

NUMERACY PROJECT CASE STUDY

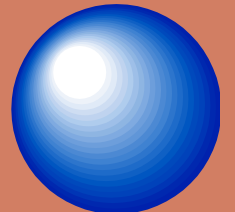
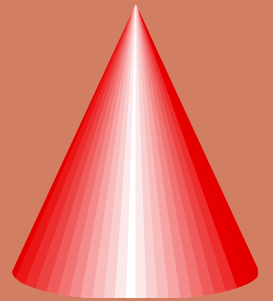
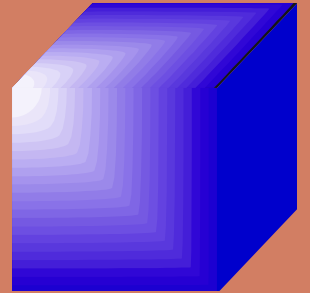
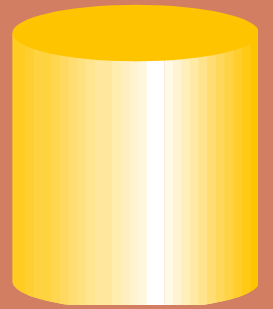
2012

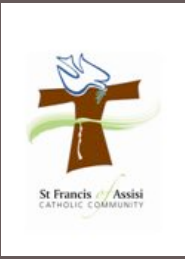
ST FRANCIS OF ASSISI SCHOOL NEWTON

FIONA GRANOZIO



HOW DO I DEVELOP
GEOMETRIC
REASONING USING
AN INQUIRY BASED
PEDAGOGY?



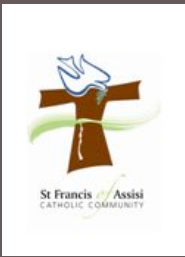


DESCRIPTION OF OUR SCHOOL

ST FRANCIS OF ASSISI NEWTON

St Francis of Assisi School is a Catholic Parish school with a mission to provide a quality education based on Christian values for children in the local area. St Francis of Assisi is an Eastern Suburbs R-7 Catholic Primary School. The current student enrolment is 568 students with 24 classes comprising of single year level within a three stream structure. This has been prominent since 1997.

Information & Communication Technology plays a significant role in students' learning. Information Technology is, and will increasingly become an integral part of education at St Francis of Assisi School. Information Technology is an effective tool that enhances and compliments contemporary educational methodologies and motivates students in their learning. At our school all students have access to information technology in their classrooms and other areas of the school. Currently our classrooms have Interactive Whiteboards and the school has recently introduced a laptop program where most children in upper primary had the opportunity to rent or purchase a Mac Book Pro or Ipad. The school resource center also has 3 sets of 6 Ipads and Mac books available to borrow.



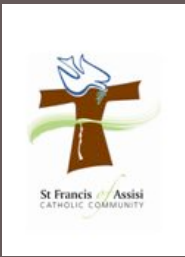
DESCRIPTION OF OUR SCHOOL

ST FRANCIS OF ASSISI NEWTON

The student within the school are predominately from English speaking, working middle class families of mostly Italian heritage. In recent times, the cultural diversity within the school has been enriched with enrolments of children from Asian, African and other European backgrounds.

At St Francis of Assisi school, the concepts, skills and processes that learners will need to acquire are those that will support them to work effectively and confidently with rapid, pervasive change. It is desirable for each child and student to leave their formal schooling equipped with the abilities to be competent lifelong learners who use mathematics confidently and ethically in their home and working lives.

Mathematics is a many-faceted aspect of human experience which satisfies a need to imagine, understand and quantify. It is a science of pattern and order that involves processes of abstraction, representation and communication. The mathematical concepts, skills and processes that learners will need to acquire are those that will support them to work effectively and confidently with rapid, pervasive change. Mathematics learning is central to numeracy. Numeracy is described as the ability to understand, critically respond to and use mathematics in different social, cultural, and work contexts.



DESCRIPTION OF OUR SCHOOL

ST FRANCIS OF ASSISI NEWTON

Through our commitment to our school vision, we aim to develop and foster the following qualities:

- We foster the total development of the child
- Each child is recognised as an individual with special gifts and talents
- A sense of pride, excellence and self-discipline is developed in the children according to Christian values.
- A balanced and developing curriculum promotes an understanding of the changing needs of today's world.
- We respect life and the environment as part of God's Creation

Our school strives to be a living witness to the gospel values of hope, love, justice, reconciliation, peace and freedom.

BELIEF STATEMENT

Improving learning outcomes for all students is central to a quality Catholic education at St Francis. I believe that students learn best when the school and parish community work together to create a faith-filled environment based on gospel values. I am committed to the total care of the whole student – physically, emotionally, intellectually and spiritually.

