

Explain why teacher subject knowledge is important in relation to teaching Language and Mathematics in primary schools in Wales

According to Grigg (2015) teachers throughout Wales are expected to have resilient subject knowledge and understanding in order to become effective professionals. Teachers consistently increase their knowledge, skills and understanding and show reflection in order to challenge and develop learning across all aspects of the curriculum. Doing this progressively develops the teaching pedagogy (Welsh Government, 2018). This essay will examine the importance of teachers subject knowledge in the subject area of mathematics and language; it will argue that while there are other crucial elements in being a primary teacher, together mathematics and language are fundamental and will ultimately sculpt the children's futures if taught effectively.

(Estyn, 2017) Over the past seven years, the Welsh Government have made numeracy and literacy skills a key priority for improvements, similarly, Hansen (2008) explains that subject knowledge on a whole has developed an essential focus with government and education lecturers. This suggests the standards in Wales need improving. As a result, transformations are being addressed, for example, Successful Futures. The Education Secretary, Williams (2016) explains it is significant to have high standards in mathematics and literacy, to ensure all children have equal opportunities in order to reach their full potential. Estyn (2017) states good literacy and numeracy knowledge are equally life-long skills that are compulsory by all young children within the school environment and throughout the individual's life.

In order to become a Primary teacher in Wales, all trainee teachers need to attain a B grade in GCSE mathematics and English Language, if trainee teachers do not meet these requirements, they are unable to teach in Wales (Cotton, 2010). Standards of entry within initial teacher training were raised in order to “cultivate a strong culture of collective responsibility for improved learning and achievement for all students” (Schleicher, 2014, p. 82).

Haylock and Cockburn (2013) state mathematics should be taught in an approach that promotes understanding, this means helping each pupil to make connections with their learning. According to Linder and Powers (2011), if children are involved in engaging and meaningful mathematical experiences from a young age, they are more likely to continue to develop an enthusiasm and passion for mathematics in their further education. Cotton (2010) explains in order to develop mathematical skills as a professional it is essential to focus on three specific areas; mathematical subject matter knowledge, mathematics curricular knowledge and pedagogical content knowledge.

Teachers with good subject knowledge can generate deeper thinking skills, this allows children to develop and advance their current understanding. Having the subject knowledge and confidence to use probing questions within a mathematical lesson to generate understanding is important and it allows children to consider how they arrived at the answer, in comparison to getting the answer right or wrong (Cotton, 2010).

As seen in figure one there are four significant factors which are essential, teachers need to incorporate each element when teaching mathematics to young learners.

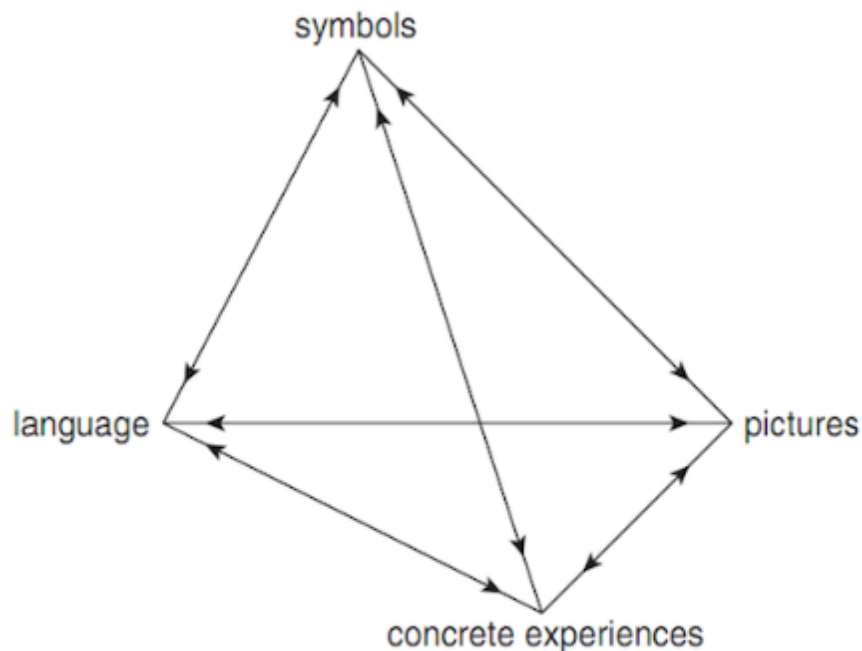


Figure 1 - Mathematical understanding through making connections - (Haylock and Thangata 2007)

