

Final Sabbatical Report:

Ben Rode October 10, 2012

The Research and Practice of Teaching Math to Adults with Learning Differences with the Goal of Improving Instruction in the Two Semester Intermediate Algebra Course at Moorpark College

I will begin my report with an excerpt from my original proposal for sabbatical leave. This will establish my goals, and will frame the report that follows.

Proposal for Spring 2012 Sabbatical Leave for Ben Rode

Purpose:

The purpose of my sabbatical leave is to improve the success rate for ACCESS students in the two-semester Intermediate Algebra sequence at Moorpark College.

Background:

For the past 21 years I have been a full-time math faculty member at Moorpark College and have taught the full range of mathematics course offerings. Each semester I have taught at least one of the basic skills math classes (Pre-Algebra, Elementary Algebra, or Intermediate Algebra). Over the years I have been involved in a number of attempts to improve student success in these classes. For six years, I helped organize and teach a “self-paced” series for all three of the basic skills courses. Before the self-paced program, another faculty member and I adapted and used the “Kumon” approach for Pre-Algebra and Algebra. I have also experimented with the University of Chicago Algebra series. Most recently, I led in the development of a two-semester version of Elementary Algebra (Math M01A and M01B) and Intermediate Algebra (Math M03A and Math M03B). These courses were developed to serve ACCESS students (students at Moorpark College who have verified disabilities) and other students interested in having the pace of algebra slowed down without omitting any topics. A large proportion of the students in Math M01A, M01B, M03A and M03B are ACCESS students.

Rationale:

The goal of my sabbatical leave is to improve the success rate for ACCESS students in the two-semester Intermediate Algebra sequence. The two-semester Elementary Algebra sequence has been very successful for ACCESS students, but the success rate is noticeably lower at the higher level. Since Fall 2006, I have been teaching the courses in a four-semester cycle that starts with Math M01A, and continues with Math 01B, Math 03A, and ends with Math 03B. The courses are popular and have an average enrollment of 40 students. I am on my third cycle, and I typically work with a core group of students who take all four courses in the cycle. After four semesters, I know these students quite well, and I see how they struggle with the more advanced material in Math M03A and M03B, which is now required for the AA degree. I would like to find out as much as possible about why ACCESS students have trouble with the intermediate algebra concepts, and what can be done to help them overcome their difficulties.

The Research and Practice of Teaching Math to Adults with Learning Differences with the Goal of Improving Instruction in the Two Semester Intermediate Algebra Course at Moorpark College

Phase 1: The Research

I began my investigation of the current research available on *Teaching Math to Adults with Learning Disabilities* by visiting the Education Research Collection at the CSUN Library. I was also able to access several Education Research databases online.

I discovered that there is a limited amount research available on adults with math learning disabilities (dyscalculia) and much of that is quite recent. Therefore, I was able to locate most of this research, and I read everything I located. There is, on the other hand, quite a lot of research on *children* with dyscalculia. I browsed through some of that research to get a feel for it, and to compare it to what is known about adults.

I became familiar with the vocabulary of Learning Disability, especially in the area of math. It was not my goal to learn to diagnose dyscalculia, and I discovered that it is not easy to diagnose dyscalculia even for the experts. Neither did I intend to become an expert in the various types of math disability, and their possible causes. I did discover that there were multitudinous things, both "nature" and "nurture", that contribute to learning differences in math, and I realized that every individual was probably unique in the exact make-up of their dyscalculia. This did not bode well for my finding a simple recipe for teaching math to adults with dyscalculia.

One important result of my initial research was my realization that the term "learning differences", which I had originally dismissed as jargon, was in fact a powerful new way for me to think about all my students. I envisioned a learning differences continuum that went from severe to mild and embraced all students whether they were part of ACCESS or not. If I expanded my point of view to embrace ALL students as having some form of "math learning differences", this made the results of my work far more broadly applicable to all my classes and of interest to all my colleagues.

