

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

Introduction

There is an emphasis on teachers needing a deep understanding of subject matter when teaching at school (Kleickmann et al, 2013). However, the extent of how important this actually is will be addressed within this essay. This essay aims to focus on teacher subject knowledge and the role it plays in effective learning and teaching within a primary school. Furthermore, it shall focus on whether teacher subject knowledge is the most important aspect that leads to effective learning or if other aspects play a role - such as pedagogical content knowledge.

Part one will consider some of the literature regarding teacher subject knowledge and will focus on the works of Shulman (1987), Rowland (2009) and Hattie (2012), with a specific focus on the similarities and differences within their work and the implications within teaching that may arise.

Part two will analyse my own Professional Teaching Experience (PTE) in regards to my subject knowledge and shall draw on the experience I have gained. It will reflect on what I have learnt about subject knowledge and the impact it has had on my teaching as well as evaluating on how I can improve for future teaching experiences.

For my PTE I was based in an English medium school in Swansea. There were approximately 400 pupils in the school, with a pupil teacher ratio of 22.9 (Welsh Government, 2018). The amount of children eligible for school meals was 35% which is higher than the average for Wales which is 21% (Estyn, 2014). I taught the year group 4/5 which has 32 pupils in. The children were aged between 8 and 10 and had varying abilities within subjects. In accordance to BERA guidelines and to ensure anonymity, throughout this assignment there will be no mention of the school name, pupils or staff (BERA, 2018).

A consideration of the literature

This first section is a review of some of the literature regarding subject knowledge and its impact on learning and teaching. There will be a focus on how important subject knowledge is or whether the way it is taught is more important. This argument presents itself as

content knowledge versus pedagogical content knowledge. Moreover, there is an emphasis on the importance of technological pedagogical content knowledge (TPCK). Both Shulman (1987) and Rowlands (2009) work on the Knowledge base and the Knowledge Quartet are prominent in both sides of the debate.

A key argument is that an understanding of content knowledge is essential for teaching (Ball et al, 2008). Content knowledge refers to a teachers understanding of the subject matter being taught (Kleichmann et al, 2013). Shulman (1987) believes that when a teacher teaches they need to not only understand something but understand why. This suggests that they need to know a subject in depth in order to teach the subject, therefore, they will be able to answer any questions that arise. Shulman (1987) discusses this aspect in *Knowledge and teaching: foundations of the new reform*, in which he argues teachers must have a liberal education that works as a framework for new learning and previous learning because it is the teacher's responsibility to have a good content knowledge. This is because they are the primary source for students understanding the content (Shulman, 1987).

Despite Shulman's research being dated, his work is seminal in identifying a difference between content knowledge and pedagogical content knowledge (Hurrell, 2013). Shulman's (1987) work focuses on the idea of a knowledge base. This is composed of seven categories: content knowledge; curriculum knowledge; general pedagogical knowledge; pedagogical content knowledge; knowledge of educational contexts; knowledge of educational ends and knowledge of learners and their characteristics. He believes this knowledge base is what teachers need to understand in order to promote learning in students (Shulman, 1987). He argues that "teaching is essentially a learned profession" in which teachers must understand structural matter and alternative theories and how these might relate to the curriculum and teaching, suggesting that teachers need to 'know the territory' within their subject (Shulman, 1987, p.9).

This is further emphasised in Rowland's (2003) work on the Knowledge Quartet. Shulman's work provided the inspiration behind the Knowledge Quartet and while Shulman focused on pedagogical knowledge and subject matter knowledge, the Knowledge Quartet highlighted how knowledge can be seen in teaching (Rowland, 2003). The Knowledge Quartet consists of 4 categories: foundation, transformation, connection and contingency. Similarly to

Student Number: 1803104

Module Code: M6X02149-C

Word Count: 4,398

Shulman, who focuses on the comprehension of subject matter in his model of Pedagogical Reasoning and Action (Shulman, 1987), Rowland et al (2009) focuses on the foundation of knowledge within the Knowledge Quartet. He argues that knowing a foundation of knowledge and understanding is required within the classroom and it is this knowledge which fundamentally informs pedagogical choices.

