The goal or purpose - What is the goal of the procedure? What are we trying to accomplish?
- 1b - Predicting or estimating the answer - What sort of answer should we expect?
- 2a - Performing the procedure - How do we solve this? What are the steps?
- 2b - Alternate methods or representations - How else could we do this?
- 3 - Why is it effective & valid - Why does this work? What's the conceptual basis?
- 4 - Evaluating the results using context or connections - Does this make sense? How could we check?
- 5 - Relative efficiency and accuracy - Which method is "best," and how can we tell?
- 6 - Empowerment as a problem solver - What types of problems can we solve with this?

Nature of Activity

- Lecture / Note-taking
- Teacher Led Discussion
- Individual Work / Practice
- Group Work / Discussion
- Quiz or Test
- Free Time

Resume New Line

Pause

Clear Data / Reset

Close

Remember: You must click "Record" or "Resume" before this program will record anything!
 Row 37. [9:33:46 AM] Literacy: 2b - Alternate Methods, Activity: Lecture, Comment: -n/a-
 Row 38. [9:33:46 AM] Resuming...

Lesson Progression - Primary

Legend	Total	%
stopped	#####	
other	01:10.0	19%
1a	00:00.0	0%
1b	00:20.0	5%
2a	02:58.0	48%
2b	00:00.0	0%
3	00:35.0	9%
4	00:29.0	8%
5	00:00.0	0%
6	00:00.0	0%
concept	00:37.0	10%
	#####	100%

ep: 0:00:05.0 0.00005787

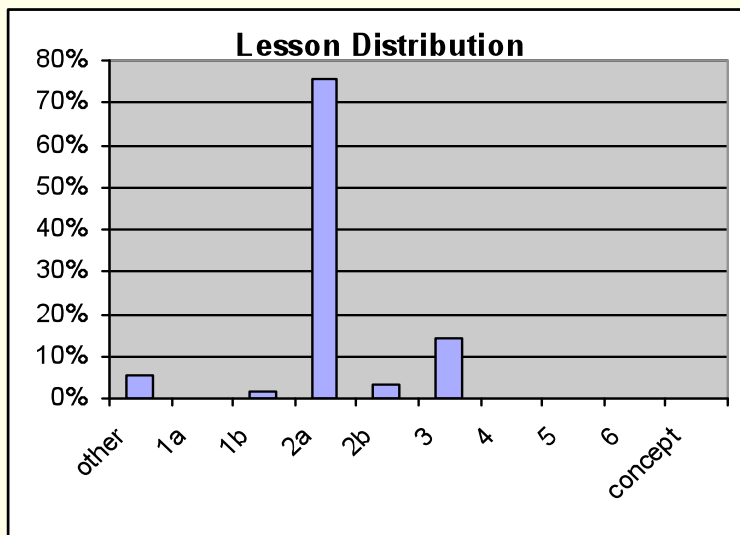
Time-step may be changed by selecting it and

