

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

Word count: 4393

Introduction

In this essay, I will focus on the relationship between teacher subject knowledge and its effect on pupils learning in primary schools in Wales. Firstly, I will critically analyse and evaluate reading surrounding this relationship before reflecting on my own subject knowledge and its effect on pupils I have taught during PTE1. Whilst reflecting on PTE1 I will use the readings I have undertaken to influence my reflection and draw my evaluation and targets on areas that need further development.

The school in which I undertook PTE1 will remain anonymous during this essay and any names of pupils or staff members will be changed in accordance to the BERA (2018) guidelines.

The school is a green school situated in Barry in The Vale of Glamorgan. It is a large school with 36% of pupils eligible for free school meals. The school caters for pupils aged 3-11 with 31% of pupils in the school identified as having additional learning needs (Estyn, 2017). The school in question is a pioneer school for the new curriculum in Wales for digital competency (reference removed for anonymity). During PTE1 I was placed in a year 5 class with 31 pupils: ten of whom have additional learning needs. There were two class teachers due to one teacher working as a lead practitioner for the new curriculum, therefore in school on a part-time basis. There were no teaching assistants for the year group however pupils were often out of class for additional support and interventions.

A consideration of the literature

Teacher subject knowledge is a continually developing. It is not just what you know but the skills; ethics and understanding that accompany it (Shulman, 1987,p.4). There has been an on going debate for years by scholars and professionals about what makes a person a competent teacher. It is clear that they believe that the "knowledge base is growing" (Shulman, 1987,p.4) and that teacher subject knowledge is of utmost importance to run a learning rich environment where all learners' needs are being met.

As the curriculum develops so does it's teachers which means the expectations of their knowledge is continuously growing. The Holmes group (1986) "recognise differences in teachers' knowledge, skill, and commitment in their education" and believe that there needs to be support for teachers to improve and build upon their knowledge. However, scholars "Assume there must exist a body of knowledge and skill to examine" (Shulman, 1987, p.5) but there are no specifications anywhere within the curriculum or policies that dictate what a teacher should know (Shulman, 1987, p.5). Teachers cannot be correctly evaluated equally if there is no criterion by which to compare their knowledge. Therefore how do you define a teacher as having good subject knowledge? The Holmes group's intentions are to improve education and it's teachers (The Holmes group, 1986) but as they are deans and professionals of colleges, their changes might not affect primary school education. If pupils' needs aren't being met in primary school first, then they may not have the foundation of knowledge to carry them through into further education. Improvements need to be made from the bottom up (Jackson. et al. (2007).

After undertaking extensive research, Shulman found that there are a 'minimum' of seven categories that define teacher knowledge. These are "Content knowledge; General pedagogical knowledge; Curriculum knowledge; Pedagogical content knowledge; Knowledge of learners and their characteristics; Knowledge of educational contexts and knowledge of educational ends, purposes and values" (Shulman, 1987, p.8). Content Knowledge is a key focus on three out of seven elements on Shulman's list. Content knowledge is believed to be more than what

you know about a subject but the "knowledge of concepts, theories, ideas, organizational frameworks, knowledge of evidence and proof, as well as established practices and approaches" (Koehler & Mishra, 2009, p.63).

Firstly, Pedagogical Content Knowledge (PCK) is when a teacher combines his or her pedagogical knowledge with their existing content knowledge to form their own understanding. They are then able to translate this into a form that permits others to understand and learn in an age-appropriate manner. It also encompasses a teacher's ability to know what is too challenging or not challenging enough for the pupils in their class (Rowland et al, 2005, p.255). A teacher with good PCK is able to successfully explain a subject in different ways to meet the needs of the pupil. Koehler & Mishra (2009) agree with Shulman's definition of PCK and they also believe that it is a way of "forging connections...alternative teaching strategies...alternative ways of looking at the same idea" (Koehler & Mishra, 2009, p.64).

