California Mathematics Council Community Colleges

2017 Monterey Conference Coming Soon!

Katia Fuchs, President Elect, City College of San Francisco

The 45th annual Fall Conference will be held this year on Friday and Saturday December 8-9, 2017. We will once again be at the Hyatt Regency Monterey Hotel and Spa. Just like last year, we will have all our conference activities on the upper level of the conference center. We will continue to enjoy the free in-room Wi-Fi and free parking. The "Downtown Monterey" shuttle will again run only on Saturday night, and with construction in the downtown area being finished, we hope for service to be smoother than last year. Our group room rate remains the same at $139 per night for up to double occupancy. You can make reservations online at https://resweb.passkey.com/go/2017CMC3 (Note that the hotel services fee will be waived at check-in even though it may appear in the projected costs online.) If making reservations by phone, mention "CMC3 Group Rate" when calling Hyatt Passkey Reservations: 888-421-1442. For more information on the hotel, please see the hotel website at www.monterey.hyatt.com/en/hotel/home/html. There is an exciting program again this year that will offer a wide range of sessions appealing to many areas of professional development and classroom interests.

Our Friday night keynote, titled "Planet 9 from Outer Space" will be presented by Konstantin Batygin of Caltech. Dr. Batygin is an Assistant Professor of Planetary Sciences and the Van Nuys Page Scholar at Caltech. He has been recognized by the 2015 *Forbes* list of 30 scientists under 30 who are changing the world.

Our Saturday keynote, titled "Math Saves the Day" will be presented by Brandy Wiegers of Central Washington University in Ellensburg, Washington. Dr. Wiegers is an Assistant Professor at Central Washington University. She is a leader in mathematical outreach as founding director of the National

(see "Monterey Conference" on p. 2)

Table of Contents

Executive Board & Special Committees

Volume 46, Number 3 Fall 2017

CMC[3] Newsletter is the official newsletter of the California Mathematics Council, Community Colleges, and is published three times a year--in the spring, summer, and fall.

Monterey Conference

(continued from page 1)

Association of Math Circles and current Director of the Pacific Northwest Mathematics Outreach Web (Math POW!)

Two popular traditions will continue: Game Night (hosted by Pearson) will take place again on Friday night after the Keynote speaker, and the Estimation Run/Walk first thing on Saturday morning at 7:30 am. The full list of speakers and their titles, as well as the latest information about the conference, will soon be available at the conference website: http://www.cmc3.org/conference/Monterey17/Monterey17.html

You should soon be getting the official mini-program and registration form via US Mail. Please feel free to disseminate the information and copies of the registration form among your colleagues, both full time and adjunct! Please note that online registration is back by popular demand! We are excited to see everyone in December!

President's Report

Joe Conrad, CMC³ President, Solano Community College

This is the last President's Report that I will be writing for this newsletter. It's been a privilege to serve as your president, but it has not always been easy to come up with something to write in this column. I was anticipating the usual writer's block until late July when the LA Times reported some statements made by the California Community College Chancellor about intermediate algebra. Chancellor Eloy Ortiz Oakley said that intermediate algebra is seen as a major barrier especially for students of color and non-STEM majors. He said that there ought to be alternatives available to these students. My reaction to this was that there are already alternative to intermediate algebra permitted by Title 5 and that many (most?) community colleges have set in place alternative courses that satisfy the graduation requirement for an associate degree. (I have concerns about other things he said, but I don't have the space to address them all.)

While there appears to be universal agreement that STEM students should take intermediate algebra, there has been much debate about it for non-STEM students. Part of the problem for the Chancellor and others involved in these debates is that many blur the lines between several issues. These issues include: requirements of the UC and CSU for transfer students, the desire to accelerate access to transfer-level courses, and the graduation requirements for an AA or AS degree. We at the community college level have no control over UC (who does?) or the CSU, so it is necessary for us to do as they ask for our transfer students. Recently, the CSU has revamped their requirements for incoming students that may reduce the need for non-STEM students to take intermediate algebra. Acceleration also has its proponents and opponents who argue one way or the other about it. I do not think this is the real issue here because anyone who passes a transfer level course, regardless of the path to that course, has fulfilled the graduation requirement for an associate degree. Again it is up to the CSU and UC to determine whether this is adequate for them and the CSU, at least, appears to be moving in that direction.

