MATHEMATICS TEACHING toolkit

ISSUES IN THE TEACHING OF MATHEMATICS

Engaging Families in Mathematics Education

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ENGAGING FAMILIES IN MATHEMATICS EDUCATION

"When schools, families and community groups work together to support learning, children tend to do better in school, stay in school longer, and like school more" *(Henderson & Mapp, 2002).*

INTRODUCTION

Families are a child's first educator and this role does not halt on day one of school. Families lay the foundation for future educational success.

They make a difference to a child's attitude, motivation to learn, and academic achievement through showing their positive attitude towards mathematics and being engaged in mathematics and numeracy at home. However, these positive attitudes and actions are not so easy to achieve for all families, and this is where teachers and schools can help. Fostering school-home partnerships is pivotal in enhancing an inclusive education beyond the classroom, and in turn supports mathematics learning in the classroom. But, how are schools encouraging families to engage in mathematics, and capitalising on support from home?

> ***Consider what you and your school are currently doing to engage families in mathematics education. Evaluate and diagnose what are the strengths and areas for improvement?***

A synthesis of contemporary literature found four themes are common to good practice in engaging families effectively in mathematics education:

1. School ↔ home communication.
2. Foster respectful relationships.
3. Positive attitudes to mathematics.
4. Demystify mathematics and build confidence.

These themes come with unique challenges, so recommended actions and helpful tips for each theme are provided to show how teachers and schools can encourage families to engage more with mathematics. Some of these engaging activities include;

- Numeracy and maths take-home bags
- Problem of the week
- Maths wall
- Games
- Maths at Home Letter
- Maths Club for Families
- Family Maths Night
- Family Maths Talks

Paired with links to valuable resources, the useful advice offered in this monograph supports successful school ↔ home partnerships to support our vision for learning:

"All students are empowered to learn and achieve, to experience high quality teaching practice and the best conditions for learning which equip them with the knowledge, skills and dispositions for lifelong learning and to shape the world around them." *(Department of Education and Training [DET], 2019).*

KEY TERMS AND DEFINITIONS

In this monograph, the words "family" or "families" includes parents, caregivers, guardians, and family members who can help children to learn mathematics. 'Beyond school / classroom' means learning undertaken outside the school and classroom, for example at home or in the community. "Numeracy comprises the knowledge, skills, behaviours and dispositions that students need in order to use mathematics effectively in a wide range of situations." (*Victorian Curriculum and Assessment Authority*).

EVIDENCE BASE

The four key themes are the progressive steps teachers and schools take to engage families in mathematics education.

First and foremost is to establish authentic, purposeful two-way communication. Reach out to families to start a conversation about mathematics and ask, 'What are three things you would really like your child to accomplish in mathematics this year?'

Listen for what is being said and not being said. It is essential for respectful relationships that we listen and consider others' opinions. When educators build trust with families, all feel open to share positive and negative attitudes towards mathematics and its teaching.

A question to consider for both teachers and families is, "What beliefs about mathematics do you pass on to those around you?"

Often negative attitudes stem from anxiety and apprehension about mathematics and bad experiences in school. We demystify mathematics and build confidence for families through an explanation of contemporary mathematics classroom practices. Busting some common mathematics myths sets us on the path to stronger school ↔ home partnerships.

1 SCHOOL ↔ HOME COMMUNICATION

Meaningful communication between families and teachers is central for building successful school-home partnerships *(Emerson, Fear, Fox, & Sanders, 2012)*. There are multiple, effective ways educators can communicate school mathematics to families, e.g. "Problem of the week" in newsletters, take-home games, parent-teacher interviews, etc. This one-way communication from school to home is understandable, as many families are keen but unsure how to assist their child due to being uninformed about contemporary mathematics classroom practices *(Muir, 2012)*.

However, establishing two-way communication that values the input of both the school and families has potential to enhance a child's learning in mathematics further.

A Tasmanian school had success with building communication through take-home activities (see Numeracy and maths take-home bags in the supplementary materials) designed for students to engage in weekly activities with their families. The accompanying family feedback forms provided unique observations about their child's mathematical understanding which the teacher could capitalise on and build into the class practice *(Muir, 2012)*. Encouraging families to share anecdotes and activities they tried at home in a monthly Maths at Home Letter, compiled by volunteer parents, furthered communication not only between schools and families, but between families *(Kliman, 1999)*. Families are a rich source of everyday mathematics within varied contexts. Through feedback on discoveries during direct or indirect mathematical opportunities at home, families provide the school with valuable insights into the child's learning.