Based on the stated goal of my sabbatical, which was to improve instruction in Intermediate Algebra for adult students with *learning differences*, I focused narrowly on information that could be useful in the context of a community college math classroom. I was primarily interested in finding which teaching approaches had been effective in teaching math to adults with learning disabilities. I was also interested to know if any specific curricula were deemed effective with this same population. My initial reaction to what I found was disappointment. All the teaching recommendations were either things I was already doing or things that

seemed *obvious* to me. For example, giving students more time to absorb math concepts was recommended, as was testing frequently on small amounts of material. I had been doing both those things for many years. I was disappointed, because I had expected to learn amazing techniques that I had never dreamed about in my own attempts at teaching math to students with learning disabilities. Upon reflection, I realized that what I found validated my years of teaching math to students with learning disabilities, and so I felt better. I decided to compile the best results from the research into an "action plan" for teaching math to students with dyscalculia. About halfway through compiling the best of the research I had located, I stopped to investigate the acronym "UDL" which had appeared in the research literature and had been mentioned repeatedly by the people I had contacted for the "practice" part of my sabbatical. "UDL" is an acronym for "Universal Design for Learning". It is an approach to teaching any subject that is designed to be inclusive and effective for all kinds of learners, especially students with learning disabilities. I had been in the process of reinventing UDL when I stopped my compilation of effective teaching techniques and finally investigated UDL. I realized that I did not need to continue compiling because the UDL team had already compiled and organized a program of best practice for teaching *all* students with learning differences. That left me time to follow up several other interesting leads I had found.

My second research focus was the Statway Project which is designed to streamline the pathway from Arithmetic through Statistics for college students. The project is funded by the Carnegie Foundation, and is being promoted in California by the "California Acceleration Program" (CAP). It is a 2 semester course that replaces the usual 3 semester progression from Arithmetic through Statistics. I had first heard about this from Peter Rojas at SBCC. I am interested in Statway because it provides a radical solution to the problem students have with some of the content in Intermediate Algebra: replace it! I was able to go to the websites of the Carnegie Foundation and CAP to find out about the details of the Statway curriculum. I also got the contact information for Myra Snell at Los Medanos College who is the pioneer for Statway in California. (See my interview with her below.) As a result of my investigations into Statway, I am interested in bringing a version of this sequence to Moorpark. Initially I would like to pilot a limited version of the sequence through ACCESS, and then make more sections available if the pilot is successful.

Another interesting finding that I spent some time investigating is the "hot" research topic of "subitization". Subitization is the ability to see the size of small groups of objects without counting them. If there are 3 buttons on a table, most people will know there are 3 at a glance without counting. It turns out that there is a relationship between an inability to subitize and dyscalculia. The research originates from Brian Butterworth a neuroscience researcher in England. The most exciting finding to date is that it is possible for children to practice subitization, and those who improve their subitization skills achieve long term improvement in their math skills. In other words, practicing subitization reduces dyscalculia! Research into subitization and adults is underway.

Conclusion

During my sabbatical, I kept coming back to research new topics as they arose in my investigations. I didn't begin with research, finish it and move on to visiting and action plans. In fact, the research part of my sabbatical has never really ended. New contacts led to new information, new information led to new research, which led to new information, which led to new contacts and new research, and so on. Even as I write the "final" report, I am continuing to find new information through research.

I have compiled a thick binder with notes, printed copies of research articles and other materials from my visiting that will continue to be a resource for me to use in my continuing efforts to improve the math success of students with learning differences. I am happy to share this resource with others who are interested in the same goals.

Phase 2: Visiting

Once I had done the first cut at the research, I decided it was time to visit some experts to see what I could learn from them. I contacted the people who were recommended to me by the Moorpark College ACCESS Department. Among these were Peter Rojas and Brooke Choo. I also drafted emails to send out to other California Community Colleges to request permission to visit or met via telephone. Here is a copy of one of those emails:

Hi _____ ,

I am a Math professor at Moorpark College who is working on a semester-long sabbatical devoted to researching how best to teach algebra and higher level math to adults with learning disabilities in a Community College environment. In my initial research, your name appeared and I would be interested in meeting you.