What is most relevant for us as community college faculty is the question of what should happen with the Title 5 requirements for graduation. It was around ten years ago when CMC³ was instrumental in moving the requirement to intermediate algebra or an alternative of similar rigor. Something that has hindered students taking advantage of alternatives is a sort of placement inertia where students are counseled to take an intermediate algebra course when there is a more appropriate alternative for that student. I have been in contact with the state-wide Academic Senate about all this and Julie Bruno, the president of the Senate, has asked CMC³ to partner with them on a task force to investigate and make recommendations for moving forward. The CMC³ Board discussed the topic of the graduation requirement at its latest meeting and unanimously passed the following resolution: "CMC³ supports the current Title 5 (Section 55063) regulation allowing for locally developed alternative mathematical pathways to satisfy degree requirements. Additionally, we look forward to working further with the Senate to

develop ways to address placement and advising across the college and to assist students to make the most of their options. CMC^3 is committed to providing a resource to faculty throughout the state to help develop such pathways."

In closing, I encourage you to be watching for developments in all areas of community college including intermediate algebra. I also encourage you to attend the Monterey conference where you will hear about various items that will help you be a better informed faculty person. See you there!

Mark Your Calendar:

45th Annual CMC^3 Conference

December 8th and 9th, 2017

Hyatt Regency Monterey Hotel and Spa

Letter to the Editor

John Thoo, Yuba College

In case you or your readers missed it, the LA Times ran a story in the summer with the provocative headline, "Drop algebra requirement for non-STEM majors, California community colleges chief says" (http://www.latimes.com/local/lanow/la-me-california-community-colleges-algebra-20170717-story.html). This was followed the next month by another story in the San Jose Mercury News with the equally provocative headline, "No intermediate algebra, no problem: CSU ditches tricky math prerequisite" (http://www.mercurynews.com/2017/08/01/no-intermediate-algebra-no-problem-csu-ditches-tricky-math-prerequisite/). These two stories in two major newspapers had me pondering seriously on what mathematics should college students have to learn---and not have to learn---to obtain an associate's degree or to transfer to a four-year college or university.

After much thought and discussion with friends, I think now that quantitative reasoning or literacy needs to be taught in context in a variety of courses, such as political science, history, sociology, psychology, music, and speech, to name a few, as well as in physical science, statistical science, and mathematics courses. If that piques your or your readers' curiosity, I have put more of my thoughts online at

http://tinyurl.com/yag3l4ts

I hope to receive thoughtful reactions, and perhaps some of them might even appear here in this newsletter. I think that this is an important topic that impacts our curriculum directly, and I hope that CMC3 members will enter into a thoughtful discussion about it.

Math Nerd Musings: The Learning Power of Debate

Jay Lehmann, College of San Mateo—the dude in the middle, goofing around with Fred Feldon (left) and Rich Zucker (right)

Research has shown that collaborative learning is most effective when students are grouped with others who have differing opinions on how to solve a particular math problem. When a group of students constructively argue about a concept, they must consider other perspectives and learn to be articulate in discussing mathematics. And, hopefully, all group members will eventually converge on understanding the concept. An instructor can use clickers to identify students' viewpoints so the instructor can know how to form groups with different viewpoints. Or, if you'd like to avoid needing student devices, check out the Plickers App at www.plickers.com.

Lately, I've been experimenting with fostering disagreements at the classroom level, too. First, I have students within each group discuss a concept until they're in agreement. While they're talking, I eavesdrop on various groups. If some groups arrive at different conclusions than other groups, I then have one member from each group weigh in on the concept as the rest of the class listens.

After every group has said their peace, I underscore the differences in opinion and facilitate teams in trying to convince other teams with opposing viewpoints that they are right.

For example, in my prestatistics class, I presented my students with a two-way table that compared ethnicities of Americans and whether they were against the death penalty. Although there were more Caucasians against the death penalty than African Americans, there were also more Caucasians who participated in the survey than African Americans. So, students first had to sort out whether to work with frequencies or proportions. For teams that settled on working with proportions, they had to decide whether to find proportions such as the proportion of African Americans who are against the death penalty or the proportion of those against the death penalty who are African American.