1 **School ↔ Home Communication**

2 **Foster respectful relationships**

3 **Positive attitudes to mathematics**

4 **Demystify mathematics and build confidence**

Engaging families in mathematics education

2 FOSTER RESPECTFUL RELATIONSHIPS

Forming productive relationships between home and school has potential to improve students' achievements in mathematics *(Baker & Street, 2003)*. This complex and difficult task takes time and effort beginning with forging mutual trust and respect *(Bull, et al., 2008)*. The starting point for building authentic links with families is finding a shared mathematical purpose, perhaps reducing energy use at home and school. Families help students understand the calculations needed to check a home electricity bill and discuss ways to reduce the electricity usage.

Students share these discussions with their classmates and apply this understanding to school energy usage. Students are vital in forging respectful partnerships, since they must be interested and motivated to try out suggested activities at home with their families *(Perkins & Knight, 2014)*. Activities are more likely to be well received if they are purposeful, fun and achievable *(Goos & Jolly, 2004)*, as well as sensitive to families' feelings and knowledge of mathematics *(Berkowitz et al., 2015)*.

3 POSITIVE ATTITUDES TO MATHEMATICS

The way families and teachers view mathematics influences student engagement and success in mathematics. Views on how it should be taught and learned matter. These views influence students' ideas about their capacity to learn mathematics and are closely aligned with parental ideas about learning mathematics *(e.g., Sheldon et al., 2010)*. In mathematics, students who think they cannot do mathematics are most often unsuccessful, whereas those who have a positive mindset and recognise that mathematics can be challenging are more likely to persevere and succeed.

The importance of teachers and families working together to ensure high expectations and positive attitudes toward mathematics in and beyond school for all learners should not be underestimated. We need to actively encourage opportunities to 'see', 'do', and 'talk about' mathematical activities and examples of mathematics in our world to develop positive attitudes toward mathematics in teachers, students and families. For example, encourage students and families to think about mathematics when travelling, cooking, playing games, or shopping; recognise that these activities involve doing mathematics, and to talk to each other about this mathematics. Families can work together to plan a trip to school or the market or the park. Families can discuss what the 30% likelihood of rain tomorrow morning means.
Making constructions from blocks, or scaling up a recipe for four to feed ten, is doing mathematics together. Holding a Family Maths night, or families playing games together, are great ways to develop positive attitudes to mathematics.

Research shows that positive attitudes can lead to improved enjoyment and success *(Emerson, et al., 2012)* as a child becomes more motivated to learn. Families may need support to overcome anxiety and avoidance *(Berkowitz et al., 2015)*. Talking positively about mathematics can have a positive influence on their child's attitude toward mathematics. Whilst families are not responsible for teaching their child school mathematics, they can play an important role in working together with the teacher and child to help them learn, and apply mathematics to everyday situations.

!

Encourage students and families to think about maths when **travelling, cooking, playing games,** or **shopping**

4 DEMYSTIFY MATHEMATICS AND BUILD CONFIDENCE

A family's role in their child's mathematics learning is important *(Cai, 2003)*. Many families want to help their child learn mathematics *(Safford-Ramus, Misra, & Maquire, 2016)*, however, they often lack the confidence to do so *(Goos & Jolly, 2004; Muir, 2012.)*. Families may have a limited understanding of contemporary ways of teaching and doing mathematics, and/or anxiety about their mathematical knowledge, particularly if they were taught procedures without reasons *(Samson, 2004)*. Knowing only 'how' makes it hard to help others, especially when the way 'how' may have changed. Unfortunately, teachers are not always sure how best to support and encourage families *(Sheldon et al., 2010)*.

One approach which proved successful in demystifying mathematics and building confidence in a Western Australian school was inviting families to identify mathematical topics for discussion about contemporary mathematics practices during fortnightly maths for parents sessions *(Goos & Jolly, 2004)* (see Maths Club for families in the supplementary materials). Maths walls are another tremendous way to showcase how mathematics is learned in schools today and to see that teachers value all learning attempts, even when this includes errors or is incomplete. This helps families see that reasoning about mathematics and explaining one's thinking are an essential part of learning mathematics in today's world.

In summary, these four themes are designed to link directly to a school's teaching and learning program, outlining ways an enriched school-home relationship complements the mathematics taught in the classroom and beyond. Individual teachers, groups of teachers, or the whole school, can work toward a common goal of strengthening the home-school relationships to enhance student understanding of mathematics.