I have been teaching a large proportion of "ACCESS" (learning disabled) students in my math classes at Moorpark College for the past 20 years. Eight years ago, I led the development of 2-semester versions of Beginning Algebra and Intermediate Algebra for students who had not been successful in the 1-semester versions of those classes. I have been teaching those classes for the past 14 semesters, and those classes have increased the success rates of students with learning disabilities (and also students with a history of failure in Basic Math.) To prepare students to take the 2-semester version of Beginning Algebra, Moorpark College offers a repeatable 1-semester Pre-Algebra course through our ACCESS Department. I am compiling information on what the various other Community Colleges are doing to help students with disabilities succeed in math. I am interested to know what you are currently doing at _____(your college).

I live in Ventura, and I can come to _____ (your college) if there is a convenient time that we could meet. I am essentially free any weekday, and could schedule a meeting at your convenience. Alternatively, we could talk on the phone. Please feel free to call me if you would like.

Ben Rode
Math Faculty
Moorpark College

Home: (805) XXX-XXXX

I was surprised at the generally weak response to my emails, because the people I sent the emails to were heavily involved with helping students with learning disabilities. I had much better luck with the personal contacts I was given by the Moorpark ACCESS program. The following are brief summaries of the most important visits I made during the sabbatical.

Visit with Peter Rojas, SBCC

I visited Peter Rojas at Santa Barbara City College on 2/6/12. He had recently done a sabbatical investigating math and students with learning disabilities.

He shared the process and results of his sabbatical with me, and I have a copy of his sabbatical report. He primarily investigated the types of math disability and how local Community Colleges were addressing students with math disabilities and others struggling with remedial math. Peter also gave me an update on how his teaching and department had been affected by his work. He felt that his teaching had improved in response to learning more about math disabilities. He felt that the major impact on his department was an improved attitude towards students with math disabilities.

I shared the results of my early research with Peter, and he was interested in the new work being done on teaching math to students with learning disabilities.

While at SBCC, I also found out how their DSPS program was currently working in math. There are no "special" math courses for DSPS students. There is a "Confidence in Math" workshop available in the Tutoring Center, and faculty are paid through a grant to work in the Tutoring Center. DSPS students are encouraged to use the Tutoring Center. Peter is giving his students "extra credit" if they tutor a DSPS student.

Visit with Myra Snell, Los Medanos College

I visited Myra Snell (via phone) at Los Medanos College (near San Francisco) on 2/21/12. Myra has piloted a "Pre-Statistics" program at Los Medanos in collaboration with the California Acceleration Project. I became interested in this program through a conversation with Peter Rojas (SBCC) and my own subsequent research. I was primarily interested in using the "Pre-Statistics" curriculum to give ACCESS students another pathway to transfer level math that did not include Intermediate Algebra. Myra kindly spent an hour discussing curriculum and articulation issues involving the "Pre-Statistics" classes she had been teaching.

The "Pre-Statistics" curriculum consists of "the first 4 chapters of any Statistics text with 'just-in-time' remediation/teaching of algebra and arithmetic concepts." Myra is careful to include Linear Regression in "Pre-Statistics" in order to review and teach lines, linear equations and even logarithms for non-linear regressions. I have a copy of the official course description form from Los Medanos College.

There is very positive data on improved completion rates for "Pre-Statistics" students when compared to "Algebra" students at Los Medanos. The data also shows "Pre_Statistics" students do better in Statistics than comparable "Algebra" students. This is all very positive,

and no surprise to anyone who has taught the Algebra sequence and Statistics. It is common knowledge that Intermediate Algebra is an "articulation" pre-requisite for Statistics rather than a subject matter pre-requisite. It is no wonder that students with Pre-Statistics do better in Statistics than students who have taken Intermediate Algebra!