Before the teams argued at a class level, six of seven teams had come up with the correct solution. But what I found fascinating was that after the teams debated at a classroom level, the team that had the incorrect solution convinced all but one team that they were right! Needless to say, part of me began to panic, worried that I was facilitating the class into utter confusion. And the clock kept ticking. But I kept a neutral face, offered what I hoped would be a subtle hint, and asked the groups to discuss the issue further within their groups. Five minutes later, I facilitated the team representatives in discussing the problem at a class level. Eventually, all teams agreed on the correct solution.

Then I looked at the clock. Gulp. So much time had gone by! Had the activity really been worth it? Well, to my delight, I found that my students were able to motor through subsequent activities. Apparently the death-penalty activity had laid a strong foundation for students to build on.

Not all debate activities work out so well. One time, a student felt ganged up on. And some debates resolved far too quickly. Facilitating such activities requires me to really be on my toes! But my classes have definitely been more lively, and students have gained a deeper conceptual understanding than from passively listening to a lecture or even from working with others who agree with them.

What's Happening at Diablo Valley College

Eric Freidenreich

We were able to obtain funds through a Basic Skills Initiative (BSI) to cover expenses for 8 of our faculty to attend CMC^3 last December, and we plan to send as many as 12 faculty to AMATYC in San Diego this year. Faculty continued to talk about workshops they attended at CMC^3 throughout the year, and the experience gave our department a valuable sense of camaraderie.

The school is moving toward a 16-week semester, planned for Fall 2018. This allows the school to offer a 3-week intersession during the winter holidays. However, the math department is struggling with the details of how to fit classes that meet for longer times into a limited number of classrooms. The schedule for a finals week is particularly difficult, with some other departments across campus opting to have a final exam be less than 2-hours. Thus far, this is not acceptable for most math teachers, so we're trying to sort out those details.

Plans are being considered for remodeling some of our older classrooms. So there has been much discussion about

projectors, document cameras, computers at a podium, and modular desk arrangements.

Meanwhile, we have found impressive success rates in students taking our accelerated programs. Statway in particular has stunning success rates for students, taking students who are ready for Elementary Algebra, through the Statistics curriculum in two semesters, with nearly 80% of students passing.

Finally, there is considerable interest in using open-source textbooks, and several teachers are piloting the use of free, or inexpensive textbooks and online homework systems, with plans to report back to the rest of the department.

What's Happening at Cosumnes River College

Cindy Erickson, Phuong Le, Mary Martin, Camille Moreno, Paige Buck-Moyer, Brandon Muranaka, Sang Sertich, Roy Simpson, and Lora Stewart

We're growing! Over the past three years, CRC's full-time math faculty has grown from 15 to 21, with 3 or 4 long-term temporary professors every semester, and between 25 and 30 adjunct math faculty as well. It's a lively, hardworking group with lots of collaboration on coursework and outside-of-the-classroom projects, which makes CRC a fun place to work.

That's fortunate, because there is a lot to do. We have lately focused our collective attention on a wide variety of projects aimed at improving student success.

Building a Consistent Curriculum with (Partially) Common Finals

With 18 sections of beginning algebra (Math 100) and 23 sections of intermediate algebra (Math 120) offered every semester, we continue to search for ways to ensure we teach the entire curriculum consistently across all sections. Thus, we agreed to write for these courses a partially common final – a core set of questions each instructor can use as a starting point when writing their final exam.

In Spring 2017 we hosted our first semesterly retreat to focus on the beginning algebra curriculum. We reviewed Student Learning Outcomes (SLOs) and discussed how we might modify and assess those SLOs. Over 20 department members were present (both full-time and adjunct faculty) for a successful all-day Saturday event at a local restaurant. While we discussed questions and topics for the common final, we also had useful discussions about how we teach certain topics and to what level we each teach those topics.

We will have our second retreat in October to focus on intermediate algebra.

Supplemental Instruction Program Provides Dedicated Tutors

Ever hear students complain that their tutor confused them because the explanation was so different from what they learned in class? Supplemental Instruction (SI) tutoring addresses this issue and more.

