

A decorative border consisting of a repeating pattern of palm trees, with green fronds and brown trunks, arranged in a rectangular frame around the central text.

Knowledge Exchange Network for Developmental Math

Workbook for the pilot Faculty Collaborative on
Active Learning in Elementary Algebra, Spring 2011

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Spring 2011

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Classroom Activities for Elementary Algebra Topics

In addition to trying out the generic active strategies listed above, you can also try out active learning methods for specific course topics. Each of these learning activities for use in class includes a link to a student handout, an instructor guide, and an online space for you to comment on your experiences with the activity. You can find this page with active links online at <http://tinyurl.com/sakeactivelearning>.

Linear Equations:

[Simulating Mixture Problems with Beads](#)

Graphing, scaling conventions:

[Scaling a Graph](#)

Linear Functions (modeling) and systems:

[Modeling CO₂ Levels](#) (modeling)

[Rate and Slope - Car Depreciation Activity](#) (modeling)

[Modeling Gas Prices](#) (linear functions, systems)

[Batting Averages in Baseball](#) (ratio and proportion; systems)

[Trapping Lab - Linking Equations and Graphs](#) (systems)

[Forearm Length vs. Height](#) (linear modeling)

Functions (general):

[Introduction to Functions - Basics and Applications](#) (intro to functions and function notation info, and has some good *linear* modeling activities. A small part of the activity requires factoring quadratics for identifying the domain)

Exponents (and Scientific Notation):

[How Big? How Far? How many?](#)

Factoring Quadratics:

[Factoring Research - Projectile Motion](#)

Rational Equations:

[Paying the Price - Rational Equations](#)

Equations and Formulas:

[Down to Business - Rewriting Formulas](#)

Introduction to Active Learning in Elementary Algebra

Welcome to the KEN for Developmental Math Active Learning Collaborative! This is a pilot group to make a local professional development activity - at Orange Coast College - available to a wider audience. We want to provide you with an experience that will enhance your teaching and your students' learning. That will include experimenting with a number of active learning strategies and activities to apply in your classroom, a coach to answer your questions and provide advice, and a group of colleagues with whom to share experiences, ideas and pedagogical discussions.

Here are the intended outcomes of this collaboration for Spring 2011:

Participants will:

1. implement active learning strategies & activities in their classes
2. provide feedback on strategy implementation and activity use
3. suggest additional classroom strategies or activities that address identified needs in a specific subject area
4. identify gaps in the topics covered by the learning activities
5. evaluate our processes for collaborative professional development.

This workbook is intended as a tool for you to use to collect information about strategies that you implement and to provide you with space to think about how to apply these strategies differently in your classroom or program. Our intention is that the workbook will help us all implement strategies and activities during the semester and maintain a record of strategies and activities used as well as their outcomes.

Enjoy the semester!

Joan Córdova &
Bohdan Rhodehamel

How to participate in the Spring 2011 faculty collaborative:

Open to any interested faculty members in the San Diego, Los Angeles and Bay area community colleges. To join the faculty collaborative, email Bohdan Rhodehamel at bohdanr561@yahoo.com. Our collaboration begins March 1: you can join any time & choose how to participate.

Please include the following information to help us plan:

- Name, email, department and college(s)
- The course(s) where you will test the strategies & activities
- A course syllabus so that we can track the topics you plan to cover
- Tell us how you expect to participate - *you can vary your level of participation based on your workload in any particular week* ☺
 - test strategies/activities with advice & feedback from coaches
 - share ideas with other faculty in an online discussion space
 - share ideas with other faculty in occasional phone meetings
 - provide feedback on the resources and processes in this pilot.