The downside is articulation. There are no existing agreements with UC/CSU to recognize "Pre-Statistics" followed by Statistics as equivalent to Intermediate Algebra followed by Statistics. "Pre-Statistics" is not recognized as a pre-requisite for Statistics. The California Acceleration Project is meeting with UC/CSU to try to work out an articulation agreement. Community colleges that are currently offering "Pre-Statistics" can use the "challenge procedure" to get students credit for Pre-Statistics followed by Statistics. Myra pointed out that many "Pre-Statistics" students did not have their transcripts questioned by their transfer colleges.

Subsequent to our phone meeting, Myra and I communicated via the internet. She sent me the course descriptions of "Pre-Statistics" and updates on the progress of articulation agreements between Los Medanos and the UC system.

Visit With Dr. Sally Spencer, CSUN

I visited Dr. Sally Spencer at CSUN (CSU Northridge) on 3/12/12. Dr. Spencer is a professor of Special Education with an interest in math teaching.

I asked her about recent trends in research on teaching math to adults with dyscalculia (learning disabilities). She explained that the concept of "subitization" is a current focus. She loaned me a book by Ronit Bird that works on strengthening subitization skills among others. The book is designed for High School students, and so could be helpful in the LS07 courses at Moorpark. I have forwarded the title to Sile Bassi who teaches the LS07 classes. (Bird, R. 2009. *Overcoming Difficulties with Number*)

Dr. Spencer also gave me a contact at the University of Central Florida who is doing research in subitization and other issues in dyscalculia, Dr. Lisa Dieker.

The bulk of our conversation dealt with the lack of research in general on dyscalculia in adults. What research there is supports the "common sense" teaching techniques that most practitioners who are successfully teaching math to students with learning disabilities already use.

This was an important contact, because it gives me an expert's current analysis of the state of research in dyscalculia.

Visit with Brooke Choo, Irvine Valley College

I spoke with Brooke Choo at Irvine Valley College on 3/20/12. Brooke is with the DSP&S Department, and is the Region 8 representative for Learning Disabilities for the State Chancellor's Office. Brooke spent over an hour discussing various issues relating to teaching math to students with Learning Disabilities with me.

The primary reason I got in touch with Brooke was to find out what IVC was doing to help LD students in math. They offer a Special Services class in Basic Math. The class is taught by DSP&S staff, but funded through the Math Department. That is the only class that is modified to help LD students in math.

LD students get 2 hours per week in the Success Center which provides 1 on 1 tutoring in Pre-Algebra and Beginning Algebra. (Non LD students can get 1 hour a week.) This is grant funded. There is Math Center that offers drop-in tutoring for all math classes using student tutors.

Brooke was interested in what MC is doing to help LD students in math, and I went through that in detail. She had very positive comments about our efforts in math.

Brooke had mentioned Statway when she responded to my email, and we talked about that for some time. This is a national project funded through the Carnegie Foundation that is piloting a one year Pre-Statistics/Statistics course. It is very similar to the course being piloted by CAP at Los Medanos Community College. The issue of articulation came up, and Brooke thinks CSU is "on board" with articulating the STAT way program. She gave me some names of people I can contact to find out more about Statway and the articulation issue.

Another topic we discussed was the "universal design for learning" (UDL) approach to teaching math. I have encountered this repeatedly, and I need to do more research into how universal design impacts math instruction.

Visit to De Anza College

I visited De Anza College on March 30. I chose De Anza because they were the most mentioned California community college in my research on teaching adults with math disabilities. I met with Debbie Centanni, Director of the Educational Diagnostic Center and Janet Takahashi the learning specialist in math. They were very interested in our 2 semester approach to Beginning and Intermediate Algebra, and I explained our program and answered their questions.