An example of the importance of having a foundation of knowledge can be seen when applying to do a PGCE Primary course at University of Wales Trinity St David. On their website when applying for the course, applicants need a Grade B at GCSE in English or English Literature as well as in Mathematics and they also require a Grade C in GCSE Science. Also, if offered an interview, applicants have to perform well in selection tests (UWTSD, 2018). If an applicant has inadequate qualifications, they do have the opportunity to do an equivalency test to prove they have adequate content knowledge in English and Mathematics. Consequently, this suggests that content knowledge is important in the relationship between teacher subject knowledge and effective teaching and learning in the primary school. Without an understanding or qualification within the foundations of English, Mathematics and Science, a student has a reduced chance of being accepted on a PGCE course at UWTSD to become a primary teacher.

John Hattie (2012) further agrees that content knowledge is key in providing effective learning and teaching in the primary school. He believes that one of the greatest influences on student achievements is teacher commitment and beliefs, and that this is something teachers have control over (Hattie, 2012). In his work *Visible Learning for Teachers*, he emphasises that teachers must start believing that they can be “positive agents to change” and that too often the blame goes on the student and excuses are made about why the child is not learning (Hattie, 2012, p.25). He created a checklist to make teacher more enthused, passionate and inspired by their teaching, with an emphasis on expert teacher. By having expert teachers, they not only have increased levels of understand and knowledge about their subjects but can assist the students to progress more as they are able to guide and monitor learning to get the best outcomes (Hattie, 2012). Thus, it is pivotal that an educator is considered an expert teacher, as they create an effective learning environment within a classroom.

Furthermore, Coe argues that “the most effective teachers have a deep knowledge of the subjects they teach, and when teachers’ knowledge falls below a certain level it is a significant impediment to students’ learning” (Coe, 2014, p.2). This is shown in a study by Willingham (2013), which looked at science teacher’s content knowledge and the effect on students. Willingham (2013) concluded that when a teacher has a strong content knowledge they can anticipate student misconceptions and plan for them. This results in the student learning more. He highlighted how a teacher having a weak content knowledge had a greater impact on low achieving students whereas higher achieving students were more competent. Thus, this argues that content knowledge is important in ensuring effective teaching and learning in the primary school because by being an expert in a subject a teacher can highlight the most effective way to teach their subject (Hattie, 2012) and shows that knowledge is at the heart of professional competence (Kleickmann et al, 2013).

On the other hand, Riches (2018) argues that knowing how learning takes place makes an effective teacher because, understanding how to adapt learner to help them achieve is key to success within the classroom. This provides an argument for the importance of pedagogical content knowledge in regards to effective teaching and learning in the primary school. The term pedagogical content knowledge was created by Shulman who observed a gap between content knowledge and pedagogy (Beer, 2009). Pedagogical content knowledge is the integration of pedagogical knowledge with content knowledge (Cochran, 1991), meaning there is focus on the way in which the knowledge is taught. Shulman supports this, by presenting the view that “pedagogical content knowledge is of a special interest” (Shulman, 1987, p.8) because pedagogical content knowledge presents the blending of pedagogy and content into an understanding on how certain topics can be adapted to meet the abilities of all students (Shulman, 1987).

Differentiation within the classroom is a key example of this. Differentiation means changing the level, pace or instruction provided to manage a variety of different abilities within a classroom (Heacox, 2012). Therefore a teacher needs to understand a student’s needs, whether they have a specific learning difficulty or if English is not their first language, a teacher needs to adapt their lesson to make sure the children are benefitting from the content knowledge. This suggests that having a good pedagogical understanding can result in knowledge being adapted in ways students can achieve the most. However, Coe et al

argues that while pedagogical content knowledge is effective, it must be understood because it consists of more than a set of classroom methods, instead it involves a complex judgement of being able to choose which technique to use (Coe et al, 2014).