I believe that students learn best when our learning environment:

- is stimulating and welcoming
- is safe, happy and consistent
- values and caters to the diverse needs of each child
- celebrates the contributions made by students
- promotes opportunities for inquiry, investigation and discovery
- encourages collaborative learning and creative problem solving
- is well resourced.



I believe that students learn best when the teacher:

- provides enjoyable, meaningful and purposeful activities at all levels of learning
- models and encourages positive attitudes
- models and facilitates independent thinking
- motivates and invites students to participate in and plan their learning
- celebrates and affirms students' progress
- commits to meaningful self reflection, evaluation and is open to new challenges
- engages in ongoing professional development.

BELIEF STATEMENT

I believe that students learn best when learning is fun and when they:

- engage in activities that are relevant and purposeful
- take control of their own learning and are responsible for it
- experience the freedom to question and record their own processes
- verbalise concepts
- take risks, have a go, guess, try a new or different way of doing things (do and discover)
- believe they can do it
- recognise both their own strengths and challenges and those of others
- value uniqueness
- set goals that strive for targets just beyond their comfort zone.

I believe that students learn best when parents:

- initiate, guide and develop their child's faith
- are supportive and form part of a network of students, staff and other parents.

As a teacher at St Francis of Assisi School I am committed to developing and maintaining protective practices to ensure the safety of the people in our care. I value the uniqueness of all individuals, their customs, traditions and cultural heritage, including the Indigenous members of our community. I strive to promote mutual respect and inclusion of all.



DESCRIPTION OF THE CLASSROOM

ST FRANCIS OF ASSISI NEWTON

There are 28 students in my Year 3 class consisting of 12 girls and 16 boys.

In my classroom the students sit in groups and are encouraged to work collaboratively to develop skills which will complement set tasks. There are a large range of learning abilities in my class and specific students are provided with support in the area of Numeracy and Literacy once a day for 40 minutes. With a strong belief in Quality teaching

The year 3 teachers work closely and collaboratively in programming and planning units of work following the Australian Curriculum. Parents are welcomed into the classroom to assist with listening to reading and timetables.

Classroom teaching and learning practises at St Francis of Assisi are underpinned by the school vision statement which reflects the theme of lifelong learning, unity and making a positive contribution to the broader community.



CASE STUDY STUDENT

Student A is a hard working, conscientious student who approaches all facets of her schooling in a positive and mature manner. In relation to Mathematics, student A has a strong grasp of number facts and mathematical processes. Student A confidently applies all her times tables in all tasks and is able to accurately apply her knowledge of new concepts in classroom activities and topic assessments.

The reason I have chosen to follow student A's progress as a case study is because I would like to monitor her transition from a student who can confidently replicate formulae in Maths concepts to a student who is prepared to take risks and explore broader strategies when working through open ended activities.

Through my early observations this year, it was evident that student A was very capable in regards to learning new skills then applying the processes in class.



GOALS FOR STUDENT A IN 2012

- Encourage student A to use invented strategies to approach open investigations and have the confidence to take risks and make mistakes.
- Develop Students A's ability to record her finding and articulated her processes and learning in given task.
- For Student A to develop more confidence when working in group situations
- For Student A to further develop her knowledge of Geome Reasoning through higher order thinking task and self motivated learning



QUESTIONS ASKED BY THE TEACHER TO DEVELOP HIGHER ORDER THINKING

- What about? show?
- What might happen if?
- Can you summarize?
- What evidence supports this?
- How is this similar or different to?
- What conclusions can you make?
- what do you do with this information?
- what predictions can you make?
- How can you organize this?
- What other ways can you show or illustrate?



SPATIAL SENSE AND GEOMETRIC REASONING - QUESTIONING

- What do you know about 3D shapes?
- What do you know about line?
- What do you know about angles?
- What you know about lines of symmetry?
- How do these three topics relate to one another?



YEAR 3 LEVEL DESCRIPTION

The proficiency strands Understanding, Fluency, Problem Solving and Reasoning are an integral part of mathematics content across the three content strands: Number and Algebra, Measurement and Geometry, and statistics and Probability. The proficiencies reinforce the significance of working mathematically within the content and describe how the content is explored and develop. They provide the language to build in the developmental aspects of he learning of mathematics.