Their approach is different. They have three courses offered through the Guidance Department that are meant to be taken along with the appropriate math class. The first course is arithmetic, and can be taken alone. The next course is covers pre-algebra topics, and is taken along with Pre-Algebra. The last course covers algebra skills and is taken with Beginning Algebra. They stated that they did not always find the math Department sympathetic to the needs of students with learning disabilities.

They told me that approximately 20% of De Anza students place in Pre-Algebra based on the Acu-Placer test given at De Anza, and the math department offers many "brick-and -mortar" Pre-Algebra classes. The Math Department also began offering modules that enable students to place into Intermediate Algebra by passing all the module tests or by doing some modules and simply retaking the placement exam.

They have a program, MPS, which is Math Performance for Success. Basically, students go through as a cohort from Pre-Algebra to Statistics. There is an application form for the program, and you have to be accepted to be allowed to enroll. Counselors participate with the cohorts, and in fact, this program is run through the counseling department.

De Anza is cutting back the disabled student program due to budget issues. The last two retirees in their program have not been replaced. They expressed concern for the future.

Acceleration in Context Conference, El Camino College

I visited El Camino College May 4th to attend the Acceleration in Context Conference. Acceleration is NOT the word I would use to describe what this program is trying to accomplish. The thrust of the acceleration program is "to shorten the pipeline" into transfer level courses. They involve redesign (cutting) of topics and new teaching strategies. Statway is a perfect example of this process. A semester of unneeded overlap and off-track topics has been eliminated to bridge the gap from Pre-Algebra to Statistics in one semester. (There are acceleration programs out there that use compression to cram two semesters of work into one semester following the summer school model of 8 week, intensive courses back-to-back in 16 weeks. This is not new, and not popular with students.)

The Acceleration in Context presenters were focused on English and Counseling, but there was a large and active special interest group in math.

The math conversations revolved around two programs: IAS (Intermediate Algebra for Statistics) and BAM (Basic Accelerated Math)

IAS is essentially the Statway program created by Carnegie. College of the Canyons is affiliated with Statway and is using Carnegie's Open Learning Initiative materials for their

version of IAS. El Camino designed their own program using Pearson materials that were "custom published" into a single format, but it is very similar to Statway.

The big news about Statway is from Myra Snell: UC has approved the 1-year Statway program for transfer 'if you don't change the transfer course (Statistics) and if you verify the pre-req is at the correct level and rigor'.

BAM is more interesting to my purpose. It is a "multiple-exit-level" course that bridges Arithmetic, Pre-Algebra and Beginning Algebra. It is organized to take advantage of "student capacity" (What math has stuck with the student in their years of math exposure.) The course uses text, on-line activities and flexible testing to allow students to go at different rates and exit the semester at different levels. It is similar to our old "Self-Paced" math sequence, with the added feature of multiple exit points and active technology. This model may be useful to adapt to MC.

Visit to California Council of Teacher Education Conference, San Jose

While in San Jose, on April 1, I was able to attend the poster session for the annual California Council of Teacher Education conference. I met Connie Petit a Special Education professor at CSU Bakersfield. She was promoting and explaining the Universal Design for Learning which has become an important model for teaching students with learning disabilities.

I was already familiar with UDL from my research, and it was very helpful to talk to someone who was experienced in it's use with students who have learning disabilities. I had already concluded that UDL would be a good model for how I would want to organize teaching math to adult students with learning disabilities. Talking to Dr. Petit reinforced my intent to do so. She was very positive about the success of using UDL with this population.

Virtual Visiting

Because of the low response rate to the emails I sent, I started visiting the websites of many of the other Community Colleges and was able find out quite a lot of information about their math programs, programs for students with disabilities, and to what extent there were special math classes for students with learning disabilities. It was interesting to me how few colleges had special math classes aimed at students with learning disabilities. I was also interested to see that most colleges have dozens of math classes one or two levels below Beginning Algebra. Moorpark has eliminated that level of math class over the last few years because they are supposedly not being funded. I wonder how the other colleges are funding them?