Draft plan for the collaboration (subject to your input and suggestions):

- Each week participating faculty members will receive an email outlining a suggested active learning strategy and topical learning activity to try out in class. The active learning strategy can be applied throughout a course and in other courses; the topical activities are specific to a particular topic, and engage students in hands-on or applied tasks, often with other students. For many strategies we will provide a URL to a short video demonstration.
- You can interact with our coaches by email or with coaches and other faculty in the online workspace (where our coaches will also post a summary of individual comments and discussion from emails).
- Periodically, you will have the opportunity to join a live discussion via phone and online facilities, where we can all share experiences and discuss the pedagogical issues of active learning in our classes.
- If you identify additional topics where you would like learning activities to engage students in class, we will search for suitable exemplary resources to add to our collection.
- At the end of term, we will ask you to participate in an evaluation of the processes and resources - this is a voluntary option, to help us improve future opportunities for faculty knowledge exchange.

Week 1 - Information Gathering 3x5

Strategy: One minute paper

Objective: Gather information on the student's in the class

Implementation: Have students answer 4 questions on a 3x5 card with their name and date in the upper right hand corner

1. When did you last take a math class?
2. What math class did you take and where?
3. What was your grade in the class?
4. Have you attempted this course before?

Other relevant questions:

How many hours do you work each week?

Do you have family responsibilities? E.g. spouse, children, parents

Feedback: Quickly read through the cards making note of the span between students in all four areas.

Comments: This is not a lengthy process. Time the event to take less than 5 minutes from start to finish.

Additional Applications: Now that you have the student's names on the 3x5 cards, use them to call on students throughout the class session. Goal: call on each student at least once during the class time. Calling on students in class can be made less threatening by use the "Who Wants to be a Millionaire" model. If a student is called on, they can ask for a class poll or they can ask for a lifeline. Lifelines can be the students who are volunteering or the next card in your hand.

Feedback to Joan:

The 3x5 Information card:	Disagree	Agree
Was easy to implement	1 2 3 4 5 6 7 8 9 10	
Provided useful information	1 2 3 4 5 6 7 8 9 10	
Gave a voice to the students	1 2 3 4 5 6 7 8 9 10	
Other: _____		

Comments:

Week 2 – Diagnostic 3x5

Strategy: One minute paper

Objective: Diagnose the student's basic math skills: Addition with carrying, subtraction with regrouping, multiplication, division, fractions and decimals.

Implementation: Have students work 6 questions on a 3x5 card with their name and date in the upper right hand corner

- | | |
|-------------------|--------------------|
| 1. $29 + 45$ | 4. $2,428 \div 42$ |
| 2. $400 - 111$ | 5. $2/3 + 4/5$ |
| 3. 56×78 | 6. $2.75 + 49.642$ |

Feedback: A quick read through the cards will let you know where the problems are. Taking a little more time can help determine if this particular group of students has problem areas focused more heavily in one area.

Comments: This is not a lengthy process. Time the event to take less than 5 minutes from start to finish

Additional Applications: Now that you have the student's names on the 3x5 cards, use them to call on students throughout the class session. Goal: call on each student at least once during the class time. Calling on students in class can be made less threatening by use the "Who wants to be a millionaire" model. If a student is called on, they can ask for a class poll or they can ask for a lifeline. Lifelines can be the students who are volunteering or the next card in your hand.

Feedback to Joan:

The 3x5 card:

	Disagree										Agree									
Was easy to implement	1	2	3	4	5	6	7	8	9	10										
Provided useful information	1	2	3	4	5	6	7	8	9	10										
Gave a voice to the students	1	2	3	4	5	6	7	8	9	10										
Other:																				

Comments:

Week 3 – Classroom Assessment, Student Feedback Using Hand Signals

Strategy: Hand Signals

Objective: Determine the level of student comprehension on a specific topic

Implementation: Immediately following the discussion of a topic or completion of a worked example have the students give feedback on how well they understood the topic/example. As they raise their hand have them use their fingers to determine how well they understood.

If they understand the topic so well they are ready for the test have them raise their hand with all their fingers spread open.



Using their own judgement they can select to raise 1 - 4 fingers based on their level of understanding - more fingers, better understanding, fewer fingers, less comprehension.