Shulman also discusses the importance of subject matter knowledge (SMK). He discovered that teachers "must have not only depth of understanding... but also a broad liberal education that serves as a framework" (Shulman, 1987, p.9). Teachers must have "multi-faceted comprehension" to be able to communicate with their pupils and meet their diverse. He discusses the importance of the teacher's need to have strong SMK in order to create a learning rich environment (Shulman, 1987, p.9). "SMK is knowing the content of the discipline" (Rowland et al, 2005, p.255). It is knowing the "key facts, concepts, principles and frameworks... and how knowledge is introduced and accepted in that community" (Rowland et al, 2005, p.255). "It was accepted by many that the best teachers were those who knew their subject matter very well" (Bursal & Paznokas, 2006, p.173) If the teacher is not confident in the subject they are teaching then it is possible that there will not be enough diversity in teaching skills for pupils to understand.

The third category, which focuses on content, is curricular knowledge. Curricular knowledge is the teacher's grasp of the government documents and legislation

that outline what pupils should know (Kennedy et al, 2015, p.303). It “encompasses the scope and sequence of teaching programmes and the materials used in them” (Rowland et al, 2005, p.256) that enable teachers to know what that year group should be learning and if that pupil is excelling or is in need of extra support. A teacher with good Curricular Knowledge will know where their class needs to be and the steps in order to challenge them further.

Shulman's seminal article influenced many scholars and professionals' research. However, Shulman's research is based in America. It is possible that due to a different curriculum to Wales that there are different expectations of teachers and what is required of them.

Shulman took inspiration from Piaget's seminal work on "knowledge growth" (Shulman, 1987, p.4). Through Piaget's experiments, he proposed, "the construction of knowledge is based on individuals experiences" (Bates, 2016, p.48). Although Piaget's work has been criticized as bias due to his research being carried out through the observation of his own children, his theory can broaden "to include people of all ages" (Bates, 2016, p.48).

Shulman used Piaget's method of observing knowledge growth to apply it to student teachers. He set out to "follow their eventful journeys from being teacher education students to becoming neophyte teachers" (Shulman, 1987,p.4). He also carried out observations on experienced teachers as a comparison for his research. One case study is that of Nancy, a "veteran English teacher" who is commended for her excellent PCK and interaction with pupils in her class. "She was like a symphony conductor, posing questions, probing for alternative views, drawing out the shy and tempering the boisterous" (Shulman, 1987, p.2). She demonstrates fluency in the classroom whilst creating a learning environment catered to everybody's needs. Creating a challenging environment for pupils to push and develop themselves further: to come out of their comfort zones. Nancy used a "conceptual framework in her teaching" (Shulman, 1987, p.2) and used this framework (Appendix 1) to scaffold the lessons for her pupils. It is possible that due to the pupils having a framework to follow they could see the next steps

of development for them to push themselves to achieve a higher level. They knew what they needed to achieve to widen their knowledge and how to deepen their thinking skills. Here Nancy shows her excellent PCK and SMK with confidence, creating an open space for pupils to converse with one another and ask questions. She sets out clear intentions and expectations from pupils (Shulman, 1987, p.2). Nonetheless, Nancy's observation was carried out in a High School. When discussing content knowledge, it is more challenging for a primary school teacher to have in-depth knowledge of each subject. High school teachers specialize in a subject making it more reasonable to ask for them to be highly knowledgeable in their field, whereas a Primary school teacher needs to have a foundation of knowledge in all subject areas.

During another observation, Nancy was ill and “unable to speak aloud” (Shulman, 1987, p.3). However, this did not stop Nancy from creating a controlled environment where learning was taking place. “Once again the class had run smoothly, and the subject matter had been treated with care” (Shulman, 1987, p.3). She drew upon her knowledge of teaching to maintain standards in the classroom without a voice. Using her PCK and SMK she split the classroom into mixed ability grouping. Research shows “that lower attainers and disadvantaged students are most likely to favor mixed-attainment classes” (Tereshchenko et al, unknown, p.4). This is due to them feeling less pressured about not being able to understand and complete the task. Boaler (2006), 2008) discovered that mixed ability grouping was also beneficial as the higher ability pupils felt a responsibility to ensure that the lower ability pupils were included and understood the task (Tereshchenko et al, unknown, p.4). By using mixed ability grouping, Nancy was allowing pupils to teach each other allowing her to take a step back.

