

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

4109 words

Introduction

In this essay I will discuss the relationship between teacher subject knowledge and the learning that takes place within the classroom. Firstly, I will begin by discussing the literature surrounding teacher subject matter knowledge (SMK) followed by pedagogical content knowledge (PCK) prior to analysing and evaluating my own subject knowledge base for primary education. The teaching episodes that I will base the evaluation and analysis on will derive from my own Professional Teaching Experience (PTE1) within a placement school.

For the purpose of this essay and in accordance with BERA (2018) guidelines, the school, staff and pupils will remain anonymous and thus the school will be referred to as school X. All staff and pupil's names have also been changed to protect identities. School X is a primary school which caters for children aged three to eleven spread across ten classrooms which include four single-aged classes, five mixed-age classes and one nursery class. The school also holds a learning resource based class with nine pupils from key stage two.

The school currently has 30% of pupils eligible for free school meals which is well above the national average of 19% (Esytyn, 2018). It has identified approximately 24% of pupils having additional learning needs which is marginally above national average of 21% (Esytyn, 2018). Pupils from the learning resource based class are included within this statistic. A very small proportion of pupils are fluent at Welsh, resulting in the majority of pupils having English as their first language. The

classroom where I was placed was a nursery classroom boasting 31 pupils (13 girls, 18 boys), all aged between 3 and 4 years of age. The class teacher was the Deputy Head teacher with three support staff.

Literature Review

In recent decades, research has been providing enthralling evidence that indicates students learning and motivation is directly affected by the quality of the learning opportunities provided by the teacher (Hattie,2009; McCaffrey et al, 2004). A particular area of interest which has been identified is the teachers' subject matter knowledge (SMK) and the teachers' pedagogical content knowledge (PCK) and how the quality of these can affect a pupil's performance (Kleickmann et al, 2013).

The teachers' subject matter knowledge (SMK) represents the teachers understanding around the subject matter that is being taught. Shulman (1986) supports this statement, however believes that the teacher must not only understand the subject matter but also understand the processes and reasoning for the subject matter, therefore emphasising the importance of deeper understanding of the subject matter. This is especially important as the constructivist point of view of learning encourages the valuable contribution of pupils within a lesson (Rowland et al, 2003). If a pupil were to ask a question or provide a point of view and the teacher's subject matter is not strong enough to provide the pupil with the answer, the pupil may be dismissed. The lack of answer may result in insufficient subject knowledge the pupil will need to progress, subsequently causing anxiety (Brown et al, 1993). In accordance to Successful Futures (Donaldson,2015), a key purpose is for children to be "ambiguous, capable learners who: can explain ideas and concepts they are learning about" (Donaldson, 2015:31). If the teacher has insufficient SMK and is unable to explain the subject matter clearly and explain the process and reasoning behind it, the children will not be receiving the expected learning opportunities (Coe et al, 2014) for them to become "ambiguous, capable learners" (Donaldson,2015:31).

The importance of subject matter knowledge has been researched extensively since Shulman's first publication in 1986 with academic professionals. Recent studies have provided powerful evidence that teachers' subject matter positively affects the quality of learning provided and the progress the pupils gained (Ball et al, 2001). Hill et al (2005) found that the elementary school teachers' subject matter had a positive correlation with the pupils increased understanding of mathematical processes. Likewise, a project conducted by the Gates Foundation (2010, as cited in Hattie, 2012) focused on what makes an effective teacher. They surveyed children with higher than expected achievement (75th percentile) and found that 82% of their teachers had several ways of explaining various topics to them, compared to 53% of teachers with pupils with lower than expected achievement (25th percentile). They also found that 79% of 75th percentile teachers explained difficult subjects clearly, compared to 50% of 25th percentile teachers.

This research supports Shulman's statement, as to be able to explain a topic in different ways and clearly, you need a good understanding of the subject matter, as "the teaching necessarily begins with a teacher's understanding of what is to be learned" (Shulman, 1987: 7).