Distribution - Primary Categories

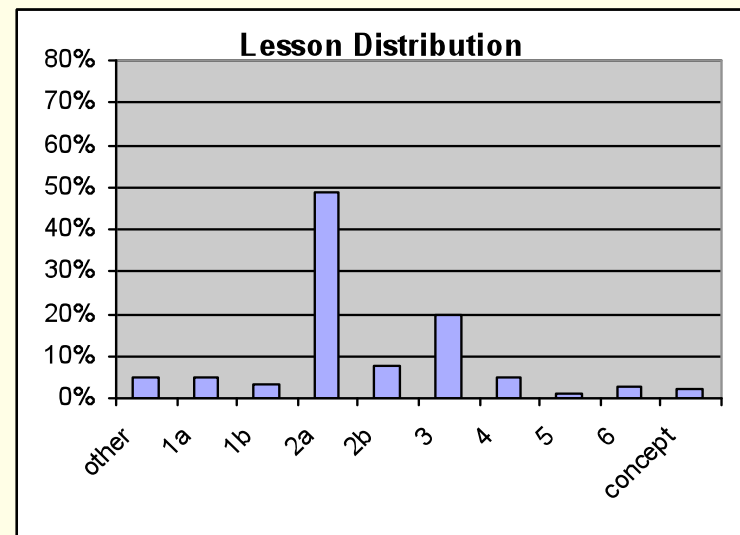
Observing Teacher Practice – Round 2

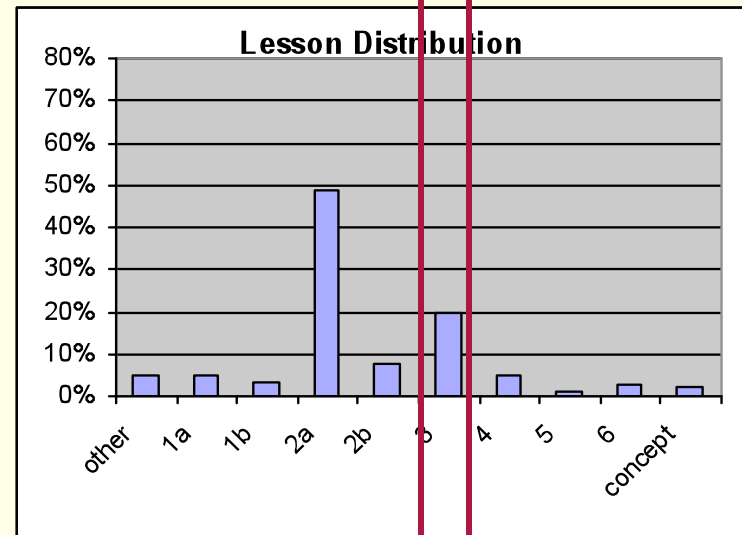
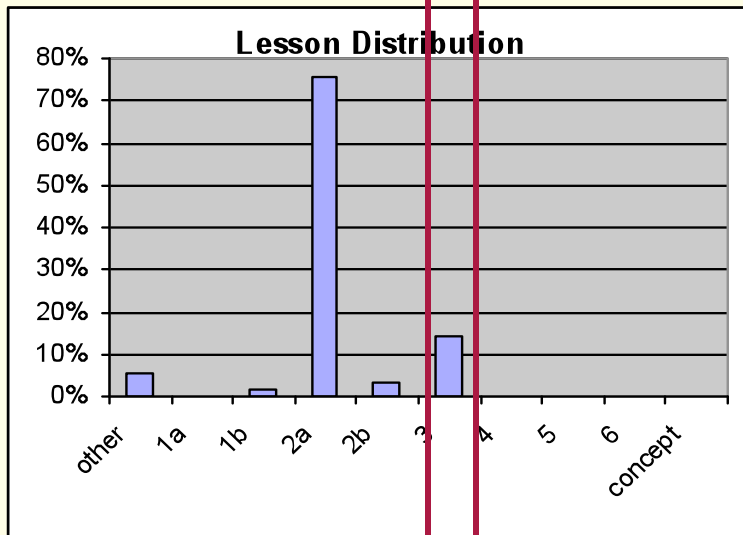
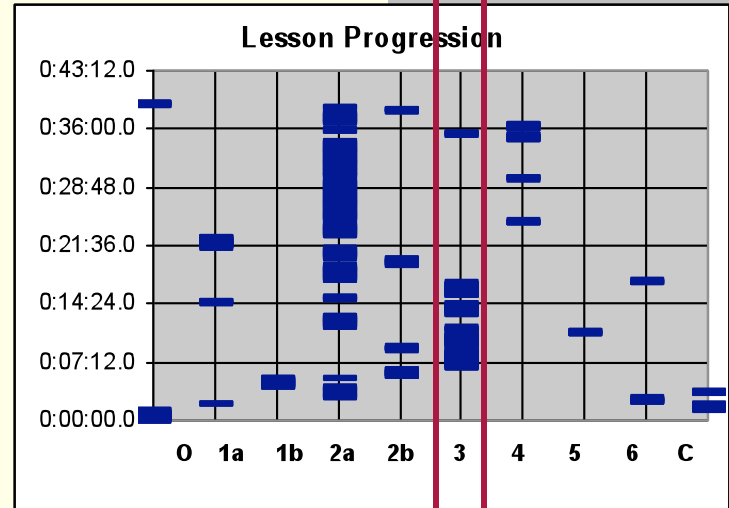
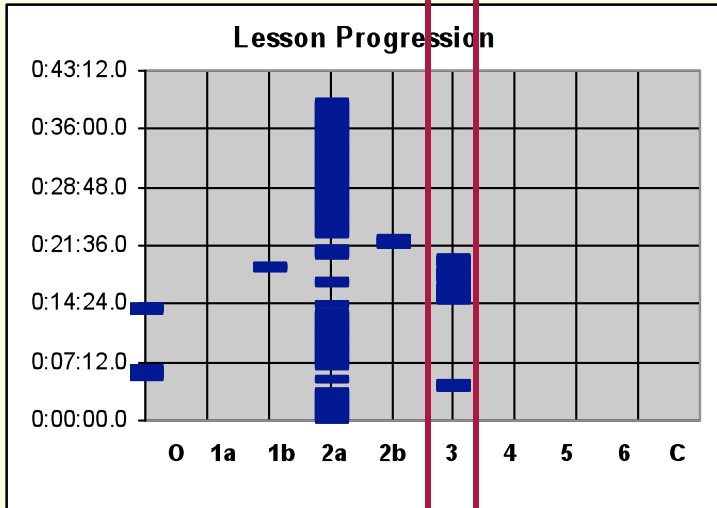
- Revised instrument provides more precise information and greater detail.