CRC implemented our SI Program in 2010 and have been polishing it since then. The program is an effective and innovative

mathematics tutoring program for students. SI tutors are assigned to a particular class, and are paid to attend class and observe the professor's lecture. They then conduct weekly study sessions focusing on what was covered in class. These tutoring sessions are unique to the course and can target exactly what students are currently learning. Ideally, professors hand-pick tutors among their own former students, so SI tutors are familiar with both the course and the professor's teaching style.

In addition to the study sessions, SI tutors provide a valuable resource in the classroom, working with students during in-class assignments. Students get to know their SI tutor during class, making it more

comfortable to ask for tutoring help in general. And, since SI tutors are community college students themselves, students find it easier to relate to them.

Currently, at CRC, we provide SI tutors for Basic Skills courses with the goal of increasing their success rates. The program provides a fun and comfortable environment for students to get the tutoring they need to excel.

Pre-Algebra Course Gets a Lab Component

To engage students with more hands-on work and group practice, we are redesigning our current 5-unit-lecture pre-algebra course (Math 30) to a 3-unit lecture with 1-unit lab format. This semester we are developing lab materials to include more measurement activities, hands-on work with area and

volume, and other manipulative labs, as well as focused work on the meaning of variable. Basic skills practice will be included as well. For each section, we plan to hire a dedicated tutor (an SI tutor) to attend lectures and help facilitate the labs when we begin teaching the new course in the next year or two.

An additional administrative benefit is the reduction of overall unit load for the student. Reducing pre-algebra from 5 to 3 (+1 lab) units relieves one of the administrative pressures facing the Mathematics Department and allows students to use financial aid resources more effectively during their stay at CRC.

Three Guided Pathways After Beginning Algebra

Supporting students as they decide how to transition from beginning algebra toward degrees or transfer, CRC's math curriculum now offers students the choice of three directed pathways.

In addition to the traditional intermediate algebra (Math 120) required for STEM majors to continue toward Trigonometry and Calculus, we offer two alternative paths: a pre-statistics algebra (Math 125), which is a revised intermediate algebra course whose major emphasis is graphing and modeling data, and Math for Contemporary Careers (Math 144, which is AA/AS degree applicable for students in CTE programs), a course which focuses on math for the informed consumer, citizen, and career professional.

Placing Incoming High School Students into the Best Course for Success

Over the past three years, our department has been proactive in readying itself for the Common Assessment Initiative (CAI) and the Multiple Measures Assessment Project (MMAP). (Our work turns out to be timely, given recent directives regarding high school student placement from our Chancellor, the CSU's Chancellor, and the State's AB 705.)

In coordination with other colleges in our District, we mapped the entire Common Core State Standards (CCSS) to our curriculum, gaining a strong understanding of the ties between K-12 curriculum and our courses. Then, we ran a placement pilot using the 'Statewide MMAP model.'

The results from the initial pilot verified some concerns we have over the use of high school transcripts as a placement tool, but we have since modified the model in hopes that our adjustments will lead to better placements. Our hope is to have a valid, tested model in place by the time CAI is implemented. Our advice to any department wanting to use the initial Statewide MMAP model is to approach it as a template. A 3.6 GPA from one of your local feeder high schools along with a B in Precalculus may not be equivalent to the Statewide model as it may have been based on a different student population.

Our work on the CCSS and MMAP has afforded us a unique perspective on the links between K-12 and the community colleges. With this knowledge and funding from the California Readiness Grant, we have started the process of co-mentoring high school math instructors with the use of a new Senior-level Math Course designed by faculty at CSUS. This course is designed to help high school students who fell short on the CAASP exam (earning a 3 out of 4) work their way to a non-STEM college-level pathway in quantitative reasoning so that they do not have to remediate in mathematics once they reach college. While it is still early days, the course looks promising.

First Year Experience Program Helps New Students Understand College

Last year, CRC started a program for incoming students who had just graduated high school called the First Year Experience. The overall goal of the program is to help students transition successfully from high school to college. In the morning the students are in small classes, determined by their initial course placement, that prepare them for either Math or English. In the afternoon, the students meet in groups with counselors and get information about how to navigate college successfully.

