



California Mathematics Council Community Colleges



**2017 Monterey Conference Announcement**

*Katia Fuchs, President Elect, City College of San Francisco*

The 45<sup>th</sup> Annual CMC<sup>3</sup>

Fall Conference will be held this year on Friday December 8<sup>th</sup> and Saturday December 9<sup>th</sup> at the Hyatt Regency Monterey Hotel and Spa. We are looking forward to yet another fantastic conference! At this time there are still many details to fill in, but things are starting to take shape.

2017 will be our fifth year at the Hyatt Regency, and we are happy to once again be able to hold all our conference activities in the

activities in the upstairs area of the conference center, rather than in the basement. This allows our session rooms to be a little bit bigger, while still keeping us all in one place.

Last year the shuttle to downtown Monterey on Saturday evening, while very popular, encountered some obstacles due to construction and to some communication mishaps. We are working diligently to ensure that the service does a better job meeting demand this year. We will be able to report more as the dates of the conference draw near.

Our room rate starts at \$130/night for double occupancy (with a slight increase in fee for a third or fourth occupant), and reservations can be made even now at <https://resweb.passkey.com/go/2017CMC3> . For more details about the amenities at the hotel you can go directly to their website, at <http://monterey.hyatt.com/en/hotel/home.html> .

This year we will once again have a keynote speaker to start the conference on Friday night. We are still finalizing the details, and will post updates on our website as soon as they are available.

Saturday will feature another keynote speaker and our usual lineup of talks spread over six threads, with details still to be ironed out. In our aim to educate our membership on current events, we hope to be able to offer a significant number of talks on the topics of Student Equity, Basic Skills education, and Open Educational Resources! We still have slots available for speaking, and eagerly welcome first time speakers! To submit a proposal to speak, please go to: [www.cmc3.org/conference/callForProposalsMonterey.html](http://www.cmc3.org/conference/callForProposalsMonterey.html).

Last but most certainly not least please be aware of our student poster session! The poster

(see “Monterey Conference” on p. 2)

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## Monterey Conference

(continued from page 1)

session provides an opportunity for students to take part in a faculty-mentored research project that goes beyond the traditional community college curriculum. Posters will be judged and winners will be awarded monetary scholarships during the luncheon. Please encourage your students early this fall to develop a poster for presentation at the conference. More details will follow.

As we work on finalizing details, they will be posted on the conference website at [www.cmc3.org/conference/Monterey17/Monterey17.html](http://www.cmc3.org/conference/Monterey17/Monterey17.html). We expect the conference registration form will be posted before the end of the summer.

We look forward to seeing you in Monterey for another fabulous fall conference!

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## The 21<sup>st</sup> Annual CMC<sup>3</sup> Recreational Math Conference in Lake Tahoe



*By Larry Green, Lake  
Tahoe Community College*

Last spring we got to enjoy another wonderful conference. The 21<sup>st</sup> annual recreational math conference in Lake Tahoe was our first Tahoe conference that was not held inside a casino.

Having it at Lake Tahoe Community College allowed us to enjoy Lake Tahoe without the smoke and other issues that come with the casino.

The conference began with keynote speaker Rick Luttmann who showed us how to use mathematics to win in a simplified game of Battleship. It turns out that Battleship and many other games are just a matter of matrices, algebra and probability. The Friday evening keynote talk was followed by a Foundation get together where we reconnected with our colleagues from California and other states. We partook of plentiful food and drinks while at the same time contributing towards the Foundation scholarships to help out our students.

On Saturday morning we were challenged with math puzzles, learned about Lewis Carroll and fought off pirates who unsuccessfully tried to do us in with mathematics. Then we played a “heads or tails” game that once again raised money for student scholarships. After a record breaking snowy winter, the weather was warm and inviting so we then went outside in search of hidden

geocache items whose GPS coordinates could only be found by solving challenging mathematics questions. This was followed by a delicious Greek lunch to honor the greatest Greek mathematicians. The highlight of the conference came next as we were delighted to have John Calles, the director of the Mars rovers and fellow math instructor. He showed us spectacular pictures of our universe, especially Mars. He explained to us how mathematics is used in the search for life on Mars and beyond.

After the keynote presentation we were once again entertained by math lectures that involved music, the history of calculators,

Anyone is welcome to attend our board meetings. If you'd like to attend, please contact anyone on the board. We'll be happy to tell you the date and location of our next meeting.

ancient Egyptian mathematics, randomness and zombies. The grand finale of the conference was our student speaker, Gabriel Fredricks, who explained L functions and other challenging questions from mathematics. We were all impressed with how a community college student can go above and beyond what we teach in our classes and mathematics at a much deeper level.

The conference was such a success that next year, we plan on having the 22<sup>nd</sup> annual Tahoe Recreational Math Conference again at Lake Tahoe Community College on April 27 and April 28, 2018. Look for more information about it in future newsletters.

## President's Report



*Joe Conrad,  
CMC<sup>3</sup>  
President,  
Solano  
Community  
College*

We had a wonderful conference at Lake Tahoe Community College this spring! I really enjoyed the new hotel's location and the clean air at the college. Although there is a full report on page 3 of this newsletter, I wanted to take this opportunity to thank the board members who were there and worked hard to pull it off. I especially want to thank Larry Green who put in many hours of work ahead of time setting up the logistics for the conference as well as being the go-to guy during the conference. Not having the conference at a hotel made for many little details that are not normally our responsibility, for example, making the coffee, getting the food and cleaning up afterwards. Our board stepped up and made sure it happened. We look forward to next year when we hope to do even better!