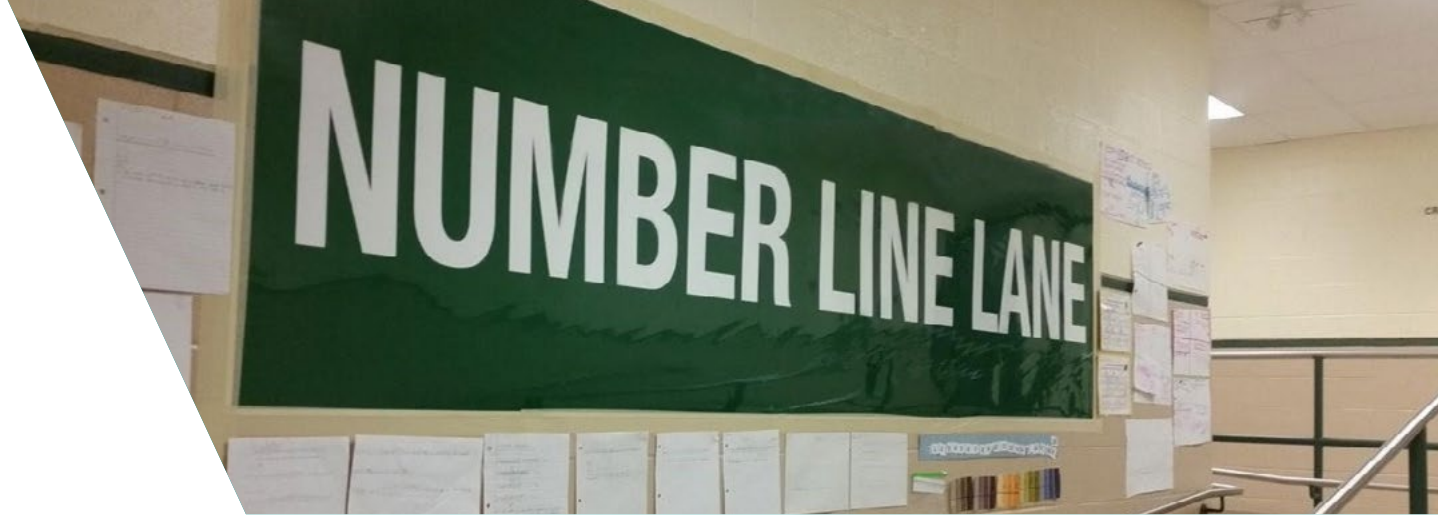


Image courtesy: Marian Small and Doug Duff

ISSUES AND CHALLENGES

Teachers and families have long known how helpful it is for families to regularly read to children and listen to children read as an important component of developing literate students. The same practices need to be extended to mathematics, with families engaged in a range of mathematical activities together (playing games, shopping, cooking) as well as supporting current school mathematical work.

Families are an untapped resource in students' learning of mathematics. How can schools encourage families to engage in mathematics, and capitalise on support from home?

Several barriers must be addressed when developing strategies to engage families in the mathematics education:

- Teachers and families expect families to read to students. The challenge is to build that expectation for mathematics as well.
- Shared awareness that families can and do help with mathematics.
- Awareness that teachers' and families' attitudes to mathematics impacts on engagement and success.
- Families' knowledge of mathematics.
- Families' feelings about mathematics.
- Knowledge of effective approaches to engaging families.
- Challenges to some teachers' traditional beliefs on the teaching and learning of mathematics.
- School-wide approaches to leveraging the potential of school-home partnerships provide opportunities to engage families in their children's mathematics learning. Respectful, two-way communication ensures a seamless flow of information between home and school, supporting students in their learning.
- Building families' awareness of contemporary practices and approaches to teaching mathematics may assist in breaking down the barriers between home and school and boost families' confidence to assist in the learning. Fostering positive attitudes to mathematics both at school and at home counters negative societal views of mathematics.

FIRST STEPS:

What do schools need to do about engaging families in mathematics education?

When teachers and schools foster respectful relationships and engage with families in mathematics education, students' attitudes, engagement and achievement are enhanced. Anyone who reads this monograph and identifies that more engagement with families in mathematics is needed has taken the important first step in the improvement cycle towards affective change. What follows are the actions and a series of enjoyable activities supporting the four themes to plan for change. Monitor and evaluate feedback from families, students, and peers to identify the impact and effectiveness of your actions. Look for changes in students' and families' attitudes towards mathematics, and their engagement or interest with mathematics.

ACTIONS

SCHOOL ↔ HOME COMMUNICATION

Teachers promote authentic two-way communication with families to enhance students' mathematical learning.