In regards to pedagogical content knowledge, both Shulman's (1987) and Rowland's (2009) work show similarities within them. In Shulman's (1987) model of Pedagogical Reasoning and Action, he identifies five key aspects, which work in a continuous cycle: comprehension, transformation, instruction, evaluation and reflection. Comprehension is similar to the foundation category in the Knowledge Quartet in which they both identify the content knowledge. Both transformation sections within these models specifically focus on how the content knowledge can be adapted and understood by the students. Rowland identifies a connection category in the Knowledge Quartet which is concerned with coherence of planning and making connections (Rowlands, 2009). Although the Knowledge Quartet is applied to Mathematics, this does link to Shulman's knowledge base, specifically the curriculum knowledge, in which a teacher is able to make cross curricular links within students' learning (Shulman, 1987). However, a key difference between the texts is that Rowlands study focuses on primary school, whereas, Shulman's study was based in a secondary school and thus, although he states that his research could hold well in primary schools due to the similarities, he does not want to make such a bold claim (Shulman, 1987).

Krauss et al further agrees with Shulman and Rowland in regards to the transformation category, with Krauss stating teachers need to not only know mathematical concepts but know how they can be explained to students (Krauss et al, 2008). Therefore, Mahnken (2018) argues that coaching programmes are needed to enhance student achievement and quality of teaching. He believes it is important that teachers first develop their pedagogical content knowledge and then they can use their developed knowledge effectively in regards to the content knowledge. Thus suggesting a teacher's knowledge of the subject is less important in effective learning and teaching in a primary school than factors such as pedagogical knowledge and teaching skills (Ellis, 2009).

While there seems to be a lot of research done on the debate between content knowledge and pedagogical content knowledge, it is important to highlight the research which has been done on a third aspect of teacher subject knowledge, which is technological pedagogical

Student Number: 1803104

Module Code: M6X02149-C

Word Count: 4,398

content knowledge (TPCK). This is the blend of content knowledge, pedagogical knowledge and technology knowledge together (Mishra & Koehler, 2006). Below is a diagram showing how they are interconnected.

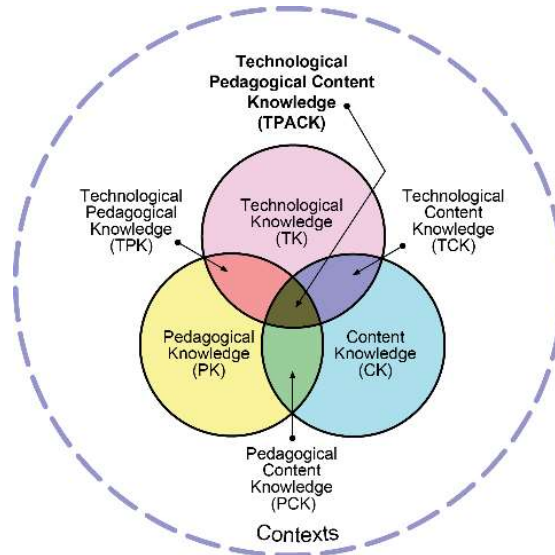


Figure 1: Technological Pedagogical Content Knowledge Framework. Taken from:

<https://matt-koehler.com/tpack2/tpack-explained/>

Mishra and Koehler (2006) argue that technology is often looked at but there is little focus on how it is used. They believe that technology needs to not only be introduced but teachers need to know how to incorporate this technology into their teaching. This is evident in Wales. In Donaldson's *Successful Futures*, he highlights that the "current curriculum was out of date in relation to digital technology...schools were out of touch with the emerging digital workplace" (Donaldson, 2015, p.15). This concept of TPCK could be useful in the application of Wales's new curriculum in regards to digital competency. Donaldson (2015) wants children to be able to use technology to analyse information and to communicate so it is important that teachers understand the technology in order to teach the children especially as there is an emphasis on how digital competency should have a similar importance in the new Welsh curriculum as literacy and numeracy (Donaldson, 2015).