The math portion of the program was developed by math faculty to help students understand what to expect from college-level math classes and help them review the skills

necessary for their Fall course. The students are divided into groups by their Fall class placement. This allows students to do review targeted at their existing skills through short math lessons. All levels develop problem-solving skills and learn to work in groups effectively with difficult and unusual problems of the day. However, the program is largely focused on developing students' reflective thought and study skills. Students read articles, watch short videos, and discuss various topics such as learning styles, test taking, math anxiety, and note taking. They also participate in activities to help them choose study partners, balance their schedule, navigate the resources on campus, and organize their work for the upcoming semester.

Students Fill Knowledge Gaps at Math Boot Camp

Summer 2017 marked the 8th

consecutive year of CRC's Math Boot Camp. Since our first offering in 2010 with 19 students, it has grown to a size that can now serve 150^{+} students. Participants fill in math knowledge gaps while working at their own pace on customized content review objectives. The Math Boot Camp serves a wide range of students, from those preparing to take/re-take the math assessment to students who are repeating a math course. Feedback has shown that students achieve a higher level of confidence in preparation for their Fall math class.

Math Awareness Week Engages Students

Our department celebrates Math Awareness Week during April each year with a host of activities designed to let students see the math from a new perspective.

We have a Problem of the Day contest every day, with prizes. We host a Math Talk Series with talks given by both colleagues and students. Last year, Prof. Mary Martin gave a talk "Bar Codes, ISBNs, Coded Messages: How does Math Break the Codes?" and Prof. Mike Yarbrough talked about "Mathematics and the Internet." We also had a Rubik's Cube contest, a Math Scavenger Hunt, and Math Movie Day. The week always concludes on Friday with a well-attended Integration Bee for calculus students and lots of spectators!

Student Poster Contest

Jennifer Carlin-Goldberg, Santa Rosa Junior College

It's time to tell our students about the CMC^3 Poster Contest! Our Student Poster Contest is a great way for our students to showcase the great work that they do beyond the classroom. Students can explore a problem that goes beyond the normal curricula or they can explore a topic in Math History. Modeling problems are encouraged!

Motivated students at all levels are welcome to submit a poster. In previous years, we had wonderful posters submitted from beginning algebra, statistics and calculus students and we hope to continue this wonderful diversity this year.

There is no fee to enter and students get free registration to the conference, including lunch. This year, we are limiting the number of students per poster entry to two. All Poster entries receive a $150 scholarship ($150 for a single student entry and $75 per student for a group entry.) Additional scholarships will be awarded based on the judges' scores of the poster and the presentation. A special thank you to Binh Truong, from American River College, whose generous donation allowed us to offer larger awards for the poster contest this year.

Posters will be displayed during the Saturday conference only, so student participants must attend Saturday and are encouraged to attend the entire conference. Each poster needs to have a presenter that is available to present their poster and give a 5 minute synopsis of their project when the poster is being judged before lunch, from 11:30-12:00. The presenter(s) also need to be available to answer general questions in between the general sessions in the morning. Awards will be presented during the Saturday keynote session. Posters will be judged based on three categories: mathematical content, student presentation of the poster/project, and poster design. Students need to prepare a 5 minute synopsis of their project ahead of time. Submissions will be accepted until November 24, 2017.

For a student or student group to submit a proposal, please go to http://www.cmc3.org/conference/callForPosters.html for poster guidelines and the entry form.

Requirements: For a student to submit a poster, they

- should be a current community college student for Fall 2017
- have a current CMC^3 faculty member who will attend the conference agree to sponsor them
- provide an easel to display their work
- must able to attend the Saturday conference

We are also looking for volunteers from our membership to help judge the wonderful submissions we receive. You will be asked to judge each poster ranking them, on a scale from 1 to 4, in the above mentioned categories. Judging will take place during one of the morning sessions. If you are willing to volunteer to be a judge or have any other questions, please contact me at jcarlingoldberg@santarosa.edu

Let's get the word out and make this a fabulous year for the CMC^3 Poster Contest and for our students!