Shulman discusses how Nancy manages to create a learning rich environment with excellent classroom management skills when she has no voice. Because Nancy is based in a high school, pupils are more capable of independently learning and working collaboratively. However, when teaching in a Primary

school setting it is not often possible for a teacher to step back entirely from a lesson, especially in the Foundation phase, due to pupils still learning how to collaborate (Welsh Assembly Government, 2015) with each other and pupils being more reliant on adults at a younger age for guidance. This is possibly due to not being able to read fluently yet meaning step-by-step instructions are required if visual aids are not possible. It is evident that the contrast in Nancy's teaching, and the ability to maintain a high standard of teaching, means that there is no one style of teaching that creates a competent teacher. Her experience over years of service is in line with Piaget's theory that knowledge is something that develops over time through our experiences " (Bates, 2016, p.48).

Shulman's seminal article influenced the research of others, which led to the creation of the knowledge quartet. With a specific focus on Shulman's SMK and PCK Rowland et al (2005) scrutinised 24 videos of mathematical lessons. They found 18 categories through the videos that were subsequently categorised into four units. The Foundation; transformation; connection and contingency make up the four units that are the Knowledge Quartet (Williams, 2003, p.97). The 18 categories were created as a "framework for reviewing mathematics teaching with trainees following observation" (Rowland et al, 2005, p.259).

The foundation is what the trainee teacher already knows and understands about mathematics. Their understanding will then "inform pedagogical choices and strategies" (Williams, 2003) within their classroom and lesson plans. Research shows that a teacher's confidence in mathematics runs alongside their competency in the subject (Norton, 2017, p.47). It is believed that student teachers "with negative attitudes towards mathematics have performance challenges" (Norton, 2017, p.47). Therefore, a teacher who lacks the confidence in mathematics, might not possess enough foundation knowledge to successfully inform their planning and teaching.

From the foundation, they will move on to transformation. This is where trainees can take their understanding of mathematics and present it in a way that is understandable to their pupils through their planning and delivery in the

classroom. Teachers should be aware of different mathematical patterns and methods in order to teach pupils various options to find a way that suits them (Williams, 2003, p.98). According to Ball (1998), it is not what the trainee knows about mathematics but the way in which the teacher can communicate their understanding to somebody else.

The third unit, connection, is where you link the lesson to prior learning. This is where you create “structural connections within mathematics” (Williams, 2003, p.98) in order for pupils to see the progression of the subject and use those connections to help problem solve. "Teacher confidence is important ... because of the potential to replicate positive or negative effect in students" (Norton, 2007, p.49). Teachers who lack SMK can lack confidence when teaching. This will have an effect on the learning taking place in the classroom if they aren't able to confidently make connections to prior knowledge in their lessons.

Lastly, contingency, where the teacher has the ability to react and respond to what happens in the classroom. We cannot predict what pupils will do or ask therefore a teacher needs to be prepared and confident in their content knowledge. They need the ability to read situations and know the best course of action and “when appropriate, to deviate from an agenda” (Williams, 2017, p. 98). “However, Brown and Wragg (1993) observe that our capacity to listen diminishes with anxiety” (Williams, 2017, p. 98). Research shows that teachers are only allowing pupils 0.9 seconds to respond to questions asked in the classroom (Gast, p.1). This is not enough time for a pupil to think of an in-depth response. A teacher cannot check if their pupils have understood the task correctly if they are not allocating enough time for pupils to ask questions and respond to questions asked. Questioning “requires much greater emphasis on the time provided for students” (Gast, p.1). This implies that Subject knowledge does not define a competent teacher as pupils need enough time to respond and ask questions to ensure effective learning. This is a matter of teacher-pupil relationship and knowing your class, not a matter of content knowledge one might know.