Therefore, especially in regards to the new Welsh curriculum, it can be argued that there should be a relationship between technological pedagogical content knowledge and effective teaching and learning in the primary school. This is because the TPCK framework

suggests that technology, pedagogy and content all have roles to play together and individually when it comes to teaching effectively. Thus, a “dynamic equilibrium” must be established between the three (Mishra & Koehler, 2006, p.1029) to ensure effective learning and teaching within a primary school.

Ultimately, the purpose of this section was to consider the literature surrounding the relationship between subject knowledge and effective learning and teaching in the primary school, specifically focusing on the debate between content knowledge and pedagogical content knowledge. To conclude it can be argued that content knowledge is not the whole picture but that’s not to say that it is not important (Rowland, 2009) because a teacher needs to know some knowledge in order to teach, hence why when applying to a PGCE promising teachers need to show a basic knowledge in English and Mathematics. However it is important to mention that teachers need a wide range of skills and attitudes if they want to their students to achieve (Heggart, 2016), suggesting that teaching does not consist only of what teachers know but how they are going to teach this knowledge. Therefore, it can be argued that there is an overlap between content knowledge and pedagogical content knowledge and that both are key in teacher subject knowledge for providing effective learning and teaching within a primary school.

PTE Experience

This next section focuses on my recent PTE experience providing an analysis and reflection on two particular lessons, History and Numeracy. Penso (2002) believes the task of teacher education is to make trainee teacher aware of the existence of difficulties within learning. This section provided me the opportunity to evaluate my teaching and difficulties that occurred as well as, discuss the impact my content knowledge and pedagogical content knowledge had in regards to effective learning in the primary school.

I have chosen these particular incidents because I believe they show how content knowledge and pedagogical knowledge impacted my teaching, especially when teaching became challenging in Numeracy. Throughout this section I will be evaluating my teaching in relation to literature where I will be highlighting any similarities, with a focus on Shulman’s (1987) and Rowland’s (2009) work.

History:

One of the lessons I am going to reflect on is a History lesson in which the focus was on World War Two, where the children had to put events chronologically on a timeline. My previous degree concerned the disciplines of History and Sociology, with my dissertation focusing on World War Two, when I found out my class were to be studying World War Two for the term - I offered to teach the History lessons. This is because I had the foundation of knowledge, which is suggested by Rowland (2009) in the Knowledge Quartet, as well as the confidence to teach the subject. Rowland (2003) highlights how knowing the content knowledge can increase a teacher's confidence which allows them to have a stronger pedagogical content knowledge as they are able to adapt and change teaching if need be. This is shown in Shulman's Nancy study, in which Nancy's strong content knowledge enabled her to maintain classroom discourse and respond the students' academic needs (Shulman, 1987). Also, in the contingency category of the Knowledge Quartet, Rowland (2009) emphasises how teachers should be prepared to respond to children's ideas. If I did not have a good content knowledge or the confidence; I would not have been able to answer the children's numerous questions. Thus, the effectiveness of my teaching would have been hindered. In the appendix I have provided a comment from my formal observation written by my classroom mentor (Appendix A), his comments suggest that I had a good knowledge of the topic which enabled me to engage the children in the lesson.

My PTE took place in a school which are involved in creating the new curriculum under the influence of Donaldson's work *Successful Futures*. They had incorporated into the school a process known as C.O.O.L Learners. This stands for Control Our Own Learning, in which the school focuses on giving the children choice. In his report, Donaldson (2015) states how choice is important because it can engage children in their learning. This relates to the idea of pupil voice in which teachers work with children to find out their perspective of learning and what they want to learn (Cremin & Arthur, 2014). Prior to the timeline lesson, I taught a lesson which focused on activating their prior knowledge and what they already knew about World War 2. Providing the children with choice on what they wanted to learn provided pivotal in allowing me to build on my foundation of knowledge in preparation. This resulted in the children being more engaged as the lesson was going to answer their queries.