Illustrations of each connection are as follows; symbols within mathematics incorporates numerals, operations and equality. A crucial element of mathematical subject knowledge is a comprehensive understanding of mathematical language. The vocabulary children acquire naturally, is only possible with the assistance of the class teacher's understanding, when they are confident the language is a rich and vital part of every lesson. Pictures are integrated through mathematics particularly when sorting and counting, this includes resources like number lines, diagrams, pictograms and bar charts. The work of Piaget, Bruner and Liebeck all highlight the importance of physical and visual learning, therefore, many concrete experiences can be integrated amongst a mathematical lesson, to show an example; numicon, beads and interlocking cubes (Taylor and Harris, 2014)

I have recently finished my first Professional Teaching Experience (PTE) in a Pioneer School. I experienced two different year groups; I was allocated a year six class which consisted of twenty-nine pupils and then began a three-week experience in Nursery which consisted of forty-five pupils. During my six-week placement, I was able to experience the greatest range possible of ages in the primary sector. Throughout this time the importance of a teacher's higher understanding of subject knowledge became clear, especially with regard to the core subjects of Language and Mathematics.

The theme for the Year Six experience was led by the pupil's voice and was Harry Potter. I created a series of numeracy lessons around the making of Harry Potter themed cushions; the students had to select, measure and cost different materials, they had to design and create patterns and then price them up to make a profit. While motivating children to learn it is important to meet the learners needs to create a personalised journey and to ensure the curriculum fits their interests (DCELLS, 2008). Analogously, Donaldson (2015, p. 6) explains the importance of selecting effective resources that build on children's prior knowledge and experience in order to engage with their interests, to teach children the skills and dispositions that will help them “to meet the needs of today and the challenges of tomorrow”.

Putting these factors into consideration, I generated a question that would target all the essential areas of learning. “The shop owner at In-Fabrics in Haverfordwest needs to know how much fabric we need altogether in metres and the total cost.” Solving this problem acquired the children to use higher order mathematical skills, independent learning and deeper thinking skills. I had to prepare these lessons thoroughly, therefore my mathematical understanding had to be clear and thorough before I was able to consider teaching these skills to pupils. I had to draw on my own knowledge, however, I increased my own confidence and understanding by researching the necessary skills to ensure my understanding was secure before I planned and delivered this series of lessons. However, Estyn (2017) explains many improvements need to be addressed in Welsh primary schools, as children are not having the opportunity to develop their numeracy skills through real-life contexts, therefore I thought this task would be a great opportunity for the children to experience.

The mathematical skills included within the costing lesson were taken from the Literacy Numeracy Framework (LNF). The specific skills were chosen carefully ensuring children were able to develop their numerical reasoning and problem-solving skills. Donaldson (2015) explains it is essential for teachers to have mathematical subject and curriculum knowledge in order to plan to a high standard. These are the skills I addressed throughout the lesson; “Identify the appropriate steps and information needed to complete the task or reach a solution”, “To work through a problem confidently” (Welsh Government, 2016). My aim for the lesson was to include several aspects of the four core purposes, as seen in figure two. The report discusses the importance of theoretical and practical knowledge required by teachers in order to motivate and inspire children but furthermore to allow young learners to use their own initiative to study independently and effectively which connects to one essential core purpose.

>>> Recommendation

- 3. The purposes of the curriculum in Wales should be that children and young people develop as:**
- > ambitious, capable learners, ready to learn throughout their lives**
 - > enterprising, creative contributors, ready to play a full part in life and work**
 - > ethical, informed citizens of Wales and the world**
 - > healthy, confident individuals, ready to lead fulfilling lives as valued members of society.**

Figure 2 Curriculum Development - Four Core Purposes (Donaldson, 2015)

Initially planning this lesson was a challenge for myself, it was important to find the correct level of learning, differentiating it to meet each learner's needs and taking time to create and organise supplementary resources to support the differing abilities. I had to establish my own understanding before I could teach these skills in order to question and probe children's understanding. This took days of preparation until I felt confident enough to use my mathematical subject knowledge to educate the young learners. Research highlights that learning with understanding is essential, however, this does not just apply to the children, teachers themselves have to understand each mathematical concept, method and principle to teach effectively (Haylock and Cockburn, 2013).

The main mathematical process consisted of calculating the amount of material required by using methods of ratio, multiplication and addition depending on ability resulting in differentiation on the outcome. First, it was essential for the children to understand '1 metre = 1 ½ cushions' having ensured a clear understanding of the ratio, the pupils were able to explore the concept of calculating appropriate quantities and prices (see appendix 1). I felt I needed to include some visual platforms to support the different abilities, for example, the use of tally charts and tables to represent their data. I knew the children were capable of drawing their own tables, however, that was without challenge and time consuming, therefore I made the decision to produce the tally charts and tables beforehand (see appendix 2). High expectations are essential if greater levels of learning are to be gained.