Analysis and evaluation of your subject knowledge for primary teaching

The school in which I undertook PTE1 is a pioneer school for Digital Competency for the new curriculum. They are currently providing training and implementing the Digital Competency Framework (DCF) throughout the school. Pioneer schools will also contribute to the new curriculum currently being written (Education Through Regional Working, unknown) The school in question adopted a new way of teaching this academic year. Inquiry based learning (IBL) where “Children naturally explore and learn” (Wang et al, 2009, p.381) based on their own inquiry. Pupils are proposed a question or topic and they are to see where their inquiry takes them. The classroom is also structured to fit cooperative learning “carousel” style rather than whole class teaching. Pupils take turns on four different activities per lesson in mixed ability groups. This encourages them to collaborate with each other and become “interdependent” (Serrano & Pons, 2014). The four activities are: A teacher focused task (TF); Independent; Digital learning and a practical task.

Donaldson (2015) recommends that we need to “promote sustained attention to the development and application of knowledge and skills in literacy, numeracy and digital competence” (p.35). During PTE1 I taught a number of mathematics lessons. When asked to teach the lesson I felt confident with my subject knowledge as I had recently updated my maths qualification. This soon turned into anxiety as I was presented with the ‘Singapore maths’ scheme to follow. The scheme comes with a guided focus task for teachers to explain to the class as an introduction to the worksheets. Having not been familiar with Singapore Maths, I was unaware of this guided task until the morning of my lesson and had planned a different introduction. I had to leave my introduction and teach the Singapore maths guided focus, as it was the school's scheme. I took for granted my mathematical subject knowledge and assumed that I would be able to work through the sheets with ease with the pupils explaining as I went along as it was Primary level math. The lesson was to multiply six digit numbers and the sheets were displayed on the screen for pupils to see the same as me. I soon found the sheets too complex to follow; as I was not familiar with this method meaning I

gave a poor explanation to the pupils. Donaldson (2015) discussed how pupils need “confidence to use and apply numerical skills in everyday life” (p.49). However, pupils were becoming confused by the new method that I was presenting, as they were comfortable to using the column method or doing mental math. I also felt that I was hindering their understanding by my own lack of knowledge of the method. Although I had a good foundation of knowledge, I was unable to transfer this knowledge into the transformation stage of the lesson due to my lack of understanding of a new way to multiply. I was therefore unable to successfully teach the new method to the class. It is clear that in order to progress I need to ensure that I am aware of the guided focus and plan my explanations to the pupils. I also need to ensure that I incorporate the method used in the focus into the carousel activities.

I was given the opportunity to teach the next math lesson. This time I was fully aware of what was required and not to take my subject knowledge for granted when planning the lesson. The learning objectives for this lesson were to subtract within 1 million (Appendix 2). This time I planned each carousel activity to be in line with the objective. I used my SMK and PCK to create an interactive carpet session for this guided focus. Pupils worked in their cooperative learning pairs on the carpet, pairing higher ability pupils with lower ability pupils, to achieve the most out of pupils. I implemented strategies during their cooperative learning to ensure maximum learning was taking place. One strategy was to get pupils to work out sums on whiteboards in their pairs. Both pupils had to put their hands up when they had finished the sums. The benefit of this strategy is that pupils can only put their hands up if both pupils in the pair understand and can explain how they reached their answer. This ensures that the higher ability pupils explain to the lower ability pupils how to complete the work and it allowed me to roam freely around the classroom to help anybody who found it a challenging task. This then gave the lower ability pupils a sense of confidence when chosen to come out to the board and explain their answer as they understood the question and had completed the question already. The second math lesson was much more of a success as pupils were given the opportunity to become “ambitious,

capable learners who...can explain the ideas and concepts they are learning about” (Donaldson, 2015, p.29). They could also link what they were learning to everyday life through the use of the carousel activities being relevant to them.