However, is it fair to say that a teacher's SMK has the highest effect on the pupils' achievement levels as the evidence provided so far suggests? A longitudinal study conducted in Germany does support the claim that SMK has a positive effect on pupils' learning, however, it also concluded that PCK additionally has a positive effect on pupils' learning. Despite the high correlation of both SMK and PCK on pupils learning, SMK had lower power for pupil's progress than PCK, therefore suggesting that PCK is an essential tool for effective teaching. The previous studies have not illustrated the pedagogical skills and procedures that were used alongside

the SMK which may have had a contributing effect to the overall progress the pupils have made.

Pedagogical content knowledge (PCK) is the knowledge needed to have the ability to make the subject matter easily assessable to the pupils (Shulman, 1986). This statement by Shulman indicates that both the SMK and PCK are essential to the pupil's learning and a combination of the two have shown to have a positive influence for teaching effective sessions as well as a positive effect on students learning in mathematics (Baumert et al, 2010; Hill et al, 2005).

The Successful Futures curriculum currently being designed for Wales is to be constructed around "curriculum, pedagogy and assessment" (Donaldson, 2015:25), therefore indicating that the subject matter being taught and the way it is taught is at the centre of the new curriculum; demonstrating Shulman's concepts still being relevant and influencing current academic practice.

The project conducted by the Gates Foundation (2010, as cited in Hattie, 2012) also identified how effective teachers captivate and consolidate information. They found that 81% of the 75th percentile pupils liked the way they learn in class, compared to 47% of the 25th percentile pupils. In regards to consolidating the information, 86% of 75th percentile pupils state that their teacher checks to make sure they understand the subject matter, compared to 58% of 25th percentile pupils. These results indicate that in order for these teachers to have high percentages, they have to be using sufficient pedagogical knowledge that supports their pupil's progress. From the 7 C's identified in the study (care, control, clarify, challenge, captivate, confer and consolidate), the 75th percentile teachers had higher percentages for each, suggesting that they have strong SMK and PCK and the ability

to combine the two in order to deliver effective, thought provoking lessons, as previously stated by Shulman (1987).

Despite the evidence provided, Hattie (2012) expressed that teachers' SMK and PCK had little effect on the outcomes of pupils' progress. He concluded that expert teachers and experienced teachers had no difference in their SMK and PCK and found that expert teachers thrived in the way they organise and use the content knowledge. Hattie (2012) argues that expert teachers make lessons unique by introducing new subject knowledge by building on pupils' previous subject knowledge and changing the lessons according to the pupils needs. This was identified as a great importance in a report conducted by OECD (2014) on improving schools in Wales. They recommended that "schools meet the learning needs of all their children" (Donaldson, 2015:19), which is also being echoed in the reform of the Welsh education curriculum currently being led by Dr Graham Donaldson (Donaldson,2015). By meeting the needs of the pupils, Hattie (2012) believes that teachers are able to predict errors pupils may encounter and thus be prepared to respond to them effectively.

Despite this, Shulman (1987) believes that the SMK of a teacher has a direct effect on the teachers' lesson delivery. In a case study by Shulman (1987) that followed a trainee teacher Colleen, this became evidently clear. Colleen had completed two English degrees and had a strong SMK of literature and texts. When delivering lessons surrounding texts, Colleen generated an active classroom with pupils engaged and drew on ideas they had previously not encountered. At this point, Colleen was strong in her SMK and PCK with this evident in her delivery. Conversely, when Colleen came to deliver a lesson where her SMK was insufficient, it became apparent. Colleen's teacher style had changed and her ability to engage

and interact with the pupils to generate an active classroom diminished. It was clear that her insufficient SMK had a direct effect on the pupils learning opportunity. The pupils were not able to ask any questions and she did not check the pupils understanding throughout the lesson; showing that her PCK, which had previously been strong was also effected by her insufficient SMK.

Shulman (1987) concluded that Colleen's active teacher style was not available to her when she did not have a clear understanding of the subject matter being taught. This demonstrates that to be the expert teacher Hattie (2012) discusses, you have to have the SMK and PCK in order to deliver the learning styles effectively; which contradicts Hattie's statement.

The information Hattie (2012) provided surrounding the importance of meeting children's needs and building on prior knowledge is essential and is what teachers in Wales are striving for. As previously stated by Shulman (1987), in order to achieve these within your lesson you need a strong SMK and PMK. Both of the points above stated by Hattie surrounding children's needs require pedagogical knowledge for them to be implemented effectively, even though Hattie stated that SMK and PMK does not affect pupil's progress.