At this year level:

- *Understanding* includes connecting numbers representation with number sequences, partitioning and combining numbers, flexibility, representing unit fractions, using appropriate language to comes and identifying environmental symmetry.
- *Fluency* includes recalling multiplication facts using familiar metric units to order and compare objects, identifying and describing outcomes of chance experiences, interpreting maps and communicating positions
- *Problem Solving* includes formulating and modeling authentic situations involving planning methods of data collection and representation, making models of three-dimensional objects and using number properties to continue number patterns.
- *Reasoning* includes using generalizing from number properties and results of calculations, comparing angles, creating and interpreting variations in the result of data collection and data displays.



3D SHAPES - ENQUIRY OF PRIOR KNOWLEDGE

LEARNING INTENTION

To discover the children's prior knowledge of 3D shapes by asking inquiry questions in order to determine where to take the students learning and further their knowledge.

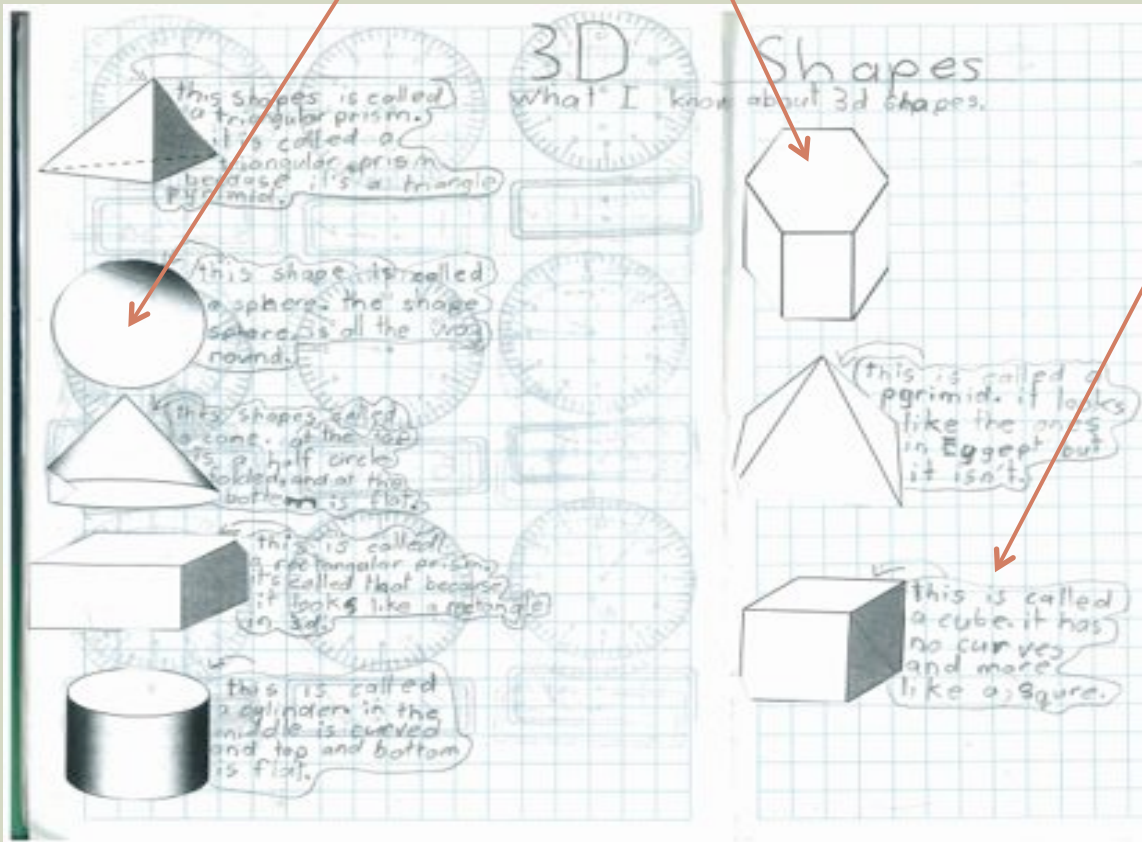
TASK

The students were ask to record any existing knowledge in their math's books. They were given a choice at whether or not the wished to use some photocopied images of 3D shapes to assist with recording their knowledge, or if they preferred they could draw them themselves or not use images at all. This was an open ended task and the students could take which ever direction they felt comfortable with.



REFELCTION:

- Student A was confident at sharing her existing knowledge of basic 3D shapes as she has a deep understanding of the names and key features of 3D shapes. She demonstrated this as she used the correct mathematics language which relates to 3D shapes.
- Student A was able to distinguish the 2D shapes within the 3D shapes. For example although the sphere appears to look like a circle she recognised it as the correct 3D shape.
- Student A made connections with the real world by relating the squared based pyramid to those seen in Egypt
- Student A was unable to identify the hexagonal prism
- She recorded her knowledge using images in a clear and concise way.