The lowest hand raise is a fist. If they are so unclear on the concept they are wondering what language you are speaking, the student raises a fist.



Feedback:

Comments: _____

Feedback to Joan:

The Hand Signals :

	Disagree					Agree				
Was easy to implement	1	2	3	4	5	6	7	8	9	10
Provided useful information	1	2	3	4	5	6	7	8	9	10
Gave a voice to the students	1	2	3	4	5	6	7	8	9	10
Other: _____										

Additional Applications: _____

Comments:

Week 4 – Think, Pair, Share

Strategy: Think Pair Share

Objective: Increase student cognitive processing to complete work and evaluate their work and classmates

Implementation: Use the last 5 - 10 minutes of class to assign a problem for students to work. Specify the students are to show ALL their work, ALL the steps taken. Once they have completed the problem they are to share their work with a classmate. Exchange papers. Discuss the steps taken. Compare differences in their work. Make notes on the classmates paper specifying the differences. Compare final answers. Can they determine who has the correct answer and why?

Feedback: _____

Comments: _____

Feedback to Joan:

The Think/Pair/Share activity :	Disagree					Agree				
Was easy to implement	1	2	3	4	5	6	7	8	9	10
Provided useful information	1	2	3	4	5	6	7	8	9	10
Gave a voice to the students	1	2	3	4	5	6	7	8	9	10
Other:	_____									

Additional Applications: _____

Comments: _____

Week 5 - Variation on the One Minute Paper

Strategy: Muddiest Point

Objective: Determine concepts least clear to the students

Implementation: Either 5 minutes before break or 5 minutes before the end of the class ask students to answer the question, "What is the "muddiest point" in today's material? Or "What do you find unclear about (topic)?"

Feedback: _____

Comments: 3x5 cards are particularly useful for this exercise. It keeps comments concise and easy to read through quickly.

Feedback to Joan:

The Muddiest Point :	Disagree					Agree				
Was easy to implement	1	2	3	4	5	6	7	8	9	10
Provided useful information	1	2	3	4	5	6	7	8	9	10
Gave a voice to the students	1	2	3	4	5	6	7	8	9	10
Other: _____										

Additional Applications: _____

Comments:

Week 6 – Variation of the One Minute Paper

Strategy: Assessment Problem

Objective: Assess student comprehension of material

Implementation: Display a sample problem for the students to work without use of materials or any input from classmates. Ask them to show their work.

Feedback: _____

Comments: This can be done anytime including before class starts. I like to have a problem on the screen as students come in. They are allowed 3-5 minutes to work the problem. It is a great spring board into discussion of the topic. If used at the end of class it helps fill in the "holes" during the next class session.

Feedback to Joan:

The Assessment Problem:	Disagree										Agree									
Was easy to implement	1	2	3	4	5	6	7	8	9	10										
Provided useful information	1	2	3	4	5	6	7	8	9	10										
Gave a voice to the students	1	2	3	4	5	6	7	8	9	10										
Other:	_____																			

Additional Applications: _____

Comments:

Week 7 – Clarification Pauses

Strategy: Clarification Pauses

Objective: Promote Active Listening

Implementation: After stating an important point or key concept - STOP - WAIT - ask if anyone needs clarification on the important point.

Feedback: _____

Comments: The Pause/Wait time can be used to walk around the room looking at students notes.

Feedback to Joan:

The Pause/Wait:	Disagree										Agree									
Was easy to implement	1	2	3	4	5	6	7	8	9	10										
Provided useful information	1	2	3	4	5	6	7	8	9	10										
Gave a voice to the students	1	2	3	4	5	6	7	8	9	10										
Other:	_____																			

Additional Applications: _____

Comments:

Week 8 – Active Review Session

Strategy: Active Review Session

Objective: Promote student involvement and student cognition.

Implementation: The instructor presents questions for the students to work on in groups. Students are then asked to show their solutions to the whole class. Discuss differences in process and solutions.