Donaldson (2015) has identified that there are “four purposes of the curriculum” (p.29). He believes that pupils should be “ambitious, capable learners who... can communicate effectively in...both Welsh and English” (p.29). The new curriculum will be written to "ensure appropriate emphasis on the Welsh language” (Donaldson, 2015, p.35) as the government is committed to increasing the level of Welsh used in English medium schools. After Donaldson (20015) recommendations, the new curriculum will have six areas of learning and experiences. One of the areas is Language, Literacy, and Communication. During PTE1 the school was eager for me to teach Welsh language as I come from a Welsh educational background. They were aware of the new expectations of the level of Welsh in schools that will come into place over the next few years. Estyn has found that although standards of Welsh are good in the FP, standards would drop once pupils researched KS2 (Donaldson, 2015, p.59). To teach Welsh, I incorporated carousel learning into the lesson. After the first carousel was successful, pupils developed a great interest in Welsh and were eager to have more Welsh lessons. The topic this term was ‘the time’. I found I had a good foundation of knowledge in this area coming from a Welsh background. I also felt that my transformation skills were stronger in Welsh as I could draw on my own prior knowledge of teaching the time in English and transfer that into Welsh in an appropriate manner that the pupils could understand. I was also able to connect the lesson to the pupils’ prior knowledge by ensuring they could tell the time in English and then connected it to Welsh. The use of visual aids of clocks for them to move the hands on was great support in consolidating their learning. I found the contingency aspect of the knowledge quartet the most challenging whilst teaching language. This was due to the pupils being so eager to learn Welsh that they would ask for translations of anything they could think of. It was challenging for me to translate to welsh off the top of my head due to not speaking Welsh for a number of years. I had also only planned ‘the time’ in

Welsh and the use of incidental Welsh so that I was unprepared for these questions. I was torn between dismissing the questions, as I didn't want to deviate too far from the topic or look foolish if I did not know the answer, but I also did not want to dismiss their enthusiasm to the language. I decided to allow the pupils to ask the questions, as I would rather encourage their development in the language as a whole. I just admitted to not knowing everything and explained that I am also learning with them. I encouraged them to use the ipads to find the answer during an active break if I did not know it. I did not want my fear of not knowing to affect their learning. The new area of learning for language, literacy and communication is committed for pupils to have "a high level of competence in literacy in English and Welsh" (Donaldson, 2015, p.49) therefore even though I deviated from the original lesson planned for a few minutes, a lot of learning took place due to pupils finding out the translation of what they wanted to know in Welsh not just the Welsh we are told to cover. By encouraging this enthusiasm to learn through asking questions and becoming inquisitive learners they will develop a wider vocabulary in Welsh. The use of cooperative learning was effective for the use of a Welsh lesson as I was able to provide four different activities that could cater to the learning styles of each pupil (Appendix 3).

The school in which I undertook PTE1 had access to many digital devices due to being a digital pioneer school. Digital competency has become an equally important part of education now and has been acknowledged as needing "similar status within the curriculum to that of literacy and numeracy" (Donaldson, 2015, p.40) due to it being a large part of children and young peoples lives today. As the classroom was set up for carousel learning one of the four activities always encompassed a digital aspect. At the start of PTE1, I made the assumption that I would be covering the strands with ease due to always having a digital task. I lacked the Curriculum knowledge to know that I was only touching on parts of the Digital competency framework (DCF). My lack of knowledge and research meant that I believed through pupils learning welsh by playing a Welsh language game online, that I would be the strands in the DCF. I quickly learned that this was not the case, and that however much fun the pupils were having I was not

expanding their digital knowledge by doing this, only their level of Welsh. After discussion with the class teacher about the matter, I was praised for the website as a Welsh resource. As the pupils are used to ICT as a part of their daily lives it was acceptable for me to use a game for the purpose of learning Welsh.

Furthermore, the DCF should be incorporated into pupils' daily school lives, therefore I needed to work on my curriculum knowledge in order to not make this judgment again. Through reading the DCF and studying the year 5 strands I was then able to correctly incorporate the DCF into their everyday lessons. I used the digital devices allocated to the classroom for pupils to do collaborative research, evidencing their work through a planned method of presentation (Appendix 4).

Conclusion

The research of Rowland (2005) the knowledge quartet and Shulman (1987) makes it clear that teacher subject knowledge is of utmost importance. It is also specified that teacher subject knowledge is far more than subject knowledge. It is made up of a number of factors and skills such as SMK, PCK, and curricular knowledge that when combined create a positive learning experience for pupils (Shulman, 1987). It is clear through Piaget's influence on Shulman that Teacher subject knowledge is something that develops over time. This shows in the excellent lesson veteran teacher Nancy taught when ill, due to her experience and knowledge (Shulman, 1987).

