

Intersection Points

The Newsletter of the Research Council on
Mathematics Learning

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The Research Council on Mathematics Learning seeks to stimulate, generate, coordinate, and disseminate research efforts designed to understand and/or influence factors that affect mathematics learning.

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PRESIDENT'S COLUMN



by Kay
Wohlhuter

RCML as the editor of *Focus on Learning Problems in Mathematics* and of *Investigations in Mathematics Learning*. Thank you for setting high expectations, nurturing authors and manuscripts, and producing a quality journal.

Celebrate!!!!

Five things to celebrate about RCML:

Celebrate Jean Schmittau

I want to personally echo Sheryl's thoughts from the October newsletter about how much I appreciate everything Jean has done for

Celebrate research

With our conference proceedings and our journal, it is obvious that RCML values quality research. For me, much of the celebration of research comes from our conferences. I have always appreciated our openness to having conference presentations that involve content ranging from "I have an

idea and I need some guidance” to “this is where I am at with my project” to “here are the final results.” No matter the context, you have a chance to be involved in conversations that challenge one’s thinking about how research helps us to understand and to facilitate the teaching and learning of mathematics.

Celebrate opportunities

Opportunity to network: I have always appreciated that our conference size provides multiple chances to interact with each other – be it over a meal or during a session. I find the energy present at our conferences encourages people to really learn about each other and their interests. RCML networking can lead to supportive mentorships and collaborative research projects.

Opportunity to serve: Little did I know that when I was elected to a Conference Committee position that it would lead to serving as Vice President of Conferences and as President. Each of these opportunities enabled me develop more connections with the RCML family while giving back to the organization. In our next election we will be electing people to the following positions: President Elect, Secretary, and 2 Conference Committee Positions. Seize the opportunity to serve by running for one of these positions.

Celebrate challenges

Challenges need to be celebrated because working through them requires teamwork and makes one stronger. For RCML, the

challenge is maintaining and increasing membership. I mention maintaining memberships as a reminder that the 2013 memberships were due on January 1. For many of us, the conference is when we remember that we owe our dues. I would encourage you to pay your dues now. With respect to increasing membership, I appreciate that many members have invited people to learn about RCML through actions such as bringing their colleagues and graduate students to conferences, talking with visitors at the NCTM exhibit booth, and purposefully advertising conferences. At the same time, I know that we will need to continue to actively seek out members. Please feel free to send me your ideas for increasing membership.

Celebrate transitions

I am also very grateful to Jean for her leadership and assistance as we make the transition to Vicki Schell as our editor. Finding an editor to continue Jean’s outstanding work was not on my wish list when taking on the duties as president. With Jean’s guidance and Vicki’s willingness to serve, we are making a smooth transition.

I also want to thank all of you for your support during my term as president. It has been an honor to serve this organization, and I look forward to being a part of Mary Swarthout’s support team.

2013 RCML Election Results

Thanks to the membership for participating in the recent RCML election. Over 50% of the 2012 members cast a ballot for the three positions being contested (secretary and 2 conference committee members). The membership's vote resulted in the election of the following candidates:

Secretary [2013-2015]

DARLINDA CASSELL

Conference Committee Member [2013-2016]

TRAVIS OLSON

Conference Committee Member [2013-2016]

KANSAS CONRADY

A huge *thank you* to all who ran for office and were represented on the ballot. Be thinking now about participating as a candidate in this year's election – look for nomination forms and information at the upcoming Tulsa conference.

*“Where the Mathematics Comes Sweepin’
Down the Plain”*

RCML 40th Annual Conference

Downtown Doubletree, Tulsa, Oklahoma



A **preliminary conference program** will be posted on the RCML website at <http://web.unlv.edu/RCML/13Program.html> no later than February 15th. Speakers should have already received a preliminary outline of when their sessions were scheduled and we have worked to accommodate changes that have been requested due to travel logistics.

Conference registration can be found at <http://web.unlv.edu/RCML/13Registration.html>. A late fee of \$30 should be added to all registration that occur after February 1, 2013.

Hotel reservations should be at the DoubleTree by Hilton Hotel Tulsa Downtown *by February 13, 2013 to receive the conference room rate of \$85/night* plus taxes. Reservations can be made by calling 918-587-8000 and mentioning RCML and the code **MTH** to receive the discounted rate. Reservations can also be made online by going to <http://www.tulsadowntown.doubletree.com/>. Under “**Special Accounts**” section – Enter the Group ID Code in box next to “**Group/Convention Code**”. Your Group ID is **MTH**.