Actions for teachers and schools to consider:
(activities referenced can be found in the supplementary materials)

1	Co-design opportunities with families that connect mathematical learning within and beyond school.	See Family Maths Talks
2	Invite families to share their insights from home and personal everyday mathematical tasks.	See Maths at Home Letter
3	Meaningfully communicate current approaches to teaching and learning mathematics with ongoing conversations between families and school.	See Maths Club for Families
4	Actively work with families to discuss student progress and feedback.	See Numeracy and maths take-home bags

FOSTER RESPECTFUL RELATIONSHIPS

Teachers foster respectful relationships with families that value their expertise and detailed knowledge of their children.

Actions for teachers and schools to consider:
(activities referenced can be found in the supplementary materials)

1	Seek and value families' opinions and expertise.	See Parents should be children's first maths teachers
2	Acknowledge and encourage families' independence in creating opportunities for learning mathematics specifically designed for their child.	See Support your parents to kickstart maths learning at home
3	View families as legitimate and valued partners in their child's mathematical learning.	See Advice for Parents, from Professor Jo Boaler
4	Demonstrate sensitivity to families' perceptions of mathematics so that families are empowered through engagement with mathematical activities.	See Maths anxiety in parents | Teacher Talk with Eddie Woo

ACTIONS

POSITIVE ATTITUDES TO MATHEMATICS

Teachers encourage families' positive attitudes to mathematics to nurture students' engagement, enjoyment, and mathematical success.

Actions for teachers and schools to consider:
(activities referenced can be found in the supplementary materials)

1 Work with families to identify and share both positive and negative experiences of mathematics in school and real life contexts to overcome anxiety and avoidance.	See Family Maths Talks
2 Inspire families to value their child's persistence with challenging mathematical tasks.	See The Importance of Struggle and Mistakes are Powerful videos to share with families
3 Co-design opportunities with families to develop positive mindsets to value and enjoy mathematics.	See Shifting the maths mindset in Victorian schools
4 Convey to families contemporary research and resources illustrating mathematical challenges are an opportunity for growth rather than an impediment.	See Twelve steps to increase your child's math achievement

DEMYSTIFY MATHEMATICS AND BUILD CONFIDENCE

Teachers demystify mathematics with families to inspire confidence in doing and talking about mathematics at home.

Actions for teachers and schools to consider:
(activities referenced can be found in the supplementary materials)

1 Explain contemporary mathematics classroom practices to show families how and why mathematics learning and teaching has changed.	See Maths with Parents and Two Strategies to Help Your Child Learn to Love Math
2 Encourage families to engage in ongoing conversations about mathematics at home.	See Maths at Home Letter
3 Provide opportunities for families to engage with mathematical activities at home.	See Games See Family Maths Talks
4 Encourage families to visit or volunteer in the school and see students' multiple representations of mathematical work to expand their view of mathematics.	See Maths wall See Family Maths Night

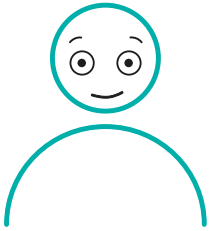
Engaging Families in Mathematics Education

SUPPLEMENTARY MATERIALS

Activities and reference material

ENGAGEMENT ACTIVITIES

Individual: Games



PURPOSE

This individual engagement activity is intended to provide teachers with a stimulus for thinking about the use of games to engage families in students' mathematical thinking and learning. The activity offers a suitable game to try with suggested ideas about evaluating its usefulness in engaging with families. A teacher could consider ways of collecting feedback from families about their experience with playing games. Finally, this engagement activity draws attention to the importance of reflecting on the game's potential to facilitate a rich mathematical experience for families to share.

STIMULUS: APPROXIMATELY 15 MINS

Read the article by James Russo, Toby Russo and Leicha Bragg.

Russo, J., Russo, T., & Bragg, L. A. (2018). Five principles of educationally rich mathematical games. *Australian Primary Mathematics Classroom, 23(3)*, 30-34.

Read the article by Sandra Herbert and Robyn Pierce.

Herbert, S., & Pierce, R. (2004). Gifted are lifted higher: an exploration of the development of higher order thinking skills of gifted students playing strategy games. TalentEd, 22(1), 22-30.

ACTIVITY: APPROXIMATELY 1 HOUR, AND ONGOING

Play a game, for example, Nine Men's Morris.

