

A critical analysis of the relationship between teacher subject knowledge and effective learning and teaching in the primary school

In this essay I will be discussing literature regarding teachers' subject knowledge and its relation to effective learning in primary schools across Wales. From this, I will analyse my own subject knowledge within my experience on Professional Teaching Experience 1 (PTE1). I will refer to my placement school as School x, I will also be changing any names for confidentiality.

School x is set on two different campuses, infants and KS2. I was based on the KS2 campus in year 6 class. There are 32 children within the year 6 class. However, the children were placed into different ability groups for English and Maths and then were in mixed ability groups in the afternoon. This included the children from year 4, 5 and 6. School x is an urban school on the outskirts of Swansea. 29% of children within the whole school are entitled to free school meals.

Literature review

Throughout education there are many factors that contribute to being an outstanding teacher but throughout reading I have been able to see one factor, which seems to be compelling. This is that teachers must have a strong subject knowledge.

According to Grigg (2010) we define outstanding teaching through the difference they make to school life. An outstanding teacher is measured through their ability to make children want to learn and to want to know more. A teacher stands out because of their adaptability, enthusiasm and commitment. However, Cremin and Arthur (2014) suggest, to be an effective adaptable and creative teacher, you require subject knowledge. According to the Department for Education's (2011) Teacher's Standards teachers must have a good subject knowledge and ensure to keep their knowledge and skills up-to-date. It is essential for teachers to keep their knowledge and skills up to date because of the new curriculum (Successful Futures) change which will be made statutory in schools in 2020. Donaldson (2015) suggests that education needs good teaching to get effective learning. He states that there are various elements to good teaching. These include methodological and subject expertise and having the ability to inspire children to want to learn. Changing of the curriculum can give teachers anxiety and can be complex and demanding. Wilson and Miller (2018) suggests that the new curriculum is going to be one of the most challenging and most pivotal.

Donaldson (2015) also recognises the importance of scaffolding in education. Developed by Vygotsky's Zone of Proximal Development, Scaffolding is the way in which a practitioner 'scaffolds' or supports children's learning. A teacher must know each child's capabilities and then set challenges for them. At first, they will struggle, however, they will eventually overcome that challenge and another one can be scaffolded for the child by the teacher (Pound, 2006). A teacher plays a very important role in scaffolding children's learning. However, a teacher cannot scaffold children's learning if they do not have a good subject knowledge. It is essential that teachers know how to transfer their knowledge and understanding of subjects making them attainable to children. A teacher must know how to produce ideas in ways children can comprehend. Also, a teacher needs to make the topics and subjects interesting and enticing for children. This is a part of teachers continuing professional development. Staff must also have continuing curriculum knowledge (Arthur et al, 2006).

Shulman (1987) cited in Arthur et al (2006) suggests there are numerous areas of professional knowledge all teachers need to acquire. Shulman grouped subject knowledge into seven categorises. These are:

Content knowledge (better known to us as subject knowledge), general pedagogical knowledge, curriculum knowledge, pedagogical content knowledge, knowledge of learners and their characteristics, knowledge of educational contexts and knowledge of educational ends.

(Arthur et al, 2006, p.74).

Pedagogical content knowledge is unique to each individual teacher. It is the way in which teachers correlate their subject knowledge, which is what they know, and their pedagogical knowledge, which is what they know about teaching. It is not about the quantity and quality of a teacher's subject knowledge but it is about how they present and use their knowledge (Cochran, 1997).

Shulman (1986) cited in Brant (no date) believes that literature focuses too strongly on classroom management, behaviour, set time for activities and questioning techniques instead of focusing on lesson content.

Hedges and Cullen (2005) disagree with Shulman as they suggest that some authors believe subject based ways of teaching the curriculum is conflicting to the way children learn and think. They conclude this way of teaching is too formal and irrelevant.