Vygotsky's (1896-1934) theory of Zone of Proximal Development (ZPD) is the gap between what a child can do independently, in contrast with what they can do with help from another adult or peer who is more experienced, knowledgeable and competent. Similarly, DCELLS (2009) explains solving mathematical problems by communicating with their peers develops thinking across the curriculum. Putting this into consideration I attempted to pair the children to support their learning, initially, I found the teaching strategy challenging as some children wanted to sit next to their preferred peers. Overall this had a negative impact on the children's

attitude to learning. As a consequence, I introduced a positive reward strategy in order to promote positive behavior and essentially to encourage the children to make correct decisions. Skinner's theory of behaviorism is responsible for teaching methods, the strategies are used to sculpt the behaviour of learners using positive or negative approaches (Pound, 2006).

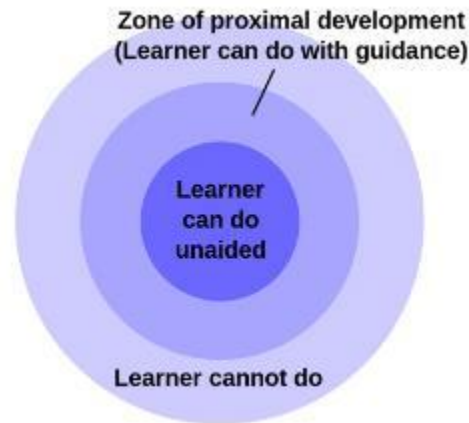


Figure 3 - Zone of Proximal Development - (Wright, 2016)

Finally, to conclude the lesson I asked the children to give each other feedback and feedforward. Using this teaching strategy allows teachers and pupils to understand their current level of learning and impacts future lessons.

“Competency in literacy is integral to successful learning across all schools in Wales” (ERW, 2018, p. 2). Gamble (2013) explains effective teaching and learning in language and literature varies upon deep subject knowledge, this revolves around a variety of texts and different methods to study them. Similarly, Cremin and Arthur (2014) understood that teachers need extensive subject knowledge of children's literature, in other words, teachers need a broad range of different varieties of books. Allowing children to explore different styles of books is fundamental as statistics show that children's enthusiasm to reading throughout their childhood has great benefits in the classroom, therefore, as a teacher it is essential to encourage children to reach their full potential in order to transform academic success (National Literacy Trust, 2017).

As stated by Gross (2013) three elements are apparent when teaching language within the teaching environment. These include receptive which is what we understand from others, expressive is how we talk through a high-level of language with increased vocabulary and pragmatic is how we communicate with others using, tone of voice, facial expressions and body language to substitute our feelings and thoughts. Vocabulary is a vital part of education, research shows that language at the age of five is a vital indicator of success at GCSE level, as a result of this, evidence shows that classrooms which provide a wide range of opportunities for talk achieve higher (Gross, 2013).

I am passionate about the use of art in the classroom and selected it as the hook for a language lesson. Dewey's (1860-1931) theory clarifies the requirement for cross-curricular approaches within the teaching environment (Pound, 2006). The main purpose of the task was to develop children's vocabulary and understanding on how to paint a daffodil with greater detail. Statistics show "Children who have a poor vocabulary in their early years have lower

qualifications and less chance of being employed at the age of thirty-four" (Gascoigne, 2017, p. 45). This demonstrates the importance of teachers' subject knowledge in speech, language and communication are, especially as it has such a great impact on their futures.

To start the lesson a 'cold task' was introduced, the explanation of this term is constructed on independent learning. The oracy skill developed was "To listen and carry out a two-step instruction". (Welsh Government, 2015, p. 15). The children had no input from myself and therefore had to use their own general knowledge in order to follow the instruction given. 'Can you paint a daffodil, using the paints in front of you?'. On reflection, various paintings were portrayed although no knowledge of the main concept was embraced (see appendix 3).