Feedback: _____

Comments: _____

Feedback to Joan:

The Active Review Session:	Disagree					Agree				
Was easy to implement	1	2	3	4	5	6	7	8	9	10
Provided useful information	1	2	3	4	5	6	7	8	9	10
Gave a voice to the students	1	2	3	4	5	6	7	8	9	10
Other:	_____									

Additional Applications: _____

Comments:

Week 9 – Student Summary

Strategy: Student Summary of Another Student's Work

Objective: Promote active listening and increase cognitive processing through evaluation of classmates work.

Implementation: After one student has volunteered an answer to your question, ask another student to summarize the first student's response. Many students hear little of what their classmates have to say, waiting instead for the instructor to either correct or repeat the answer. Having students summarize or repeat each others' contributions to the course both fosters active participation by all students and promotes the idea that learning is a shared enterprise. Given the possibility of being asked to repeat a classmates' comments, most students will listen more attentively to each other.

Feedback: _____

Comments: _____

Additional Applications: _____

Feedback to Joan:

The Student Summary:	Disagree										Agree									
Was easy to implement	1	2	3	4	5	6	7	8	9	10										
Provided useful information	1	2	3	4	5	6	7	8	9	10										
Gave a voice to the students	1	2	3	4	5	6	7	8	9	10										
Other: _____																				

Comments: _____

Week 10 – The Fish Bowl

Strategy: Fish Bowl

Objective: Increase student participation and cognitive process.

Implementation: Students are given index cards, and asked to write down one question concerning the course material. They should be directed to ask a question of clarification regarding some aspect of the material which they do not fully understand; or, perhaps you may allow questions concerning the application of course material to practical contexts. At the end of the class period (or, at the beginning of the next class meeting if the question is assigned for homework), students deposit their questions in a fish bowl. The instructor then draws several questions out of the bowl and answers them for the class or asks the class to answer them.

Feedback: _____

Comments: _____

Feedback to Joan:

The Fish Bowl:	Disagree										Agree									
Was easy to implement	1	2	3	4	5	6	7	8	9	10										
Provided useful information	1	2	3	4	5	6	7	8	9	10										
Gave a voice to the students	1	2	3	4	5	6	7	8	9	10										
Other:	_____																			

Additional Applications: _____

Comments: _____

Week 11 – One Minute Paper

Strategy: One Minute Paper

Objective: This is a highly effective technique for checking student progress, both in understanding the material and in reacting to course material.

Implementation: Ask students to take out a blank sheet of paper, pose a question (either specific or open-ended), and give them one (or perhaps two - but not many more) minute(s) to respond. Some sample questions include: "List the steps used to complete the square.", "What determines an equation is quadratic?", "List two methods used to solve a quadratic equation, include the steps.", "Discuss the difference between -10^2 and $-(10)^2$.", and so on. Another good use of the minute paper is to ask questions like "What was the main point of today's class material?" This tells you whether or not the students are viewing the material in the way you envisioned.

Feedback: _____

Comments: _____

Feedback to Joan:

The One Minute Paper:	Disagree										Agree									
Was easy to implement	1	2	3	4	5	6	7	8	9	10										
Provided useful information	1	2	3	4	5	6	7	8	9	10										
Gave a voice to the students	1	2	3	4	5	6	7	8	9	10										
Other: _____																				

Additional Applications: _____

Comments: _____

Week 12 – Wait Time

Strategy: Wait Time

Objective: Increased cognitive processing

Implementation: Rather than choosing the student who will answer the question presented, this variation has the instructor WAITING before calling on someone to answer it. The wait time will generally be short (15 seconds or so) - but it may seem interminable in the classroom. It is important to insist that no one raise his hand (or shout out the answer) before you give the OK, in order to discourage the typical scenario in which the five students in the front row all immediately volunteer to answer the question, and everyone else sighs in relief. Waiting forces every student to think about the question, rather than passively relying on those students who are fastest out of the gate to answer every question. When the wait time is up, the instructor asks for volunteers or randomly picks a student to answer the question. Once students are in the habit of waiting after questions are asked, more will get involved in the process.