Speaking of our board, this fall will be time for our elections. These are held every other year and you can expect a ballot to arrive sometime early in the fall. I wanted to take this time to remind you that this organization is run by volunteers who serve us all in the mission of advancing professional development for California community college mathematics instructors. Please consider joining us! If you want more information, contact me. Our next board meeting will be on September 9 at Solano College and you are welcome to attend.

By now members should have received an email from me on behalf of the board about the latest developments (as of early May) in the ongoing saga of acceleration, statistics and the CSU. I don't want to repeat that message here except to reiterate the last sentence which was, "It is important to recall that CMC<sup>3</sup> does not exist to propagate dissension, but to facilitate faculty development through sharing of our experiences and knowledge at our conferences and in our newsletter." On behalf of myself, I want to invite you to speak to us at the Monterey conference about this or any other issue that is important to community college mathematics instruction. Please see the website (CMC3.org) for speaker proposal information.

Finally, I was once told that the reason someone goes into teaching is to get summers off. However, this summer will mark the first summer since 1981 (when I was in graduate school) that I will not be teaching or participating a college-related paid activity of some type. (Solano canceled the summer session a few years ago due to finances, but I managed to get appointed to do SLO work for the college that summer. What fun that was!) I am looking forward to relaxing, traveling and doing the things teachers do who are able to recharge over the summer. I am hoping that this will make fall that much better, but, if not, at least I will have had the summer!

### Call for Nominees

**Please consider joining the CMC<sup>3</sup> Board. Contact Joe Conrad if you are interested in running or query any board member for information about the board. (See page 2 for contact information.)**

## Math Nerd Musings: I Don't Know



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

I started editing this newsletter and writing this column in 2002, when my son, Dylan, turned four years old. In a past column, I shared my attempts to not dampen his innate sense of curiosity.

With him returning home for the summer after completing his first year at Evergreen College in Washington, he's had lots to share about student protests for equity on campus, including a gun threat, which resulted in the campus closing down for one day. These conversations have been a bit rocky. Dylan feels strongly about social issues and wants to make a difference in a significant way *now*—even questioning if he should be in college—but my wife, Keri, and I are quick to urge him to stay in



school, pointing out that he will be more empowered with a college education to do whatever he wants, including fight for social change.

These discussions feel right on target for a son returning from his first year in college, but all three of us are too

emotionally invested for there to be much room for a sense of exploration, aside from understanding why my son feels as he does.

So it was a relief the other day for Dylan and I to go out for pizza and talk about other important things, but ones that don't threaten him leaving college, like friendships and struggling to be patient when a girl doesn't reply right away to a text you sent, inviting her on a date.



*Dylan with his best friend, Josh, both celebrating graduating from high school*

On our return from pizza, the almost-full moon caught our attention. Dylan wondered with the moon rotating about the Earth while the Earth is rotating around the sun, how scientists could determine that the universe is expanding with all that local movement going on in each solar system. This launched us into a huge discussion about astronomy, most of which I know very little about, which put us on an even playing field. Our conversation was peppered with lots of questions, half-baked conjectures, and me saying "I don't know" a lot. In other words, we were having a great time.

When it was time for me to get back to revising textbooks and Dylan to do his voice lesson, he said he was still going to major in music, but that he hoped he could take some more physics classes. It did my heart good to hear he was looking forward to returning to college and that his curiosity is alive and well.

## What's Happening at Los Medanos College

*Michael Norris*

There have been a number of changes at LMC over the last few years. The following instructors, who at least at one point taught Math full time at LMC, have retired relatively recently: Gil Rodriguez, Pat Wagener, Jeanine Stein, Dan Henry, Lois Yamakoshi and Brendan Brown.

A'kilah Moore moved up to be our Dean. The more experienced math professors still remaining are: Kwadwo Poku, Michael Norris, Jill DeStefano, Myra Snell, Erich Holtmann, Jennifer Saito, Jim Cohen and Scott Johnson (apologies to those who don't think they belong in this category). Mid Rangers: Julie Von Bergen, Mara Landers, Ryan Pederson, Tue Rust and Matt Stricker. Relatively new: Scott Hubbard, Rick Estrada, Maria Perrone, Bertha Ramos and Maria Magante.

The "new" Math building is considered new only by an ever-shrinking group of those who knew what it was like to teach math at LMC before 2008. However, many of the classrooms have recently received a technology



makeover by purchasing furniture that have full sized computers, keyboards and mice that recede

underneath the desk. This allows complete flexibility for any instructor as to whether they would like to use computers to enhance their lesson on any given day. We are in the process of purchasing a cart-full of netbooks to be used for getting internet access for students to use online programs such as StatCrunch in the

computer-less classrooms. We are also closing in on blueprints for a brand-new college site in Brentwood, which should have a new STEM wing and a new Math lab!

Most of our efforts in curriculum recently have been in the design, creation, teaching and assessment of new acceleration classes. We now have Math 29, which accelerates students through Elementary Algebra and Intermediate Algebra in one semester by eliminating much of the overlapping material in those courses.