Lesson A



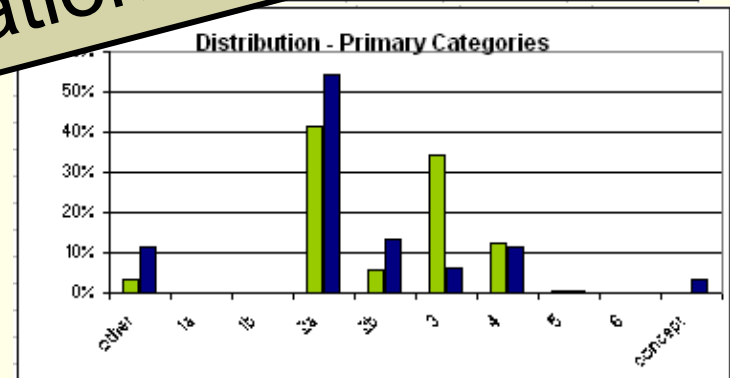
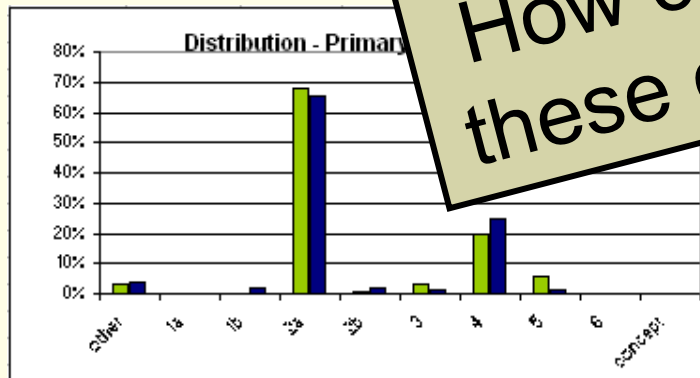
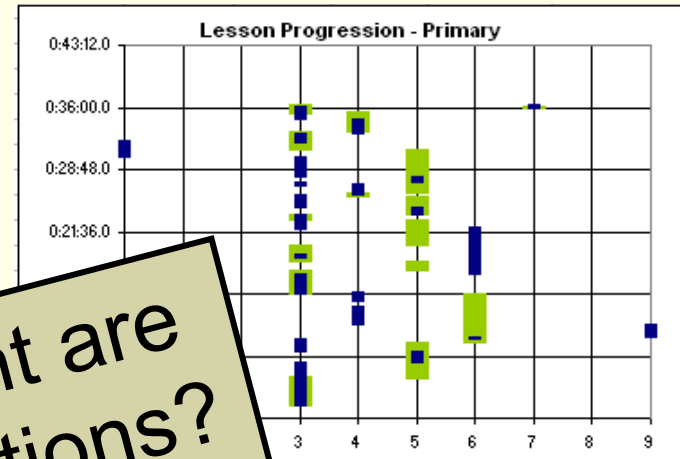
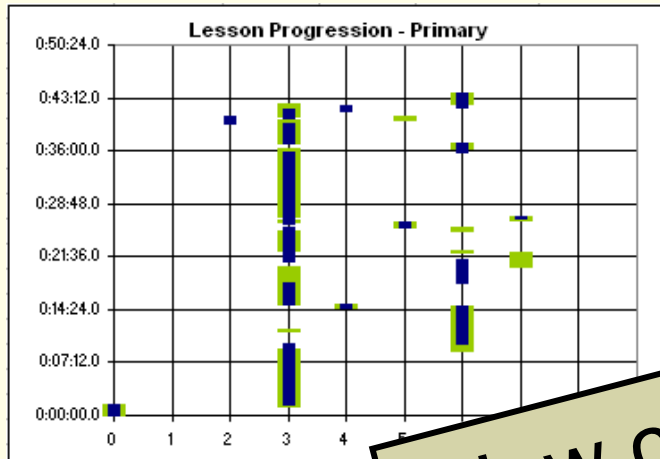
Lesson B





Inter-rater Reliability

- Comparing independent observations is possible by merging the graphs:



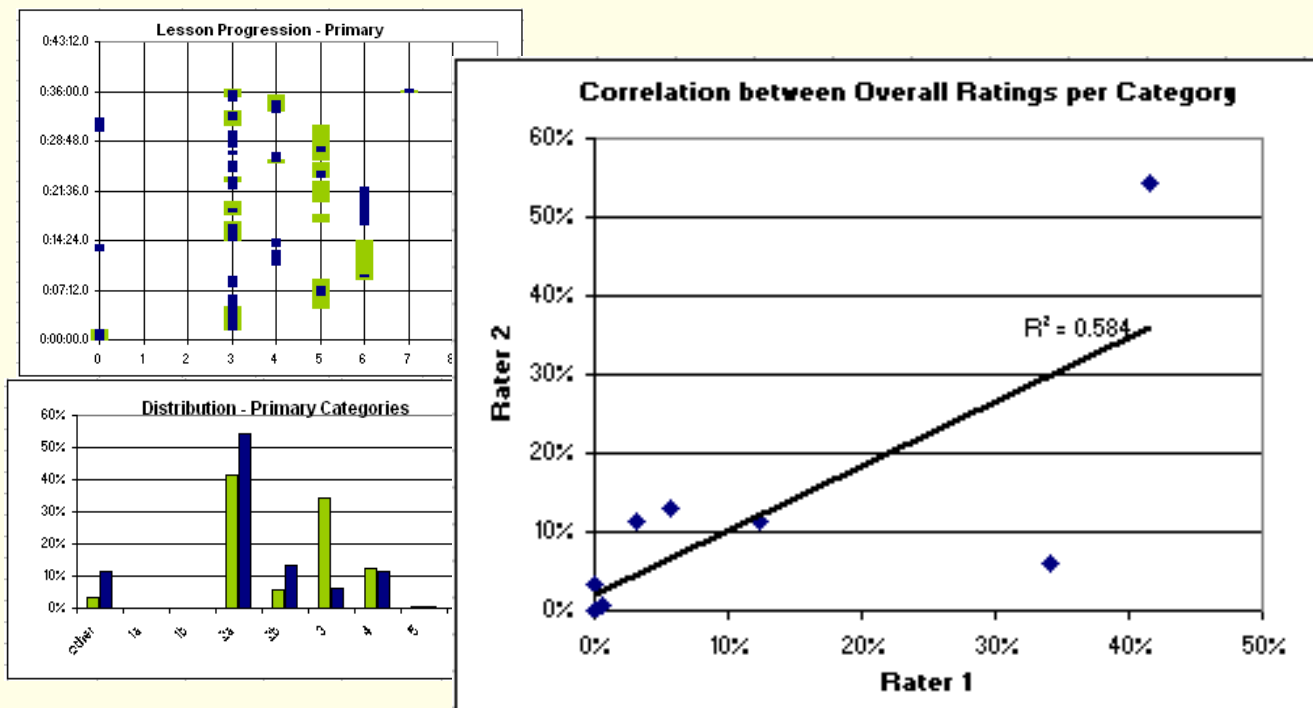
How consistent are these observations?

Inter-rater Reliability - Options

- Options for assessing inter-rater reliability:
 - Association
 - Linear correlation (R or R^2), using *aggregate* data (overall frequency per category, per observer)
 - Agreement
 - Raw agreement (%), moment by moment
 - Cohen's *kappa* (Agresti, 1990, p. 366), moment by moment agreement beyond that expected by chance.

Inter-rater Reliability – Correlation

- Simple correlations are not appropriate.
 - High-leverage points skew regression.
 - Clustering near (0,0) inflates R^2 .
 - Strong correlation does not guarantee high agreement.

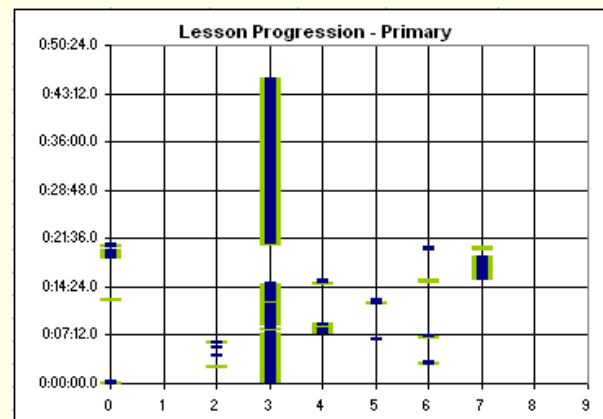
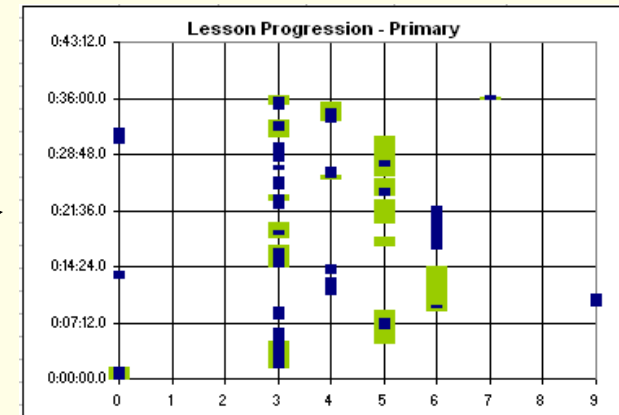