According to Rowland and Ruthven (2011) knowledge of a subject when differentiated establishes that teaching expertise is more than just subject knowledge. When subject knowledge is contextualised, it highlights the importance of embedding subject knowledge early on through training and through various teaching tools.

To support learners' teachers must begin with the 'process of going inside to outside'. It is not what teachers can do pedagogically however, it is what is already inside (Gagnon, 2001, p. 51).

Hill et al. (2005) cited in Rowland et al (2009) suggested that pupils of teachers with a higher subject knowledge gained higher scores in assessment than those pupils with teachers with little subject knowledge. However, according to Hattie (2012) outstanding teachers can identify ways to produce the subject they teach. Outstanding teachers and teachers who are experienced do not differ in their curriculum knowledge capacity or their pedagogical knowledge, but they do differ in the ways in which they coordinate their knowledge and pedagogy. Hattie calls this Visible Learning. This has shown that teachers' subject knowledge had a small effect on student outcomes. If a teacher has a low subject knowledge and less pedagogical knowledge but does have a deep understanding of the subjects they teach and if their judgment on how to teach the subject clearly, student outcomes will still be the same (Hattie, 2012).

Rowland (2012) suggests that instead of considering normal factors of a lesson, for example behaviour management and organisation the knowledge quartet identifies events in a lesson with specific focus on the topic being taught and the subject knowledge that a teacher uses and refers to whilst teaching.

The Knowledge Quartet was developed by Rowlad et al (2009) was developed on the research and observation of initial teacher trainer mathematics lessons and their feedback. One PGCE student who they observed was Naomi. They observed Naomi's mathematics lesson and observed that she was teaching subtraction with the early years. Naomi included an introduction with a lesson objective and she also introduces children to subtraction as difference and language. Naomi explains her lesson in term the children can understand as she teaches through the image of frogs in a pond.

Things didn't go to plan however Naomi was able to come up with a solution quickly. After the introduction, she puts children into group of ability and helps one group. This group didn't understand their task, so she removed them off the set task and onto the carpet to do a count on activity instead. According to Grigg (2015) good practitioners can think flexibly in their teaching. This adaptability is shown when staff come away from set lesson plans and respond to children's ideas. At the end of the session, she sat the class back on the carpet to complete a plenary.

Rowland et al (2009) identified Naomi needed subject knowledge of subtraction and how to teach it during this lesson.

From these observations of the PGCE students Rowland et al created a framework on the practice of subject knowledge. This framework is called 'The Knowledge Quartet'. It began with 18 codes which were 18 ways that content knowledge might be implemented which gave them a new look on teaching mathematics in primary education. With a strong focus on a teacher's subject knowledge of maths. They had to find a way to reduce these 18 codes. They narrowed them down into four categories known as the knowledge quartet. They named these categories 'dimensions'. These four dimensions are 'foundation, transformation, connection and contingency'.

The first dimension in the knowledge quartet is 'foundation'. This category refers to the teacher's background and beliefs. The background includes their prior knowledge from either school, teacher training or both. The foundation dimension is different to the next three as it looks at knowledge already attained and possessed without regard of if it is being used or not.

The next three dimensions refer to the ways in which different context and knowledge is implemented when teaching.

Transformation is the second dimension in the knowledge quartet. Transformation is at the centre of what it means to teach a specific subject. This is the way teachers transform the information they already know into a way they can teach someone else, so they then can learn it.

The third dimension in the knowledge quartet is connection. Connection is the decisions and choices a teacher makes during lessons. This relates to teachers' planning and series of lessons. Connection includes the teacher's instruction between

lessons, the sequence of lessons and the sequence of topics in line with the curriculum. Also, a teacher makes connections between cognitive demands of various topics.

Contingency is the fourth dimension in the knowledge quartet. Contingency is events that take place within the classroom that a teacher did not plan for or an even that cannot be planned for. It is a situation where a teacher must think on their feet. Contingency is also when a teacher is willing to change their lesson plans in response to children's ideas, contributions and thoughts on a topic or lesson.