We have combined a section of first and second semester calculus into an accelerated CalcPath

section. And we have written two new acceleration courses connected to the Statistics Pathway: Math 27 (Pre-Stats) and Math 28 (Stats co-requisite support class). The Pre-Statistics course in one semester accelerates students through the prerequisite knowledge truly necessary to succeed in transfer level Statistics. The new Co-requisite class allows students who have passed Algebra I to complete their transfer level Statistics in one semester by simultaneously providing extra lab hours, more practice and more time for deeper conceptual understanding to support the normal topics in the Statistics class. Members of the department have also created other new courses separate from acceleration, including a Math for future K-12 teachers, a Discrete course used as part of the ADT for Computer Science, and two new math support courses for those students entering into either the Electronic or Process Technology CTE degree programs.

## What's Happening at Las Positas College

*Randy Taylor*

Las Positas College Mathematics Department has had some changes recently and there are now fifteen full-time faculty and thirty part-time adjunct faculty. We have seen three retirements recently: Brenda Weak in Summer of 2012, Cindy Keune in Spring 2015, and former CMC3 President Randy Taylor in Fall 2015. We also have added six new full-time faculty members. In Fall 2013 Jennie Graham was hired and is now in her final year of the tenure process. In Fall 2015 Elizabeth Owens, Michael Peterson, and Bhairav Singh came on



board. In Fall 2016 two of our part-timers, David Powers and Ashley Young, became full-time faculty members.

Bobby August has served as the Mathematics Department Coordinator for the past two years. He is very active in teaching online courses and he also teaches acting classes part-time. Teri Henson is our CMC3 Representative and she developed our non-STEM "Core Intermediate Algebra" course. She is currently revising our Technical Mathematics course for our automotive and welding students. Greg Daubenmire has served as the Professional Development (formerly Staff Development) Coordinator for four years. He is also the Integrated Learning Center Coordinator. Kristy Woods is the Mathematics

Coordinator for the Hispanic Serving Institution (HSI) Grant, the Mathematics Coordinator for the school's "Middle College" an alternative way for high school students to get an education, and the founder and coordinator of Math Jam, an intensive one-week mathematics preparation program offered the week before the Fall and Spring semesters. Ashley McHale is the Basic Skills Student Outcomes and Transformations Grant co-coordinator, co-chairs the Basic Skills committee, and serves as the Alpha Gamma Sigma Honor Society faculty advisor. She will become the Mathematics Department Coordinator in Fall 2017.

Ruchira Majumdar is the faculty advisor and Michael Peterson is the faculty co-advisor for the Math Club. In Fall 2016, they invited Dr. Simon Rubinstein-Salzedo, Director of Euler Circle, who gave a talk "Games and Codes" to an overflow audience. Ruchira and Michael took 5 and 10 LPC STEM students to the 2017 and the 2016 CMC3 Recreation Math Conference in Lake Tahoe. Ruchira is also working on the math department tutoring collaborative with the local high schools. Michael is also working with Ruchira on the tutoring collaborative and he is looking into AMATYC project *ACCESS*. Jason Morris is the Chair of both the Sandia Honor Program for STEM students and the Math Department scholarship program. He also serves on the Academic Senate. Craig Kutil has been the college's Curriculum Committee Chair for the past two years and probably will continue in that position for the next two years. In addition to teaching mathematics courses, he teaches Danzan Ryu Jujitsu and Tenio DeCuerdas Eskrima for Kinesiology and Goshin-Jutsu for our Community Education program.

Howard Blumenfeld is currently the Professional Development co-coordinator and he will become the Professional Development coordinator in Fall 2017. He also helped create

the “Working Together” small group conversations on campus. He gave a talk on “Building Communities on Campus” at this year’s ASCCC. Jennie Graham has been revising our self-paced Math X program into the Math Emporium mode. The mode will have knowledge checks at the beginning of each chapter that will filter the content to be learned in order to create a streamlined, personalized pathway for each student using technology that is supplemented with interactive face-to-face learning support. Elizabeth Owens is the Division’s tech reviewer and she coordinates the department’s graphing calculator rental program as well as our participation in the TI Rewards program. She is also involved in the “Working Together” workshops. Bhairav Singh is the college’s AMATYC Student Mathematics League moderator. He administers and grades the exams, secures the scholarships and awards for the LPC team members, and present them to the students at the LPC Student Recognition Ceremony. Ashley Young helped the library get a set of scientific calculators for students to check out. She is also developing a workshop to help instructors learn how to use tablet computers to dynamically interact with instruction materials

(PowerPoint, PDFs) displayed on classroom projectors. Workshop attendees will all get free tablet computers. David Powers

handles the Math Department website and has given a presentation to the school’s “Middle College” students, plus he works on the tutoring collaborative with the local high schools. David serves on the LPC scholarship committee as a sub-committee chair and is also looking into AMATYC Project *ACCESSS*.

Fourteen LPC math instructors, eight full-time instructors: Teri Henson, Ashley McHale, Ruchira Majumdar, Jennie Graham, Michael Peterson, David Powers, Ashley Young, and Bhairav Singh and six part-time instructors: Shanna Erickson, Charles Barnett, Namita Saxena, Ozlem Guclu, Seth Lavender, and Zach Straus, all attended the Fall 2016 CMC3 Conference in Monterey. Charles Barnett was a Conference Speaker and David Powers served as a Conference President. Charles was a also a Conference Speaker at the Spring 2017 CMC3 Recreational Math Conference in Lake Tahoe. Ruchira Majumdar also attended the 2017 MAA Golden Section meeting at Santa Clara University. During the Spring 2017 Flex Day, both Howard Blumenfeld and Shanna Erickson led workshops. We are grateful for our beautiful location here in Livermore and invite you to come visit our campus and see our department.