Following this I asked the children to stop and think, this teaching strategy is used to support reflective learning. The oracy skill being developed was "To participate in discussion with other children and/or adults" (Welsh Government, 2015, p. 17). During the reflective process I asked the children several questions based on their cold task paintings; what can you see? What do you like about your learning partners work? What do you think you could do to improve? What does a good one look like? These questions allow the children to explore and develop vocabulary in order to answer the question and communicate. Cremin and Arthur (2014, p. 58) explain "talk is central to learning" as it allows children to express and share their thoughts and feelings. One pupil said, "I like your daffodil because of the nice colours.", I responded "What do you like about the colours?" and "Why you like them?" The pupil could not answer so additional support was required - ..." are they bright, dark, light?" Later we were able to incorporate this new vocabulary and understanding into improving work. Encouraging children to communicate is important as it allows children to internalize cognitive strategies. It also allows them to understand the meaning, become independent learners and take ownership of their learning. Teachers support talking by asking open-ended and higher order questions, these questions can often lead to meaningful discussions. (Cremin and Arthur, 2014)

Piaget's (1896-1980) theory defines the importance of actively experimenting with materials and resources in order to develop thought, this allowed the children to visually make sense of their learning. (Pound, 2006) For that reason, I used a constructivist approach and brought a vase of real daffodils into the learning environment. This allowed the children to use their senses to explore, touch and smell. Once each child grasped their own daffodil, the aim was to generate a discussion on what they can see using their senses, vocabulary and language. To show an example; describe what can you smell? What is a petal? What is a stalk? Where do you find daffodils? Use of key vocabulary such as "...bright...dark...light..." was easy to demonstrate. Questioning plays a vital part of teaching and learning, it was important for me to plan these specific questions beforehand. Bloom's Taxonomy is a hierarchy model which allows children to think critically following the six cognitive levels of thinking. (David, 2014) Putting these areas into consideration is essential in primary teaching. .

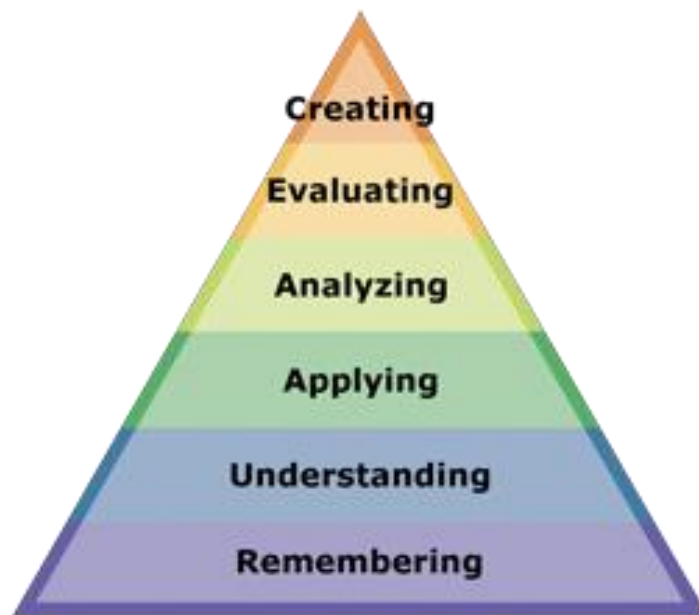


Figure 4 Bloom's Taxonomy (Coffey, 2008)

Each individual response was unique, to show an illustration, a pupil answered, “daffodils come from the ground and need water to help them grow big” in comparison to “daffodils come from Tesco”. The overall response created an alternative and engaging discussion between the group which enabled the children to think to develop cognitive thinking skills.

Research suggests that modelling is an efficient instructional approach in allowing children to observe the teacher. Bandura (2017) states modelling engages young learners as it encourages a positive attitude to learn. Taking this into consideration a hot task was introduced, to illustrate the precise way to paint a daffodil and to use this as visual success criteria. "As a teacher, it is our role to influence creative and engaging learning" (Jeffery, 2006, p. 9). I asked the children “Do you think you will be able to help me paint a daffodil?” Giving the children authority and responsibility to take control of their own learning is important and encouraged by Donaldson (2015). I probed the group, “What do you need to include to make the painting look like a daffodil?” This entitled the children to listen to the question, observe their daffodil and to communicate to the group to their thoughts. I incorporated Bruner’s (1915-2016) theory of scaffolding in order to probe and develop meaningful discussions. The children’s responses were sensible, for example; “We need six yellow petals” and “one green stalk”.