Rules: http://www.gamepuzzles.com/mfrules.htm#Morris

Printable playing board

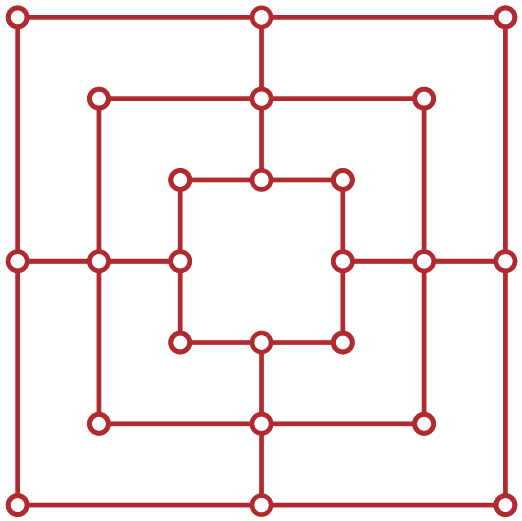
Try out some other games and assess:

- The mathematical potential.
- Engagement potential.
- Clarity of instructions.
- Ease of play.

After playing a few games think about feedback that could be requested from families e.g. Describe a strategy used;

- What was the most challenging part of the game?
- What was something you (the family) learned or need to learn?

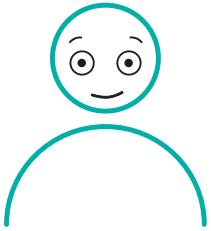
REFLECTION



From the Russo, Russo and Bragg articles, which of the five principles for educationally rich mathematical games do these games address?

ENGAGEMENT ACTIVITIES

Individual: Numeracy and Maths take-home bags



PURPOSE

This individual engagement activity is intended to provide teachers with a stimulus for thinking about the design of suitable take-home activities for families to experience together. The activity offers an article to provide a stimulus for considering how to create suitable open-ended tasks for families. Next, families trial the take-home activities and the teacher collects feedback over time about what families consider useful in the numeracy and maths take-home bags.

STIMULUS: APPROXIMATELY 15 MINS

Read the article by Tracey Muir.

Muir, T., (2012). It's in the bag: Parental involvement in a numeracy at-home program. *Australasian Journal of Early Childhood,* 37(2) 27-33.

ACTIVITY: APPROXIMATELY 3 HOURS, AND ONGOING

After reading the paragraph, brainstorm suitable take-home activities to create for numeracy and maths take-home bags. Draw on tasks from the Mathematics Curriculum Companion to include authentic open-ended tasks for effective differentiation.

You may wish to collaborate with your colleagues for ideas and to support each other.

Create a set of numeracy and maths take-home bags. Consider what each bag will need to support families. We recommend including a family feedback form to assist in evaluating the effectiveness of the tasks.

Enlist family volunteers to trial your numeracy and maths take-home bags for clarity, suitability and accessibility.

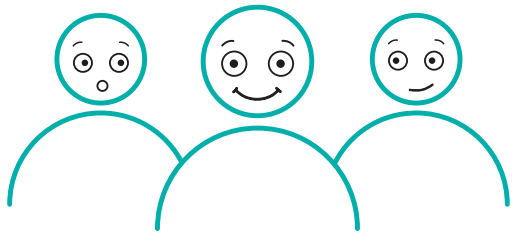
At the end of each week, review the family feedback forms:

- What mathematical concepts were parents noticing?
- What information from the feedback forms can I utilise in my mathematics lessons?
- After a month, review the family feedback forms:
- What are the successes I am noticing?
- What changes can I make to improve this activity?
- What mathematical concepts will I focus when creating new take-home tasks for the bags?

Ensure you share ideas with families and provide additional ways for them to support their child's numeracy at home. Recommend the DET Birth to Level 10 Numeracy Guide – Numeracy at Home section website for inspiration.

ENGAGEMENT ACTIVITIES

Team based: Whole school approach to family engagement



PURPOSE

This team-based engagement activity is intended to leverage the power of working collaboratively with fellow teachers to consider the stimulus of the monograph regarding the role families' engagement with mathematics education can play in improving mathematical outcomes for students. The discussion builds on your shared reflections of the ideas outlined and your joint response to the provocations in developing an agreed plan of action.

STIMULUS: APPROXIMATELY 15 MINS

Read this monograph and its accompanying resources.

REFLECTION

- Which ideas and strategies in the Monograph and resources stand out as most helpful for engaging families in mathematics?
- What is a new idea you would like to try?

ACTIVITY: THE IMPROVEMENT CYCLE 50 MINUTES +

The Australian Professional Standards for Teachers highlights the importance of school-home partnerships, particularly engaging with families in Standard 7. Reflect on the first provocation posed in the monograph which addresses the AITSL standard.

Consider what you and your school are currently doing to engage families in mathematics education. Within Evaluate and diagnose: What are the strengths and areas for improvement?