As a result of this research conducted, Rowland et al (2003) have developed a theoretical framework for the development of teaching mathematics. The framework is split into 4 units.

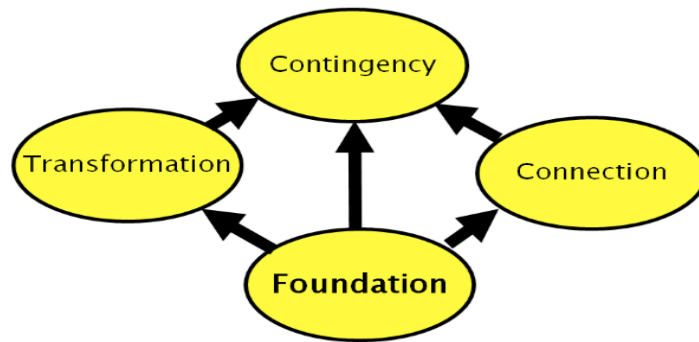


Figure 1. Knowledge Quartet (Rowland, 2017)

At the start of the framework is the foundation. The foundation consists of the SMK, PCK, and curriculum knowledge, using appropriate terminology and being able to identify pupil errors. This supports the research and evidence provided, that SMK and PCK are essential in an effective lesson delivery for pupils' progress (Shulman, 1987; Baumert et al, 2010; Hill et al, 2005). This also supports the path in which the new Welsh curriculum is being developed (Donaldson, 2015). As demonstrated in Figure 1, the foundation threads into every unit, therefore signifying the importance of SMK and PCK throughout the teaching process.

Unit two is the transformation of the information. In this section teachers need to be able to explain the subject matter whilst giving examples, selecting appropriate equipment and ensuring concepts are understood. To be able to do this the teacher must have a good SMK and PCK as 'teachers cannot help children learn things they themselves do not understand' (Ball, 1991, p5), which is also supported by Shulman (1987).

The third unit is connection in which the pupils need to make connections between their new subject matter and their previous subject matter in order to implement them effectively. Hattie (2012) believes this is of great importance and

has a positive effect on children's learning; however unlike Hattie, Rowland et al (2003) suggests that in order to complete this effectively you first need sufficient SMK and PCK, as demonstrated by Figure 1.

Lastly, the fourth unit is contingency which is one's ability to think on their feet for aspects in the lesson in which planning isn't possible, such as questions or points of view from pupils. As previously stated, it is essential to respond to the pupils, however this is not achievable without a secure knowledge of the subject matter, yet again stressing the importance of SMK along with PCK when delivering a lesson.

Evaluation of my subject knowledge

In this section I will be discussing the teaching experiences I completed in my Professional Teaching Experience (PTE1) and will be using the research and evidence provided above to analyse and evaluate my own subject matter knowledge (SMK) and pedagogical content knowledge (PCK) against the knowledge quartet. It is split into four sections in relation to Figure 1. Knowledge Quartet (Rowland, 2017).

Foundation

The first unit Rowland (2003) identifies is the “Foundation”. As previously stated the “Foundation” is the subject knowledge, the ability to identify potential error and to identify appropriate terminology. Whilst on teaching practice I completed a series of mathematical sessions surrounding 2D shape on the first week of teaching. The area was new to the pupils and they had not received any prior input on the subject.

To ensure I planned effective sessions for the pupils I had to guarantee my subject matter knowledge was strong (Shulman, 1986). In this particular area of mathematics my subject matter knowledge was robust as I had a good understanding of the simple 2D shapes and their properties. However, this particular subject matter knowledge may be categorised as common subject knowledge; knowledge that you expect non teachers to know and is not specialised subject knowledge (Ball et al,2005).

Despite this, whilst teaching it became apparent that the mathematical vocabulary being used, for example sides, became a difficult concept for the pupils to grasp. This was due to the vocabulary and pitch of the activity being too advanced, showing that my curriculum knowledge was not strong as discussing

properties of shapes is not identified in the Foundation Phase curriculum until Year 2 (Welsh Government, 2015). This is predominantly due to the lack of experience in using the Foundation Phase curriculum documents whilst planning. This could be detrimental for the pupils' academic progress as it is essential that pupils are receiving the appropriate activities for their age and development in order to progress in all areas of learning (Department of Education, 2017).