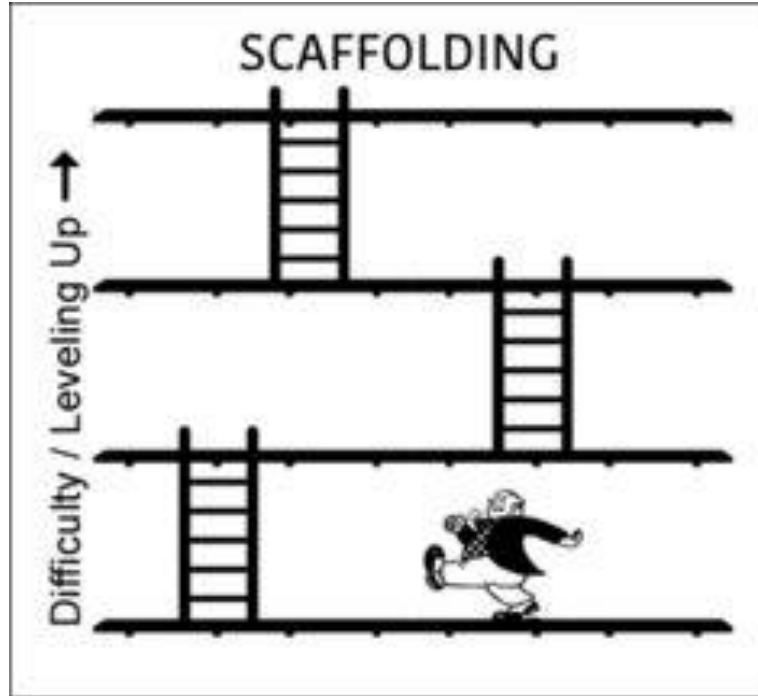


Figure 5 - Visual Diagram of Scaffolding - (Pinterest, n.d.)

In reflection on my own teaching, the manner in which I instructed the children, to begin with, had an impact on their understanding and attitude throughout the lesson. A study has discovered that teachers' subject knowledge and high quality of instruction improves pupil's attainment (Aloisi, 2014). This would enable me to create the visual criteria, based on the different shapes, colours, amounts, lengths, plant structures and size.

The children were able to follow the visual success criteria in order to paint their daffodil (see appendix 4). The resources were prepared, although I purposefully did not put the paint brushes in the paint as I wanted the children to communicate appropriately in order to ask questions like "please can you pass me a paint brush?". Gross (2013) explains language-rich environments encourages children to exchange a conversation and communicate independently and effectively. Teachers ask the questions too frequently, consequently, it is important to allow the children to take control of their thoughts and feelings and to encourage them to use their voices to communicate effectively. "Children need every opportunity to explain thinking, explore and discuss ideas using language skills at an appropriate level" (Donaldson, 2015, p. 40).

According to Cremin and Arthur (2014) integrating reflection, feedback and celebration are essential as it allows the children to critically evaluate their own work. To conclude the lesson children were able to reflect on their work and the work of their peers. I verbally used the teaching strategy 'green for growth' and 'tickle pink' to develop their oracy skills. "Talk about in simple terms, drawings, models and actions" (Welsh Government, 2015, p. 14). The way in

which I modelled was verbally communicating “wow, boys and girls, I am definitely tickle pink about his yellow petals, what are you tickle pink about? What do you like about them?” Modelling is an effective strategy used by teachers, it is used to demonstrate to students a new skill by observing (Salisu and Ransom, 2014).

In conclusion, teachers need to acquire an appropriate level of subject knowledge in Mathematics and Language in order to teach effectively, this develops constant development and achievement in order to raise standards. “The national mission is to raise standards, reduce the attainment gap, and deliver an education system that is a source of national pride”. Many transformations are taking place throughout Welsh Education. In order to enhance the learning of children in Wales education must be; engaging, exciting and accessible (Education Wales, 2019, p. 3). Donaldson (2015, p. 6) explains the importance of selecting effective resources which build on children's prior knowledge and experience in order to engage with their interests, to teach children the skills and dispositions that will help them "to meet the needs of today and the challenges of tomorrow". Mathematics and Language skills are life-long proficiencies; therefore, it is essential for teachers to become confident in these areas of learning and experience. It is important for teachers to integrate highly effective pedagogical teaching strategies in order to meet the needs of each individual pupil (Estyn, 2018). “Mathematics and Language are international disciplines, they play a critical part in our private, social and civic lives, and in the economic health of the nation” (Education Wales, 2019, p. 3)

Bibliography

Aloisi, C. (2014) *What Makes Great Teaching?*. London: The Sutton Trust.

Bandura, A. (2017) *Psychological Modelling: Conflicting Theories*. New Brunswick: Transaction Publishers.

Coffey, H. (2008) Bloom's Taxonomy. *Learn NC*.

Cotton, T. (2010) *Understanding an teaching primary mathematics*. Edinburgh: Pearson.

Cremin, T. and James, A. (2014) *Learning to Teach in the Primary School*. 3rd ed. London: Routledge.

David, L. (2014) *Learning Theories*.