Inter-rater Reliability – % Agree

- % Agreement (moment to moment) is easy to calculate from our data...
 - Triangulate with plots to see *where* we differed.

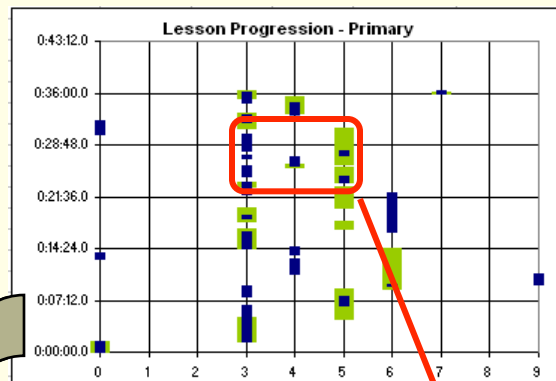
- % Agreement for all joint observations:

- 3|9
- 4|
- 5|91
- 6|6
- 7|9522
- 8|861
- 9|2



Inter-rater Reliability – % Agree

- When necessary, we can drill down to explore the areas of disagreement.



	-1	0	1	2	3	4	5	6	7	8	9	Jon:
-1	-	-	-	-	-	-	-	-	-	-	-	0%
0	-	4%	-	-	3%	-	2%	2%	-	-	-	11%
1	-	-	-	-	-	-	-	-	-	-	-	0%
2	-	-	-	-	-	-	-	-	-	-	-	0%
3	-	-	-	-	22%	2%	21%	1%	-	-	-	46%
4	-	-	-	-	1%	5%	3%	8%	-	-	-	16%
5	-	-	-	-	-	-	7%	-	-	-	-	7%
6	-	-	-	-	6%	-	8%	0%	-	-	-	14%
7	-	-	-	-	0%	-	-	-	0%	-	-	1%
8	-	-	-	-	-	-	-	-	-	-	-	0%
9	-	-	-	-	-	-	-	4%	-	-	-	4%
Jenn:	0%	4%	0%	0%	31%	7%	42%	16%	0%	0%	0%	

Inter-rater Reliability - *kappa*

- Cohen's *kappa* is a measure of agreement beyond what is expected by chance.
- Range of *kappa* for our joint-observations:
 - <0.0 (worse than chance) -
 - 0.0-0.2 (slight agreement) -
 - 0.2-0.4 (fair) .22, .24
 - 0.4-0.6 (moderate) .42, .45, .48, .48
 - 0.6-0.8 (substantial) .60, .61, .70, .74, .75, .79
 - 0.8-1.0 (almost perfect) -

Inter-rater Reliability - Remarks

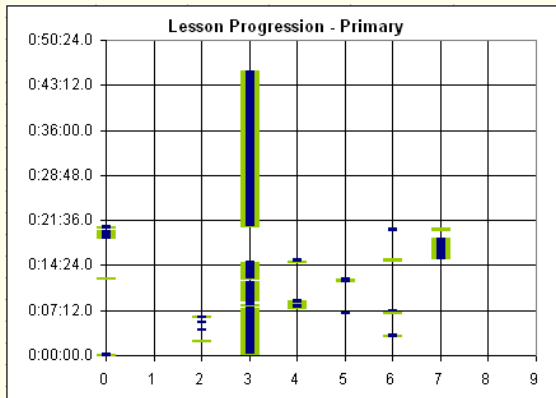
- Remarks about reliability:
 - Categories should be mutually exclusive...
 - ...our *Framework* items may not be.
 - “% agreement” and *kappa* are influenced by long unbroken periods in a single category (e.g. homework time at end of period.)
 - Next steps include trimming data to explore only teacher-centered time.