Student Number: 1803104

Module Code: M6X02149-C

Word Count: 4,398

Consequently, I realised that having a class based on Vygotsky's (1978) principle on communication, is imperative in creating an effective classroom.

In the Knowledge Quartet, as previously mentioned, the transformation category focuses on pedagogical content knowledge and how the teacher can demonstrate and explain in a way that students can understand. Constructivists, such as Jean Piaget, are interested in how children arrive at what they know and the journey they have taken in gaining that knowledge (Graham-Matheson, 2015). The transformation of knowledge allows children to have an understanding and when done well, history teaching can be seen as a sense of adventure which motivates students to open their minds to what happened in the past (Ofsted, 2009). Upon reflection, I believe I transformed my foundation knowledge regarding the events of World War Two in a way that the students understood.

After establishing with them a definition of the word chronological and what a timeline was, I designed an interactive activity which promoted active learning. Active learning is defined as "learning that engages and challenges children's thinking" (Grigg, 2015, p.123). Lesson with active learning include a focus on reviewing what a child already know and provides opportunity for children to try out new skills (Grigg, 2015). A selection of students were given an event with a date on and with the help of the class these students had to arrange themselves in chronological order around the classroom. This activity provided high levels of engagement between children as they were debating and discussing where they thought the events should go. Once I was satisfied they understood how events were laid out on a timeline, the children then wrote the events onto a template in chronological order. To ensure all children could take part in this aspect, I differentiated the task. Higher ability children had to write 12 events in order whereas lower ability children were sat with a teaching assistant and had to write 8 events in order. All children produced high standards of work which I was really impressed with, therefore I believe I transferred my content knowledge in a way that was effective for student learning.

History encourages children to ask questions about the past and whether these relate to their lives (Smith & Dawes, 2014). To keep the children engaged, motivated and interested, I made connections to Swansea, to make it more personal for the students. Within the timeline events I mentioned the Swansea Blitz, which sparked the interests of a few

Student Number: 1803104

Module Code: M6X02149-C

Word Count: 4,398

students as most had only heard of the London Blitz. I also showed past and present pictures of Swansea which showed a comparison of Swansea today and during World War Two. By comparing History with the presents it can help children understand a relevance of what they are studying (Ofsted, 2009). Therefore, by having an awareness of the pedagogical content knowledge needed to make connections, effective learning within the primary school can be achieved.

Using a timeline, allowed me to make many cross curricular links, specifically within the Literacy Numeracy Framework. The lesson allowed children to transfer mathematical skills to a different context by arrange numbers in an order, they worked collaboratively in groups contributing to discussion and reached agreements (Welsh Government, 2014). There was also a link to Geography as there was a focus on what continents were involved in which events and what countries made up the Axis and Allies. Being able to make these cross curricular connections is key when teaching and relates to Shulman's idea of Curriculum Knowledge, in which a teacher must show a depth of understanding of how the topic can be related to other subjects (Shulman, 1987).

Grigg (2015) states how passion can often be a force for the creation of new ideas and Vygotsky believes that teachers are important for developing student learning. Vygotsky focuses on the Zone of Proximal Development (ZPD) which is the zone between a student's actual level and their potential level and that teachers provide the scaffolding for this (Vygotsky, 1978). I believe that my passion and content knowledge allowed me to have strong pedagogical content knowledge, which enabled me to be an effective teacher within this task because all students reached their potential level.

Numeracy:

The next lesson I am going to reflect on is a numeracy lesson, in which the aim was for students to understand how to use a Venn diagram. Haylock (2014) believes that maths is essential to everyday life and that for children to enjoy maths they must have an understanding.

In relation to the foundation phase in the Knowledge Quartet, I would argue that my content knowledge and understanding was good in preparation for the role of the classroom. Within my experience I taught many numeracy lessons, and had felt confident

while teaching. Haylock's (2014) study in *Mathematics Explored for Primary Teachers* showed that many adults admitted feelings of anxiety when it came to teaching maths, however, I did not get this feeling as I have always enjoyed learning and understanding maths. Therefore I do believe I had the foundation of knowledge for this lesson.