Future Direction:

Questioning: I could ask Student A to identify the 2D shapes in the pictures.

Ask student A if she knows what a prism is and if she can describe it and continue by asking her to identify the 2D shape in the 3D shape that she did not know (hexagon)

To encourage Student A to explain the key features of 3D shapes in more depth, focusing on faces, points and vertices.

SHAPES IN OUR EVERYDAY ENVIRONMENT

LEARNING INTENTION:

Locate 3D shapes in our everyday environment

TASK:

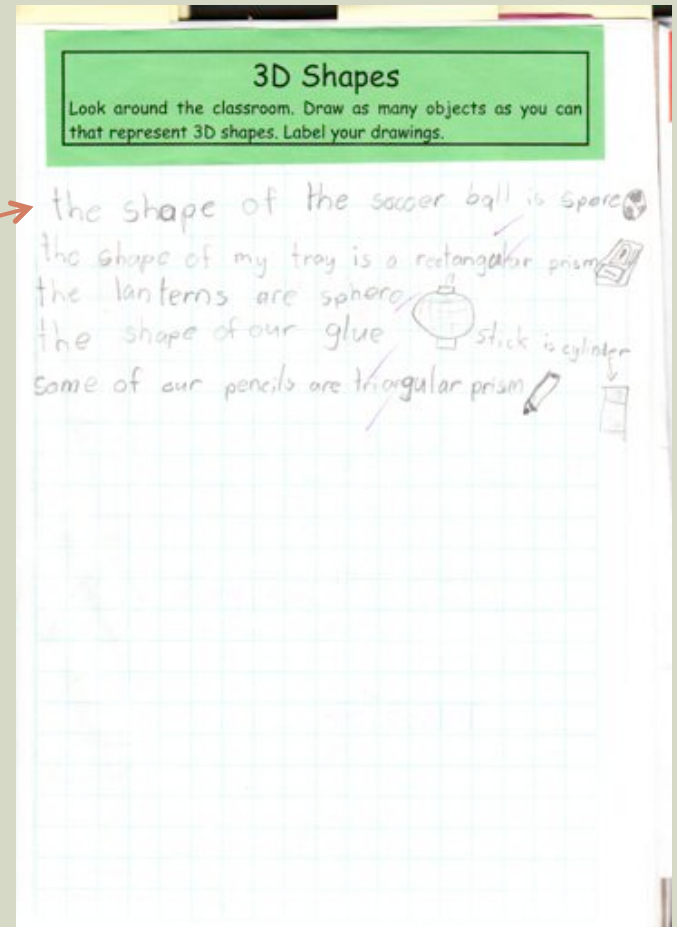
Students were asked to find objects in the classroom that represent 3D shapes and record findings in their math's book.

REFLECTION

Student A was able to locate some 3D shapes within the classroom and recorded her findings with images and a comparison of the object with the 3D shape. At times I felt that Student A lacked confidence in this task. She asked me on two occasions for reassurance "is this lantern a sphere?". Student A spent a lot of time procrastinating about which items in the classroom she wanted to use and therefore was only able to record the following.

FUTURE DIRECTION:

- To get student A to compare the ball beside the lantern and look at the features of them both in more detail and question her. Eg. Which part of the lantern is NOT a sphere?
- To incorporate ICT and use the iPad's to locate and record 3D shapes in the school environment



MAKING 3D SHAPES

LEARNING INTENTION:

To create models of 3D shapes using a variety of resources. (Make models of three-dimensional objects and describe key features [\(ACMMG063\)](#))

TASK:

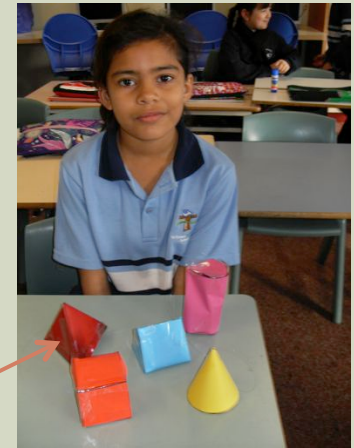
The children were given some A4 printed net and were asked to create as many 3D shapes as possible. They were also asked to label the shapes and record the features on them. Once they had created some shapes from nets the children had the opportunity to make 3D shapes using a variety of materials of their choice (newspaper, play dough etc.)

REFELCTION:

Student A not only enjoyed this task and approached it with ease and confidence. She was able to capably create 3D shapes from nets. She used plasticine to create a variety of 3D shapes. Her shapes were well formed and matched all the key features of three dimensional shapes.

FUTURE IMPLICATIONS:

- Questioning :Eg, Why did you choose to make these particular shapes? What other materials/resourced could you use to make shapes?