The hotel will provide complimentary **internet** in your room and complementary **airport shuttle**. Airport Shuttle runs every hour or you can contact the hotel to set a specific time. Parking is free in the hotel garage.

Conference Highlights



Linda M. Gojack, President, National Council of Teachers of Mathematics will provide the closing keynote talk on Saturday. Her talk is entitled, “*Preparing teachers for the CCSS: Looking towards the future.*”

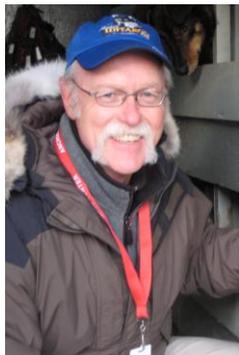
Description: The content standards and mathematical practices of the Common Core State Standards support the learning of mathematics through providing students with opportunities to reason and make sense of the mathematics they are learning. Strategies comparable to those used with students can help teachers to develop a deeper understanding of the content of the common core while encouraging development of the mathematical practices. Let's look at some specific examples.



Melfried and Judith K. Olson, University of Hawaii at MĀNOA, will provide the Founders Lecture on Friday afternoon. Mel and Judy are long-time members and supporters of RCML. Their talk is entitled, “Firm foundations forged by founders and those that follow.”

Description: The lens through which we view our profession is shaped during our graduate studies and our early professional experiences, which hopefully includes RCML. We will provide examples showing how the early mission of RCML (aka RCDPM) to stimulate, generate, coordinate and disseminate research efforts that focus on the learning of mathematics with particular emphasis on those factors which inhibit maximal learning is currently exemplified in many standard practices in mathematics

education. What foundations can we establish so RCML's mission can influence future directions in mathematics education?



Douglas B. Aichele, Oklahoma State University, will provide the Wilson Lecture on Thursday afternoon. Douglas is a Professor of Mathematics. His talk is entitled, “Mathematics and sled dog racing – It’s all about the dogs.”

Description: Alaskan Huskies are amazing canine athletes capable of surviving in extremely cold temperatures for long periods of time and maintaining their racing strength throughout. We will share with you some of the fundamentals of sled dog racing, recent research findings related to their endurance capabilities, and our school-related experiences with young children. There will be time for you to ask Gumbie questions.

Schedule of Events

Thursday, February 28, 2013

Registration, Council Oak Foyer	3:30 p.m. – 6:30 p.m.
Wilson Lecture	5:30 p.m. – 6:30 p.m.
Reception, Council Oak Ballroom	6:30 p.m. – 8:00 p.m.

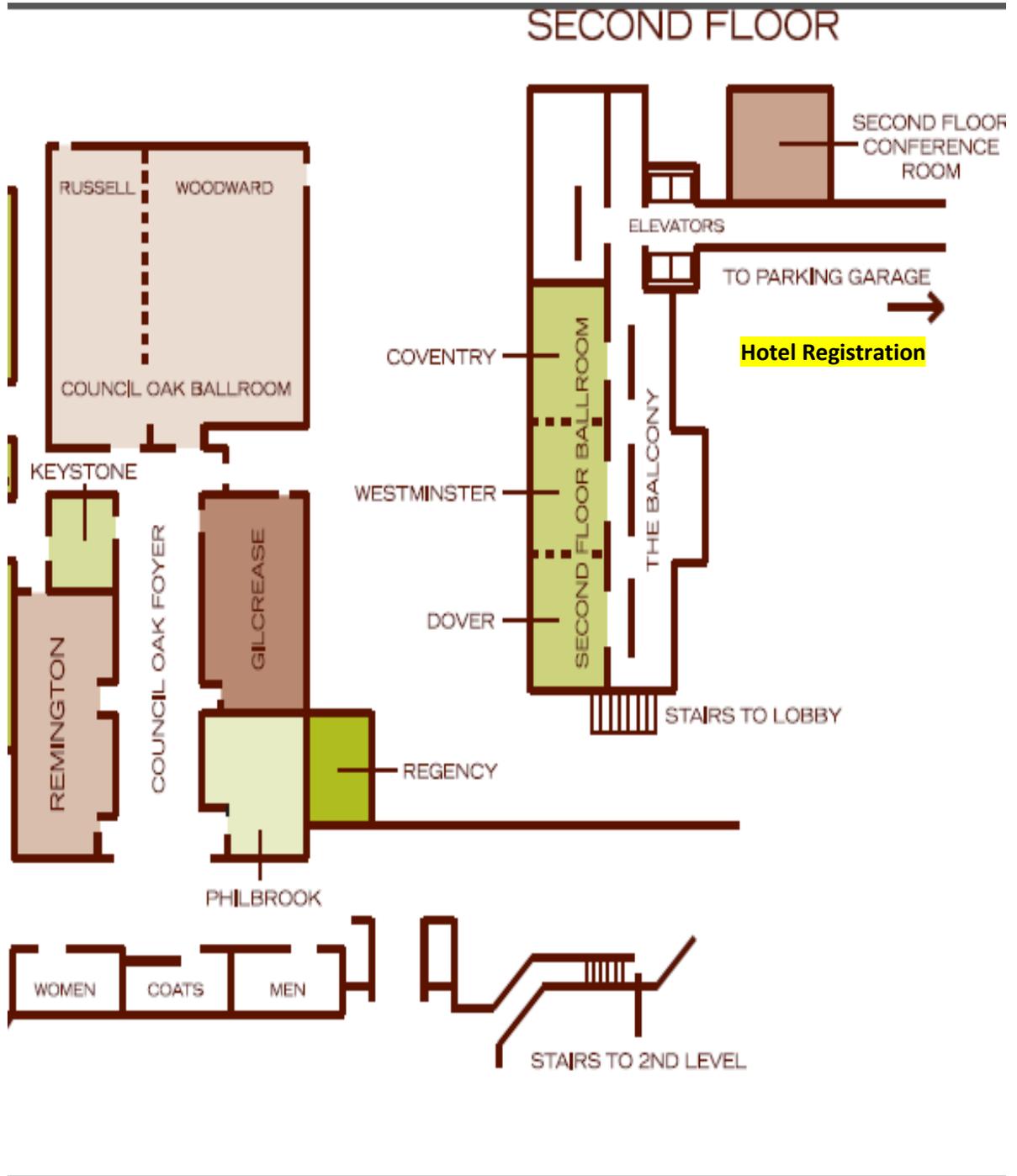
Friday, March 1, 2013

Break-out Sessions	8:00 a.m. – 11:50 a.m.
Lunch and Business Meeting, Council Oak Ballroom	12:00 p.m. – 1:20 p.m.
Break-out Sessions	1:30 p.m. – 4:20 p.m.
Founders Lecture, Council Oak Ballroom	4:30 p.m. – 5:30 p.m.
Dinner on your own	

Saturday, March 2, 2013

Break-out Sessions	8:00 a.m. – 11:50 a.m.
Boxed Lunch and Closing Keynote	12:00 p.m. – 1:30 p.m.

Map of Break out Rooms





Modeling Statistical Significance



by Mehmet Türegün
Barry University

Connections: Modeling, conceptual understanding of significance levels, chance, data collection, and evaluating evidence provided by data.

The purpose of my contribution to the Connection Points column is to describe a modeling approach designed to have students arrive at the idea of statistical significance levels by way of discovering the notion of significance based on their own observations as they play the role of data detectives. I wish I could claim this clever idea as my own original thought. I have come across a similar activity or demonstration many years ago in a Journal of Statistics Education article written by Stephen Eckert of Texas A&M University (Eckert, 1994). A few years later Roxy Peck of Cal Poly – San Luis Obispo has talked to me about another yet slightly different version of this activity in an AP Statistics meeting. I have been using various versions of the activity over the years in my undergraduate statistics, and graduate level mathematical problem solving, and research methods courses.

Increasing importance of collecting and organizing data, and exploring chance are described repeatedly by the National Council of Teachers of Mathematics (NCTM) standards documents (NCTM, 2000; 1995; 1989) as major goals and trademarks of statistical activity across the school years. Also stressed were the use of statistical methods to describe analyze, evaluate and make decisions, and the creation of experimental and theoretical models of situations involving probabilities for grades 5-8 (Watson, 1998).

Some of the most difficult inferential statistics concepts for teachers to teach and students to understand can be listed as the sampling distributions, standard error of the mean, the idea of statistical significance, and the logic behind hypothesis testing (Ryan, 2006). In the age of readily available computer simulations and applets, one can certainly use various applets available to demonstrate these ideas via simulations. However, starting with a hands-on simulation or model, and involving students in the process have numerous intrinsic values, and are highly recommended by the statistics education research community (Chance & Rossman, 2006). Not only do the hands-on models give students a sense of ownership, but these hands-on models also provide a better understanding of the concepts. Hence, the use of a subsequent computer simulation has a less chance of becoming a meaningless activity using technology.

Typically most classroom discussions on statistical significance in hypothesis testing involve statistical significance levels of

$\alpha=0.05$ and/or $\alpha=0.01$, which are to be compared to the calculated P-values in order to decide whether to reject or fail to reject a null hypothesis. In their statistical diversions piece, Petocz & Sowe (2008) challenged teachers to come up with practical ideas on advancing statistical literacy. One of the questions they posed was as follows: Where do these "almost iconic" numerical values come from? When questioned as to where these significance levels of 0.05 and 0.01 come from, teachers generally refer to them as commonly used conventions. A few teachers might mention that they are commonly agreed upon definitions of a chance occurrence. In other words, an event occurring as extreme as 1 out of twenty or 1 out of a hundred times is likely to have happened by chance.

The above outlined discussion hinges on using the significance levels $\alpha=0.05$ or $\alpha=0.01$ as the starting point, and tries to explain the reasons behind using these two significance levels, but falls short of developing a conceptualization of these significance levels. What follows is a description of a modeling activity which can be used to help students develop a conceptual understanding of statistical significance levels. Two decks of playing cards with identical design faces, and an optional twenty-dollar bill are the materials needed to carry out the activity. The optional twenty-dollar bill may be used at the conclusion of the activity to order a pizza for the class to enjoy while reflecting on the activity.

Prepping: Prior to going into the classroom start by taking the cards with identical design faces out of the boxes in which they were originally packaged. Since the jokers will not be used, take out the jokers from each deck, and set them aside. Arrange the decks so that each deck consists of only red or only black color cards. Put the decks, now consisting of the same color, back into their original boxes.

At this point, you have a deck of only black cards in one box, and a deck of only red cards in the other box. Be sure to have an inconspicuous way of identifying which deck is all red, and which deck is all black.

Romancing: Start your class by announcing that you feel lucky and are in the mood for a little game of chance, and take out the \$20 bill, show it to the students, and lay it out on the table. Take out the two decks of cards still in their original boxes, and ask students to choose which boxed deck they want to use. After one of the boxed decks was chosen by the students, make an offer of \$20 to the first student who draws either a red or a black card, depending on the deck chosen.

Delivering: Take the cards from the box, and ask a student to shuffle the cards. You may want to talk to the student who is shuffling to distract him or her from inadvertently noticing that the cards in the deck are all the same color. Now you have a nicely shuffled all black or all red deck of cards. Repeat the offer of \$20 to the first student who draws a red card from the deck, if the deck with all black cards had already been chosen previously by the students, or vice versa. For the sake of simplicity in the ensuing discussion, let us assume that the deck with all black cards is being used. At this point, to add to the suspense, and make the play more convincing, you mention that in order to make it fair for all students, random assignment must be used to determine who is going to draw a card from the deck first. It is important to use random assignment if all students are to have an equal chance of getting that \$20.

You proceed with the first draw. To the disappointment of the first student, the color of the card drawn is not red. You mention, at this point, that the chance of first student drawing a red card was 50-50, or the probability was $26/52=1/2=0.5$. Put the black

card drawn back into the all black deck, and ask the next randomly assigned student to draw the next card. As you repeat this process, usually after the fourth or the fifth draw you start hearing students' murmurs. At this point, they begin to grow suspicious that a surprising event is taking place, and something other than chance is in the play. This is a good point to direct the discussion to the following probabilities of drawing a black card for several successive draws. The probabilities of drawing a black card successively are given as follows:

First draw:

$$(1/2)$$

Second draw:

$$(1/2)(1/2)=1/4=0.25$$

Third draw:

$$(1/2)(1/2)(1/2)=1/8=0.125$$

Fourth draw:

$$(1/2)(1/2)(1/2)(1/2)=1/16=0.0625$$

(growing suspicious?)

Fifth draw:

$$(1/2)(1/2)(1/2)(1/2)(1/2)=1/32=0.03125$$

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Sixth draw:

$$(1/2)(1/2)(1/2)(1/2)(1/2)(1/2)=1/64=0.015625$$

Seventh draw:

$$(1/2)(1/2)(1/2)(1/2)(1/2)(1/2)(1/2)=1/128=0.0078125$$

Based on these probabilities, you form a group discussion on the following questions: Is what we have observed likely to occur by chance? In the absence of an underlying pattern in the population, what is the probability of getting a random sample such as the one we have observed from the population?

The subsequent discussions, sometimes with a little guidance, usually lead to the conclusion that if the probability is small, then we suspect that there may be some underlying pattern in the population. Even though what one may consider small is relative, in this activity, almost invariably it

turns out to be between $1/16=0.0625$ and $1/32=0.03125$. As is the case for many scientific disciplines which use 5 percent (.05) as the border between small and not small when deciding whether an observed result is statistically significant or not. In order to tie the activity to stating a null hypothesis, one may initiate a discussion on the assumptions made by the students regarding the nature of the particular deck of cards used. It is important to point out the essence of the logic of significance testing: You start with a hypothesis (i.e., that the deck is fair), collect sample data (i.e., the successive draws), and ask whether the observed results would be surprising if the hypothesis were true. When the answer is that the results would indeed be surprising, you reject the initial hypothesis (i.e., conclude that the deck is not fair). You may ask students to take a few minutes to write down this reasoning process in their own words while remembering how the results were only unusual based on the underlying initial hypothesis of having a fair deck of cards.

Even though it is not technically correct in the standard hypothesis testing sense, this activity is useful in demonstrating the conceptual understanding of statistical significance, significance levels, and motivates the students to think about stating a null hypothesis and concepts of hypothesis testing. In closing, best of luck to you all in using this activity, and, most importantly, have fun.

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2013 MEMBERSHIP

Membership payment was due on **1 January** for the calendar year **2013**. To renew your membership please send **\$35** to the treasurer, Jean McGehee at the address below. Please note that the conference registration fee is **\$160**. If you are attending the conference and paying for membership, you should pay a total of **\$195**. Also, notify Mary Swarthout, Membership Chair, at swarthout@shsu.edu that you are becoming a member by filling out the form located at our website <http://web.unlv.edu/RCML/memberform.html> and mailing this to her address

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INVESTIGATIONS IN MATHEMATICS LEARNING

Sheryl A. Maxwell, VP

ATTENTION! HAVE YOU PAID YOUR RCML 2013 dues? If you are attending the RCML Conference in late February-Early March 2013 in Tulsa, OK, you have a suburb opportunity to do this in conjunction with the conference registration. This is IMPORTANT as membership in RCML for 2013 is connected to the Volume 6 issues of *Investigations in Mathematics Learning*. You can also send the \$35 annual membership directly to

Jean McGehee
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CHECK your BOOKSHELF:

Have you NOT been receiving the Volume 5 issues of *Investigations in Mathematics Learning*? Were you a member of RCML last year, paying your dues sometime during the year? If not, then you did not receive any of the *Investigations* issues: Volume 5, No. 1 mailed in September 2012, Volume 5, No. 2 mailed in December 2012, and Volume 5, No. 3 that will be mailed and received in April 2013. You see, \$29.00 of the \$35.00 is dedicated to the publication of *Investigations in Mathematics Learning*. The current RCML membership number along with institutional subscribers is how it is determined how many copies of each issue will be printed. We have a

minimal number of extras, but not that many! This calendar year, we had a drop in the number of paid RCML members by August 2012, so fewer number of Volume 5 issues were printed and continue to be printed. Let's change that trend. The RCML Executive Board made the decision to connect membership with the Annual Conference Registration . . . you help by connecting this payment to you RCML Conference by checking the appropriate box.

DID YOU KNOW?

RCML has a new *Investigations* editor – Dr. Vicki J. Schell. She was introduced to you in the last fall newsletter. She will be introduced personally to you at the upcoming RCML Annual Conference in Tulsa, OK. She is scheduled to have a presentation time slot, where she will tell you about the submitting, reviewing, and perhaps eventual publishing of your manuscripts. It would be worthwhile for you to attend this session to gain some of the pointers that she has for you. Then, you can schedule a time to talk personally with her about your ideas. Additionally, you might want to volunteer to be a reviewer of submitted manuscripts. Just give your name, address, e-mail information, and areas of expertise to Vicki Schell. She will be delighted to have new reviewers to add to her list of helpers.

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