According to Rowland et al (2009) the four dimensions relate strongly to Shulman's seven categories of teaching. The first dimension's 'Foundation' surrounds knowledge of purpose category and subject knowledge category which correlates to the knowledge quartet.

The knowledge quartet's second dimension 'transformation' is a phrase used by Shulman when he explained teachers' pedagogical content knowledge. These ways are very similar when classifying subject knowledge.

The dimension of connection within the knowledge quartet is not really linked to any of Shulman's seven categories of teaching. The connection of a teacher's own subject knowledge is an aspect of their understanding of what is being taught. Teachers must have the ability to make connections for their pupils. This is a part of their pedagogical knowledge.

A dimension which is linked to Shulman's seven categories of teaching is 'contingency'. Contingency is the way in which teachers can 'think on their feet'. This is not a surprise that a teacher's subject knowledge plays out within their teaching and relates to Shulman's categories of subject knowledge, curriculum knowledge and pedagogical knowledge.

Reflection

I will now analyse my own subject knowledge within Professional Teaching Practice 1 using the knowledge quartet and referring to my literature review.

As I stated within the introduction of this essay, on PTE1 I was with Key Stage 2 (KS2) in a year 6 class. However, I taught years 4, 5 and 6. School x taught mathematics

and literacy in set ability groups mixed year 4, 5 and 6. Also in afternoon sessions the groups were again mixed but were mixed ability groups. I was very nervous initially when I found out that I would be in KS2 as the most recent experience I have had within a school is in a nursery class. The main subject I was concerned to teach was mathematics.

Since completing the literature review in this essay, I have been able to see how vital subject knowledge is but also pedagogical knowledge.

From reading I am anxious my subject knowledge isn't as good as I originally thought. Throughout PTE1 I taught most subjects in the curriculum but the ones that stood out as most difficult to me I will discuss below.

I am firstly going to discuss my subject knowledge in Digital Competence and Language and Literacy. I had the opportunity to teach a lesson on algorithms within ICT. At first, I was unaware of what an Algorithm was but once I researched thoroughly the lessons went very well and now, I feel my subject knowledge on that topic is very good.

Within language and literacy, I did not have many opportunities to teach as the children had oracy projects to do during my teaching time. However, I prepared a pupil evaluation sheet for peer assessment and still got to use my pedagogical content knowledge. I also completed a book review of the butterfly lion which we read as a class throughout my time on placement (See appendix 1). This was a very good lesson and all the children met the learning objectives.

By using the knowledge quartet, I will reflect upon my teaching in KS2 using 3 different lessons I taught.

Foundation

As discussed in the literature review 'foundation' is a teacher's prior knowledge. As a trainee teacher, my main concern is teaching mathematics. This is because of the bad stigma I feel surrounds maths. According to National Numeracy (no date) negativity towards maths is caused by numerous aspects. Sometimes it can be caused by bad experiences from school or anxiety. National Numeracy (no date) suggests that 25% of people have negative memories of maths in school.

The first few sessions I was asked to plan and prepare for was maths. School x asked me to cover percentages, fractions and decimals within my lesson and incorporate the topic they've been covering which is the Egyptians. I was put at ease when I was told to teach percentages, fractions and decimals as I feel my foundation subject knowledge is very good. However, I was very nervous when I had to create an activity worksheet and incorporate the Egyptian theme. In school x Maths is taught for 2 and a half hours on Monday and Tuesday and for 1 hour on Wednesday. So, I had to plan enough content to cover these lessons. I managed to create a worksheet (See Appendix 2) and my school mentor confirmed.

Regarding the Egyptian era, I felt my subject knowledge was lacking. Despite my best efforts to learn as much as I could about the topic, I struggled, and my confidence declined. According to Alsubaie (2016) teachers are the most knowledgeable about teaching and it is their responsibility to teach the curriculum in a classroom. It is teacher who must make the effort to understand and know the curriculum content. So, reflecting on this before I went to placement, I should have found out the topic and improved my subject knowledge.