NETS OF A CUBE

LEARNING INTENTION:

For students to identify that 3D shapes are made up by 2D shapes and to explore the different nets of a cube.

TASK:

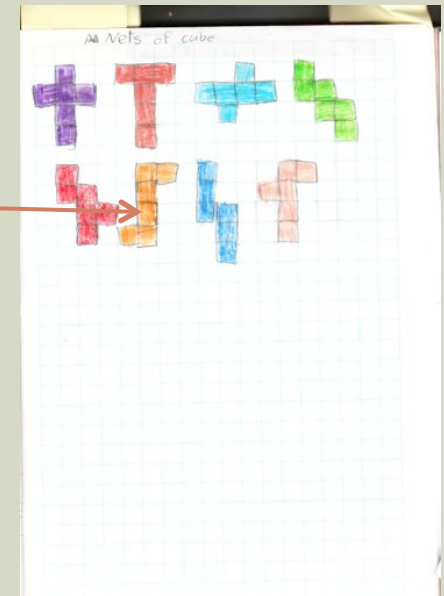
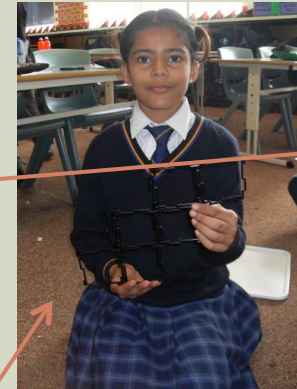
Use the Geo shapes to create as many nets for a cube as possible, record your findings.

REFLECTION:

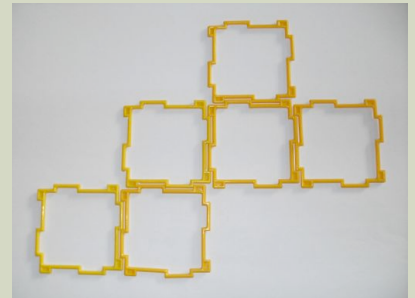
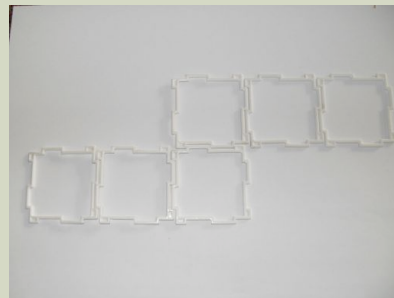
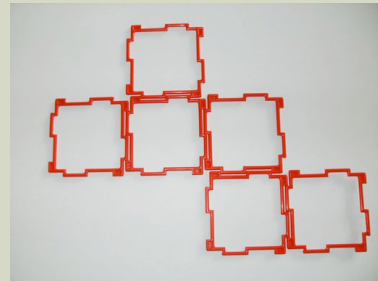
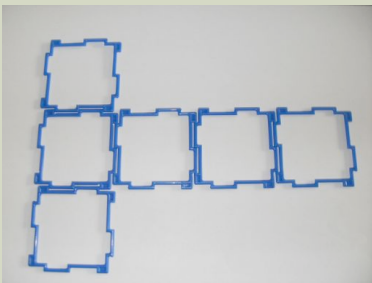
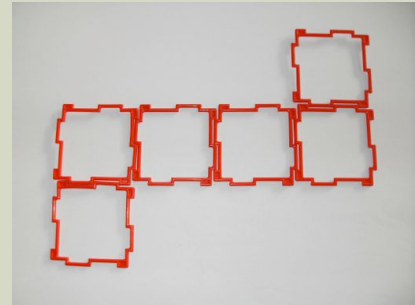
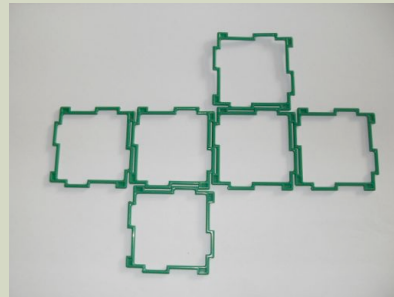
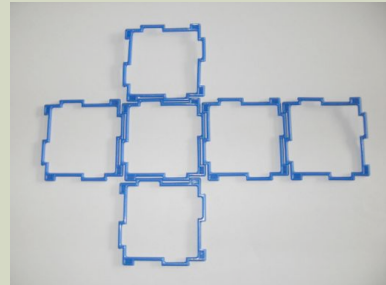
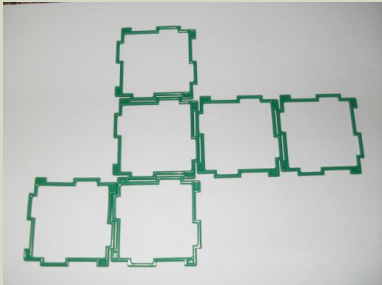
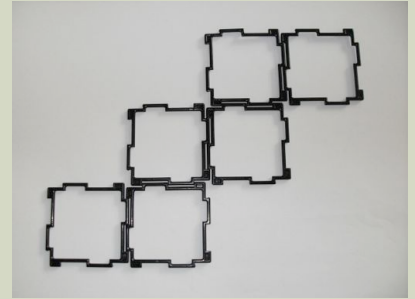
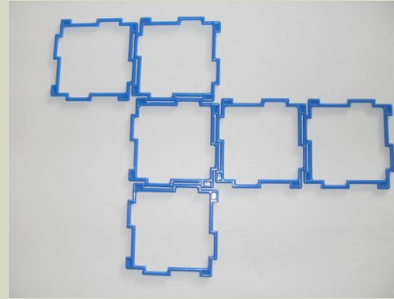
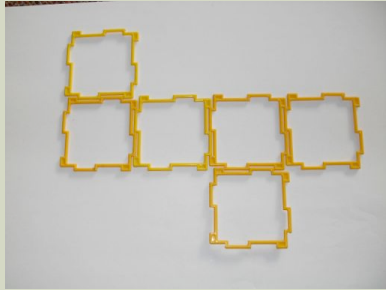
Student A was able to successfully create 8 different nets to form a cube. Once she has formed 6 nets using concrete materials she questioned me asking 'how many nets are there all together?' I informed her that there were still another 5 or 6 that should could create. With some trial and error she was able to create another 2 nets and recorded her findings in her book in a clear, legible way. Student A was also to distinguish that the nets can tessellate (flip and turn) and therefore did not draw the same net twice.