Share your reflections on the provocation with your colleagues.

Identify your common understanding of the strengths and areas for improvement in your current practices with families.

What ideas for engaging families did your colleagues suggest that you would consider with your families?

Building on your shared reflections on the first provocation reflect on the second provocation posed in the monograph.

Families are an untapped resource in students' learning of mathematics. How can schools encourage families to engage in mathematics, and capitalise on support from home?

What goal/s will you set as a school for engaging families in mathematics education?

From the monograph and resources, follow the improvement cycle to identify and agree on one activity your school could collectively trial collectively and develop and implement the plan.

Monitor progress and keep an anecdotal record of feedback from families and students.

POST IMPLEMENTATION OF YOUR ACTIVITY

Share anecdotal records with colleagues at your next meeting.

What were the successes and challenges you experienced while implementing this activity with your parents?

Consider which of the themes your activity supported.

1. School ↔ home communication;
2. Foster respectful relationships;
3. Positive attitudes to mathematics; and,
4. Demystify mathematics and build confidence.

Evaluate and reflect on what your school could do to improve further engagement with families.

How often should we repeat this activity?

Consider undertaking another activity with families.

Repeat this process and try a different focus theme for next time.

ENGAGEMENT ACTIVITIES

Numeracy and maths take-home bags

Similar to a take-home reader, students take home one mathematics activity at the start of the week to complete with their family members. The numeracy and maths take-home bags are suitable for all age groups and designed to spark mathematical rich discoveries and conversations with family members. The numeracy and maths take-home bags include the activity materials with accompanying checklist, instructions, outline of the mathematical concept addressed in the activity, and a feedback form for a family member to complete and return to school by the end of the week. The activities may be puzzles, problem-solving tasks, games, fun investigations, etc.

For further information, read *Muir, T., (2016). Out of the Classroom, into the Home. Teaching Children Mathematics, 22(8) 496-504.*

Problem of the week

The whole school, year level or class, send home a problem each week for families and students to work on together. Feedback and sample solutions can be shared in the school newsletter. Problem of the week encourages engagement and allows families to see multiple approaches to solving problems.

Problem #1

Look at the calendar. Draw a square around 9 of the numbers. What do you notice? Prompts: If I tell you the top left number, can you tell me the bottom right number? If I tell you the middle number, what can you tell me? Extension: What if the figure can be any rectangle? A cross? What if we replace the calendar with a number grid?

Problem #2

Some people claim rolling a six is harder than rolling a two. Roll a die many times, collect and record your data. Make a convincing argument using your data and other ideas about the claim. Extension: Extend the situation to a 10-sided die or rolling two dice and finding the sum. Think of some claims and investigate.

Problem #3

Many graphs about the coronavirus show two graphs and talk about flattening the curve. Find some examples. If the area under the graph represents how many people become infected, work out a way to see if the two areas are the same or different.

Image courtesy: Marian Small and Doug Duff

Maths wall

A maths wall is an area in your school where you can regularly present 2D or 3D displays of mathematics tasks and student work. The idea is to create a display area where mathematics for a year level or area or the whole school is taken outside the classroom and is on show for the school community.
Teachers may invite families to contribute their home mathematics discoveries or experiences to the maths wall.

Games

Playing games with family members is a fun and enjoyable way to explore mathematical concepts, strategies, engage in logical thought, and problem-solve. Games teach collaboration and help students and their families develop perseverance. Families who experience the games played in school at home with their child witness first-hand the utility of games as a vehicle for promoting mathematical thinking.

Families can play strategy games, such as, Connect 4, Junior Monopoly, Monopoly, Pass the Pigs, noughts and crosses, Mastermind, Guess Who, battleships, checkers, and chess, Mancala, card games (e.g., Set, Spot it) and dice games (e,g., Yahtzee). Families can make their own games, see 20 games for 5–8 year olds or find games online.

For secondary student visit, Secondary Interactive Games. Students can play online or make a version for home. Try Connect Three which uses two spinners with positive and negative numbers and a game board, players choose addition or subtraction and try to get three in a row and block their opponent.

You can find fabulous online games at https://education.abc.net.au/home#!/games Try Building Site, Photo Hunt, Spinners, Dice duels, Scatterplots, Graph Investigator, and many more.

You can find games developed by the indigenous peoples of North America at Games from the Aboriginal People of North America: Math Content

ENGAGEMENT ACTIVITIES

Maths at home letter

Families are encouraged to share their ideas and experience of engaging in mathematics outside the classroom with other families in the Maths at Home Letter. Each month families forward anecdotal notes of their experiences to a volunteer who collates these experiences and ideas into a letter sent out to all families *(Kliman, 1999)*.