## The Pleasures of Problems

Kevin Olwell, San Joaquin Delta

Summer 2017: A famous unsolved problem



claims that the (nontrivial) zeros of Riemann's zeta function lie on the line  $\text{Re}(z) = 1/2$ . Show that all the zeros of the function given below also lie on  $\text{Re}(z) = 1/2$ .

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

Spring 2017: Treat Earth as a perfect sphere with a radius of 4000 miles. Imagine a wire encircling Earth at the equator at a uniform height 1 foot above the ground. If you pull it taut, how far above the ground will the wire reach?

Solutions were submitted by Fred Teti, Carlos Valencia and Joe Conrad.

Let  $r$  = radius of Earth,  $\Delta r$  = the uniform height of the wire above Earth,  $h$  = max height of the wire. When the wire is pulled taut, a right triangle is formed with vertices at  $C$  = the center of Earth,  $P$  = the highest point on the wire, and  $T$  = the point where the wire is tangent to Earth (the right angle). Let  $\theta = \angle TCP$  = angle at the center of Earth, and  $L$  = length of the leg opposite  $\theta$ .

$$\cos \theta = \frac{r}{r + h} \Rightarrow h = r(\sec \theta - 1).$$

Replace  $\sec \theta$  with the first two terms of its Taylor series. (By "think like a physicist" I meant replacing a function with the first two terms of its Taylor series.) This yields the following approximation for  $h$ :

$$h \approx r \left( \frac{1}{2} \theta^2 \right).$$

We now seek a formula approximating  $\theta$ . The length of the wire from its highest point to the antipodal point on Earth is  $L + r(\pi - \theta)$ . This is equal to half its total length. Hence

$$L + r(\pi - \theta) = \frac{1}{2} [2\pi(r + \Delta r)]$$

$$\Rightarrow L = r\theta + \pi\Delta r.$$

Returning to the right triangle, we see that

$$\tan \theta = \frac{L}{r} = \frac{r\theta + \pi\Delta r}{r}$$

$$\Rightarrow \tan \theta - \theta = \frac{\pi\Delta r}{r}$$

Replace  $\tan \theta$  with the first two terms of its Taylor series. This yields the following approximation for  $\theta$ :

$$\frac{1}{3} \theta^3 \approx \frac{\pi\Delta r}{r} \Rightarrow \theta \approx \sqrt[3]{\frac{3\pi\Delta r}{r}}$$

Substitute this into the formula for  $h$ :

$$h \approx \frac{r}{2} \left( \frac{3\pi\Delta r}{r} \right)^{2/3} \approx \frac{1}{2} \sqrt[3]{(3\pi\Delta r)^2 r}$$

With  $r = 4000$  miles and  $\Delta r = 1$  foot we get  $h \approx 616$  feet 8 inches.

All are invited to submit a solution to the Summer 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

## Tahoe Conference Student Speaker

*Joe Conrad, CMC<sup>3</sup> President, Solano  
Community College*

I have the pleasure of reporting on this year's student speaker at the Tahoe conference. This year's speaker was Gabe Fredericks from Solano Community College and the title of his talk was, "Practical and Theoretical



Significance of L-Functions." I suppose I am a little biased since he is one of my students from Solano College, but he did a great job! Students from the entire CMC<sup>3</sup> service area which includes 57 community colleges in northern and central California are eligible to compete for this honor. The funding for the student speakers contest and the \$500 award that comes with winning it is generously provided by past CMC<sup>3</sup> president Debra Landre.

Gabe told us that L-functions are functions that satisfy three conditions. First, they are generalizations of series of reciprocals

of powers which were investigated by Euler and are now known as defining the zeta function for reals greater than 1. Dirichlet generalized these series by allowing the numerators to have values other than 1. The second condition is a further generalization by Dirichlet of Euler in that the function can also be expressed with product formula using prime numbers similar to Euler's product formula for the zeta function. The third condition for an L-function is a functional equation as in Riemann's functional equation which extended the zeta function over (most of) the complex plane. Gabe told us about how these functions are being used in various areas of mathematics including two of the Millenium Prize problems, namely, the Riemann Hypothesis and the Birch and Swinnerton-Dyer Conjecture.

Overall, Gabe's talk was a wonderful to finish the day and the conference. Please consider encouraging your students to compete for this honor next year!

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

## CMC<sup>3</sup> Foundation Report

*James Sullivan, Foundation President, Sierra College*



The primary mission of the CMC<sup>3</sup> Foundation is to conduct fund-raising events and solicit

donations in order to award scholarships and prizes to qualified and deserving California Community College students in our service region who demonstrate promise and interest in the area of Mathematics and Mathematics Education. So, in pursuit of our mission, it is with great pride that we announce the awarding of six \$1000 CMC<sup>3</sup> Foundation scholarships to six outstanding students for the 2016-2017 academic year.

Brett Bussell (pictured below) from Modesto Junior College is a returning student whose nominator described him as “a true testament to the function, spirit and mission of the California Community College” system.