Available at: <https://www.learning-theories.com/blooms-taxonomy-bloom.html>

[Accessed: 24 July 2014].

DCELLS (2008) *Learning and Teaching Pedagogy*, Cardiff: Welsh Assembly Government.

DCELLS (2009) *Learning Wales*.

Available at:

<https://learning.gov.wales/docs/learningwales/publications/0901mathguidanceen-v2.pdf>

[Accessed 8 July 2015].

Donaldson, G. (2015) *Successful Futures: Independent Review of Curriculum and Assessment Arrangements in Wales*. Crown copyright. Available at:

<https://gweddill.gov.wales/docs/dcells/publications/150225-successful-futures-en.pdf>

[Accessed 22 November 2018]

Education Wales. (2019) *Draft Curriculum for Wales 2022: Mathematics and Numeracy*, Cardiff: Welsh Government.

ERW. (2018) *Literacy and Numeracy Strategy*, Cardiff: Education through Regional Working.

Estyn. (2017) *The Annual Report of Her Majesty's Chief Inspector of Education and Training in Wales*, Cardiff: Welsh Government.

Estyn. (2014) *Raising standards in literacy and numeracy*, Cardiff: Government Wales.

Estyn. (2017) *The Annual Report of Her Majesty's Chief Inspector of Education and Training in Wales*, Cardiff: Government Wales.

Gamble, N. (2013) *Exploring Children's Literature Reading With Pleasure and Purpose*. 3rd Edition ed. London: Sage.

Gascoigne, M. and G. J. (2017) *Talking About a Generation*. The Communication Trust.

Grigg, R. (2015) *Becoming an Outstanding Primary School Teacher*. 2nd ed. Milton: Routledge.

Gross, J. (2013) *Time to Talk*. Milton Park: Routeledge.

Hansen, A. (2008) *Extending Knowledge in Practice Primary Mathematics*. Exeter: Learning Matters.

Haylock, D. and Cockburn, A. (2013) *Understanding Mathematics for Young Children*. 4th ed. London: Sage

Jeffery, B. (2006) Creative teaching and learning: towards a common discourse and practice. *Cambridge Journal of Education*, 36(3), pp. 399-414.

Linder, S. (2011) Mathematics in Early Childhood: Research-Based Rationale and Practical Strategies. *Early Childhood Education Journal*, 39(1), pp. 29-37.

National Literacy Trust. (2017) *National Literacy Trust*.
Available at: <https://literacytrust.org.uk/information/what-is-literacy/>
[Accessed 01 June 2017].

Pound, L (2006) *How Children Learn*. London: Practical Pre-School Books.

Salisu, A et al. (2014) The role of modelling towards impacting quality education. *International Letters of Social and Humanistic Sciences*, Volume 32, pp. 54-61.

Schleicher, A. (2014) *Improving Schools in Wales: An OECD Perspective*, Paris: OECD: Better Policies for Better Lives.

Taylor, H. and Harris, A. (2014) *Learning and Teaching Mathematics 0-8*. London: Sage.

Thangata, H.W. (2007) *Key Concepts in Teaching Primary Mathematics*.
Available at: <http://studysites.uk.sagepub.com/haylock/Making%20Connections.pdf>

Welsh Government (2013) *Learning Wales*.
Available at: <https://learning.gov.wales/docs/learningwales/publications/130415-Inf-guidance-en.pdf>
[Accessed January 2013].

Welsh Government. (2015) *Learning Wales*.
Available at: <https://learning.gov.wales/docs/learningwales/publications/140624-maths-in-the-national-curriculum-skills-and-learning-en.pdf>
[Accessed 8 July 2015].

Welsh Government. (2015) *Curriculum for Wales: Foundation Phase Framework*.
Available at: <https://gov.wales/sites/default/files/publications/2018-02/foundation-phase-framework-revised-2015.pdf>
[Accessed 2015].

Welsh Government. (2016) *Learning Wales Raising Standards Together*.
Available at: https://learning.gov.wales/resources/browse-all/nInf/framework?component=numeracy&year=6938374_2&selectedYear=col_12&lang=en
[Accessed 20 October 2014].

Welsh Government. (2018) *An introduction to the professional standards for teaching and leadership*.

Available at: <https://learning.gov.wales/docs/learningwales/publications/180319-professional-standards-for-teaching-and-leadership-guide-en.pdf>

[Accessed 31 August 2018].