FUTURE IMPLICATIONS:

- For Student A to explore nets of more complex 3D shapes such as prisms.
- Get the students to draw nets and get a friend to put them together.



NETS OF A CUBE



FEATURES OF 3D SHAPES

LEARNING INTENTION:

For students to discover and record the features (corners, faces, edges) of 3D shapes.

TASK:

The students were given a blank template and were asked to fill out the names and record the number of points, vertices and faces of each 3D shape. I provided the students with blocks and real life 3D shapes to assist them if they wished.



FEATURES OF 3D SHAPES

REFELCTION:

Student A was able to do this task with confidence and ease. She did not use any concrete materials initially and was able to work out the properties of the shapes based on the images provided.

When she completed the task I asked her whether she had edited her work and she replied 'No', I suggested that perhaps she use the 3D shape blocks to double check her answers. She happily agreed to do so. By doing this Student A was able to pick up some basic errors and self correct her work and pick up on some basic errors made.









FUTURE IMPLICATIONS:

- Extend the students by getting them to imagine splitting/sectioning the shapes and looking at the features of them when they have divided.

Name: _____

3D Shapes

Complete the following chart.

Shape	Name	Number of faces	Number of edges	Number of corners
	cube ✓	6 ✓	12 ✓	8 ✓
	cylinder ✓ circular	2 ✓	2 ✓	0 ✓
	rectangular prism ✓	6 ✓	12 ✓	8 ✓
	rectangular based pyramid ✓	5 ✓	8 ✓	5 ✓
	pyramid ✓	5 ✓	9 ✓	5 ✓
	triangular prism ✓	5 ✓	9 ✓	6 ✓
	cone ✓	1 ✓ curved face	1 ✓	0 ✓
	sphere ✓	1 ✓ curved face	1 ✓	0 ✓

3D SHAPES ACROSS THE CURRICULUM



Integrating 3D shapes into Oral Language presentation



LEARNING INTENTION:

3D shapes is a topic that can be taught across many of the curriculum areas including Literacy and the Arts. The learning intention of this task is to develop confidence in public speaking, developing the skills of oral language presentations and discussing the process and reasoning for creating a 3D object.

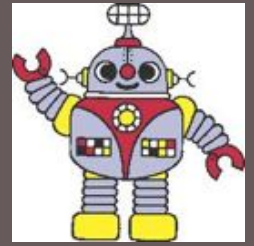
TASK

The students had to complete an oral language project which was divided into 2 areas. The first part of the project was to design and make a 3D item, object or creature using 3D things that you find around the home (recycled boxes, toilet rolls, dice, Lego, foods, your own constructions).

Following the construction on the 3D item the students were asked to show their creation to the class and talk about their design, and discuss the 3D shapes used and how they made their 3D artwork. The talk should go for 2-4 minutes, uses the Features of a Clever Speaker.