Huy Duong, Elizabeth Rygg, and Claudia Plascencia from American River College are pictured below with their scholarship nominators. Huy Duong has won certificates,



attended leadership conferences, works multiple tutoring jobs, and is always giving back to the community. Elizabeth Rygg accommodates the needs of other students, has a positive attitude and is creative, detail-oriented and well-organized. Claudia Plascencia is a highly-regarded tutor, active in many campus clubs, and immigrated to the U.S. in order to attend college.

Jonathan Mendez (pictured below) from Mendocino College has been awarded two



Eisenhower Transportation Fellowships and has

a strong love of learning and mathematics.

Kang Nguyen (pictured below) from Mission College has a warm personality, strong work ethic and is a recent immigrant who loves to volunteer and give back to the community.



The CMC<sup>3</sup> Foundation Board offers its gratitude to Allyn Washington (retired from Dutchess CC in NY, now living in Penn Valley) and Lauren Syda (retired from Yuba College) for volunteering to review this year's scholarship



applications and selecting the scholarship recipients.

CMC<sup>3</sup> Foundation scholarships are made possible through generous donations from our members like you. Please consider supporting our scholarship fund by making a tax deductible cash donation either by credit card or PayPal using the “Donate” button on the CMC<sup>3</sup> Foundation webpage or by mailing a check to Leslie Banta, CMC<sup>3</sup> Treasurer, Mendocino Community College, 1000 Hensley Creek Rd, Ukiah, CA 95482.

## CMC<sup>3</sup> History Quiz, part 9

Mark Harbison, Sacramento City College

1. Rearrange the letters in “smart rub” to spell the last name of a Tahoe 2016 keynote: Bruce \_ \_ \_ \_ \_  
\_ \_ .
2. (multiple answers are correct) Which of the following talks have been given at a Recreational Math Conference in Tahoe?
  - a) *The Mathematics of Surfing*
  - b) *The Da Vinci Code*
  - c) *Managing the Spotted Owl*
  - d) *Math and the Cajon Drum*
3. In what year was the first annual Fall CMC<sup>3</sup> Conference?
4. Who were the first officers of CMC<sup>3</sup>?
5. How many Monterey talks have included *Geometry* in the title?

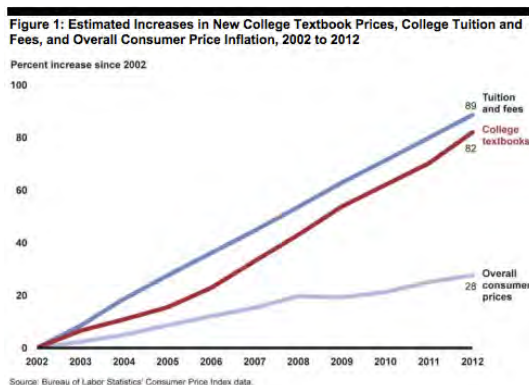
(see “HISTORY ANSWERS” on p. 18)

## Bull: Counting the Cost

*Ken Bull*

*College of San Mateo*

Bull is now retired. However, I keep weekly contact with colleagues at the college. Recently, the college instituted a policy that instructors and departments are to choose low cost or no-cost teaching materials where this is possible. This policy is clearly in response to the very high cost of textbooks, felt especially in STEM disciplines. A graph that is often cited shows that tuition fee and textbook price inflation have outpaced consumer inflation. (See <http://www.gao.gov/assets/660/655066.pdf>, Figure 1.) For most, the idea of a \$200+ textbook suffices to define the problem.



Both students and instructors have strategies to cope with the high cost of texts. Students buy a used text, rent a text, go without a text or share, or rely on materials on-line. All of these strategies have additional costs, some monetary, some non-monetary. On-line access may only be available at a price (See <http://www.studentpirgs.org/reports/sp/access-denied>). The rental market for texts appears to be driven by supply and demand, so that renting a text

may or may not be cost effective. It is often pointed out that the cost to students is often determined by what instructors choose for teaching materials.

Some instructors and departments are happy to ignore the high cost for the convenience of choosing materials that they know well. But instructors who are concerned with student costs have employed various strategies: one is to continue using a previous edition of a textbook with the idea that there will be more used and cheaper choices for students. Another strategy is to use Open Educational Resources (OER): texts and teaching materials that have some kind of open copyright and are generally much cheaper to the student. The price of an OER print version text can be a tenth of the cost of a text from a “big publisher.”

Open Educational Resources are often spoken of with leftist evangelical fervor as the good guys against the big, bad, and old publishers (See, for example: <http://studentpirgs.org/open-textbooks/about>). As one who has created and used and thereby supported OER efforts, I may be in a position to evaluate some of their costs and benefits. Although there are definite benefits to students, especially in terms of money spent at the beginning of term, there are also costs in using OER both to students and to faculty. These costs are not often recognized, but they are real. A story may illustrate some of these costs.

### A Story

Bull wrote a somewhat innovative introductory statistics text book that emphasized using real data to answer statistical questions. The idea was to engage students in the process of using statistical methods to answer research

questions. By using a sequence of guided questions in the context of data analysis, the concepts and techniques of the introductory course are presented in more natural way. The text was written specifically with a “flipped” group work class setting in mind, although it has been used also in an on-line and hybrid format. The materials were written over the course of some years and I ended up doing the fun part: finding data, thinking of relevant questions to ask about the data, making the guided questions that would hopefully lead student understanding, writing the narrative. It was, and is still being used at the college at which I taught by a team of instructors using a common timetable and tests.