As a result of this, all planning that was completed after the sessions in question were planned around the Foundation Phase skills individually identified for the pupils' ability.

My SMK was also strong when completing language, literacy and communication sessions with the pupils. During these sessions the pupils were learning to identify and beginning to form the sound "s". The SMK that was needed to provide effective learning opportunities was the phonological alphabet and to be able to identify phonemes. This type of SMK can be classified as specific subject knowledge; knowledge that only professionals would know (Ball et al, 2005). In this area of language, this is essential, as if teachers did not have the correct phonological knowledge and taught the children the letter sound rather than the phoneme, the children would have incorrect information that would be detrimental to both reading and writing (Poole, 2001).

When planning the session, it became difficult to identify what vocabulary would be used to demonstrate how to form a "s". This was due to a lack of knowledge surrounding the scheme of work that school X uses for phonics, yet again demonstrating the importance of strong curriculum knowledge (Rowland et al, 2009). I did not have the knowledge in this scenario compared to previous experience in

another school where my knowledge of the scheme of work was strong due to the training that was provided.

Regrettably, training on the scheme of work was not available during the professional teaching experience that I had completed, however the framework was still essential information that I needed to have a secure understanding of. As a result, I spent a considerable amount of time reading the scheme of work, looking at examples of work, and asking experienced staff member's questions to ensure my understanding of the scheme of work was secure.

Transformation

The second unit identified by Rowland (2003) is transformation. This is how the teacher explains the subject to the pupils, the resources chosen and ensuring that the pupils understand the work.

When completing the 2D shapes activities with the children it was important to me that all children were engaged and actively involved in the activity within the first three minutes, which is something ESYN inspectors identify as good practice (Welsh Assembly Government, 2010). To ensure this was effective, I had to guarantee the resources that were selected were engaging and thought provoking, which is an aspect for effective active learning practice (Bonwell et al, 1991). I used shape characters (see appendix 1) to engage the pupil's attention and set the activity as a challenge as opposed to asking the pupils to identify shapes.

Post the initial input, the pupils had to work together, with selected support from myself. The questions I asked (see appendix 2) provoked deeper thinking between the pupils as they had to justify their answer to fellow pupils. In the new curriculum being devised by Donaldson this is essential as he recommends pupils

“can explain ideas and concepts they are learning about” (Donaldson, 2015:31).

Therefore, by the pupils justifying their answers, they can explain why they have chosen that particular answer. On the contrary, if my SMK was not strong enough I would not have been able to provide the pupils with this kind of learning as my questions needed to be strong enough to guide the pupils, without giving them the answers. I also needed deeper SMK to be able to provide the children with a deeper understanding of the subject matter (Shulman, 1986).

The questions that I asked the children were also planned in accordance to Bloom’s revised taxonomy (Bloom, 1956) to ensure the pupils could remember, understand and apply the subject matter being taught in the session. In order to be able to create the questions (see appendix 2), I needed to have a good understanding of the pedagogical research and strategies surrounding Bloom’s revised taxonomy.

However, it is not simply enough to understand the strategy. In regards to Nursery pupils, it is important to understand the way children begin to think and process vocabulary in order to devise questions and explanations in a way the pupils will comprehend. This is something I initially found difficult when not knowing the pupils’ vocabulary abilities.

This was not just isolated to mathematics as it also became apparent in knowledge and understanding of the world (KUW) where the pupils needed to identify familiar people in the community. Individuals such as policemen, paramedics and lollypop lady images were provided to the pupils, yet when the children were asked questions about who helped them in school, they found it difficult to understand. Therefore, I had to rephrase questions or statements given to the pupils for them to understand what I was saying and asking from them. This is something

the pupils surveyed by The Gates Foundation (2010, as cited in Hattie, 2012) identified as an attribute to being an expert teacher.

Once I gained a rapport with each child, I was able to adjust my vocabulary to meet the individual needs of each child, which Hattie (2012) believes is an effective way of teaching. However, to be able to meet the individual needs of each child I need to have strong SMK and PCK before implementing strategies to achieve this (Baumert et al, 2010; Hill et al, 2005), yet Hattie (2012) does not believe that SMK and PCK has an effect on how a teacher delivers a lesson.