Maths club for families

Maths Club for Families is a monthly group run for adults who seek to understand contemporary teaching of mathematics to better support their child at home. Topics for exploration are suggested by the group members. Open-ended and hands-on activities explored in the group are designed to build families' confidence and demystify mathematics.

For further information, read:

Goos, M. (2004). Home, school and community partnerships to support children's numeracy. *Australian Primary Mathematics Classroom, 9*(4), 18-20.

Muir, T. (2012). Numeracy at home: Involving parents in mathematics education. *International Journal for Mathematics Teaching and Learning*, (25 January 2012), 1-13.

Encourage families to share feedback on their interaction with the suggestions from the Birth to Level 10 Numeracy Guide The Numeracy at Home page, which is designed especially for families.

Family maths night

Family Maths Night is a whole school event typically run annually. Activities involve families and students working together on mathematical tasks. Family Maths Night provides an exceptional opportunity to illustrate that mathematics is enjoyable, challenging, rewarding, and that collaboration is a powerful tool for increasing the likelihood of solving a task. These events allow the school to show families first-hand what contemporary mathematics teaching and learning looks like, so that families better understand how and why schooling has changed since they went to school. Families are welcome to ask questions about mathematics and mathematics teaching in a casual, relaxed environment. Program ideas to consider are: invite a guest speaker for part of the session; run a round robin of activities where families make choices about the tasks they want to participate; puzzles; student initiated tasks; maths games as prizes. The greater the participation rates by staff, students, and families, the greater the success of the Family Maths Night.

Family maths talks

Family Maths Talks offer a range of approaches to increasing communication about mathematics between schools and families, and within families.

TEACHER INITIATED CONVERSATIONS

The teacher-initiated conversations are prompted by the teacher or school, stimulating students and families to share and explore mathematics beliefs and understandings together.

Some suggestions are:

- How would your child describe their mathematical capability? What are your child's strengths and limitations in mathematics?
- What beliefs about mathematics do you pass on to others around you? How would you help your child to develop positive attitudes towards mathematics?
- How would you describe your mathematical capability? What is one mathematical skill you wish you were better at? Why?

STUDENT COMMUNICATION ABOUT A MATHEMATICAL TASK OR INVESTIGATION TO FAMILIES

Encourage students to talk to family members about something they have been working on in maths class – an investigation, a problem solving task, a big idea. Explaining helps families learn about what students are doing at school and methods used, as well as providing additional occasions for students to explain their thinking.

Student explanations about a mathematical procedure or concept to families.

Teachers encourage students to explain to family members contemporary approaches to doing mathematics. This can promote discussion about different methods, the school way versus the ways family members do it. An emphasis for current school methods is on understanding why a method works as well as being able to use the method. For example, sharing differing methods of subtraction, or dividing fractions.

DATA COLLECTION OR PROBLEM-SOLVING TASK OR FOR STUDENTS TO EXPLORE WITH FAMILIES

Teachers set home-based tasks that students explore with families. Data collection tasks may include: How much water is used each day in the home? How much rubbish is put in each bin? How long does it take to travel to school? Families work together to solve a problem within the home context. For example, check a household bill to make sure it is correct, or scale up a recipe to serve more people.

FAMILY INITIATED CONVERSATIONS

Teachers and schools encourage families to look for authentic, everyday problems and work together to solve these. Once suggested, these ideas can be taken up by families at any time. For example, gardening, scheduling activities, woodwork, planning a journey, and shopping. When shopping, a child is asked to estimate the total cost of all groceries in the basket or trolley before arriving at the checkout. While in the car, especially on longer distance trips, a child is asked to calculate fuel usage to work out where or when it will be necessary to fill up next. The importance of mathematics in solving these everyday authentic problems should be made explicit.

FAMILY CHALLENGES

Encourage families to seek out mathematics problems to work together on. For example, families with students in Year 5-9 could explore the website Figure This! Math Challenges for Families. In particular, Math Challenges for Families – Video Introduction that presents key features of the Figure This! challenges and shows families working together on challenges. Math Challenges for Families – Family Corner includes timely advice about working together and how best to help learners with mathematics. There are 80 challenges especially designed for families to work on together.

The article Why play I spy when you can do mathematics is about conversations between a Year 8 boy and his mathematics educator father and the many nice mathematics problems related to prime numbers they explore and discuss. Think about using this article to encourage families to talk about maths.