Conclusion

Overall, the visits were extremely helpful because I found out so much unexpected information talking to other educators. Many new lines of inquiry were opened through these discussions, and my understanding was expanded enormously. Based upon my actual visits, phone calls, and virtual visits, Moorpark College is doing more than most other Community Colleges in California with math and students with learning disabilities. All such programs are experiencing budget cuts, and it is important that math departments gain a better understanding of how to teach mixed classes with many levels of math "differences" present. I think UDL has the best roadmap for how to deal with these all levels of math "differences" in our classes.

Phase 3: Presentations

In the spring of 2012 I applied to make a presentation at California Association of Teacher Educators (CAMTE) conference in Asilomar in November 2012. I am also planning to apply to make a presentation at the California Mathematics Council of Community Colleges (CMCCC) spring 2013 conference which is usually in Fullerton. The abstract of my proposed presentation is below.

Abstract for Proposed presentation at CAMTE North Conference:

Teaching Mathematics to Adults with Dyscalculia and other Learning Differences: Theory and Practice

Ben Rode, a math professor at Moorpark College, brings 20 years of experience teaching math to college students with learning disabilities. This presentation will review current research on teaching math to adult students with learning disabilities and will also review what some colleges are doing in practice to help this population. The primary mathematical focus will be on Beginning and Intermediate Algebra. The findings from the research and practice are incorporated in an action plan that can be applied to all students who are struggling with Developmental Math whether or not they have a diagnosed learning disability. Discussion will be encouraged.

To date I have made 3 presentations on my sabbatical findings to Moorpark College Faculty. My first was "Teaching Math to Adults with Learning Disabilities" made during flex week. The presentation was geared to a general audience, but was of interest primarily to math faculty. I have attached the Powerpoint slides. I made another panel presentation during flex week with the other 3 sabbatical awardees discussing our sabbaticals and what we had learned.

In September, I was the featured speaker at a Moorpark College Math Department meeting. I used the same title, "Teaching Math to Adults with Learning Disabilities", but I geared the presentation to the needs of classroom teachers of math at Moorpark College. All three presentations were well received.

The presentation I gave to the math department generated some very productive discussion about teaching math, groupwork, and students with dyscalculia. It was the only time I can recall in my 23 years of department meetings that we had an extensive, positive discussion about teaching methods. In fact, there is a follow-up faculty meeting scheduled to focus specifically on groupwork! My idea of the *math learning differences continuum* resonated with many at the meeting because it helps us to be more aware of our teaching strategies and to be more sensitive to our students' needs. I was very pleased with the results of my presentation to the math department.

I intend to continue to make presentations related to my sabbatical topic, and I am scheduled to make another presentation on Statway to the math department in February. This might lead to the department experimenting with the Statway curriculum as a way to improve the rate of success for non-STEM students passing their math transfer requirement.

Phase 4: Action Plans

Fall 2012

I have decided to wait to post the "Teacher's Guide for Math 3A and 3B" until I have tried the new ideas that I intend to include in my recommendations. I would prefer to speak with the authority that using the activities I am promoting will provide. It is also quite likely that I will change and adapt these ideas once I have tried them in my classes, thus improving the usefulness of the "Guide". My action plan for the fall is to incorporate as many new ideas as I can into the teaching of my Math 3A class (Intermediate Algebra part 1). Here is a list of the things I propose to initiate or increase, to continue as usual, and to decrease.