To use the text effectively, however, someone had to translate the questions designed for classroom use using paper, pencil and software to something that students could use on-line at home. The “translation-into-Moodle” tasks fell primarily to two of my colleagues. Neither they nor I have any idea of the hours they have toiled doing this, but the number is certainly more than what they would spend teaching a three hour course. Moodle is not as sophisticated as, for example, WebWork, in the sense that in Moodle every possible answer considered correct must be individually entered: the answer 0.013 as well as .013 are considered separate, different answers. Alternately, very detailed instructions must be given to students about syntax. So the students as well as the faculty pay a cost: for the students, a small but constant and irritating frustration.

As it happens, these two colleagues have had to redo their work after the college changed classroom management platforms. They have also recently been making the materials ADA compliant. The lesson here is that using OER, while cheaper for

students, is not at all cost-free; some of the cost is borne by creators of materials, and in this case faculty. And some of the cost is borne by students in additional frustration in the learning process.

The materials now need serious revision. For one thing, being a statistics text, the data need to be updated. There are an increasing number of interesting data sets and contexts that are available. But apart from that, there are ideas and concepts and even matters of terminology that need strengthening. There are new ideas about generating and using data through classroom experiments and games that need to be tried out. Moreover, students and faculty complained that the British-influenced and wordy English used made the materials hard to read.

Hence, one of Bull’s retirement projects was to have done a thorough revision. A start was made, but another academic project pushed out the bulk of these efforts. That other project has involved doing a thorough (and therefore tedious) study of exercises in introductory statistics texts.

### **A dilemma**

For that new project, one of the texts examined I will call “The White Book” (or TWB) because of the dominant color of the cover. As it happens, TWB is everything my revision would be, and probably more. It carries on the vision that also motivated my writing. The pedagogy, the material, and the emphasis on “using statistics to answer research questions” are all there. This is in contrast to most of the texts published either by big publishers or in the OER world. Most of these make a nod to the vision of doing statistics as statistics, but most still have their legacy in mathematical statistics; the texts look

like math textbooks, and not statistics textbooks. Given that TWB shares our vision for teaching statistics, and given that it arguably carries it out as well or better than our materials, and especially given that one of the key toilers referred to above is herself planning to retire, I am inclined to push that my colleagues adopt TWB.

Potential problem: TWB is published by one of the big publishers. True, according to the publisher's website, students can buy an electronic version of the text for a bit over \$60 or a binder ready copy for a bit less than \$140. That is relatively reasonable for textbooks, but it is some way from free electronic access or the \$20 for a print copy that students now pay. Also in its favor is that TWB has a website with free access to anyone for the data used in the text, and another for applets that is also open to anyone, and not just those with an access code. Knowing the authors of TWB, I would not be surprised to find that being as open as possible was a deliberate policy.

At this point I do not expect that my colleagues would have to "make their case" for adopting materials that increase the cost to the student, compared to what the students now taking the course are paying. But the dilemma still stands. Here is a case where adopting a text from a big publisher may be the wiser choice in a cost-benefit analysis for both students and faculty, and result in higher quality materials for students and also free faculty time for other tasks.

### **Buying or building, and implications for colleges**

The story and the dilemma recounted here may be unique. However, a recent report looking into OER adoption in universities and colleges in Connecticut

supports the idea that using OER incurs costs for institutions and for faculty (See Open Source Textbook Report). The report encouraged use of OER, but one of their conclusions (page 12) was: "While OER materials are free and open by their licencing, there are institutional costs associated with the selection, evaluation, implementation and maintenance of OER." Perhaps we can characterize the distinction between using materials published by traditional publishers and using OER materials by thinking about housing. One can buy a completed new house, or one can act as as a general contractor and build a house, where this option may entail doing at least some, perhaps much, of the construction oneself. At the present time, using OER looks more like being ones own general contractor. There are resources ("sub-contractors") such as OpenStax, Lumen Learning, and MyOpenMath as well as others. But there is still choosing and implementing work to do.

Another conclusion of the Connecticut report was: "Institutions may need to consider their internal policies regarding intellectual property rights to material developed, as well as recognition for, faculty OER work towards tenure and promotion." Often, the regulations in place do not appear to recognise the various kind of creative commons copyright. More than that, a committment to using OER should imply recognizing that faculty will spend time creating and modifying materials; ways need to be found to facilitate this.

### **And yet . . . implications for faculty, and conclusion**

The paragraphs just above might be taken to be a warning against using OER; they are not. They are an admonition that faculty and administrators should be aware

**(see "COST" on page 17)**

## Through the History Glass

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False position (or single false position) and double false position are methods for solving linear equations that, respectively, can be put into the form  $ax = b$  and

$ax + c = b$  without any transpositions. These methods were generally used before algebraic methods were developed [1, p. 83]. We introduced these methods in the Fall 2009 installment of this column, but we did not expound upon them then. We take up the methods in a little more detail here. You may then try these methods to solve the problems that are in the Spring 2017 installment of this column.

**False position** To solve  $ax = b$  using false position, in modern notation,

1. guess a solution, say  $g$ ;
2. if  $ag = h \neq b$ , let  $c = b/h$ ;
3. the solution is  $x = cg$ .