Preliminary Results – The Nature of Algebra Instruction

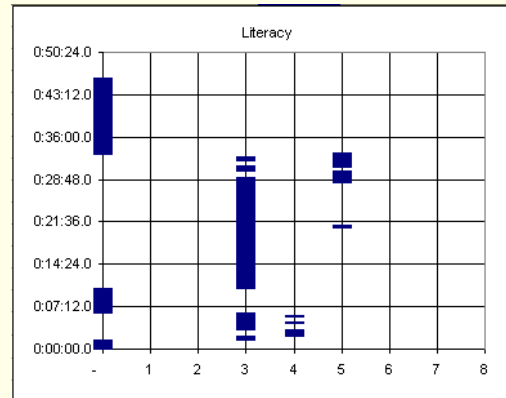
- We observed 14 *algebra* lessons (11 hr. 45 min.) using the instrument (7 jointly).
- Teachers were told to “sprinkle in” Framework-related items. How well did they do?

Algebra Results – ES and AE

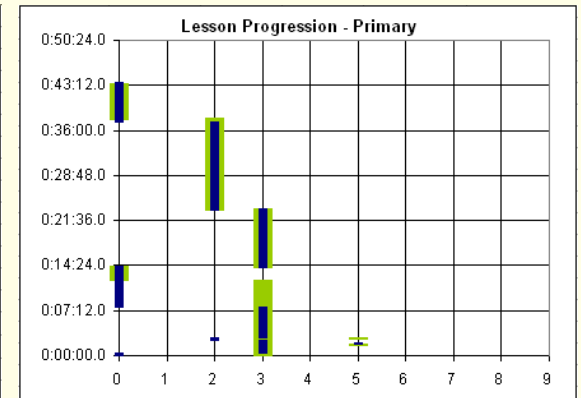
ES



Sep. 2007

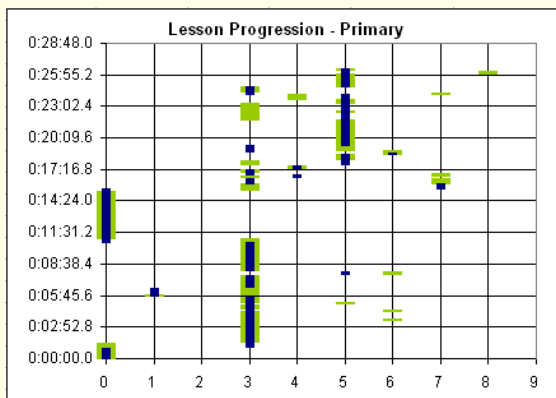


Nov. 2007

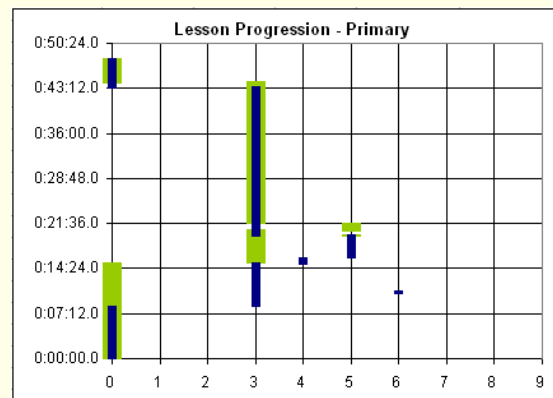


Feb. 2008

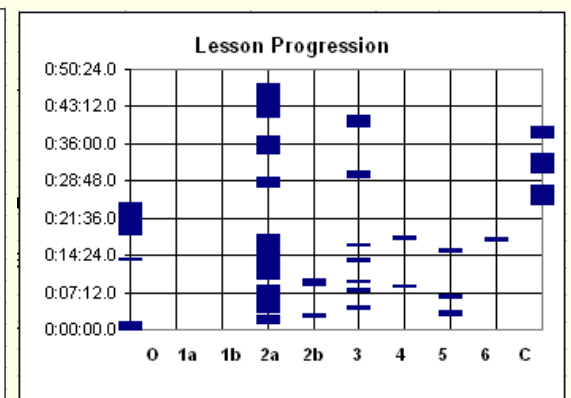
AE



Oct. 2007



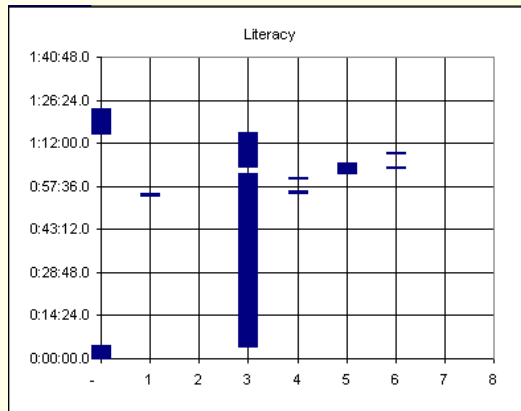
Dec. 2007



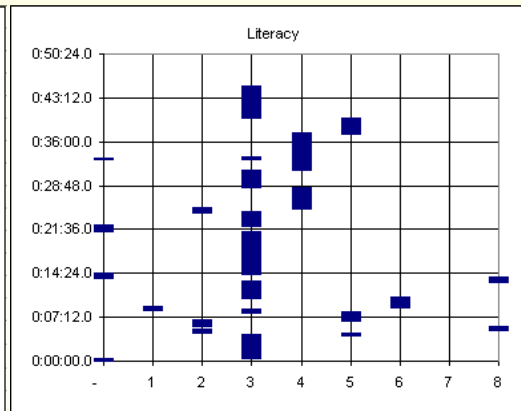
Feb. 2008

Algebra Results – KE and BE

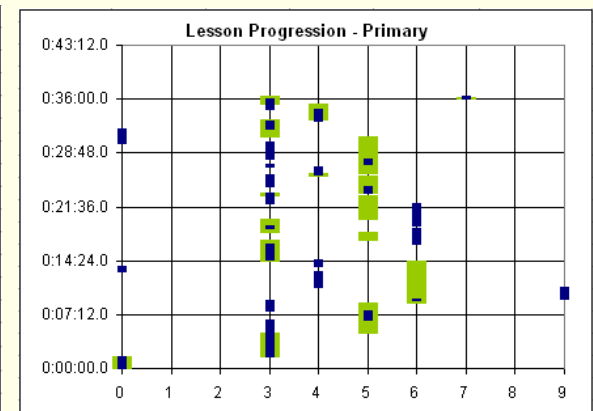
KE



Oct. 2007

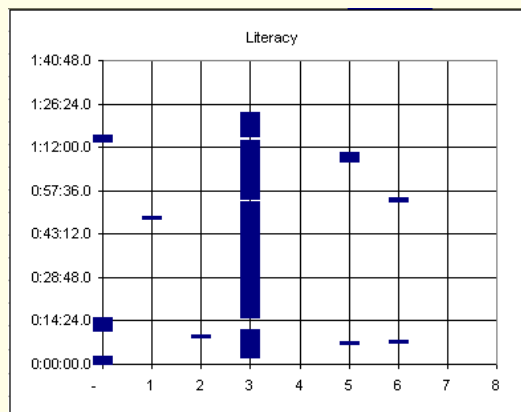


Nov. 2007

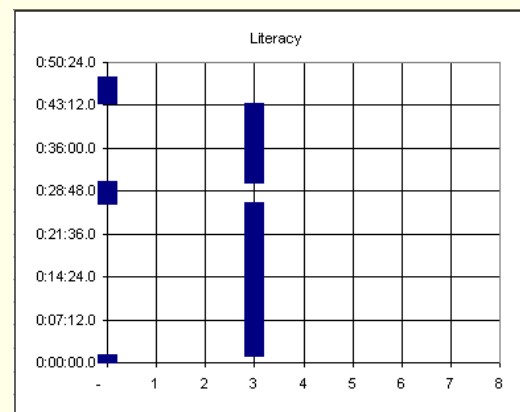


Feb. 2008