However, issues became apparent within the transformation aspect of this lesson, where I struggled to transform my knowledge into understanding for students. One reason for this, was the task. After the introduction was completed, the children were given Christmas themed worksheets in which they needed to sort presents into Venn diagrams, and once this was completed they sorted numbers. In hindsight, as this was an introduction to Venn diagrams, I believe I should have promoted active learning (Grigg, 2015) and created a more engaging and interactive activity for the children in which they could all be involved.

Learning should be fun and educational (Graham-Matheson, 2015) and the approach I took was too formal and lacked an element of fun, which hindered my pedagogical content knowledge. Therefore, next time I teach Venn diagrams I would get the children to create life size ones so they can stand in them and be actively involved. This would be a more effective way for children to understand how to use a Venn diagram.

Another reason for why my pedagogical content knowledge was inadequate for this lesson was that I did not understand the student's needs. The worksheets they were given were differentiated on the children's ability to do their timetables however, the children struggled because they did not know what an odd or even number was. This is something I assumed they would know. In hindsight I should have checked their understanding of odd and even numbers in my introduction, which would have highlighted this issue sooner.

In relation to the categories connection and contingency within Rowland's (2009) Knowledge Quartet, I believe I showed a good pedagogical understanding. Although the children did not understand the worksheets, within the introduction I made the examples relevant to them and their life and they were, as a class, able to sort students into Venn diagrams according to whether pupils had been to a music concert or a Swansea football game. This suggests there was an understanding and that the aim was partially achieved. In regards to contingency, in which Rowland (2009) describes as unexpected classroom events and the ability to improvise, I believe I achieved this, due to the lack of understanding. I was

Student Number: 1803104

Module Code: M6X02149-C

Word Count: 4,398

able to, on the spot, come up with a new task in which children could practice their knowledge of odd and even numbers.

Overall, in my PTE I had good content knowledge, especially in relation to History. However, if the two lessons were compared against Vygotsky's (1978) ZPD model, it could be argued that only the history lesson allowed pupils to reach their potential in the task. This shows that despite content knowledge being good in both subjects, my experience highlighted the weaknesses within my pedagogical content knowledge, especially in relation to the transformation of knowledge. Therefore, I needed good content knowledge as well as pedagogical content knowledge to ensure effective learning and teaching was taking place.

Conclusion

Overall, after a consideration of the literature and a reflection of my PTE, it can be seen that there is a clear overlap between content knowledge and pedagogical content knowledge in which one cannot exist without the other. In teaching you have to be adaptable to change and new ideas. This is particularly important in Wales, where a new curriculum is being implemented. A teacher therefore, is continually learning new information and skills which they need to be able to transfer to their students. Therefore both the teachers' subject content knowledge and pedagogical content knowledge play a key role in creating effective learning and teaching within the primary school.

Student Number: 1803104
Module Code: M6X02149-C
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Appendix

Appendix A: Formal observation by classroom mentor. Date: December 2018.

S2: Knowledge and Understanding

Good

- **Comments and Evidence**
- **Targets for improvement and suggested ways forward**

██████ is clearly passionate about History and used her own subject knowledge effectively to motivate the learners. She has shown an ability to use ICT to enhance the quality of her lessons - the PowerPoint ██████ created and the video she selected for the plenary was evidence of this. The key questions ██████ displayed on the board during the Think, Pair, Share activity were effective. I also liked how ██████ encouraged the children to repeat back as a class key terminology for the lesson - it was essential the children understood what was meant by 'timeline' and 'chronological' so emphasising these words to them was definitely worth doing. ██████ is continuing to develop an understanding of effective learning and teaching approaches. I really liked the cross curricular Geography link (Axis Vs Allies) she made where the children had the opportunity to use the world map to identify which side different countries were on. The ability to spot cross curricular opportunities is an important skill which you have already demonstrated you possess, well done.