Here is an example. This problem was posed by Francès Pellos, a fifteenth century nobleman from Nice [1, p.83]:

A lance has half and a third in the water and 9 palms outside. I ask you how long is it?

In modern notation, the problem may be expressed as

$$x - \frac{1}{2}x - \frac{1}{3}x = 9,$$

where  $x$  represents the length of the lance. Note that the equation can be put into the form  $ax = b$  without transposing any terms. The solution that Pellos provides goes like this.

1. Guess 12 palms for the length of the lance (because 2 and 3 are factors of 12, thereby avoiding fractions); so,  $g = 12$ .

2. Now, 12 less half of 12 and less one-third of 12 is 2, not 9; so, let  $c = 9 \div 2$ .

3. The length of the lance is then  $x = cg = 9 \div 2 \times 12$  or 54 (palms).

We note that false position may not be used if Pellos' problem is expressed as  $(1/2)x + (1/3)x + 9 = x$  because this equation cannot be put into the form  $ax = b$  without transposing any terms.

**Double false position** To solve  $ax + c = b$  by double false position, in modern notation,

1. guess a solution, say  $g_1$ ;
2. if  $ag_1 + c = h_1 \neq b$ , let  $e_1 = b - h_1$ ;
3. guess again a solution, say  $g_2$ ;
4. if  $ag_2 + c = h_2 \neq b$ ; let  $e_2 = b - h_2$ ;
5. the solution is

$$x = \frac{g_1e_2 - g_2e_1}{e_2 - e_1} \quad \text{or} \quad \frac{g_2e_1 - g_1e_2}{e_1 - e_2}.$$

Here is an example from Leonardo of Pisa's (Fibonacci's) *Liber Abaci* [2, p. 456], in which he refers to double false position as the *method of elchataym*:

Four men having denari found a purse of denari; the first man said that if he would have the denari of the purse, then he would have twice as many as the second. The second, if he would have the purse, then he would have three times as many as the third, and the third, if he would have it, then he would have four times as many as the fourth. The fourth, five times as many as the first; it is sought how many denari each has.

In modern notation, the problem may be expressed as the system of equations

$$\begin{aligned} A + x &= 2B, & B + x &= 3C, \\ C + x &= 4D, & D + x &= 5A, \end{aligned}$$

where  $A$ ,  $B$ ,  $C$ , and  $D$  are the amounts, respectively, that the first, second, third, and fourth man has, and



$x$  is the amount of the purse. Eliminating  $B$ ,  $C$ , and  $D$ , this system is equivalent to

$$2\{3[4(5A - x) - x] - x\} - x = A,$$

which can be put into the form  $ax + c = b$ . Leonardo implicitly seeks whole numbers of denari. He begins by guessing  $A = 9$  and  $x = g_1 = 21$ . This leads to

$$B = 15, \quad C = 12, \quad D = 8\frac{1}{4};$$

but then  $5A = D + g_1 = 29\frac{1}{4}$  on the one hand, and  $5A = 5(9) = 45$  on the other. Thus, he finds that

$$-e_1 = 45 - 29\frac{1}{4} = 15\frac{3}{4}.$$

(Leonardo avoids negative numbers.) Likewise, by guessing second  $A = 9$  and  $x = g_2 = 27$ , he finds that

$$-e_2 = 45 - 37\frac{1}{2} = 7\frac{1}{2}.$$

Leonardo then finds that the solution is

$$x = g_1 + \frac{(g_2 - g_1)(-e_1)}{-e_1 + e_2} = 32\frac{5}{11}.$$

(It is remarkable that he knew this without the advantage of symbolic algebra.) Finally, to obtain whole numbers of denari, Leonardo multiplies both  $A = 9$  and  $x = 32\frac{5}{11}$  by 11. This yields  $x = 357$  and

$$A = 99, \quad B = 228, \quad C = 195, \quad D = 138.$$

◇

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.

## References

- [1] Jean-Luc Chabert (editor) et al., *A History of Algorithms: From the Pebble to the Microchip*, Springer-Verlag, Berlin (1999). Translator of the English Edition: Chris Weeks.
- [2] Leonardo of Pisa (Fibonacci), *Fibonacci's Liber Abaci: A Translation into Modern English of Leonardo Pisano's Book of Calculation*, Springer, New York (2002). Translated by L. E. Sigler.

## COST

(continued from page 15)

of the possible costs, and plan for them. The reason for the “and yet” is to say that some of the costs are good things. They are costs that faculty should gladly embrace; they are part of what we should be doing, as well as being inherent in the OER model. We deplore the teacher whose lesson plan only consists of: “Cover section 7.6, assign 1 - 35, odds”. No. What we admire is a careful and creative consideration of examples, practice problems and activities, in the light of student needs – needs both in terms of difficulties and where one hopes to take them. Years doing this kind of creative work is similar to the work that goes into modifying, using and implementing OER, or indeed traditionally published materials.

The extra costs involved in OER, and implied by the OER paradigm, are consistent with what we think successful teachers or indeed authors do. Creating on-line resources or using or making WebWork exercises is worthwhile work. So using OER involves doing some of the work that traditional publishers do, but it also involves doing what we as teachers naturally do.