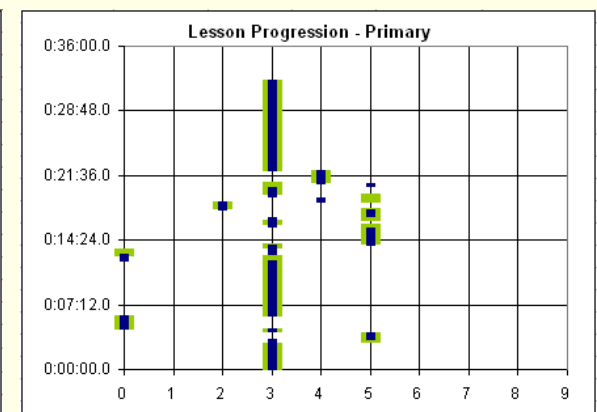
BE



Oct. 2007



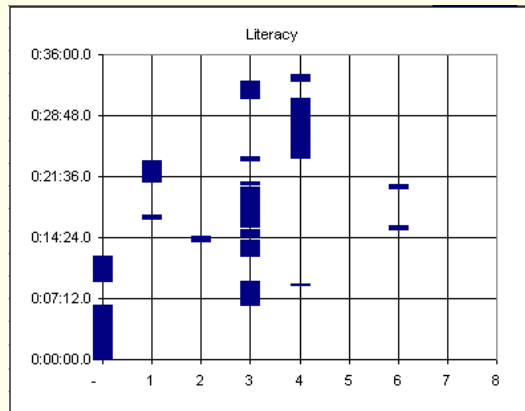
Nov. 2008



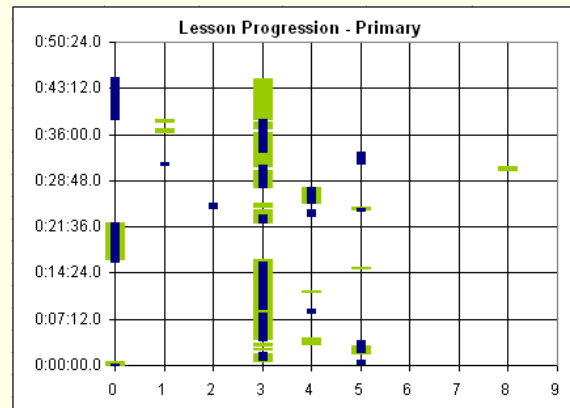
Feb. 2008

Algebra Results – EZ

EZ



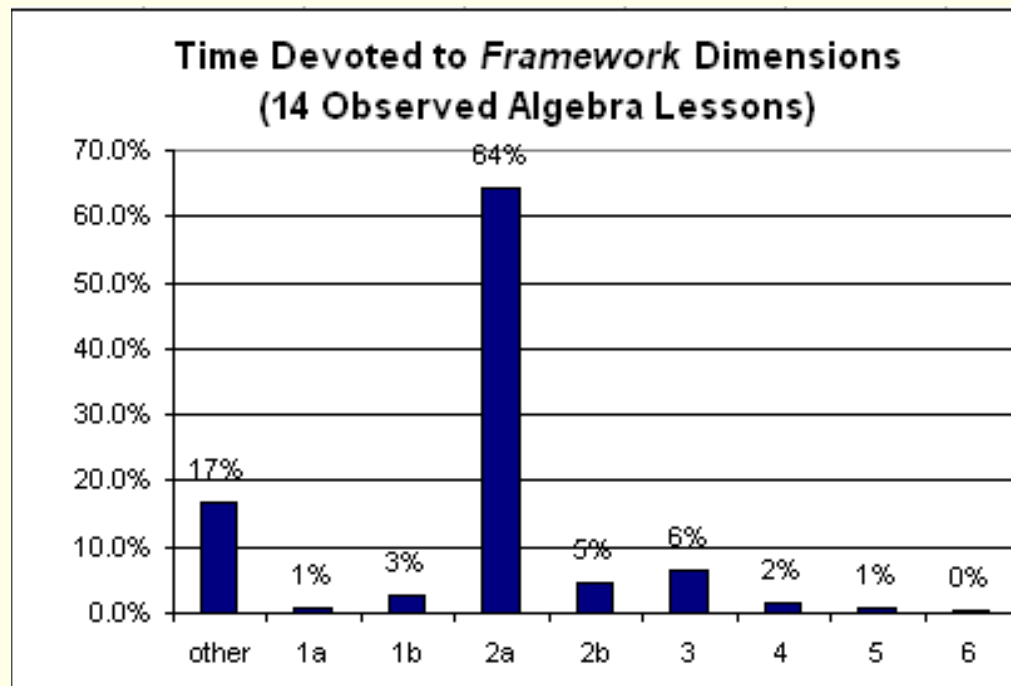
Oct. 2007



Nov. 2007

Preliminary Results – The Nature of Algebra Instruction

- Allocation of time in 14 algebra periods:
 - 64% “How do we do it? What are the steps?”
 - 18% Other *Framework* questions.
 - 17% “Other activities (taking attendance, etc.)”



Connections to Other Projects

■ Praxis III: “Classroom Performance

Assessments” instrument uses an observation sheet with:

- Time, Comment, Evaluation Code

■ “Instructional Skills Observation Instrument” based on Hunter’s Lesson Design Model with:

- Categorical codes: Set/Focus, Instruction, Guided Practice, and Independent Practice

The screenshot shows a software window titled "Classroom Observation Form". It features two main columns of radio button options. The left column, "Framework Literacies", includes items 1a through 6, plus "Conceptual" and "Other" categories. The right column, "Nature of Activity", includes "Lecture / Note-taking", "Teacher Led Discussion", "Individual Work / Practice", "Group Work / Discussion", "Quiz or Test", and "Free Time". Below the options are buttons for "Resume", "New Line", "Pause", "Clear Data / Reset", and "Close". A status bar at the bottom contains a reminder message: "Remember: You must click 'Record' or 'Resume' before this program will record anything! Row 37, [9:33:46 AM] Literacy: 2b - Alternate Methods, Activity: Lecture, Comment: -n/a- Row 38, [9:33:46 AM] Resuming..."

References

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