Overall through evaluating my own practice, I have found that my curricular knowledge is weaker than I had acknowledged. As I did not fully understand what was required to teach in the strands and skills of the curriculum I was unaware that I was missing opportunities to incorporate the DCF into daily classroom practice. Because my focus was to incorporate the Literacy and Numeracy Framework (LNF) into each lesson, I neglected the DCF; something Donaldson (2015) suggests should have as high value in our curriculum as the LNF. To move my practice forward I need to expand my curricular and Pedagogical knowledge in order to successfully plan lessons that will get the best

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learning from pupils whilst understanding the reasoning behind strategies that are put in place.

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Appendix 1

Basically, I break reading skills into four levels:

Level 1 is simply translation. . . . It is understanding the literal meaning, denotative, and frequently for students that means getting a dictionary.

Level 2 is connotative meaning and again you are still looking at the words. . . . What does that mean, what does that tell us about the character? . . . We looked at *The Scarlet Letter*. Hawthorne described a rose bush in the first chapter. Literal level is: What is a rose bush? More important, what does a rose bush suggest, what is it that comes to mind, what did you picture?

Level 3 is the level of interpretation It is the implication of Levels 1 and 2. If the author is using a symbol, what does that say about his view of life? In *Moby Dick*, the example I used in class was the boots. The boots would be the literal level. What does it mean when he gets under the bed? And the students would say, he is trying to hide something. Level 3 would be what does Melville say about human nature? What is the implication of this? What does this tell us about this character?

Level 4 is what I call application and evaluation and I try, as I teach literature, to get the students to Level 4, and that is where they take the literature and see how it has meaning for their own lives. Where would we see that event occur in our own society? How would people that we know be behaving if they are doing what these characters are doing? How is this piece of literature similar to our common experiences as human beings? . . . So my view of reading is basically to take them from the literal on the page to making it mean something in their lives. In teaching literature I am always working in and out of those levels. (Gudmundsdottir, in preparation)

Appendix 2

Main activities

TF- Singapore Maths Subtracting within 1 000 000-

Worksheet 6. Pupils will use column method to complete the work sheets and write in their maths books.

ICT- Mathletics website. Challenges have been set for the pupils for the next half term for Addition and Subtraction.

Independent area- Subtraction board game. Pupils will work in groups of 3 to play a subtraction board game. If they land on a number they need to answer it correctly or they have to go back to their previous space. Pupils may have a white board to work the answers out.

IA 2- Pupils will pretend they have won £1000000 on the lottery. They will price up what they would buy with their money. They will then need to add the total cost up and subtract it from 1000000 to see how much money they will have left.

Appendix 3**Main activities**

ICT –

<http://adnoddau.canolfanpeniarth.org/clock/index.php>**More challenging**<https://resources.hwb.wales.gov.uk/VTC/2010-11/maths/awen-robot-factory/amser.html>

TF – Pupils are to glue clocks in their books and write down what the time on the clock is next to it e.g. Mae hi'n hanner awr wedi pump. Pupils will also have a go at writing their own sentence and then drawing the hands on the clock so that it matches.

Independent Area- Pupils are to read scripts with blank spaces in them where they can take it in turns to fill in the blanks during the conversation choosing from the vocabulary we have learnt. This is to encourage welsh conversations and improve their oracy skills. It will ensure they repeat the same phrases in order to imbed the learning.

Independent area 2- Jenga game.

Pupils are to work in groups to play jenga. As they pull a piece of jenga out it will have an image of a clock or sentence on it. They will then have to tell the time in welsh or translate the word/sentence whilst playing the game. This will encourage them to think more whilst playing and encourage them to use the vocabulary in the lesson.

Appendix 4

ICT – Research into electricity.

Pupils will be given a question sheet to work through.

They will need to find out what is dirty and clean energy?

What is bad about dirty energy? Where does it come from?

Why is it running out?

What is clean energy? Where does it come from? What is

good about it? What types of clean energy are there?

Developing research skills. Pupils are to use the buddy system to ask other people in their group for guidance if needed.