Interactive Lecture in Two-Year College Calculus Classes

Helen Burn, Highline Community College, and Vilma Mesa, University of Michigan

As part of MAA's national study of college calculus, we observed calculus courses, interviewed faculty teaching calculus, and conducted student focus groups in four different two-year colleges. We found that the typical method of instruction was to mix lecture and opportunities for students to engage in course content (e.g., fielding questions, working problem in class). Some instructors we interviewed felt compelled to defend their use of lecture and contrasted it with traditional lecturing. Thus, we came to refer to this instructional method as *interactive lecture.* In an article published in the May 2017 issue of MathAMATYC Educator (Burn & Mesa, 2017), we identified the "lecture" and "interactive" features of interactive lecture. We were particularly interested in whether interactive lecture shares features of active learning or other practices associated with high-quality instruction. Our purpose was not to defend lecturing but, rather, to help mathematics instructors develop a more nuanced understanding of this instructional method and identify areas for professional development that might improve interactive lecture.

Lecture features of *interactive lecture* include:

- Instructors lecture for various amounts of time (minimum ~15-20 minutes).
- Instructors solve problems (average of 7 problems in 60 minutes, 88% solved by the instructor at the board.
- Instructors use technology to demonstrate or motive concepts and in problem solving.
- Instructors motivate student through content relevance and "wow factor."

Interactive features of *interactive lecture* include:

- Instructors field student homework questions (75% of instructors started class with this).
- Instructor and students interact during lecture (e.g., whole-class discussion during lecture, in-class problem solving interwoven with lecture).
- Students solve problem in class individually, in pairs, or in groups (~53% of instructors ended class with this).
- Instructors interact with students during problem solving (used to evaluate learning, establish relationships with students, and provide feedback).

Overall, our research suggests that mathematics instructors in two-year colleges may be oversimplifying or mischaracterizing when they describe their instruction simply as "lecture." In a climate where lecture is typically cast in a negative light, we encourage instructors to highlight dimensions of instruction that attend to active learning, student-instructor interactions that promote relationship building, validation, student engagement, and opportunities for feedback.

(See "Interactive Lecture" on p. 13)

The Pleasures of Problems

Kevin Olwell, San Joaquin Delta

Fall 2017: A triangle with vertices at $A = (0,0)$, $B = (3,0)$ and $C = (3,4)$ is rotated about A until C lies on the positive y axis. Find the area of the region R formed by the intersection of the original triangle and the rotated triangle.

Summer 2017: Show that all the zeros of the function given below lie on the line $\mathrm{Re}(z) = 1/2$.

$$f(z) = z^{10} - (z-1)^{10}.$$

Solutions were submitted by Fred Teti and Carlos Valencia.

Let z be a root of f. Then

$$z^{10} = (z-1)^{10}.$$

Take the absolute value and then the positive 10th root. Geometrically the equation $|z| = |z-1|$ says that z is equidistant from 0 and 1, or that z lies on the perpendicular bisector of the line segment joining 0 and 1.

A very pretty argument by Fred Teti uses the geometry of Mobius transformations. Instead of taking the absolute value above, divide both sides by z^{10}.

$$1 = \left(1 - \frac{1}{z}\right)^{10}.$$

This shows that $w = 1 - 1/z$ lies on the unit circle. Solve for z: $z = 1/(1-w)$.

Now comes the pretty part. The function $z = M(w) = 1/(1-w)$ is a Mobius transformation mapping the unit circle onto the line $\mathrm{Re}(z) = 1/2$.

All are invited to submit a solution to the Fall 2017 problem either via email or US mail at the address below.

Kevin Olwell
San Joaquin Delta Community College
Agriculture, Science and Math Division
5151 Pacific Avenue
Stockton, CA 95207
kolwell@deltacollege.edu

Interactive Lecture

(continued from p. 12)

Our findings also suggest the benefit of professional development focused on effective classroom questioning techniques, appropriate use of praise, validating strategies, and facilitating small-group problem solving.

Burn, H., & Mesa, V. (2017). Not Your Grandma's Lecture: Interactive Lecture in Calculus I in the CSPCC Two-Year Cases. *MathAMATYC Educator, 8*(3), 24-29.

Helen Burn is an instructor in the Department of Mathematics and director of the Curriculum Research Group at Highline College. Vilma Mesa is associate professor of education and mathematics at the University of Michigan. They are co-PIs on *Transitioning Learners to Calculus in Community Colleges* (NSF DUE I-USE #1625918).

Through the History Glass

J. B. Thoo, Yuba College, jthoo@yccd.edu

I last wrote about the method of false position. Before beginning this installment, I want to alert you to an excellent article on false position by Don Chakerian [1] that was pointed out to me since then, and that I very much encourage you to peruse.