FAMILY CONVERSATION STARTERS

Some suggestions for starting conversations within families are:

- Play a game. Notice and talk about strategies. Notice and talk about where maths is used.
- List how you use mathematics on a typical day.
- Name something you did today that did not involve maths.
- What is one thing your child is good at?
  Identify the mathematics in that action/activity.
- Ask your child to explain some maths they are doing at school and talk about the way that you did that same thing when you were at school.
- Complete the maths myths questions in the Birth to Level 10 Numeracy Guide together with your child.
- Discuss what you do when you are faced with a challenging problem, what do you do to solve it?

REFERENCES

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WEBSITES FOR FAMILIES

DET – Birth to Level 10 Numeracy Guide: The Numeracy at Home page within this site is designed especially for families

DET – Everyday Maths Animations encourage families to explore maths everyday with children as they walk, talk and play. Suitable for early years to Level 2 families

DET – FISO Continuum to assist school leaders and teachers to identify areas of practice that require attention, such as family engagement in mathematics, to deliver improved student outcomes.

DET – Literacy and numeracy tips to help your child every day: A literacy and numeracy 56 page resource for parents of children aged 0-12 to keep the learning going at home.

DET – Home Learning activities for Secondary Students.

DET – Home page: Information for Victorian parents, carers and families and support for schools, teachers, students, apprentices and employers. Includes updates on what's happening in the Education State, latest videos and tweets.

DET – The Mathscots is an animation series that has been developed to support numeracy at home for young families.

DET – Victorian Teaching and Learning Model brings the framework for improving student outcomes (FISO) into the classroom. The VTLM will focus on high impact improvement initiatives such as engaging families in mathematics education.

The Mathematical Association of Victoria (MAV): The MAV's Made by maths app provides different maths trails that you can enjoy in Melbourne or your own neighbourhood.

The Mathematical Association of Victoria (MAV) Parent Page: Information and resources to help families support their children at home, to increase their interest and engagement in maths.

Victorian Maths Talent Quest: The Maths Talent Quest promotes interest in mathematics and fosters positive attitudes amongst students, teachers and parents through numeracy and mathematical investigation.

Numeracy – Families working it out together: An Australian Government brochure for families and carers of young children (early years) encouraging numeracy by looking for opportunities in everyday situations.

National support for Literacy and Numeracy: The Australian Government programs and initiatives to support literacy and numeracy skills.

Maths at our house: New Zealand site containing ideas for home-related activities relevant to the Australian context.

National Council of Teachers of Mathematics (USA) Back to School: The Time to Engage Parents and Families Explaining to families how mathematics has changed.

U.K. The Family Maths Toolkit is brimming with tips and advice to help parents, families and children aged 13 and under enjoy everyday maths activities together.

VIDEOS TO SHARE WITH FAMILIES

Dan Finkle offers simple and clear advice on how families can have productive mathematics conversations with their child at home.
Math Conversations – How many ways can we find the answer? (1:47sec)

Demystify Math: Every person is a math person
A 2 min video that could be used as part of a Family Maths Nights or Maths Club for Families.

Trinity College Dublin YouTube playlist: Numeracy in the Now. This a collection of videos showing how families can be involved in their children's learning of mathematics.

PODCAST

Podcast [11 minutes]: Demystifying the Math Mindset: A Guide for School Leaders with Abbie Eklund with Marian Small and Douglas Duff Available. One way to demystify mathematics is to have a school maths wall (6.21 sec) – this takes the maths out of the classroom and into the community – at least those who enter the school. Listen to the podcast for more on this idea.

RECOMMENDED READINGS

Clarke, D. (no date). A guide for parents: Helping your children with mathematics.

Professor Doug Clarke, Australian Catholic University, suggests ideas for parents in helping their child in mathematics. This 3 page guide includes a range of suggestions, activities and games for lower primary.

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BOOKS / BOOKLETS

Eastaway, R. & Askew, M., (2014). Maths for Mums and Dads. London: Square Peg Random House.

Ministry of Education Ontario, Canada, Helping your Child Do Mathematics: A Guide for Parents This 56 page booklet includes advice to families and a series of activities for families to explore together.

National Council of Teachers of Mathematics (USA) (2004). A family's guide: Fostering your child's success in school mathematics. Pre-kindergarten–Grade 12.

National Education Association (USA) A Parent's Guide to Helping Your Child with Today's Math [Brochure]

Small, M., & Duff, D. (2018). *The School Leader's Guide to Building and Sustaining Math Success.* Alexandria, VA: ASCD. Chapter 1 can be downloaded HERE.

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