However, traditional publishers have an infrastructure or support system for authors that needs to be there for good quality work, and if OER materials are to be used, something like this infrastructure must be built. If it is not somehow built, the OER project may well collapse. As an example: publishers generally employ reviewers (and generally pay them a pittance, one might add!) to evaluate an author's work. Authors outside this traditional system have to create a community or a sounding board lest what they produce becomes idiosyncratic or just sloppy.

The conclusion: OER has been driven by the idea of reducing student costs; but count the cost to others.

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**HISTORY ANSWERS**

*(continued from page 12)*

1. Bruce **Armbrust** (Lake Tahoe CC) gave a Tahoe 2016 keynote *Worlds Beyond Our Own*.
2. **All** answers are correct.
  - a) In 2002, Richard **Werner** (Santa Rosa JC) gave the *Surfing* talk.
  - b) In 2007, Viji **Sundar** (CSU Stanislaus) gave the *Da Vinci* talk.
  - c) In 1996, Dan **Munton** (Santa Rosa JC) gave a *Spotted Owl* talk AND in 2001, Dave **Gilbert** (Santa Barbara CC) gave another *Spotted Owl* talk.
  - d) In 2014, Eric **Hutchison** (C. of Southern Nevada) gave a *Cajon Drum* talk.
3. Ray Wuco (SJ Delta C.) gave a talk at the Dec. 2, 1972 CMC Asilomar conference on *Junior College Calculus*. [The “California Mathematics Council” is a K-12 group]. Then on Dec. 7, **1973**, part of the Asilomar grounds were dedicated to the First Annual CMC<sup>3</sup> Conference, featuring talks by Gerald Alexanderson (UCSC), Al Utterback (Cabrillo C.), Pat Boyle (SJ Delta C.) and George Polya (Stanford U.).
4. In the Spring of 1972, the following officers established CMC<sup>3</sup>:
  - President – Jim **Curl** (Modesto JC)
  - Vice Pres. – Ray **Wuco** (SJ Delta C.)
  - Secretary – Art **Dull** (Diablo Valley C.)
  - Treasurer – Les **Birdsall** (Diablo Valley C.)
  - Board Member – Frank **Denney** (Chabot C.)
  - Board Member – Allen **Utterback** (Cabrillo C.)
  - Board Member – Patrick **Boyle** (Santa Rosa JC)
  - Board Member – Betty **Luan** (American River C.)
  - Board Member – Brandon **Wheeler** (Sacramento City C.)
  - Board Member – Sister Clarice **Sparkman** (San Jose City C.)
5. These **14** talks have included *Geometry* in the title at a CMC<sup>3</sup> Monterey conference:
  - The Cycloid: Helen of Geometry* by John Martin (Santa Rosa JC), 2005;
  - The Role of Geometry after Descartes* by Jean-Marie Laborde (Cabri Geom.), 2002;
  - A Combined Trig and Geometry Course* by Joe Berland + Egl Batchlor (Chabot C.), 2000;
  - Using 4-Dimensional Geometry to Teach Remedial Math* by Peter Graube (NASA), 1995;
  - Connections through Fractal Geometry* by John Engelhardt (S. Oregon State U.), 1993;
  - Fractal Geometry and Chaos* by Tom Teegarden (Taft C.), 1993;
  - Geometry in All Math Classes* by Frad Lane (L.A. Valley C.), 1993;
  - Non-Euclidean Geometry and Mathematical Truth* by Richard Hansen (De Anza C.), 1991;
  - Computers in Geometry* by Barbara Pence (Jan Jose State U.), 1983;
  - Bachmann Geometry for Beginners* by Brother Raphael (St. Mary’s C. in Moraga), 1982;
  - Problem Posing and Solving in Geometry* by Marion Walter (U. of Oregon), 1981;
  - Geometry* by Don Chakerian (UC Davis), 1980;
  - Geometry in College* by Brother Raphael (St. Mary’s C. in Moraga), 1979;
  - Thinking Geometrically* by Don Chakerian (UC Davis), 1976.

**Mark Your Calendar:**

**45th Annual CMC<sup>3</sup> Conference**

**December 8th and 9th, 2017**

**Hyatt Regency Monterey Hotel and Spa**

## Calendar

October 6 - 7, 2017, FTYCMA Fall Retreat, State College of Florida, Bradenton, FL. Contact: C. Altay Özgener Website: <http://scf1.scf.edu/ftycma/html/events.html>

October 6, 2017: ArizMATYC Meeting: Teaching Mathematics in 2017 and Beyond, Chandler-Gilbert Community College Contact: Scott Adamson Website: <http://arizmatyc.org/wp/>

October 7, 2017: 24th Annual WisMATYC Conference, Janesville, WI. Website: [wis.matyc.org](http://wis.matyc.org) Contact: Turi Suski

October 7, 2017: MATYCNJ Fall Conference, Raritan Valley Community College. Website: <https://www.brookdalecc.edu/stem-institute/mathematics/matycnj/> Contact: Sally Mulvey

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

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<sup>3</sup> 44th Annual Conference, Hyatt Regency Monterey Hotel and Spa, Monterey, CA. Contact Katia Fuchs, City College of San Francisco, (510) 325-1616, [efuchs@ccsf.edu](mailto: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/>

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](http://www.momatyc.org)

April 13 - 15, 2018: 51st Annual NYSMATYC Conference, Glens Falls, NY. Contact: Chris Kemp Website: [www.nysmatyc.org](http://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](http://www.cmc3.org)**

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