President’s Message  
December 2016  by George Reese, ICTM President

A Visit to the  
Complex Instruction  
Consortium

The ICTM 2016 Conference in Peoria was a wonderful time for me, and I hope for all who attended. Final numbers are still coming in, but we had over 600 ICTM members in attendance. The post conference survey indicated that most who could not come found the Columbus Day weekend, distance to travel, or conflicting schedules as reasons for not making the event. For those who did attend, there were many choices for favorite aspects: connecting with colleagues, the keynotes, and the different sessions were all mentioned. The awards ceremony was especially nice for me as it was a mix of people I have known and worked with along with new teachers that bring different voices to our organization. One set of voices that I am most excited about is our newest ICTM affiliate: The Complex Instruction Consortium (CIC).

A perk of being Board President is the responsibility and the opportunity to travel to affiliate conferences and meetings around the state to see mathematics professional development and the programs that support teachers growing into the field. My most recent trip was to Evanston Township High School (ETHS) on November 3rd where I attended the CIC conference. There were perhaps 50 teachers there for the day. I was especially encouraged by what seemed a wide range of ages and experience among the participants. My favorite part was working on the teacher-created math problems and then visiting classes where they modeled the instruction and facilitated group work.

When I entered the session in the morning, the participants had been given a problem with three squares. The three squares were in a line and the middle square had been lifted and rotated 45 degrees as pictured below. We were asked to find the distance from the upper corner (K in this diagram) to the base, segment AE. I sat with a group that had three practicing middle school teachers, and we had a wonderful time with this. Is the distance irrational? If we construct a line through the midpoints of GH and FE, would it also go through the point I? How would we know? The problem stuck with me such that I am recreating it from memory now. I was pleased with that. As a learner, I could hold onto the outlines of the problem. In a sense, I made it my own by working on it alone and with peers.

In the afternoon we visited a freshman class where the instruction was modeled with students. The group of observers included approximately ten teachers. Many were from middle schools that “feed” students to ETHS. I knew this because, as the students came in, they recognized their former teachers. There were hugs and joy as these reunions took place. When the students and observers settled for the lesson, the kids were put into groups of four. The problem was one of a 3x3x3 cube (like a Rubik’s Cube) made up of 27 smaller cubes. If
the large cube is dipped in paint so that all
the outer faces are covered, how many faces of the total are
covered? If additional cubes are added to make the larger cube a
4x4x4, how many of the total faces will be covered? How many
cubes will there be with three faces painted? With two? With
just one face painted? With no paint on them at all? How will
these number change as the larger cube grows?

We watched as the students wrestled with the problem, and the
students shared some plausible solutions with their peers by the
end of the class. There was not adequate time to build on the
ideas presented, and none of the groups found any generalized
solution. That is, none were able to come up with a rule for how
many individual cubes are painted in a large NxNxN cube.
The part that really impressed me with the conference was that
the challenges also became clear. When the observers convened
to discuss what we had seen, I learned that many of the students
should have been familiar with the problem! Connected
Mathematics (the middle school program) has a unit called,
Frogs, Fleas, and Painted Cubes. So while there were shouts
of recognition and affection for the teachers, surprisingly, there
were none for the problem that they were working on.
Should we be concerned that there was not a lot of obvious
retention for the mathematics material? I would say, somewhat,
but not too much. I witnessed effort and perseverance from these
young people. I saw their attachment to their former teachers
and their willingness to engage. From my observation, I did
not see their ownership of the mathematics, but the groundwork
was there, and the process needed to be fleshed out. It was a
testament to the courage of these young teachers that they were
willing to share their problems and instructional methods in an
actual classroom and let us outsiders in to see the process. As I
observe more of these sessions and see the CIC present more of
their work at the ICTM conferences, I look forward to seeing
students taking ownership of their learning and building the
same affection for mathematics that these teachers had.

Greetings, mathematics educators across Illinois! Thanks to
all who made this year’s ICTM/ISTA Annual Conference in
Peoria a success! And a special thank you to all participants who
not only took a moment to fill out the post-conference survey,
but also to those of you who offered to contribute your time
towards the planning of future conferences. As we form new
planning committees, we promise to be in touch in the near future
regarding these volunteer possibilities. Remember that our next
ICTM/ISTA Annual Conference will be held in October 2018
since Chicago will be hosting the NCTM Regional Conference,
November 29-December 1, 2017.

As we move forward in the coming year, we are excited to
continue providing opportunities for mathematics teachers to
share resources across a variety of platforms. For example, our
webinar series brings inspiring speakers and relevant teaching
information right to our doorsteps. I also encourage you to like
us on Facebook (Illinois Council of Teachers of Mathematics,
ICTM), and/or follow us on Twitter (@mathictm or use
#ILmathchat).

To our outgoing board members—Bob Mann, Anita Reid, Craig
Cullen, and Martin Funk—you will be missed! We hope you
continue to share your time and expertise with ICTM even though
we won’t be seeing you at board meetings. And to our incoming
board members, welcome! Our newly-elected board members—
Annie Forest, Evan Taylor, Esther Song, Tammy Voepel—are
a talented, energetic, and passionate group of mathematics
educators! We are so very fortunate to have all of you on the
board.
ICTM 2016 Scholarship Awardees
from left to right:
Katie Yan, Theodora Neofotistos, Katina Tole, Mackenzie Becherer

ICTM 2016 Awardees
front row left to right:
Richard Rukin, Emily Weber, Reggie Duncan, Jennie Winters, Ben Hyman, Back row left to right:
Andy Isaacs, Steve Viktora, Bill Roloff

Newly Elected ICTM Officers and Directors
from left to right:
Jackie Murawska ICTM president-elect, Evan Taylor at-large, Annie Forest director 5-8, Esther Song director 9-12, Tammy Voepel director University/Community College
Friday afternoon, October 23, many Illinois mathematics teachers had a wonderful experience as the ICTM awards were presented. The recipients were recognized by their colleagues for their excellence, and those in attendance were able to affirm what it means to be a truly outstanding educator. Once again, it was inspiring to experience the good feelings that went out to these distinguished colleagues.

Now it is time to identify the next group of award winners for 2016. The first step in the process is nomination. That requires a few people to take the time to identify the strengths and contributions of someone that they work with or someone who has taught them or their children. The sad part of this year’s award ceremony was that no one received the outstanding elementary math teacher or outstanding post-secondary teacher award because no one was nominated for either. I know there are many deserving teachers. So do you. Please take the time to help them get the recognition they deserve. Instructions for nomination are on the ICTM website. Nominations do not need to be submitted until the last day in March, 2016, but now is a good time to decide who you are going to nominate and get organized to do it. If you nominated someone in the past who is still eligible for the award, and that person did not get the award, all you need to do is ask us to reactivate the nomination. You can add to it if you like. Many of the recipients of recent awards were nominated in previous years and did not get the award at that time.

ICTM AWARDS AVAILABLE

• Elementary Mathematics Teaching Award
• Middle School Mathematics Teaching Award
• T.E. Rine Secondary Mathematics Teaching Award
• Post-Secondary Mathematics Teaching Award
• Max Beberman Mathematics Educator Award
• Lee Yunker Mathematics Leadership Award
• Distinguished Life Achievement in Mathematics Award
• Illinois Promising New Teacher of Mathematics Award
• Fred Flener Award: Engaging Students in Mathematics Beyond the Classroom

Specific award criteria and application forms can be found on the ICTM website, at www.ictm.org. With your help, ICTM can continue to recognize excellent mathematics educators in Illinois!

Award application deadline is March 31, 2016

John Benson and Eric Bright
Planning to Attend the T3 International Conference?

The 2017 T3 International Conference will be held at the Hyatt Regency in Chicago Illinois from March 10-12, 2017. The October 15th deadline for the early bird $100 registration has passed, BUT don’t despair! If you contact Ray Klein at rklein9019@aol.com, he will share a special T3 instructor promotion that will allow you to register for the special $100 registration fee.

2017 Regional Conferences & Expositions:
Chicago, Illinois
November 29 - December 1, 2017
Polynomial Paper Assignment: Teacher Comments

After studying polynomials and polynomial behavior, students in an Algebra 1 level course are asked to write a paper answering the question:

*How and why does changing the constants and coefficients in linear, quadratic and cubic equations written in standard form change the graph of a function?*

Some thoughts on each:

- **LINEAR FUNCTIONS**
  - **COEFFICIENTS:** Graph \( x + y = 1 \) as the original function. Using the standard form linear equation \( Ax + By = C \), change the coefficient \( A \) and the coefficient \( B \).

  Students are tempted to explain these changes by only saying it changes the slope. While that is true, students should be able to show that the slope (or rate of change) is \(-\frac{A}{B}\) which means that changing the value of the coefficients will change that ratio in specific ways. They should also be able to address why the \( y \)-intercept is anchored when \( A \) changes and why the \( x \)-intercept is anchored when \( B \) changes.

  - **CONSTANTS:** Then change the constant \( C \).

    Is this a translation up and down or left and right? If we let \( g(x) = -x + C \) where the parent function if \( f(x) = -x \), we can see that \( g(x) = f(x) + C \) so that it is really a translation up and down. Another way to view this is to let the slope be something other than one or negative one and note that the left/right movement does not match the \( C \) value while the up/down movement does.

- **QUADRATIC FUNCTIONS**
  - **COEFFICIENTS:** Graph \( y = x^2 \) as the parent function. Using the standard form quadratic equation \( y = ax^2 + bx + c \), change the coefficients \((a \text{ and } b)\) one at a time.

    While these changes can be explained quickly with calculus, they can also be explained with ease by simply thinking about big/small and pos/neg numbers. For example, increasing the \( a \) value makes the parabola skinnier because every previous output (height) is being multiplied by a bigger number thereby making the new output (height) even larger. This can also be seen by showing that if \( f(x) = x^2 \) and \( g(x) = ax^2 \) then \( g(x) = a \ast f(x) \) which means it is being stretched a times farther from the \( x \)-axis.

    Explaining graphical changes when increasing or decreasing the \( b \) value can be in the form of knowing the vertex is at \(-\frac{b}{2a}\) from the quadratic formula, but it can also be explained by looking at positive and negative inputs separately. Consider when \( b \) is increasing greater than 0. On the positive side of inputs (when \( x > 0 \)), we are now adding a value thereby increasing the total output. On the negative side of inputs, we are subtracting a value thereby decreasing the total output. That makes it shift the vertex down and to the left. You can also have students find the zeros of \( f(x) = x^2 + bx \). A fun bonus exploration is seeing why the new vertex is always on the parabola \( y = -x^2 \).

  - **CONSTANTS:** Then change the constant \( c \).

    This is again the translation piece.
CUBIC FUNCTIONS

○ **COEFFICIENTS:** Graph \( y = x^3 \) as the parent function. Using the standard form cubic equation \( y = ax^3 + bx^2 + cx + d \) change the coefficients (\( a, b \) and \( c \)) one at a time.

*Changing the value of \( a \) again changes how far it stretches from the \( x \)-axis. Changing the value of \( b \) always increases (when \( b > 0 \)) or decreases (when \( b < 0 \)) because \( x^2 \) is always positive. Changing the value of \( c \) will have different effects on either side of the \( y \)-axis due to the fact that we are adding either a pos*pos on the right while a pos*neg on the left or vice versa (depending on whether you have \( c < 0 \) or \( c > 0 \)).*

○ **CONSTANTS:** Then change the constant \( d \).

*Again with the translation up and down.*

Desmos (found at [www.desmos.com](http://www.desmos.com)) is a fantastic and free option to use for this exploration. Having the sliders available is very powerful for students to see the graph “in motion”. I usually dedicate about a week of class time to exploration and discussion while students are writing the paper. Specifically, I graph these:

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<thead>
<tr>
<th>Linear: Changing ( A )</th>
<th>Compare ( x + y = 1 ) to ( Ax + y = 1 ) with a slider on ( A )</th>
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<tbody>
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<td>Linear: Changing ( B )</td>
<td>Compare ( x + y = 1 ) to ( x + By = 1 ) with a slider on ( B )</td>
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<tr>
<td>Linear: Changing ( C )</td>
<td>Compare ( x + y = 1 ) to ( x + y = C ) with a slider on ( C )</td>
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<td>Quadratic: Changing ( a )</td>
<td>Compare ( y = x^2 ) to ( y = ax^2 ) with a slider on ( a )</td>
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<td>Quadratic: Changing ( b )</td>
<td>Compare ( y = x^2 ) to ( y = x^2 + bx ) with a slider on ( b )</td>
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<td>Quadratic: Changing ( c )</td>
<td>Compare ( y = x^2 ) to ( y = x^2 + c ) with a slider on ( c )</td>
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<td>Cubic: Changing ( a )</td>
<td>Compare ( y = x^3 ) to ( y = ax^3 ) with a slider on ( a )</td>
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<tr>
<td>Cubic: Changing ( b )</td>
<td>Compare ( y = x^3 ) to ( y = x^3 + bx^2 ) with a slider on ( b )</td>
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<tr>
<td>Cubic: Changing ( c )</td>
<td>Compare ( y = x^3 ) to ( y = x^3 + cx ) with a slider on ( c )</td>
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<tr>
<td>Cubic: Changing ( d )</td>
<td>Compare ( y = x^3 ) to ( y = x^3 + d ) with a slider on ( d )</td>
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For enrichment, you can ask students to look at cases where multiple transformations are taking place. Speaking of transformations, this is a good opportunity to connect the transformation of these functions to the transformations students saw in the 8th grade Common Core standards. Which of these things produced translations? Which produced rotations (about what center of rotation)? Which produced reflections (specifically across the \( x \)- and \( y \)-axis)? *BELOW IS A LOOK AT DESMOS IN ACTION.*

![Slider in Desmos](image)

You’ll see the graph moving down and to the left away from the parent function as the \( b \) value increases.
Polynomial Paper Assignment

Write a 3-5 page paper (11 pt. Calibri font, double spaced, 1 inch margins) answering the question:

*How and why does changing the constants and coefficients in linear, quadratic and cubic equations written in standard form change the graph of a function?*

Specifically:

- **LINEAR FUNCTIONS**
  - **COEFFICIENTS:** Graph $x + y = 1$ as the original function. Using the standard form linear equation $Ax + By = C$, change the coefficient $A$ and describe how that affects the graph. Explain why the graph changes the way it does when $A$ is increased to higher positive values, decreased to lower negative values, and near zero. Note any significant observations while graphing the functions. Do the same thing for $B$.
  
  - **CONSTANTS:** Then change the constant $C$ in the linear function and describe how that affects the graph. Explain why the graph changes the way it does when the constant is increased, decreased, and near zero.

- **QUADRATIC FUNCTIONS**
  - **COEFFICIENTS:** Graph $y = x^2$ as the parent function. Using the standard form quadratic equation $y = ax^2 + bx + c$, change the coefficients ($a$ and $b$) one at a time and describe how that affects the graph. Explain why the graph changes the way it does when $a$ is increased to higher positive values, decreased to lower negative values, or near zero. Explain why the graph changes the way it does when $b$ is increased, decreased, or near zero. Note any significant observations you made while graphing the functions.
  
  - **CONSTANTS:** Then change the constant $c$ in the quadratic function and describe how that affects the graph. Explain why the graph changes the way it does when the constant is increased, decreased, or near zero.

- **CUBIC FUNCTIONS**
  - **COEFFICIENTS:** Graph $y = x^3$ as the parent function. Using the standard form cubic equation $y = ax^3 + bx^2 + cx + d$ change the coefficients ($a$, $b$ and $c$) one at a time and describe how that affects the graph. Explain why you think the graph changes the way it does when $a$ is increased to higher positive values, decreased to lower negative values, or near zero. Explain why you think the graph changes the way it does when $b$ is increased to higher positive values, decreased to lower negative values, or near zero. Explain why you think the graph changes the way it does when $c$ is increased to higher positive values, decreased to lower negative values, or near zero. Note any significant observations you made while graphing the functions.
  
  - **CONSTANTS:** Then change the constant $d$ in the cubic function and describe how that affects the graph. Explain why the graph changes the way it does when the constant is increased, decreased, or near zero.
## Grading Rubric

<table>
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<th>Increasing Conclusion and Explanation for Why (3 pts)</th>
<th>Near Zero Conclusion and Explanation for Why (3 pts)</th>
<th>Negative Conclusion and Explanation for Why (3 pts)</th>
<th>Graphs Given as Supporting Evidence (1 pt)</th>
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**Final Score:** ____ / 100
I was incredibly humbled and honored to receive the 2016 ICTM Excellence in Elementary Mathematics award with both my proud mother and father present. It was very fitting that the award ceremony took place on my father’s birthday as he and my mother’s combined lifetime of sacrifices and emphases placed upon education birthed within me the decision to pursue a career in this great field. Both my mother and father came from very humble beginnings and instilled within both of my siblings and myself a strength of will, work ethic, humility, and appreciation for all things, big and small, we have been blessed enough to receive in this life. My father, the oldest of nine, and my mother, the third of seven, both made clear to all of their children the importance of education, hard work, and opportunity.

As military brats, it could have been very easy for us to take for granted the educational and financial opportunities we were provided both inside and outside of the classroom as we traveled the world during our formative years. However, my parents always kept us centered and accentuated how very blessed we were to be in the privileged positions the United States Air Force and my parent’s sacrifices provided us on a daily basis. My father’s education took place in both the streets and the school hall and he was sure to point out to us that although we all have the power of choice, we must never be remiss in respecting the scale-tipping influence of both education and opportunity many of our close friends and family members did not have the luxury of enjoying.

At the awards ceremony, I stood proudly before both of my parents as a true testament of the transformative power of education. Both were the first in their respective families to attend college and, as a result of their hard work and indomitable wills to maximize every opportunity afforded to them, they cultivated a family of accomplished doctors, teachers, and authors. My father retired as a CMSgt. in the United States Air Force with a Master’s in Business Administration, my mother a PhD in Psychology with a private practice close to home, my brother a PhD in Medical Administration and published author, my sister a licensed therapist with a Master’s in Social Work with a play therapy center in St. Louis, and I am honored to be an award-winning teacher with a Master’s in the career that has changed all of our lives.

Somewhere along our collective journeys, we all encountered teachers of varying levels of experience and effectiveness, but as an educator, I try to remind myself every day that I have that very same power to change a student’s life, perspective, or circumstance through the classroom and life lessons I teach each day. My favorite hip-hop artist, author, and social activist is Brooklyn emcee Talib Kweli whose chosen name is a combination of Arabic and Ghanaian origin meaning “seeker of truth” or “student of knowledge.” His quote from the classic album Black Star is what drove me to pursue a career as a lifelong learner and educator: “At one point will you start to realize that life without knowledge is death in disguise?” It is a powerful question I ask myself every single time I design a lesson for my students to tackle the daunting task of mastering the “magic” of mathematics with the same fervent inquisition that drives me to create it.

In a workshop led by Janet Moore of Western Illinois University a discussion emerged that math is not magic or a series of parlor tricks in the possession of the privileged few gifted enough to unlock its great mysteries. Mathematics, like all knowledge, should be pursued, mastered, and disseminated to all that seek to master it. Each second we are either growing and improving or regressing and dying and I teach all of my students that a life without knowledge is no life at all. Whether these words resonate with them and change their lives in the way it has my own is yet to be seen, but if they do, that would be the true measure of excellence in our field of education.
Attend the TENTH INTERNATIONAL Conference on CAS in Secondary Mathematics

Come explore the future of mathematics education!

Saturday and Sunday June 24-25, 2017
Hawken Upper School, Gates Mills OH (approximately 27 miles from CLE Airport)

Optional Saturday evening tour to Rock and Roll Hall of Fame –more details will be posted online
More information available at http://usacas.org

Organized by MEECAS (Mathematics Educators Exploring Computer Algebra Systems)
The Complex Instruction Consortium (CIC), an ICTM Affiliate, held its annual fall workshop on November 3rd at Evanston Township High School. Over 80 educators representing 34 schools convened to learn effective collaborative learning strategies, write complex mathematical tasks, and observe real classrooms implementing group work strategies. Visit CIC’s website to learn more and attend the Spring workshop at East Leyden High School in Franklin Park on March 8, 2017. https://sites.google.com/site/complexinstruction/
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Please contact any of the following ICTM board members if you have any questions or concerns:

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For ICTM Membership Services, please contact:

[https://ictm.memberclicks.net/](https://ictm.memberclicks.net/)

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**Why You Should Join**

- Connect with other educators working to improve mathematics education.
- Contribute to mathematics education.
- Stay current about regional, state and national meetings.
- Attend conferences at reduced rates.
- Receive the *ILLINOIS MATHEMATICS TEACHER*, a journal with articles about teaching and learning mathematics at levels from kindergarten to college.
- Receive the *ICTM BULLETIN*, with classroom activities, news and information about professional development opportunities.

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**CALL FOR ARTICLES**

*Can you help?*

The Illinois Mathematics Teacher is always looking for new reviewers and articles. If you would like to volunteer as a reviewer or have an article to submit, please contact the editors at imt@ictm.org.

We look forward to hearing from you.