Kandisa ORAL LANGUAGE ASSESSMENT—Week 9, Term 2				
Overall Assessment	Visual Art Assessment	3D SHAPE CONSTRUCTION		
A = 4 stars	A	Design and make a 3D item, object or creature using 3D things that you find around the home (recycled boxes, toilet rolls, dice, Lego, foods, your own constructions, etc.). Show your creation to the class and talk about your design, the 3D shapes you used and how you made your 3D artwork.		
B = 3 stars	Oral Language Assessment A-	What We Expect Your talk should go for 2-4 minutes, use the Features of a Clever Speaker, you should show your construction to the class and talk about your design, the 3D shapes you used and how you made your 3D artwork.		
C = 2 stars				
D = 1 star				
E = Not Attempted				
	★	★★	★★★	★★★★
Visual Art Assessment	Produced a construction using one or two 3D shapes and limited design or fixing knowledge	Produced a simple construction using three or four 3D shapes and some design and fixing techniques	Produced a more detailed construction using five 3D shapes with greater knowledge of design detail and fixing techniques	Produced a construction with significant design detail and polished fixing skills using six or more 3D shapes
	Oral Language Skills — I...			
<input type="checkbox"/>	looked at my classmates	<input checked="" type="checkbox"/>	smiled and looked confident	
<input checked="" type="checkbox"/>	talked to everyone, not just a few people or the teacher	<input checked="" type="checkbox"/>	spoke slowly and did not speak too fast	
<input type="checkbox"/>	spoke clearly	<input type="checkbox"/>	didn't forget what I was saying	
<input checked="" type="checkbox"/>	used an easy to hear voice	<input checked="" type="checkbox"/>	spoke with expression	
<input checked="" type="checkbox"/>	used my hands, face and eyes to communicate	<input type="checkbox"/>	used cue cards or written work (poster, paragraph, etc.) to help my talk	
<input checked="" type="checkbox"/>	used 2-4 minutes	<input checked="" type="checkbox"/>	used relevant information about your design, the 3D shapes you used and how you made your artwork	
	★	★★	★★★	★★★★
Oral Language Assessment	I used 0-5 Features of A Clever Speaker	I used 6-8 Features of A Clever Speaker	I used 9-10 Features of A Clever Speaker	I used 11-12 Features of A Clever Speaker

3D SHAPES ACROSS THE CURRICULUM



Reflection of Oral Language Presentation and Art work

During her oral language task Student A talked about her reasons for choosing to make this particular model. She talked about the materials she used and discussed how each object represented a 3D shapes and described the features of them:

'I asked mum to save the finished glad wrap tubes, I wanted to use them as arms and legs for my person because they look like cylinders. They have 2 faces and a curved surface.'

Student A produced well designed and carefully presented piece of the Art which met the requirements of the assessment rubric provided. Her oral language skills were exceptional, she spoke with confidence and her talk fulfilled the expectations of the assessment rubric.

As this is a homework task I was unable to track Student A's progress with this project.



USING TECHNOLOGY



LEARNING INTENTION:

Using the iPad identify angles and lines in the school environment

TASK:

Using the app EDUCREATION the students were asked to go out into the school environment and located 3D shapes. This app allows student to take photos of the shapes, record their voices over the photo and draw on the photo. As this was an open ended I allowed the children to take their learning on a personalized journey. After some time we will gather back to class to share our findings on the smart board.

REFLECTION:

Student A and her partner were able to successfully locate 3D shapes in the school yard. In the photo above student A had recognised that the slats on the stairs resembles cylinders. A photo of this was taken and they recorded with their voices what they found.

"The stair rails looks like a cylinder, a cylinder has 2 faces and 1 curved surface".

FUTURE IMPLICATIONS:

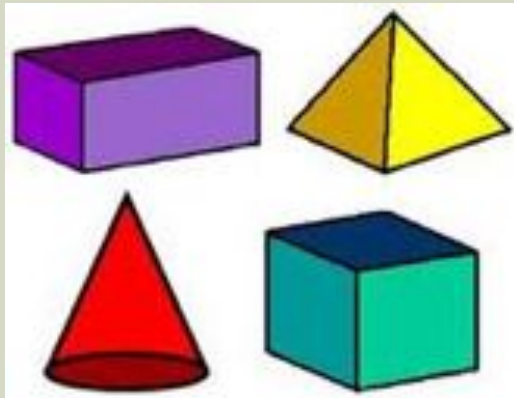
This particular task could be extended in a number of ways by allowing students to explore different environments in the school. The students may have to describe the features of the shapes in more depth ensuring that correct geometric language is being used





OVERALL ACHIEVEMENT

ASSESSMENT

Student A has been very successful in this topic and is currently working in stage A. She is now ready to move on to exploring more complex tasks such as exploring irregular 3D shapes and splitting and combining 3D shapes.