Now to this installment. I am calling this my "*historia perezosa*" because I am going only to quote from the fascinating book, *Fleeting Footsteps* [2].[1] *Sin embargo*, although it is lazy on my part, I hope that you will find this interesting, and that you will be inspired to make your own investigation.

Pages xix–xx:

> Today when a person is asked to multiply three thousand five hundred and eight by four hundred and thirty six, he would either use an electronic calculator or calculate on a piece of paper, and produce the solution in a matter of seconds. This task appears simple. The ability to operate a numeral system with instinctive ease is something that we readily take for granted. Some may even presume that the same operation could be performed as quickly with any numeral system, and not just with the Hindu-Arabic numeral system we use today.
>
> In western Europe before the advent of the Hindu-Arabic numeral system, only a limited few would have been able to perform such a multiplication. This may be surprising, but it is only because the Hindu-Arabic system is so ingrained in us that we find it almost impossible to imagine what it would be like to live in a world without it. The primary reason that the peoples of Europe discarded their own numeral systems for the Hindu-Arabic system was that the latter could perform addition, subtraction, multiplication and division far better than any other means of computation that were then known. In the years 1200 to 1600 when the new numerals were gradually adopted, the properties of the system and the methods of performing the four fundamental operations of arithmetic were laboriously learned and practised. A problem such as the above would be taught at university level. According to Karpinski,[2] "for several centuries one who could perform long division was considered an expert mathematician".
>
> Thus, when an ancient mathematical treatise expresses in words the multiplication of two numbers and gives the correct answer, this cannot be taken for granted as a simple task. A natural question arises: how was the result derived? How was such a fundamental conceptual breakthrough achieved?

Page xxi, xxii:

> This book has three objectives. The first is to show the development of arithmetic [including using the rod numeral system] and the initial stages of algebra in China. The second is to conduct a detailed stydy of *Sun Zi suanjing* [the mathematical classic of Sun Zi that was written around A.D. 400].
>
> [. . .]
>
> We come to the third aim of this book: to advance the thesis that the Hindu-Arabic numeral system has its origins in the rod numeral system [of China].

Pages 184–185:

> The Hindu-Arabic numeral system uses a place value notation with ten as base, and the nine signs needed are those which represent the first nine numerals. The rod numeral system which was used in China for computation since ancient times till the 17th century had an identical concept. In fact, it is the

[1] Lam and Ang are the authors' surnames.

[2] Karpinski, L.C. 1925. *The history of arithmetic*. Chicago & New York: Rand McNally.

only known numeral system which is conceptually identical to the Hindu-Arabic numeral system.…

[T]he primary use of both the Hindu-Arabic numeral system and the rod numeral system was in computation.… A study of their early methods showed that these were remarkably similar, despite the fact that one system used rods and the other was a written one. This, together with the presence of other similarities in the conventions of the two numeral systems, shows that an independent origin for the Hindu-Arabic system, would be highly improbable.

It follows that the Hindu-Arabic numeral system could only have originated from the rod numeral system, which was developed centuries earlier. Transmission from China to India would not have been difficult, given the extensive use of rods in ancient China, and the considerable interaction between the Chinese and the Indian civilizations, which was fostered by trade and other contacts.

Anyone is welcome to attend CMC^3 board meetings. If you'd like to attend, please contact anyone on the board (see page 2). We'll be happy to tell you the date and location of our next

Previous columns are on the Web at <http://ms.yccd.edu/history-glass.aspx>. Thoo is coauthor with Amy Shell-Gellasch of *Algebra in Context: Introductory Algebra from Origins to Applications*, Johns Hopkins University Press, Baltimore (2015), that presents introductory algebra using history as the vehicle.

Please consider putting one or two newsletters in the copy room for other instructors to read.

References

[1] Don Chakerian, "The Rule of False Position," in *Mathematical Adventures for Students and Amateurs*, editors David F. Hayes and Tatiana Shubin, Spectrum Series of the Mathematical Association of America, MAA, Washington, D.C. (2004), pp. 157–168.

[2] Lam Lay Yong and Ang Tian Se, *Fleeting Footsteps (Revised Edition): Tracing the Conception of Arithmetic and Algebra in Ancient China*, World Scientific Publishing Company, New Jersey (2004).