Initiate or Increase

- ✧ **Directed classwork in groups:** see *Good Group Guide* (attached)
- ✧ **Mini-projects:** see *Miniprojects 1 and 2* (attached)
- ✧ **"How to Learn" assignments:** see *Miniproject 1* and *Algebra Cookbook*
- ✧ **"Big Picture" assignments:** see *Algebra Cookbook* (attached)

Continue

- 'Tizzes'
- Homework accountability
- 'Double-back' strategy

Decrease

- ✓ Lecture
- ✓ Dead time

Spring 2013

My action plan for spring is to evaluate the results from the fall Math 3A class, and "fine tune" the mix for Math 3B (Intermediate Algebra part 2) in the spring. I will begin work on the "Teacher's Guide for Math 3A and 3B" as well as the "Handbook of Mathematical Strategies" based on what I have learned in the fall. By the end of the spring semester, I should be in a position to complete the "Guide" using ideas I have tried in the classroom and have found successful. I also hope to have a sound foundation to recommend "Strategies" to others to adapt to their own math classes to improve the results for students with learning differences.

Fall 2013 and beyond

It is now clear to me that the "action plan" part of the sabbatical will be an ongoing part of my teaching at Moorpark for the foreseeable future. I have started by improving how I teach Math 3A, and in spring 2013 I will improve Math 3B. Starting in fall 2013, I plan to revise how I teach the Math 1A & 1B classes (Beginning Algebra). I did not expect the sabbatical to

influence my "non-A&B" classes, but I have already incorporated some of the new ideas into my Statistics classes. I will continue to adapt the ideas I have learned during my sabbatical to improve my teaching at all levels.

Conclusion

I want to express my thanks for the opportunity to investigate teaching math to students with learning differences. I was surprised by the things I found and also by the things I was unable to find. I expected to find remarkable research and programs to use to model new and exciting approaches to teaching math to students with learning differences. I did not find such research or such programs. Instead, I discovered that we at Moorpark are already doing many of the things that are recommended by researchers and successful programs. Teaching math to adults with learning disabilities is a frontier in education. The research and programs I discovered are pioneering how best to teach these adults. Despite the lack of recognized and established solutions, I was able to find a wealth of useful information to inform my teaching, and now I am experimenting with how to best incorporate these ideas into my classes. I am currently trying the teaching ideas that seem most useful and applicable to community college students and classrooms.

Now that I am back in the classroom, it is very clear to me how valuable a sabbatical is. I am excited to be trying new things with my students, and very excited that some of them seem to be improving student success. I feel re-energized and renewed. I could never have done the research and visiting required to gain the knowledge to improve how I teach Math 3A and Math 3B while I was teaching my full 15 hour load. I feel I have important ideas to share with other faculty members at Moorpark and in the district, and I plan to share those ideas through presentations and online. I feel lucky to have been awarded a sabbatical, and I will feel the benefits in my teaching for years to come.

GOOD GROUP GUIDE

Group work is an important part of this math class! It is your best opportunity to learn the critical math content *inside* the classroom. If you can take full advantage of the group work, it will clarify the assignment and save you time and energy when you work on the homework individually. It takes effort and commitment to get the most out of group work. If you are passive during group work, you will not learn much. If your group uses the *split and staple* strategy, you will only benefit from the problem you personally worked on. It is your responsibility to let your group know if you don't understand something, and it is the group's responsibility to help you understand. An effective group encourages everyone to participate equally. An effective group discusses each problem, and ensures all the members understand before going on. In an effective group all members benefit from the experience whether they are helping others or being helped themselves.

Here are some of the things that each of you can do to make your group more powerful and effective in math class. Each individual in the group should do all of the following things during every group work session.

Ask and answer at least 1 question during every group session.

Do not allow any group member to watch silently.

Share and exchange the responsibility of writing for the group.

Share ideas and collaborate on solutions.

Use the combined brainpower of the group to solve problems.

Ask if everybody understands the problem at hand before going on.

Do not let the group get "off task".

Get as much work done as possible.

Ask for hints and help if the group is "stuck".

Think as a group, not as individuals.

Here are 3 word problems from a Math 1 final exam.
Solve each, showing the equation and all your work.

After you have solved the problems, write 3 word problems
of your own following the directions below.

- 1) If a number is added to 2 more than 3 times itself, the result is 38. Find the number.
Show your equation for full credit.