Connection

The third unit identified by Rowlands (2003) is the connection. The connection surrounds the structure of lessons, and making connections between new subject matter and previous subject matter. Whilst on professional teaching experience I found structure an important part of planning. This was particularly evident in the planning surrounding language, literacy and communication. The sessions were all based around a book "We're Going on A Bear Hunt". The structure of the lessons focused on remembering, understanding and applying; following a Bloom's Taxonomy structure (Bloom, 1956). I found this invaluable as the pupils were able to build on basic subject matter gradually until they were able to make explained predictions about what they would do if they saw a bear. This is supported by Hattie (2012), who believes that expert teachers build on prior knowledge and that children begin to make connections. Donaldson (2015) concurs and states that's the curriculum must encourage pupils to make connections across all areas of learning.

However, whilst in nursery it can be a difficult concept for pupils to make connections. For example, when we discussed people who help us in our community

in knowledge and understanding of the world, the children found it difficult to make connections between a teacher who helps us in school and a policeman who helps us in the community. Nonetheless, children were able to identify that a lollypop lady helps us across the road and began to make connections to their everyday life. Therefore, suggesting to me that it will depend on the children's community and everyday lives when making connections, hence the importance of building a rapport and understanding your pupil's individual needs as stated in transformation.

Contingency

The fourth unit identified by Rowland (2003) is contingency. Contingency is when you may have to deviate from your plan, respond to the pupil's ideas or use the opportunities provided. This appeared in the last week of my placement prior to Christmas. The day before the session in question, the pupils followed instructions to grow candy canes and the following day pupils saw that their candy canes had grown. I had planned for the children to make observations of what had happened by drawing the before and after pictures. However when the pupils entered the classroom, one pupil picked up an iPad and said "Let's take a photo". I could have dismissed the pupil and carried on with the session that was already planned with the resources ready; however, I decided to continue with the pupil's idea.

The session completed demonstrated my ability to be flexible in my teaching and to use the pupil's ideas to develop learning that is engaging for them which is important in a child lead curriculum (Donaldson, 2015), giving the pupils a voice. The session then changed from a hand written task to a digital competency task. I embraced this task fully as my knowledge surrounding Apple applications is robust and resulted in me clearly explaining to the pupil's how to open, search and take a

photograph on an Apple iPad. If my knowledge surrounding iPads and Apple applications was not strong, I could have dismissed the pupil's idea and thus demonstrated that they could be wrong which constructivists believe could be detrimental to children (Rowland, 2003).

The overall session went extremely well and all pupils were engaged and participated fully as it was something they wanted to do. I do however, understand that in some scenarios it may not be possible for this to occur and is vital to explain to the pupils why it is not possible at this moment, as you cannot dismiss a child as previously stated (Rowland, 2003).

Conclusion

From the evidence provided above it is clear that the foundation (Rowlands et al, 2003) of teaching is subject matter knowledge, pedagogical content knowledge and curriculum knowledge. To be able to use effective strategies and meet the needs of individual pupils (Hattie, 2012), it is important to understand how the children learn, what the children will be learning, and their next steps needed to progress at their level. These are key to the new curriculum being devised in Wales (Donaldson, 2015), therefore it is important as a trainee teacher that I recognise the importance of subject knowledge and strive to develop areas of my own subject knowledge that are insufficient. Once my areas of subject knowledge are strong I can focus my attention on the pupils and their individual needs whilst being confident in my delivery. I can do this by reflecting in detail on previous sessions that have been completed, and identify areas that need development. This is especially important with the new curriculum, as there will be aspects such as computer coding that I will not be familiar with. This is not an isolated incident. Throughout my future teaching career, the world around me will be developing and moving forward and as a teacher I need to ensure that my subject knowledge progresses and develops alongside it, to be able to provide the pupils with effective and engaging learning opportunities.

Appendix

Appendix 1



Appendix 2

Shape Questions

- Who can find a circle?
- What shape is this?
- How do you know?
- Where are you going to put that shape?
- Does this shape (circle) look like this shape (triangle)?
- Why not?
- Does this shape go here? Why?

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