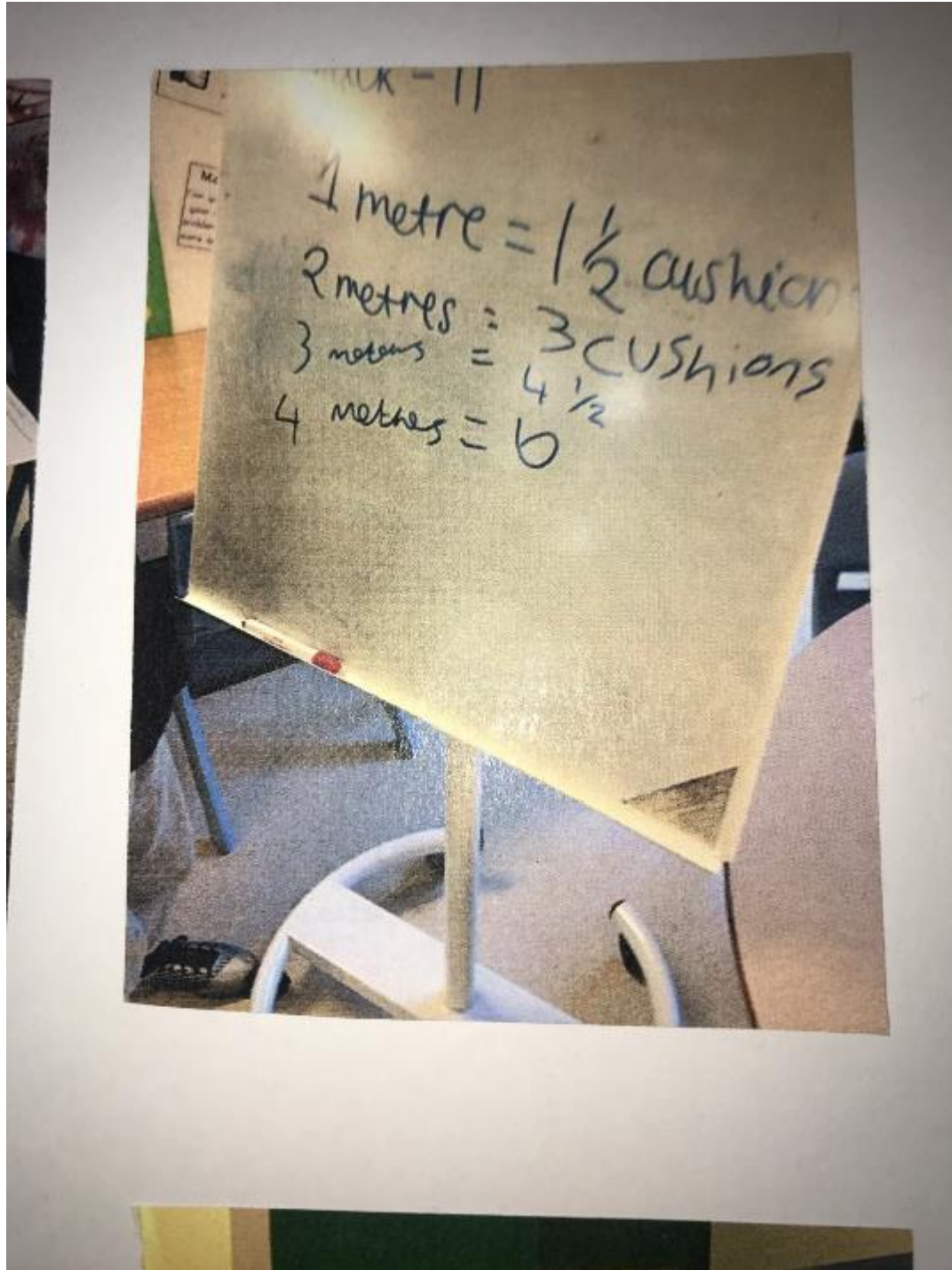
Williams, K. (2016) *New National Network of Excellence for Mathematics to be created*, Cardiff: Welsh Government.

Wooley, G. (2014) *Developing Literacy in the Primary Classroom*. London: Sage.

Wright, S. (2016) *Tes*.

Available at: <https://www.tes.com/news/30-second-briefing-what-zone-proximal-development>

[Accessed 18 May 2016].



Appendix 2 – Example of resources created

LO: To calculate the cost of fabric to make cushions

Success Criteria: Use a tally/frequency chart to calculate the cost and estimate the metres needed.

Self-Assessment:  I could have used more working out to help me solve the problem.