Another lesson I felt my Egyptian Era subject knowledge lacked and my subject knowledge in general was when I was asked to teach Welsh. I can speak basic Welsh, however, I lack confidence in my pronunciation of more complex words and sentence patterns. Despite this, I planned a lesson 'Writing a first-person profile of an Egyptian God'. I planned and practiced for this lesson prior to teaching it and I feel it went very well. I researched information on the Egyptian gods, found out about them and then translated the information into Welsh.

One lesson that the Egyptian topic was not incorporated into was Physical Education. My foundation subject knowledge of Physical Education is quite good. For my PE lesson I decided to teach a circuits class. Within the new curriculum, one of the four purposes is to have 'healthy, confident individuals who: take part in physical activity and apply knowledge about the impact of diet and exercise on physical and mental health in their daily lives' (Donaldson, 2015). Also, within the current KS2 curriculum children must take part in activities that 'contribute to general health, fitness goals and feelings of well-being' (Welsh Government, 2015). I was really looking forward to this

lesson however it did not go to plan. This will be explained in more depth throughout my reflection.

Transformation

The dimension of 'transformation' as discussed in my literature review is the way in which teachers can transform their prior knowledge into ways to teach a lesson.

This relates to 'pedagogical content knowledge' in Shulman's seven categories of teaching. According to Guerriero (no date) if a teacher has a good pedagogical content knowledge it has a higher effect on student attainments than a teacher having a good subject knowledge does.

I believe that my pedagogical knowledge is good. On PTE1, I feel even though my subject knowledge was poor the way I taught and the results I achieved from the students was very good.

However, I did not feel my pedagogical knowledge was as good in KS2 as it is in the Foundation Phase. An area in which I really struggled was behaviour management. School x has some children with very challenging behaviour. As I didn't have a set class, I found it very difficult to build rapports with these children, which made their behaviour when I taught them even more difficult.

According to Imray (2008) forming positive relationships with children in your class is the only lasting effective solution to challenging behaviour. However, Rogers (2002) disagrees with Imray as he suggests that children will not behave and have respect for disorganised teachers or teachers who have weak subject knowledge. He also suggests inexperienced teachers will have a harder time when looking at pedagogical content.

Reflecting on Rogers (2002) thoughts: in the Physical Education lesson (discussed earlier in the Foundation dimension) I felt I had no respect from the children. This was a strange experience for me as the children who usually misbehave and don't listen were the children who completed the task brilliantly and reached the lesson objective. However, the children who are usually top of the class and listen, I found it very hard to control their behaviour and they did not want to take part in the lesson. I discussed this with the class teacher and she said it happened to her also. She suggested that behaviour management techniques come with experience and even after 30 years of

teaching, she still struggles with behaviour management. The longer I am in a school the more I will be able to build good relationships with children as I do agree with Imray (2008) and believe if you build a good rapport with your class they are more likely to respect you.

Within my maths lessons I feel even though again my subject knowledge was not the best my pedagogical knowledge was good. Referring to the literature review Cochran (1997) suggested that pedagogical content is unique to each teacher and it wasn't about the quantity of what a teacher knew but it was how they used the information. I agree with this as I feel that I did not let the children see my lack of subject knowledge, instead I was confident and taught the lesson well.

Attributing to the Welsh lesson I taught, my pedagogical content knowledge was again good. I feel I delivered the lesson well and in ways the children reached the learning objective. Reflecting on this lesson, I have been able to see that I did not differentiate enough. According to Haynes (2010) all children are at different attainment levels and have different backgrounds so even though they are experiencing the same lesson they will have different experiences of it. Furthermore, we may need to provide different activities for different learners. I could overcome this by planning carefully and discussing with the teacher who takes the Welsh lessons what differentiation is needed.