- 2) Gates has 51 coins in his pocket. The coins are dimes and quarters worth \$ 9.60 . How many of each coin does Bill have? Show your equation for full credit.

- 3) The length of a rectangle is three more than twice the width. If the perimeter is 72 inches, find the dimensions of the rectangle. Show the equation for full credit.

Problem #1) Write a word problem that requires an equation to solve and has the answer 13. Show the solution including the equation and all the work.

Problem #2) Write a word problem that requires an equation to solve and involve nickels and dimes. Show the solution including the equation and all the work.

Problem #3) Write a word problem that requires an equation to solve and has Bonnie and Clyde in the problem. Show the solution including the equation and all the work.

MATH 3A

MINI-PROJECT #2

/ 50

_____ NAME

You can work together, but each person must turn in their own project.

1) Solve the system. Show ALL your work on separate paper in a clear, organized manner.

(30pts)

$$3x - 2y + z = -4$$

$$x + 3y - 2z = 13$$

$$4x + y + 3z = -3$$

2) Gates has 25 coins which are nickels, dimes and quarters worth \$3.65. The number of dimes is one more than the number of nickels. Set up a system of 3 equations and solve to find how many of each coin Gates has. Show ALL your work on separate paper in a clear, organized manner. (20pts)

ASSIGNMENT: THE ALGEBRA COOKBOOK

100 points

Ingredients: A small folder or binder

Class notes

A little bit of brainpower

Instructions: Each recipe should be *handwritten* and contain:

- 1) A title
- 2) A list of ingredients
- 3) A list of instructions (use your class notes)
- 4) An example to illustrate the instructions
- 5) A paragraph of comments explaining how to use the recipe

Example: See attached

Comments: The cookbook will be expanding as we develop more "recipes" for our algebraic algorithms. The first recipe is included with this assignment sheet as an example. Your recipes should be legibly handwritten unless you have

permission to type them. Your cookbook will be graded periodically for clarity and completeness. You will be able to use the cookbook on the final exam if it is complete and clear.

Title: **Solving a linear equation**

Ingredients: An equation with one variable and no exponents like:

$$3(2 - x) + 4 = 7x - 2$$

Instructions: 1) Simplify

a) Eliminate brackets using the distributive property

b) Combine like terms

c) Variable to one side

2) Solve

a) Add the opposite

b) Divide by the coefficient (or multiply by the reciprocal)

3) Check by substituting into the original equation

Example:

$$3(2 - x) + 4 = 7x - 2$$

$$6 - 3x + 4 = 7x - 2$$

$$10 - 3x = 7x - 2$$

$$\begin{array}{r} 10 - 3x = 7x - 2 \\ +3x \quad +3x \\ \hline 10 = 10x - 2 \end{array}$$

$$\begin{array}{r} 10 = 10x - 2 \\ +2 \quad \quad +2 \\ \hline 12 = 10x \end{array}$$

$$\begin{array}{r} 12 = 10x \\ 10 \quad 10 \\ \hline 12 = x \end{array}$$

$$\begin{array}{r} 12 = x \\ 10 \\ \hline \frac{6}{5} = x \end{array}$$

$$\frac{6}{5} = x$$

$$\frac{6}{5} = x$$

$$\frac{6}{5} = x$$

$$\frac{6}{5} = x$$

$$\frac{6}{5} = x$$

1a) Eliminate brackets

1b) Combine like terms

1c) Variable to one side

2a) Add the opposite

2b) Divide by the coefficient

3) Remember to check your answer!

Comments: Be careful using the distributive property, especially with negative values.

Steps 1a) and 1b) may have to be repeated in more complicated equations. *The idea is to isolate the variable, and every step moves you toward that.* You add the

opposite of the non-variable term. If there are denominators in the equation, you can clear the denominators by multiplying both sides by the LCD. Remember, the check can sometimes be more difficult than the solution