£3.99 Per metre



£2.99 Per metre



£1.99 Per metre

1 metre
makes $1\frac{1}{2}$
cushions

Materials	Tally Chart
Material A - Red	= 8
Material C - Yellow	= 6
Material D - Black	= 11

1 $\frac{1}{2}$ Cushions = 1 m
 3 cushions = 2 m
 6 cushions = 4 m
 8 m = 12 cushions

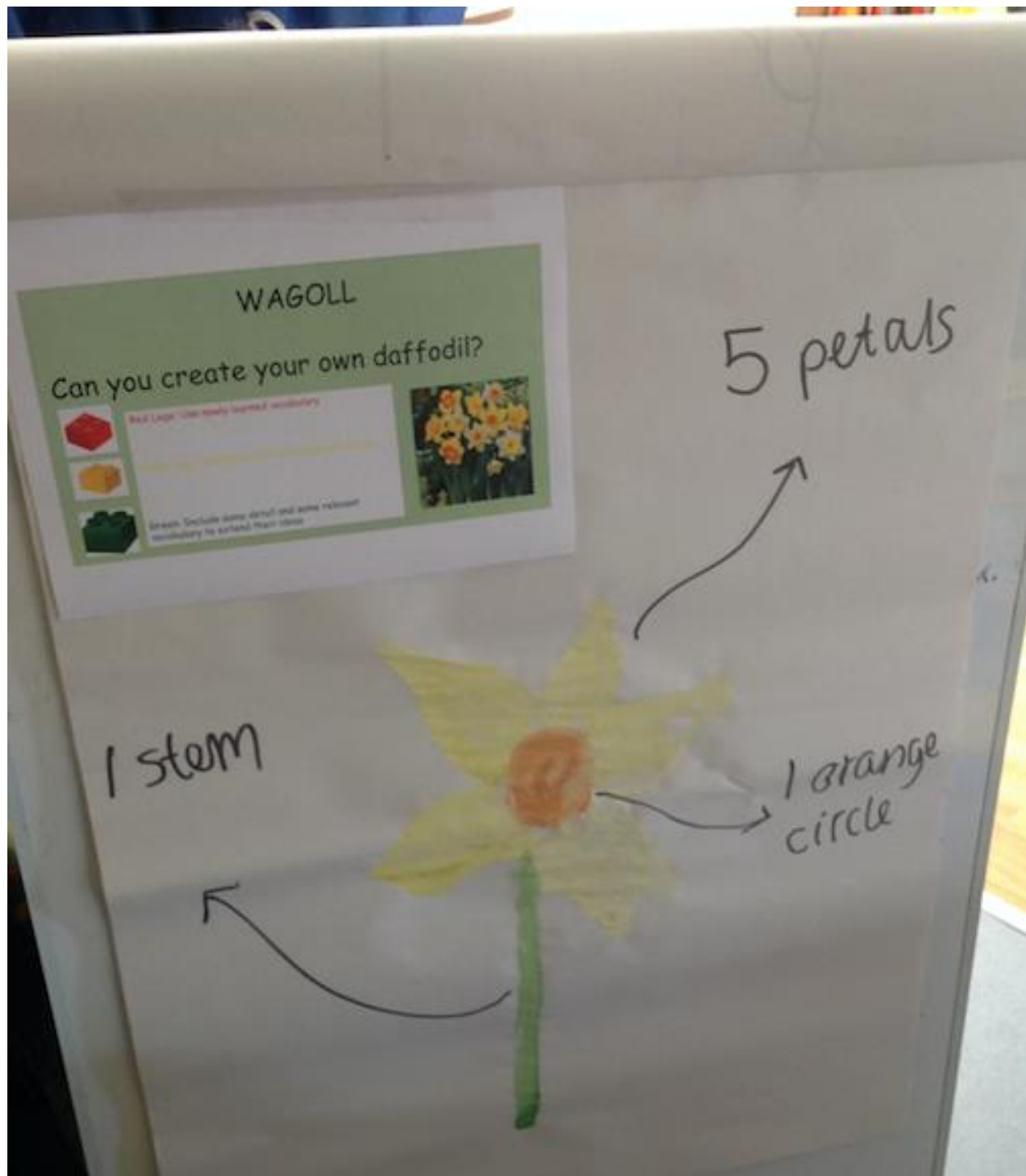
	£	1	7	.	9	4
+	£	1	5	.	9	6
	£	1	5	.	9	2
	£	4	9	.	8	2
		1	2			

Materials	Amount per metre - £	How many Metres	Total Cost
Material A - Red	£ 2.99	6m	£ 17.94
Material C - Yellow	£ 3.99	4m	£ 15.96
Material D - Black	£ 1.99	8m	£ 15.92

Appendix 3 – Cold task



Appendix 4 – Visual success criteria



Appendix 5 – Comparing and contrasting