CMC³ Foundation Report

James Sullivan, Foundation President, Sierra College

The dedicated board members of the CMC³ Foundation (Mark Harbison of Sacramento City College, Shawn Lanier of Woodland Community College, and Casey Terrill and Leslie Banta of Mendocino College) have made a commitment to increasing both the number of California Community College students to receive scholarships as well as the total monetary amount of scholarships awarded by the CMC³ Foundation this year. This commitment will be evident with this year's Student Poster Contest. Every student team that presents their Poster Contest entry at the Monterey Conference will share a $150 scholarship and compete to receive a portion of an additional scholarship pool of $500.

In order to fulfill this commitment, the CMC³ Foundation Board is seeking sponsors to support the Student Poster Contest scholarship fund. A $150 tax deductible donation will provide a travel grant scholarship to a student team submitting an entry to the Student Poster Contest. We hope to receive at least six $150 donations from individuals interested in supporting students participating in the Student Poster Contest. A $500 tax deductible donation will completely fund the Student Poster Contest scholarship award pool. Donors making contributions to sponsor the Student Poster Contest scholarship fund will receive recognition at the Monterey Conference and on the CMC³ Foundation website.

Please consider supporting this valuable experience and unique opportunity for deserving California Community College Mathematics students and make a tax deductible donation either by credit card or PayPal using the "Donate" button on the CMC³ Foundation website http://www.cmc3.org/foundation.html. Or you can mail a check to Leslie Banta, CMC³ Treasurer, Mendocino Community College, 1000 Hensley Creek Rd, Ukiah, CA 95482. You can also support our scholarship fund by attending the Annual Fall Conference held in Monterey this year on December 8th and 9th and purchasing raffle tickets or merchandise (sweaters, shirts, and hats) at the CMC³ Foundation booth.

Calendar

Oct 20–21, 2017: MichMATYC Conference, Baker College, Muskegon, MI. Website: https://sites.google.com/view/2017-michmatyc-conference/home Contact: David Tannor

October 27–28, 2017: California Mathematics Council—South 58th Annual Mathematics Conference, Palm Springs. Growing Powerful Students: Mathematics as a GPS to Empower All, www.cmc-south.org/conference.html

November 9–12, 2017: AMATYC Conference, San Diego. Website: https://amatyc.site-ym.com/?2017ConfHome.

December 1–3, 2017: CMC North Conference, Diamond Jubilee: Celebrating 60 Years of Community, Leadership and Innovation in Mathematics, Pacific Grove, CA. Website: http://cmc-math.org/cmc-north/

December 8–9, 2017: CMC^3 44th Annual Conference, Hyatt Regency Monterey Hotel and Spa, Monterey, CA. Contact Katia Fuchs, City College of San Francsico, (510) 325-1616, efuchs@ccsf.edu

February 9–10, 2018: MAA-FL & FTYCMA Joint Conferences, Davie Campus of Florida Atlantic University, Davie, FL. Contact: C. Altay Özgener Website: http://sections.maa.org/florida/

March 2–3, 2018: CMC3-South Spring Conference, Kellogg West Conference Center & Hotel, Pomona, CA. Contact: Cheryl Vallejo, cvallejo@sdccd.edu

March 3, 2018: Sacramento Valley Community College Mathematics Conference, American River College, Sacramento. Contact Phil Smith, smithp@arc.losrios.edu

March 8–10, 2018: The California Acceleration Project's Second Annual Statewide Conference, Sheraton Grand, Sacramento. Website: www.accelerationproject.org

April 5–7, 2018: MOMATYC Spring Conference 2018, Ozark Technical Community College - Table Rock Campus in Hollister, MO. Contact: Jason Boehm Website: www.momatyc.org

April 13–15, 2018: 51st Annual NYSMATYC Conference, Glens Falls, NY. Contact: Chris Kemp Website: www.nysmatyc.org

April 27–28, 2018: 22nd Annual Recreational Math Conference hosted by CMC3, South Lake Tahoe, CA. Contact: Mark Harbison Website: www.cmc3.org

Jay Lehmann
Editor
CMC^3 Newsletter
MathNerdJay@aol.com