Feedback: _____

Comments: _____

Feedback to Joan:

The Wait Time:	Disagree										Agree
Was easy to implement	1	2	3	4	5	6	7	8	9	10	
Provided useful information	1	2	3	4	5	6	7	8	9	10	
Gave a voice to the students	1	2	3	4	5	6	7	8	9	10	
Other: _____											

Additional Applications: _____

Comments: _____

Week 13 – Student Summary of Another Student’s Work

Strategy: Student Summary of Another Student’s Work

Objective: Promote active listening and increase cognitive processing through evaluation of classmates work.

Implementation: After one student has volunteered an answer to your question, ask another student to summarize the first student's response. Many students hear little of what their classmates have to say, waiting instead for the instructor to either correct or repeat the answer. Having students summarize or repeat each others' contributions to the course both fosters active participation by all students and promotes the idea that learning is a shared enterprise. Given the possibility of being asked to repeat a classmates' comments, most students will listen more attentively to each other.

Feedback: _____

Comments: _____

Feedback to Joan:

The Student Summary of Another Student’s Work:

	Disagree										Agree									
Was easy to implement	1	2	3	4	5	6	7	8	9	10										
Provided useful information	1	2	3	4	5	6	7	8	9	10										
Gave a voice to the students	1	2	3	4	5	6	7	8	9	10										
Other:	_____																			

Additional Applications: _____

Comments:

Week 14 – Problem Comparison/Sharing

Strategy: Problem Comparison/Sharing

Objective: Increase cognition and involvement.

Implementation: Students are asked to complete an individual homework assignment showing all the steps in the process. On the day the assignment is due, students submit one copy to the instructor to be graded and one copy to their partner. These may be assigned that day, or students may be assigned partners to work with throughout the term. Each student then takes their partner's work and depending on the nature of the assignment gives critical feedback, standardizes or assesses the process/steps, corrects mistakes in problem-solving and so forth.

Feedback: _____

Comments: _____

Feedback to Joan:

The Problem Comparison/Sharing:	Disagree										Agree									
Was easy to implement	1	2	3	4	5	6	7	8	9	10										
Provided useful information	1	2	3	4	5	6	7	8	9	10										
Gave a voice to the students	1	2	3	4	5	6	7	8	9	10										
Other: _____																				

Additional Applications: _____

Comments: _____

Week 15 – Work at the blackboard

Strategy: Work at the Blackboard

Objective: Increase student involvement/participation/cognition.

Implementation: Instructors tend to review homework or teach problem solving techniques by solving the problems themselves. Students learn more by doing, rather than watching. Rather than illustrating problem solving, have students work out the problems themselves, by asking them to go to the blackboard in small groups to solve problems. If there is insufficient blackboard space, students can still work out problems as a group, using paper and pencil.

Feedback: _____

Comments: _____

Feedback to Joan:

The Work at the blackboard:	Disagree					Agree				
Was easy to implement	1	2	3	4	5	6	7	8	9	10
Provided useful information	1	2	3	4	5	6	7	8	9	10
Gave a voice to the students	1	2	3	4	5	6	7	8	9	10
Other: _____										

Additional Applications: _____

Comments:

Week 16 – Active Review Session

Strategy: Active Review Session

Objective: Promote student involvement and student cognition.

Implementation: The instructor presents questions for the students to work on in groups. Students are then asked to show their solutions to the whole class. Discuss differences in process and solutions

Feedback: _____

Comments: _____

Feedback to Joan:

The Active Review Session:	Disagree										Agree									
Was easy to implement	1	2	3	4	5	6	7	8	9	10										
Provided useful information	1	2	3	4	5	6	7	8	9	10										
Gave a voice to the students	1	2	3	4	5	6	7	8	9	10										
Other: _____																				

Additional Applications: _____

Comments: