

PLAY BASED LEARNING



Opportunities to teach mathematical concepts occur in many play based settings.

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14 Increasing the participation rate of girls in maths

As an educator or a parent we have all heard the term play based learning thrown around but what does it actually mean? Isn't it a contradiction in terms? Absolutely not! As an early childhood educator I have the privilege of learning the vast capabilities of a child's brain but even more importantly, I have my capabilities consistently challenged by children. This ensures that I am constructing an environment conducive to play based learning.

WHAT DOES PLAY BASED LEARNING LOOK LIKE?

Often I hear this question from parents 'where are all the maths games?'. It seems as though the only way for children to learn numbers is if it is explicitly taught through rolling a dice and counting the number of spaces they have to jump. Don't get me wrong, some children love structured games and there is certainly a place for this sort of play. But what gets me excited is seeing a child develop a mathematical theory regarding capacity while elbow deep in sand.

Continued on page 4

FROM THE PRESIDENT

Jim Spithill - ACER

THE COMMON DENOMINATOR

The MAV's magazine published for its members.

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As the nature of teachers' work continues to evolve it becomes ever more important to adopt a 'strength in numbers' approach, otherwise known as professional collaboration.

The questions surrounding good provision of numeracy/mathematics teaching and learning are pretty much the same from school to school: defining the 'what' to teach, exploring 'how' to do it in amongst the daily routines, finding effective ways to measure the learning growth and address gaps in understanding, and communicating outcomes to learners, leaders and parents. The answers will vary from school to school and from stage to stage.

ACER had two visitors in March from a school in Dubai that has over 5000 students from beginners upwards. The Principal spoke passionately about how she is turning challenges into opportunities, finding time to enrich the curriculum at many levels by 'blurring the boundaries' between the formal curriculum strands in order to provide opportunities in everything from robotics to the arts. She described a process of data capture and deep analysis, so that common weaknesses amongst groups of students are addressed by the most skilled teacher in that area. She expressed concern that too many students are not being sufficiently challenged, as instanced by 18 out of 530 students at one level getting 100% in an ACER mathematics test; 'we need two or three really hard questions in each paper, please'.

We have many, many schools locally with similar challenges and passion to provide better solutions for students. It can be helpful to our professional self-awareness to rebrand a lot of traditional 'teacher work' as 'action research': identify an issue, formulate a solution, reflect on how well it is working, then adapt to changing circumstances.

At the MAV Conference last December it was heartening to attend sessions where teachers were sharing their experiences of classroom trialling and adaptation. The energy and engagement of a number of early career teachers was great to see, along with the evidence of outstanding mentoring being provided to them by their experienced colleagues. Action research exemplified.

As this edition of *Common Denominator* reaches schools, the CEO of MAV, Simon Pryor, will be on long service leave in his ancestral Crete. Simon has been bringing his vast experience in the not-for-profit sector to MAV since 2002, and has guided us through many challenges, lately of a budgetary kind.

In March Simon advised the MAV Council that he will be taking retirement from the time he returns from leave in July. In so many ways Simon has been the public face of MAV during his tenure, and he will be greatly missed. We thank him for his professionalism and generous commitment to MAV, and wish him well for the next phase of life. MAV will hold a farewell function for Simon in July.

Council has initiated a formal recruitment process to find his successor. Meanwhile the previous CEO, Sally Turnbull, is the Acting CEO, as you will note from various other communications lately. We thank Sally for taking on this role.

MAV CONFERENCE

The call for options for the annual MAV conference will open in April. Visit www.mav.vic.edu.au for details.

The conference will be held on 1 and 2 December 2016.

THE MATHEMATICS OF LA TROBE

Katherine Seaton - Associate Professor, Department of Mathematics and Statistics, La Trobe University

The most recently added walk to the Made by Maths app is a mathematical tour of La Trobe University (the Melbourne campus, located in Bundoora).

This campus has native flora, new and old buildings, and many statues and other works of art from each decade since the sixties. The Made by Maths walk enables students to investigate some of these. It could be used as a half-day activity, or in conjunction with one of La Trobe's outreach activities to make a full day, for lower secondaries. You might even consider doing it with an upper primary extension program or maths club.

An example of an activity is investigation of the face of the newest building on campus, the Sylvia Walton building. Using a tablet or mobile phone, students can photograph the features that they see, and annotate them to demonstrate understanding of reflex angles, co-interior angles, complementary angles and various polygons.

One of the earlier features of La Trobe is the beautiful glass panel quartet, The Four Seasons by Leonard French. They are utilised in the walk to investigate symmetry.

From the mathematics of the ancient Greeks (geometry) to the mathematics of the present day – the gardens are used as a chance to be introduced to fractals. A gabion wall is an opportunity to do some estimation. In total, there are 13 tasks to do, with three or four questions in each. These comprise multiple choice or taking a photo and writing about it, or making a short video to explain their response to a question.

The walk does not require students to enter the buildings, focusing on features that are externally visible. But it would also give your students the chance to experience a university campus on a working day. I hope you enjoy doing the walk with a class as much as I enjoyed writing it.



Made By Maths

- > LEARN REAL WORLD MATHEMATICS
- > MASTER THINGS TO DO
- > COLLECT TROPHIES

EXPLORE MELBOURNE WITH THE MAV'S NEW APP

The Made By Maths app showcases mathematics in an engaging and meaningful way. It has been designed to house a number of walks for use by students and teachers on school excursions. The first walk will focus on Swanston Street in Melbourne, suitable for Australian Curriculum levels 7-10.

The app is available for smartphones and tablets. It will provide real world learning as users embark on a journey discovering mathematics in our society.



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PLAY BASED LEARNING (CONT.)

Kirsten Goldsmith - Early childhood educator, Smith Street Children's Centre and Kindergarten

Let me give you some context.

While five children were digging away in the sand pit they decided to create a 'lake for the dinosaurs'. As the team continued to build, one boy decided it was time to fill the hole with water. Another child inspected the hole and decided the lake was just not big enough. As they dug wider they began to notice 'the water is going down'. The child responsible for water kept pouring in water but as they kept digging they continued to make the same observation 'the water is going down'. This is where the role of the educator is so vital. She used an open question to see what the children were actually taking from this. Here is the dialogue that followed:

Educator: So tell me, what exactly are we noticing?

Child 1: The water is going away.

Child 2: When we dig, the water is going down.

Educator: So what is happening to your lake when you dig?

Child 2: The lake is getting bigger.

Educator: Oh interesting, so what was it we noticed about the lake and the water again?

Child 1: The water goes down. The lake is getting bigger.

Educator: Are they connected at all?

Child 2: Yeah! The water goes down when the lake gets bigger.

Child 1: It does, look! (Digs wider, causing the water to spread more)

Educator: Wow you are right! Could we test it?

Child 1: Maybe we can make it smaller and see if the water comes back? (Throws sand into the lake)

Child 2: Look it's going up!

Educator: Have we changed the amount of water?

Child 1 and 2: No

Educator: But we have changed the size of the lake?

Child 1 and 2: Yes.

Educator: So what does this mean?

Child 1: The bigger the lake, the lower the water.

Child 2: The smaller the lake, the higher the water.

Educator: I wonder if this would work with anything else...

And so began our two week long exploration of capacity. The boys were keen to teach others about their observation, learn more about the meaning of capacity once this word was introduced to them.



Did I mention these children were four years old? Incredible right? Let me ask:

- were these children playing?
- was it a specifically designed maths activity?
- did the children discover mathematics through their play?

The role of an educator is to view all children as capable learners. Capable to find meaning in the world around them, to discover patterns in observations they are making and draw conclusions according to these. It is not our role to direct the play so that mathematics or literacy is the key focus but to help draw attention to how these concepts organically fill our lives and experiences. In this way we are building a foundation for deeper thinking, problem solving, investigation and enquiry which they can transfer to their future learning.

MAV UPDATES

EARLY YEARS MEMBERSHIP

Membership is complimentary for early years meeting in 2016. If you are a teacher in an early years setting and would like to take advantage of this opportunity please call Michael Green, MAV's Membership Officer.

There will be a free MAV Early Years Network meeting at Windsor Community Children's Centre, Union Street Windsor from 6pm on 14 June 2016. Register at www.mav.vic.edu.au/pd.

MATHS TALENT QUEST

The Victorian MTQ Rubric has been upgrade to reflected best practice and the Victorian Curriculum. We are grateful to the teachers and coordinators for their consultation and advice on these improvements. The rubric is downloadable from the MTQ website. Registrations are now open!

We look forward to seeing an amazing variety of mathematical investigations in Term 3.

GAMES DAY

Statewide Games Days registrations are open. Thank you to all host schools and sponsors. We are looking forward to these events!

<http://mav.vic.edu.au/activities/student-activities/student-games-days.html>

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To help students understand the careers available, RMIT is offering free maths presentations and interactive activities for your students in your own classroom.

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> To find out more and to book, visit the website or email smgs@rmit.edu.au

www.rmit.edu.au/sciencecurious



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The cover image features a close-up of a person's eye on the left, looking towards the right. Overlaid on the right side is a white wireframe model of a complex geometric shape, possibly a dome or a similar structure. In the background, there is a chalkboard with a handwritten formula: 'Area of panel 1.5m x 2m = 3m²'. The text 'NEW EDITIONS' is printed in large, bold, blue capital letters at the bottom right of the image.

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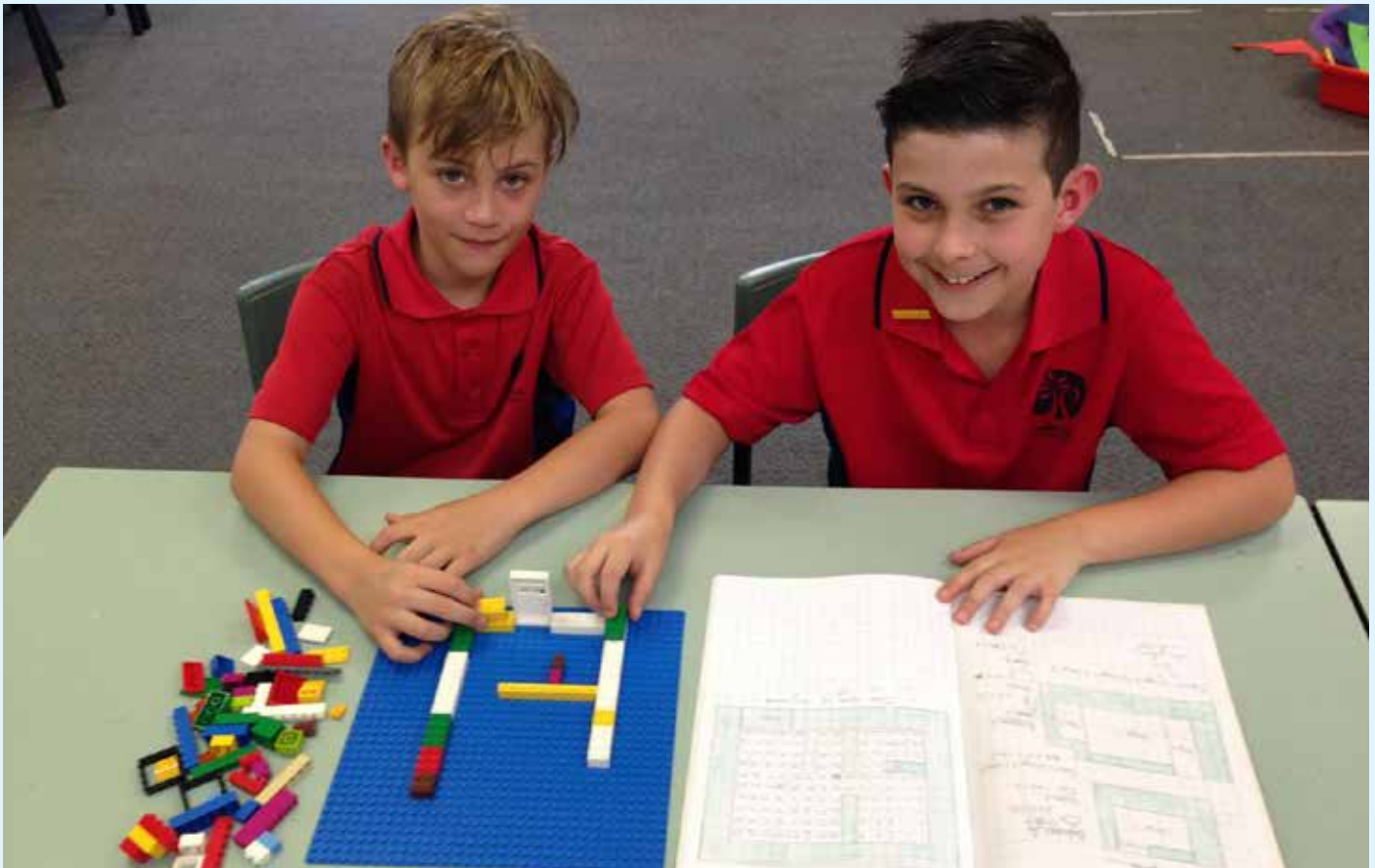
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LEGO FUN

Andrew Noordhoff - Year 3 teacher, Jells Park Primary School



Last year we were invited to the Maths Active School exclusive PD at Inside The Brick (www.insidethebrick.com). The focus was to look at how we could use Lego in the classroom to enhance our Maths program. We loved the PD and soon purchased some Lego kits for the school.

Last year at the MTQ judging I saw a Year 3 project on Lego houses. I loved the project and after the Lego PD at Inside The Brick we wondered if we could devise a project for students to do. From this the *My Lego House* project was born.

We wrote the project on planning day at the end of Term 3 ready to roll it out in Term 4. We would be exploring a range of maths concepts including area, perimeter, counting, money, graphing and interpreting data. The students were extremely excited to start the project once it was introduced. We started the project by having a guest speaker in, my brother who is doing a drafting course. Dave showed us through some of his design sketches and then the students began designing their houses.

There was lots to think about, how many bedrooms would you have? Where would you put them? How big does a room need to be?

The students did a great job with their designs and once they were approved by a teacher they began building their houses according to their design sketch. We had the students build a base layer (one brick high) so that alterations could be made before the walls were built six bricks high. Most of the students found this challenging but with some further instructions the houses began to take shape which was extremely exciting.

In the following lessons we explored many of the other maths concepts and the students loved being able to refer back to their models each time to connect what they saw on paper and what they could visually see. The project stretched on for nearly three weeks and the students walked away with a much greater understanding of the concepts covered which was extremely pleasing from a teaching perspective.

We will be running this project every two years from now on in the Year 3 and 4 classes with our Potato Pentathlon project running in the opposite year which was a huge success two years ago.

Having projects in the classroom has been a fun way to connect multiple competencies for students and the real life connections show how these skills are used in everyday life and in particular occupations.

**MATHS ACTIVE SCHOOL
ACCREDITATION
2016 APPLICATIONS ARE OPEN**

Being awarded MAV's Maths Active School accreditation is a fantastic way to recognise your schools excellence in mathematics learning and teaching. To download the application form visit mav.vic.edu.au/apply-to-join.html.



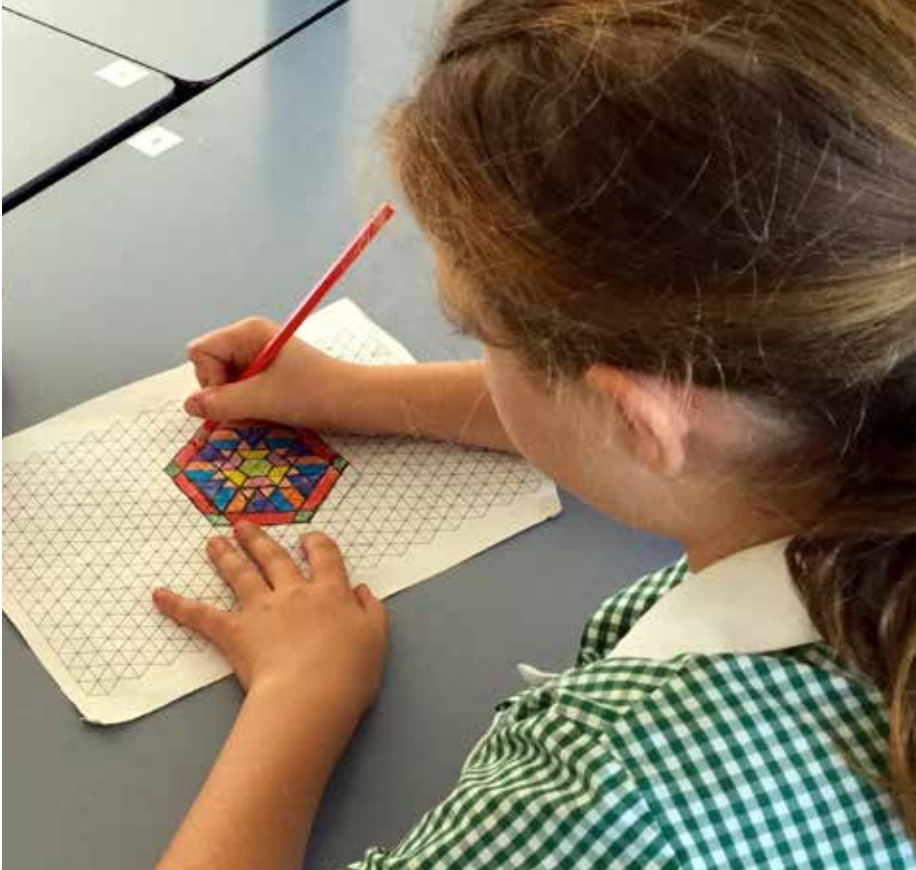
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MATHS ACTIVE
ACCREDITATION

THE QUILT PROJECT

Deb Simpson - Year 3 teacher, Ashburton Primary School



Planning a design on triangular grid paper.

The Quilt Project is designed to be used at the start of the new school year, as a way of helping students to get to know new classmates while introducing them to measurement and geometry concepts and skills. It also sets the scene for a maths program that values collaboration, hands on maths, the use of clear, specific mathematical language and an emphasis on problem solving.

My teaching team has used this project with students from Years 3 to 6. With Years 5 and 6, the main focus is on measuring and drawing angles. With Years 3 and 4, the focus is on identifying the attributes of polygons and naming them, while investigating symmetry and tessellation.

INTRODUCING THE PROJECT

The project is introduced by looking at pictures of quilts, as well as some real quilts - children love to bring their own quilts from home to show. Children are paired with someone they might not usually work with, for example, a Year 6 child with a Year 5 child. Each student is given a quilt

rubric. The shapes used in this project are the yellow hexagon, the red trapezium, the green equilateral triangle and the blue rhombus found in pattern blocks.

EXPLORING

In pairs, the children play with real and virtual pattern blocks, experimenting with tessellation. Walking around, chatting to groups as they work, we have found that children discover, incidentally, the fractional relationships of the blocks. This can become a focus for future maths learning.

There are several good websites with virtual pattern blocks; my favourite is the National Library of Virtual Manipulatives. Here is a selection:

http://nlvm.usu.edu/en/nav/category_g_1_t_3.html

www.mathplayground.com/patternblocks.html

<http://illuminations.nctm.org/Activity.aspx?id=3577>

www.mhhe.com/math/lbmath/bennett_nelson8e/VMK.html?initManip=patternBlocks

www.glencoe.com/sites/common_assets/mathematics/ebook_assets/vmf/VMF-Interface.html

<http://gingerbooth.com/flash/patblocks/patblocks.php#.VZKH1O2qqko>

PLANNING

After experimenting, the partners plan their quilts, first making sketches on their jotters, then putting their designs onto triangular grid paper. Students may also be given the option of designing their quilts online using this website: http://www.emaths.co.uk/images/Virtual_Manipulatives/Isometric_Grid.swf

PRODUCING

Years 5 and 6 children measure and draw hexagons using compasses and protractors. These can then be divided to form trapeziums, rhombuses and equilateral triangles. Years 3 and 4 children use pattern blocks as templates to create their designs.

Here are some websites for learning how to use a protractor:

www.teacherled.com/resources/anglemeasure/anglemeasureload.html

www.amblesideprimary.com/ambleweb/mentalmaths/protractor.html

www.visnos.com/demos/basic-angles

www.mathplayground.com/measuringangles.html

www.mathsisfun.com/geometry/protractor-using.html

www.abcya.com/measuring_angles.htm

Quilts are assembled following their plans and designs can be modified if necessary.

REFLECTING

When the quilts are completed and displayed in a gallery along the classroom wall, visitors are invited to visit and view the finished products. They are encouraged to ask questions and the children have to justify their answers with mathematical language. For example, 'How do you know that is a

THE QUILT PROJECT (CONT.)

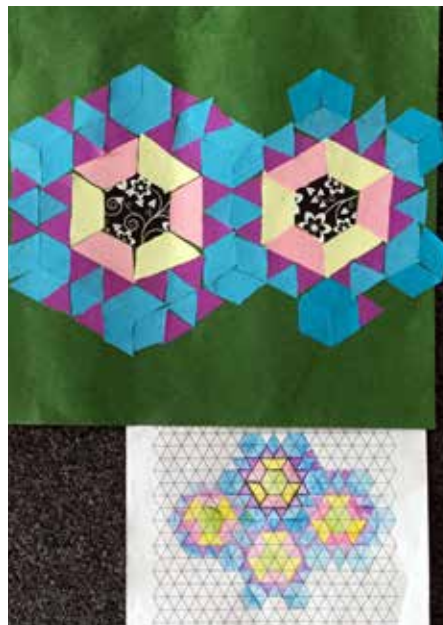


Finished quilt - geometric design.

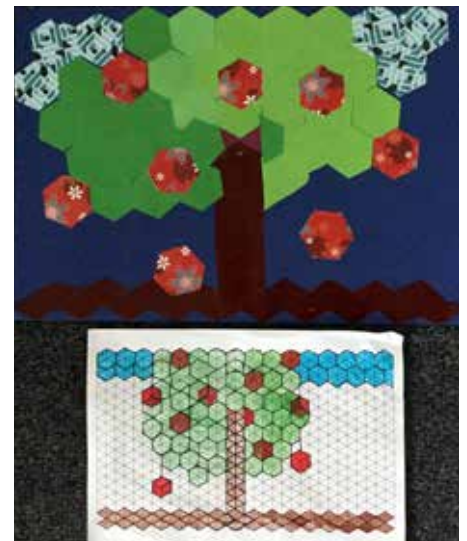
regular hexagon?' would be answered with, 'Because it has six equal sides and each interior angle measures 120° ;' (Years 5 and 6) or, 'Because it has six straight sides and the angles and sides are all equal;' (Years 3 and 4).

At the end of the project, students self assess and reflect on what they have learnt about polygons, angles, design, modifying designs, mathematical language and working collaboratively. The teacher completes an assessment rubric.

The children love this project and are very proud of their quilts; in fact, many choose to make extra quilts at home. It's a great way for children to explore ideas, use mathematical language naturally and develop their problem-solving skills collaboratively. It also gives teachers the opportunity to observe the strategies and qualities their students apply to maths tasks. It is non threatening, there is no right and wrong in this project; all students achieve success and produce something they can be proud of.



Finished quilt picture.



Another finished quilt picture.

THE QUILT PROJECT RUBRIC

In groups, students designed and made a paper polygon quilt. This project involved:

- creating an original design
- using compasses and protractors to construct polygons
- putting the polygons together to create the design.

INSERT PHOTO

FOCUS



Design	The design was not attractive or original.	The design was either attractive or original.	The design was attractive and original.
Angles	The angles were not accurately drawn.	Most angles were accurately drawn.	All angles were accurately drawn.
Polygon	The polygons did not fit together very well.	The polygons fitted together quite well.	The polygons fitted together perfectly.
Team work	The partners did not work very well together.	The partners worked quite well together.	The partners worked very co-operatively.

TEACHER COMMENTS

MATHS NETWORKS

Helen Haralambous - Mathematical Education Consultant, MAV

A mathematics professional learning network serving a group of schools or colleagues in a geographic location can provide very positive experiences through

- allowing teachers to share resources both educational and financial
- opening dialogue and collaboration between the various school levels and sectors
- reducing travel time to workshops by offering local quality professional learning.

Below I have outlined some advice set out as broad guidelines in setting up a Mathematics Professional Learning Network with input from Kerryn Driscoll, a steering committee member of the Geelong-Bellarine network, which has been successfully serving the area for more than eight years.

SUGGESTED GUIDELINES

Document your *raison d'être* (reason for the existence) – eg. A Professional Learning Network that provides Mathematics PL for primary and secondary teachers in a particular local government area (LGA).

OUTLINE YOUR GOALS: THE NETWORK WILL

- plan and offer professional learning that is presented by both members from schools within the network and external presenters (eg. sourced by the MAV)
- offer member schools support via meetings, observations, conferences etc.
- offer other goals specific to the needs of your network

ESTABLISH A STEERING COMMITTEE – DECIDE ON:

- the number of people in the steering committee, suggest that this is no more than four people.
- representation of steering committee I suggest this includes representatives from all sectors of your targeted participants (eg. If participants will be primary from all sectors and levels then the steering committee should have people who can represent the needs of

government, independent and catholic sectors and should be a mix of early, middle years etc)

ONCE STEERING COMMITTEE HAS BEEN ESTABLISHED

Assign roles to steering committee members, examples of key roles could include:

- Contact person - one person to serve as the communicator or email contact who distributes information to teachers on behalf of the steering committee and is the contact for teachers to email attendance responses. This person could also serve as the liaison between the committee and the various presenters (or this role could be shared amongst the committee members)
- Administrative organiser – one person to collate and maintain records such as registration details, i.e. sign-in sheets, participants names, participants schools. (need approximate numbers for each workshop for organising purposes). Record keeping is important as teachers require this information for their VIT PD hours. Some schools require a copy of this for their records.
- Other roles? As decided by steering committee, this could include a treasurer, a liaison person between committee and the presenters (or as mentioned above this role could be shared between committee members

Make a decision on the regularity and purpose of the steering committee meetings, how often will the steering committee meet and what is the purpose of this meeting. eg. The steering committee will meet once a term for planning purposes and otherwise correspond via email.

MEMBERSHIP OF THE NETWORK

Decide on who the members of your network will consist of - primary teachers only or primary and secondary, middle years teachers, F - 12 teachers? eg. Geelong-Bellarine network has both primary and secondary membership, attendance at workshops depends on the workshops presented.

Involve other LGA or regional contacts, such as the tertiary institute in your LGA.

e.g. Geelong-Bellarine network have a contact person at Deakin University and hence the workshops are also advertised to pre-service teachers. This also includes another important group for collaboration.

NETWORK NEEDS

Know the needs of your network. I suggest in your first steering committee meeting you brainstorm a list of PL topics that are priorities for teachers in your network. Then set up a survey and email this out to all teachers in your network. Use the results of the survey to create your program for the year. This will also give you a good indication of the sessions that require an external presenter and the planned cost.

BUDGET

What budget will you require?

- Refreshments and photocopying - you may ask member school Principals to each contribute a nominal annual amount from their PL budget
- Cost of workshops (external presenters), workshops offered by teachers from network schools would be offered as 'free' (with cost of photocopying paid through your budget) and those with an external presenter would be shared amongst participants.
- Membership fee – alternatively you could have a set membership fee that covers refreshments, photocopying and presenter costs. eg. Geelong-Bellarine network: use the model of charging schools membership based on school enrollments those with enrollments of 250 or less paying \$50 and larger schools pay \$75 or \$100 per year.

ENSURE YOU HAVE THE FOLLOWING SUPPORT

- Principals and PL Coordinators: It is important to get the support of Principals and Professional Learning coordinators of all schools in the network for this to be a success. e.g. as a starting point, ask the Principals if they could all allocate a consistent non-meeting night to allow this night for network meeting. You will soon lose staff if they are teaching for the whole



day, attend a staff meeting and then have a network PL.

- The MAV can support networks in setting up an email distribution list for schools in the network. Advertising the network events through MAVLIST, providing presenters.
- ICT support. If presenters external to the host school are using the internet or other ICT equipment have a school technician on hand even if only for the first 10-15 minutes of the workshop to assist in trouble shooting.

TIMING OF PD ACTIVITIES

- How often will the network offer Professional Learning activities/workshops? e.g. PL events will be offered once per month rotating between schools within the network.
- What time will PL activities be offered? I suggest keeping a regular consistent day and time to make it easy for people to remember and lock in. e.g. PL activities will be after school on

the second Thursday of the month from 4pm - 5.30pm. The Geelong-Bellarine network currently run one Professional Learning workshop a term in Terms 1, 2 and 3. These are Thursdays 4.15pm - 5.15pm allowing time for teachers travel and then have a quick afternoon tea and catch up.

PROFESSIONAL LEARNING PRESENTERS

Who will be your presenters? I suggest you have a mix of teachers from the schools in the network and the occasional external presenter e.g. MAV Education Consultant or a consultant sourced by MAV or through the recommendation by network members.

EVALUATE

Professional Learning workshops should be evaluated both for providing feedback to the presenters and to assist the steering committee to ensure they are meeting the needs of their members. Provide feedback evaluation forms (recommend this is done electronically e.g. SurveyMonkey to save

you time) for all sessions (also include a section for future Professional Learning suggestions). When the steering committee meets you can evaluate these and plan for future events.

VICTORIAN MATHEMATICS PROFESSIONAL LEARNING NETWORKS

A number of Mathematics Professional Learning networks are currently operating across Victoria. Below are some examples of Mathematics PL networks.

Geelong-Bellarine network

Operating for 8 years for Years F - 10 Maths teachers in the Geelong-Bellarine area.

Number of schools in the network: 20

2/3 PL events per year.

Contact: Kerryn Driscoll,
driscoll.kerryn.k@edumail.vic.gov.au

Next series of workshops 5 May,
4pm - 5.15pm at Leopold Primary.

MATHS NETWORKS (CONT.)

Warrnambool/Corangamite numeracy network

Operating since 2015 for Years F – 12 Maths teachers in the Warrnambool/Corangamite area.

Number of schools in the network: 15

5 PL events per year.

Contact: Ben Dennis,
dennis.benjamin.j@edumail.vic.gov.au

Western Metropolitan Region Maths network

Newly established, inaugural meeting 3 March 2016 for Years F – 12 Maths teachers in the western suburbs of Melbourne.

Number of schools in the network: 8

Two PL events per term.

Steering committee: Johnson Alagappan, Cherie Reid, Damon Lawty, Jenny Briggs.

Contact: Johnson Alagappan
johnson.alagappan@gilson.vic.edu.au

Next network event: 14 April, 4pm-5.15pm at Gilson College.

TWO NETWORKS ALSO EXIST FOR MATHEMATICS COORDINATORS

Mathematics Heads of Faculty Network

Operating for 22 years (started in 1994) for Years 7– 12 Heads of Mathematics, throughout Victoria. Although membership is predominantly from Independent schools, Heads of Mathematics and mathematics teachers in leadership positions from other school sectors and institutions are also welcome.

Number of schools in the network: 110

One PL event a year on the day when the VCE students sit the General Achievement Test. Teachers also regularly share ideas and resources through the email distribution.

There is no steering committee. The hosting school organises the PL.

Contact: Angela Kotsiras,
mrskotsiras@gmail.com

Details about both the Heads of Maths forums and to sign up to the MathsHoF network teachers should visit <http://mathsteachersonly.com/mathematics-forums/>

Mathematics Coordinators Network

Commenced September 2014 for Mathematics Coordinators from the Department of Education and Training schools throughout Victoria

Number of schools in the network: 200+

Steering committee: 8 members

One PL event per term

Contact: Frances Sidari
sidari.frances.f@edumail.vic.gov.au

If you are interested in joining one of the above networks email either the contact person or Helen Haralambous. The MAV is interested in hearing from other Mathematics Professional Learning Networks.

2016 MAV PD

During 2016 a variety of presenters and MAV's own mathematics educational consultants will present workshops focusing on innovative teaching practice. [Make sure you reserve a place by booking online early, www.mav.vic.edu.au/pd.](http://www.mav.vic.edu.au/pd)

TOPIC	DATE	YEARS	PRESENTER
Meet the Assessors - Burwood	12/4/16	VCE	Various
Meet the Assessors - Burwood	12/4/16	VCE	Various
Making confident maths teachers: teaching junior secondary mathematics - ratio, proportion and percentages	16/4/16	7 - 10	Ian Lowe
Regional conference: Moe	18/4/16	All	Dr Paul Swan
Games: Just trivial pursuits?	19/4/16	F - 6	Dr Paul Swan
Meet the Assessors - Wangaratta	20/4/16	VCE	Various
Algebra	26/4/16	7 - 10	Ian Lowe
Meet the Assessors - Terang	28/4/16	VCE	Various
Working mathematically through collaboration: Clue cards and investigations	3/5/16	F - 6	Jen Bowden
Maths 300 primary workshop	11/5/16	F - 6	Ellen Corovic
Connecting with maths through the body, hand and mind	19/5/16	F - 6	Ellen Corovic
Early maths leaders	2/6/16	F - 6	Jen Briggs
Making confident maths teachers: teaching junior secondary mathematics - introduction and linear algebra	4/6/16	7 - 10	Ian Lowe
Making confident maths teachers: teaching junior secondary mathematics - expanding and factorising expressions	18/6/16	7 - 10	Ian Lowe



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MORE GIRLS CHOOSING MATHS? YES PLEASE!

Janine McIntosh - Schools Program Manager and Choose Maths Program Director, Australian Mathematical Sciences Institute

Every child starts school with the potential to succeed in mathematics.

At the Australian Mathematical Sciences Institute (AMSI), we think of mathematics as a pipeline through school, tertiary education into the workplace. Different factors choke output at points along the pipeline with the result is that Australia is experiencing a period of fewer maths graduates and fewer Science, Technology, Engineering and Mathematics (STEM) capable citizens.

Let's talk about the impact of the mathematics shortage. As well being as useful skills for life in general, STEM skills are critical for Australia's national productivity and global competitiveness. Australia has reached a critical point where capitalising on economic opportunities for future generations requires intervention and innovation to ensure they have the right skills for fulfilling careers and a healthy, sustainable economy. If more girls chose mathematics, we could go some way to addressing the shortage.

According to data gathered by AMSI, 10% of Australian Year 12 students participated in advanced mathematics in 2014 and 19.3% in intermediate mathematics. Participation rates for girls are particularly poor with only 6.8% enrolled in advanced maths and 18.2% in intermediate, compared with 13.4% and 20.6% for boys.

Is the removal of pre-requisites for tertiary study the cause for the decline? Or could it be that students, parents and teachers just don't see a clear career path for the mathematically capable? And why do girls participate at a much lower rate than boys?

We should also be asking where the maths teachers are. Australia does not have a full complement of qualified secondary mathematics teachers. Of the students in Years 7 to 10 in Australian schools, 40% are being taught by teachers who are 'teaching out of field'.

AMSI has partnered with the BHP Billiton Foundation to address just these issues, with strategies across the mathematics pipeline to be implemented over the next four years. The program is designed to entice more girls and young women into mathematics.

TEACHER PROFESSIONAL DEVELOPMENT

Teacher Professional Development will be delivered on-the-ground in 120 Australian schools. Based on a cluster arrangement, where a secondary school and up to three of its feeder primary schools are formed into a professional development group, teachers will work with an AMSI Specialist to focus on enhancing content knowledge in mathematics. The schools in Choose Maths regions have begun this important work with the seven AMSI Choose Maths Outreach Officers.

WOMEN IN MATHEMATICS CAREER AWARENESS CAMPAIGN

A national public-awareness campaign will help students their teachers, parents, and the public see that rewarding and interesting careers exist for people who 'stick with maths'. Material is currently under production, and will be sent to every school in Australia.

INSPIRING WOMEN IN MATHEMATICS INITIATIVE

Drawing on the community of mathematical high achieving women and men currently working in industry and business, Choose Maths will introduce young women to role models who have achieved in STEM and also possess the ability to translate their experience for the audience.

We are gathering profiles of amazing mathematicians – this will be a valuable resource for students, parents and teachers.

THE BHP BILLITON FOUNDATION AWARDS FOR EXCELLENCE IN THE TEACHING AND LEARNING OF MATHEMATICS

Teachers are very good celebrating their students' achievements, but are seldom celebrated for their own. The Choose Maths program will recognise teachers of maths by initiating the Annual BHP Billiton Foundation Awards for Excellence in the Teaching of Mathematics.

The Student Awards will reward student teams who will produce an accurate and innovative video that explains an area of mathematics.

STUDENT AWARDS

The Choose Maths student awards provide the opportunity to acknowledge student achievement in communicating their love of mathematics. Students will collaborate in small teams to create videos around this year's theme 'Maths is more than just numbers'. The winning teams will receive prizes ranging from \$1000 to \$2000.

Encourage your students to get creative and bring their love of mathematics to life on film – head to choosemaths.org.au.

TEACHER AWARDS

Do you know an outstanding teacher of mathematics? One who has successfully mentored girls in mathematics?

The teacher awards include a number of categories with the major prizes awarded to two teachers who have impressed with their outstanding achievement in inspiring and fostering the participation of girls in mathematics. The top two awardees will each receive \$10,000 prize money and an additional \$10,000 to support their school mathematics program. Additionally, eight of Australia's leading mathematics teachers will each receive \$1000 and with an additional \$1000 for their school mathematics program.

REFERENCES

Edwards, Daniel and Smith, T Fred, (2008) Supply, demand and approaches to employment by people with postgraduate research qualifications in science and mathematics: Final Report [Available: http://research.acer.edu.au/higher_education/9]

Discipline profile of the mathematical sciences 2013, Australian Mathematical Sciences Institute (AMSI), 2014 [Available: amsi.org.au/disciplineprofile2015].

Go to choosemaths.org.au to nominate an engaging and innovative teacher who possesses the qualities that help girls to choose maths.

LAURA CHOSE MATHS



LAURA CHEMICAL ENGINEERING STUDENT - RMIT

I chose Chemical Engineering because I wanted to do a course that had both maths and science subjects as well as hands on work experience. On an average day at uni I can be doing anything from differential equations to designing water purification plants or making paracetamol in my chemistry classes. I like how the course isn't just about research and theory. It's how you apply the maths and science concepts to the real world, which is really exciting.

After Year 11, I knew I had to study Maths Methods as a prerequisite, and to keep my options open, but I didn't know whether I'd be able to keep up with the workload.

Day one of Year 12 Maths Methods was with Ms Deylen, and I knew everything would be ok. Ms Deylen encourages everyone and makes all of her students feel like they can achieve great results, even on those days when nothing clicks, the numbers come out all wrong and

you want to give up, but with Ms Deylen giving up was not an option! She'd give up lunch times, after school hours and days in the holidays to answer questions. She kept believing that everyone in our class was capable until we started believing it ourselves!

Maths is a lot of hard work but it's definitely worth it and gives you a greater choice of courses at the end of school.

JACINTA DEYLEN MATHEMATICS TEACHER SANTA MARIA COLLEGE

I have been teaching high school maths for over 30 years and I love it! I love working with people of all ages and being part of a team where we all use our strengths to enhance student learning as well as continue to work on areas that need developing. That for me is what teaching is all about. I enjoy working with other teachers and sharing ideas to help the students in our care flourish. I genuinely really care about all of my students. I want the best for them. I enjoy helping them,

guiding them, challenging them and sharing a maths journey with them.

I have a genuine interest in how all my students are coping with the maths content. I always try to have a few hints to help them out or for those who need a challenge, something to ponder. Some students may not do well in tests but have great reasoning and problem solving skills. So it's important to encourage these students to continue with their fine efforts – they often underrate themselves.

For me, every day is different. It is exciting, challenging and very much people orientated. Like most teachers I am hooked on my students having those 'oh ah' or 'light bulb' moments when everything finally makes sense. It really makes the job worthwhile.

Mathematics is everywhere! It is a universal language so having maths as one of the subjects studied in Year 11 and 12 will open doors for future choices, courses and careers.

MAV PROMOTES RESPONSIBLE GAMBLING

Ian Lowe, Rob Money and Donald Smith

Over the last two and a half years MAV has developed curriculum materials on the topic of responsible gambling. The materials were designed to fit within Year 9/10 Australian Curriculum requirements in Mathematics, English, Health Education and Social Education.

Trialling of the materials in 2015 was supported with funding from the Victorian Responsible Gambling Foundation (www.responsiblegambling.vic.gov.au).

Evaluation of the trials – including detailed statistical analysis – demonstrated positive effects on students' subject knowledge and attitudes to gambling. As far as the mathematics was concerned, some of the key outcomes were

- A better understanding of 'independent trials – 'Chance has no memory'
- A greater understanding of variability in outcomes – 'Short term gain? – Long term pain!'
- risk versus reward and the 'house margin' in commercial gambling

Trialling has led to improvements in the curriculum materials, which are now ready for wider use. The mathematics materials are offered as two units, one on 'pokies' and one on sports betting. A substantial amount of the Australian/AusVELS statistics and probability curriculum could be covered using these two units – ideally the Pokies' unit in Year 9 Semester 2 and the Sports Betting unit some time in Year 10.

In summary, the units are as follows – with Australian Curriculum references included.

UNIT 1: RESPONSIBLE POKIES GAMBLING

1. Skills 1: Four Colours

This lesson uses the same context as the next two lessons. It revisits previous learning about basic probability.

2. Lucky Colours – Fair Game VC167, 169, 171, 172, 293

Students can expose their misconceptions as they bet on which of four colours will be chosen by random selection. They learn that in this 'fair' gambling game the bet

to payout ratio of \$1 to \$4 is equal to the probability of a win. The expected long term return to the punter is 100%, all players have the same chance of winning, and 'the house' has no advantage.

3. Lucky Colours – Unfair Game VC143, 169, 171, 172, 293

Students learn that with a bet to payout ratio of \$1 to \$3, this is now an 'unfair' game, with 75% as the expected long term return to the punter. The key equation is $\text{Expectation} = \text{probability times payout}$ and the 'house' expects to win, particularly in the long run.

4. Going Broke VC 248, 249, 250, 283

Students investigate how quickly an initial stake can be completely lost through \$1 bets in an unfair gambling game. This relates to the notion of 'pre-commitment' as a strategy for responsible gambling.

5. Skills 2: Box Plots

This lesson uses simulated gambling data to review means and medians and to introduce the skills involved in drawing box and whisker graphs. This learning can be incorporated within the data analysis of the Lucky Colours lessons but is preferable to line plots for the data analysis required in the Punt on the Pokies lesson.

6. A Punt on the Pokies VC 248, 249, 250, 283

Students investigate the differences in variability between short-term and long-term betting on poker machines. There is a reasonable chance of winning in the short term, but the chance of breaking even in the long term is remote.