YEAR 3 ACHIEVEMENT STANDARD				
Make models of <u>three-dimensional objects</u> and describe key features				
	A	B	C	D
Names 3D shapes				
Names a variety of 3D shapes	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Spells a variety of 3D shape names correctly	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Describes key features of 3D shapes				
Locates and correctly counts the faces, edges, corners of 3D shapes	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Identifies a variety of lines in a range of 3D shapes	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Makes models of 3D shapes				
Accurately draws a range of 3D shapes using a ruler	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Makes 3D shapes using a range of materials	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
YEAR 3 ACHIEVEMENT STANDARD				
Identify angles as measures of turn and compare angle sizes in everyday situations				
Identifies and names angles				
Identifies a range of angle types in 3D shapes	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



YEAR 3 ACHIEVEMENT STANDARD

By the end of Year 3, students recognise the connection between addition and subtraction and solve problems using efficient strategies for multiplication.

They model and represent unit fractions. They represent money values in various ways. Students identify symmetry in the environment. They match positions on maps with given information. Students recognise angles in real situations. They interpret and compare data displays.

Students count to and from 10 000. They classify numbers as either odd or even. They recall addition and multiplication facts for single digit numbers. They continue number patterns involving addition and subtraction. Students use metric units for length, mass and capacity. They tell time to the nearest minute. Students make models of three-dimensional objects. Students conduct chance experiments and list possible outcomes. They carry out simple data investigations for categorical variables.



REFLECTION ON STUDENT A

My evidence and assessment indicates that student A's learning objectives were all achieved successfully throughout this case study. Her persistence in working on tasks and being able to ask for help and clarification have seen her experience more success. She has been able to work independently on tasks and verbally explained her thought process when analysing and recording data.

During the task where the students made nets using geo shape Student A used invented strategies to approach the open investigation. She used a trial and error approach which which enabled her to have the confidence, to take risks to realise that it is ok to make mistakes but to not give up.

Students A's has a natural ability to record her finding and articulated her processes and learning in given tasks. This is evident in all her work samples, especially in Task 2 where Student A drew the images of object within the classroom that look like 3D shapes. A reader would be able to look through her book and have a good understanding of the given task based on her recordings.

Student A is a quiet student and a goal I set for her this year was to develop more confidence when working in group situations. I have watched Student A's confidence progress and have seen her openly discuss her thoughts and personal practices with small groups. I believe this goal was also achieved as I set tasks which students can relate to their everyday life experiences which they can feel comfortable discussing.

I believe that Student A has successfully developed her knowledge of Geometric Reasoning through self motivated learning and general interest in the topic of 3D shapes. She enjoys hands on activities and benefits from using concrete materials.

A valuable goal for Student A to work on next year is to take more risks with her learning. I believe Student A would be ready to construct prism and skeletal models of 3D shapes, begin drawing 3D shapes using grid paper and could focus on looking at 3D shapes from different angles such as side and birds eye view.

REFLECTION ON MY PERSONAL PRACTICES

My personal journey as an educator in Mathematics can be best described as a steady transition from traditional teaching methods to encouraging students to take more risks in their learning. I believe this to be because I was often hesitant to take risks myself. I often found it difficult to come up with engaging mathematics activities and at times lessons were quite structured. During my time at school I often 'struggled' with mathematics and had no confidence in myself when learning mathematical concepts and sometimes I feel that this has followed through in my professional life and therefore this is why I decided to join the Numeracy Project.

Since beginning this Project I have noticed a huge positive change in my teaching, my attitude and my entire outlook on Mathematics. Beginning new topics with an "inquiry based approach" has enabled me as an educator to find out more about what my students already know and allowed me to plan lessons which build on their existing knowledge. My lessons are more hands on, the children are more engaged and I can see that the students attitude towards mathematics has changed in a positive way.

I have offered lessons which have multiple entry points, this allows students to take control of their learning and make decisions on how they go about problem solving and completing tasks. I have encouraged students to 'take risks' in their learning and apply 'invented strategies'.

A challenge I faced was keeping on top of the Project and making sure that I was adding my lessons, reflection and images and I taught each lesson rather than working on it all in one day. At times I found it was a little overwhelming trying to teach a lesson while observing my student, making notes and taking photos. This however was manageable due to the fact that I only had one focus student. I think it would be more challenging to manage with 3 students. One focus student also allowed me to really focus on her learning and development.

I have enjoyed my first year of the Math's Project and look forward to continuing next year.