Connection

As discussed in the literature review connection is the decisions and choices a teacher makes during a lesson. Also, instructions between lessons etc.

On PTE1, I needed to plan for various lessons relating to the curriculum but also the topics currently taking place within school.

In maths lesson of percentages, decimals and fractions, I planned two lessons both linked. Lesson one was to learn the skills of conversion and then lesson two was to use that skill on the topic-based activity. Haynes (2007) suggests that when a teacher is planning lessons and work it is essential to look at what the pupils have learnt before and link this to their future learning. This is to ensure that you revisit that learning and help the children move forward in their learning.

In Welsh the week before I had to plan a lesson the children were learning to write about 'what they did on the weekend' so the vocabulary they used in this they had to transfer their knowledge and use it within the lesson planned.

Connection is also instructions between lessons and the sequence of lessons. I have a strong knowledge on this as I have done it for the past year. I was nervous at first however, after the first few times of giving instruction and explaining to the children the plans for the day my confidence excelled.

Connectivity

Connectivity is events that take place within the classroom that were not planned for. On PTE1 I have experienced a lot of this.

Again, discussing the mathematics lessons, I had planned lessons however, a few children completed the task faster than other and I did not expect this. I did not plan an extension activity, so I had to 'think on my feet'. I asked the children to do some data handling. This is a situation I did not plan for however reflecting on it I should have planned an extension activity in case this did happen.

Also, within the physical education lesson I had to stop the lesson completely because of the response from the children. This group of children were not enjoying the lesson and I could see from their body language and behaviour they did not want to do it. I made the decision to stop the lesson and we played a game called 'bench ball'. The children showed teamwork, enthusiasm and enjoyment when playing this game and they all worked very hard however because I decided to change the lesson the children did not meet the lesson objectives.

Reflecting on my Welsh lesson a child asked me what the 'afterlife' was in Welsh. This was not something I had planned for as in the introduction I had given the children a list of places their gods could have lived. However, this child was building on his prior knowledge as he knew the god he had chosen lived in the afterlife. This was a very good question and related very well to his work, but I did not know the answer. I had told the children that I was unsure, and could he find out for me what it was. After a few minutes, he had found out on the computer and we then shared it with the class. This students' question was far beyond my subject knowledge and I was not prepared for his question.

Conclusion

Reflecting on Professional Teaching Practice and completing a literature review focusing closely on the importance of subject knowledge referring to Shulman's seven categories of teaching and the knowledge quartet I have come to see that I need to improve my subject knowledge a lot more as I wish to become an outstanding teacher. However, I have also come to learn that it is not only your subject knowledge that makes you an outstanding teacher but it's the pedagogical content knowledge and all the little things that when you put them all together you can still be an outstanding teacher. As a trainee teacher, I will always strive to gain knowledge and then pass that knowledge onto children but also help children understand the world they live in and help them recognise their unique part in it (Hayes, 2007). Reflecting back on my lessons it is clear to see I need to work on various behaviour management strategies and to improve my Welsh language.

Appendix

1.

Friday 30th November
Goal: The Butterfly Lion - To write a book review.
Book Review
The Butterfly Lion

Author: Michael Morpurgo
Illustrator: Christian Birmingham
Genre: adventure / animal
Themes: Friendship
Plot: Three paragraphs. ✓

There was a little boy, who was ten years old, called Bertie. He was the narrator, he decided to escape the misery of boarding school and go home on a train back to London. He met an old lady named Millie. She told him the story of Bertie and his lion. One day Bertie found a baby lion cub, he then couldn't look after the poor lion cub so they made a promise that they would never forget each other no matter how far away. He also had to sell his lion cub to a man because he went to boarding school. A couple of lovely years after that the boy and lion cub are reunited together. He also had to sell his white lion to a man.

I liked the book because it reminds me alot about Africa and wildlife. It makes me feel happy, sad and very warm hearted. ✓

I recommend that they ^{add} be a little more ^{happiness} happiness and have more pictures in the book.