7. An assessment task based on Unit 1 content.

8. Six Pokies a post-unit assessment activity to detect any remaining misconceptions students may have about gambling.

UNIT 2: RESPONSIBLE SPORTS BETTING

1. A Sweep on the Cup AC 143, 225

Different rules for a sweep illustrate differences between fair and unfair games. This is a review lesson - highly appropriate for use in November

2. Sports Betting VC 225, 226, 278

In win/lose and win/lose/draw sports betting contexts students learn how the TAB and bookies use the amounts wagered to set the payouts and their expected profits.

3. A Day at the Races VC 248, 249, 283

Students analyse bookies payouts to obtain probabilities. They calculate the expected return to punters. Betting \$20 on each simulation, some students lose all of their \$100 before the start of the last race.

4. Skills 3: Two Stage Probability

This lesson could be used in connection with the content of the next two lessons. It involves the use of tree diagrams and equally likely outcomes in calculating probabilities for two stage sampling with and without replacement.

5. Two Bets VC 225, 226, 246, 247

Students simulate to obtain experimental data for 2 or 3 stage 'sampling with replacement' betting situations. They then use tree diagrams and equally likely outcomes to calculate theoretical probabilities.

6. The Quinella VC 225, 226, 246, 247

Students use simulated data as a guide to confirming their calculation of probabilities in a 2 stage 'sampling without replacement' betting situation.

7. Getting It Together - a review lesson

8. An assessment task based on Unit 2 content.



MAV is currently developing a professional development package that it feels is an essential component in the release of these materials. This would most likely involve about six hours, with participating schools providing teachers of mathematics and at least one of the other three curriculum areas. Important topics to be dealt with in the maths-focused sessions include

- Introduction to the teachers' notes, in particular the choices available in the ways in which teachers might choose to use the materials.
- The value of hands-on role-play as engagement for the lesson and for understanding of the gambling situation to be examined.
- The value and accessibility of the spreadsheets for obtaining large data sets for the situations being modelled.
- The skills lessons – and the alternative of teaching the skills within the context of the 'gambling' lessons.
- The worksheets and how their use can be integrated with simulation activities and discussion of the key outcomes of each lesson.
- Discussion of assessment opportunities that can be fitted to the school's requirements.

If you are interested in attending this professional development and using these materials then there are two things to do:

- Contact Ian Lowe at MAV, ilowe@mav.vic.edu.au to register your interest and obtain further information about the maths and also the units available in the other three curriculum areas.
- Talk to other key staff at your school about the possibility of a cross-curricular gambling-focused curriculum.

IBM OPENS THEIR DOORS

Manuata Vaka, Zoe Maddy and Seham Herisi - students at Sunshine College

Have you ever looked at technology and wondered how much time, effort and thinking was put into that simple piece of technology we call phones, or that website we use just to get likes, or even that little advertisement that pops up in the middle of our TV shows or computers?

MAV arranged for IBM to open their doors and to the students of Sunshine College. They talked us through the how's, why's and what's of our minds to understanding the works of writing code. In the process we managed to explore the development of technology and workings of online websites, apps and programming.

It was an amazing look into the inside of making, building and fixing apps and websites. The information given to us about coding was has influenced our thoughts on future careers. The ideas that were presented created a new world of learning in our young minds.

The workshop was verbally interactive and we were all able to join in and participate. The freedom we had to ask questions opened up even more learning possibilities. During the end of the workshop we were given the chance to try out what we learnt using a website (codepen.io) which included us working with html, JavaScript and CSS.

One of the favourite parts of the workshop was when a young employee explained how she used her knowledge of maths and design to create part of the Australian Open app for the 2015 grand slam. She explained how working with variables plays a big part in working out the size and shape that the parts of the app need to be when being programmed.

The workshop has been a highlight of our learning this semester - we were given so much to discover, and for our generation - everything we do has some sort of code behind it.

- Seham, Manuata and Zoe are very successful students and have aspirations to go to university. Manuata is interested in business studies whilst Zoe and Seham are leaning towards science with Seham aspiring to eventually study obstetrics.





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2016 MAV SACs

VCE

This electronic resource is designed to provide suggested starting points for VCE Mathematics teachers for their School Assessed Coursework (SACs). MAV SACs 2016 materials have been written by experienced VCE mathematics teachers. They are for use by teachers to aid in assessment of student School Assessed Coursework for Further Mathematics, Mathematical Methods and Specialist Mathematics.

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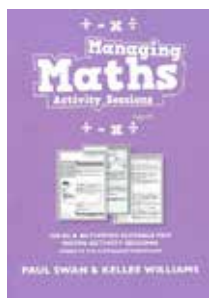


MAV'S FAMILY MATHS NIGHT RESOURCE

F-10

The MAV's Family Maths Night Resource contains a variety of hands on tasks that could be used to engage families in mathematics. The activities within the collection are clearly laid out with materials required and simple instructions for families to follow. There is also a handy resource section to add to the ease of organisation. It is in pdf format (108 pages) which will be emailed to you, it has been designed for busy teachers to quickly and easily obtain quality mathematics activities.

\$85 (MEMBER)
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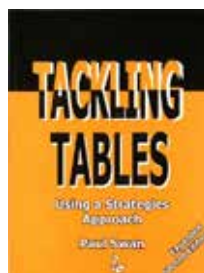


MANAGING MATHS ACTIVITY SESSIONS

2-6

Excellent ideas and activities suitable for a whole school or class based maths activity sessions. This resource has a range of quality activities, resource list and photocopiable activity sheets linked to the Australian Curriculum. From each sale \$5 will be donated to the Breast Cancer Network Australia.

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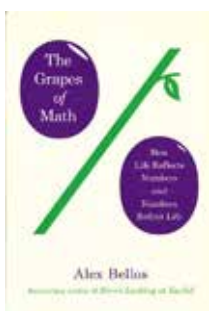


TACKLING TABLES EXPANDED SECOND EDITION

2-6

The ability to fluently recall the basic multiplication facts, or tables, is an important facet of mathematics. Drill and practice activities are often used to develop recall of these facts. The purpose of this publication is to provide teachers with some alternatives to the standard drill and practice activities used in many classrooms. The book is divided into several parts: ideas and activities, reproducible photocopy sheets, background information and teachers' notes.

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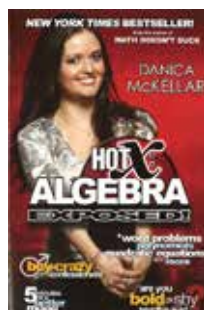


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7-9

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