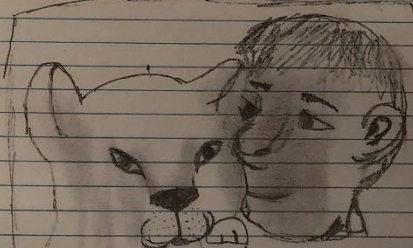
My star rating on this book would be a three because there are alot of interesting things in the book.

☆ ☆ ☆ ☆ ☆

The Butterfly Lion by Michael Morpurgo
Goal: To write a book review. D/G
SC Checklist.

Have I included:-	Me	Peer marking.
The title of the book.	✓	✓
The author of the book.	✓	✓
The illustrator of the book.	✓	✓
The genre for the story.	✓	✓
The main themes and plot (3 short paragraphs)	✓	✓
A cause and effect.	✓	✓
My opinion on the book.	✓	✓
A recommendation.	✓	✓
A star rating	✓	✓

What a beautiful picture!



Gwaith da a little bit more detail could have been added to your plot. HI

2.

Gods	Burial Chamber	%	Servants Chamber	%	Family Room	%	Fake Burial Chamber	%	Temple	%
Ma'at	15 20		27 50		20 25		2 10		47 50	
Horus	16 25		11 50	84%	19 20		11 10	10%	12 20	
Hathor	11 50	14%	21 25		8 10		29 50		14 20	
Thoth	7 10		11 25	100%	16 20		11 50	10%	23 25	
Ra	11 25	16%	7 20		15 50		11 10	40%	9 25	
Seth	11 50	44%	7 10		11 25	60%	33 50		11 20	80%
Amun	11 20	10%	13 25		11 50	56%	6 10		17 20	
Anubis	11 50	64%	11 10	50%	12 20		21 25		11 50	58%

This is the worksheet completed by a student

11.18

Goal-To convert percentages and fractions.

Gods	Burial Chamber	%	Servants Chamber	%	Family Room	%	Fake Burial Chamber	%	Temple	%
Ma'at	$\frac{15}{20} = \frac{3}{4}$	60% 75%	$\frac{27}{50}$	54%	$\frac{20}{25}$	80%	$\frac{2}{10}$	20%	$\frac{47}{50}$	94%
Horus	$\frac{16}{25}$	64%	$\frac{42}{50} = \frac{21}{25}$	84%	$\frac{19}{20}$	95%	$\frac{1}{10}$	10%	$\frac{12}{20}$	60%
Hathor	$\frac{7}{50}$	14%	$\frac{21}{25}$	84%	$\frac{8}{10}$	80%	$\frac{29}{50}$	58%	$\frac{14}{20}$	70%
Thoth	$\frac{7}{10}$	70%	$\frac{25}{25} = 1$	100%	$\frac{16}{20}$	80%	$\frac{5}{50}$	10%	$\frac{23}{25}$	92%
Ra	$\frac{4}{25}$	16%	$\frac{7}{20}$	35%	$\frac{15}{50}$	30%	$\frac{4}{10}$	40%	$\frac{9}{25}$	36%
Seth	$\frac{22}{50}$	44%	$\frac{7}{10}$	70%	$\frac{16}{25}$	60%	$\frac{33}{50}$	66%	$\frac{16}{20}$	80%
Amun	$\frac{2}{20} = \frac{1}{10}$	10%	$\frac{13}{25}$	52%	$\frac{12}{50}$	56%	$\frac{6}{10}$	60%	$\frac{17}{20}$	85%
Anubis	$\frac{32-16}{50} = \frac{16}{50}$	64%	$\frac{5}{10}$	50%	$\frac{12}{20}$	60%	$\frac{21}{25}$	84%	$\frac{20}{50}$	58%

Nof Gwaith hyfyd you can calculate fractions and percentages well.

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