

According to Morrison (2014), a sound subject knowledge is the most imperative constituent of being a good teacher. It is widely recognised by many researchers and educators that teacher subject knowledge is vital to children's learning in primary school. Without it, children cannot be expected to achieve their full potential. However, there have been some who have found no significant relationship between teacher subject knowledge and pupil attainment.

This assignment will provide a critical analysis of the relationship between teacher subject knowledge and effective learning and teaching in the primary school. To do this, I will undertake a review of relevant literature that considers different perspectives on the relationship between teacher subject knowledge and children's learning.

I will then draw on my PTE experiences to support my discussion. My PTE experience has taken place within a school in the Welsh city of Swansea. It is an English medium, mixed gender school with 514 pupils and a high pupil attendance of 95.7% (My local School, 2018). I worked for eight weeks in a year 2 class made up of 31 children aged 6-7 years old. During this time, I taught topics from each of the areas of learning within the Foundation Phase framework. During this assignment, I will maintain the anonymity of the school I had my PTE experience in accordance with BERA guidelines.

According to Coe *et al.* (2014 p.2) 'great teaching is defined as that which leads to improved student progress'. Based on findings from numerous amounts of research, they suggest that there are six components of great teaching. These six components are ordered according to how compelling the evidence is in demonstrating that concentrating on them can improve student attainment. They believe a combination of all six of these components will contribute to successful teaching. The first of these six components of great teaching is

subject knowledge. Coe *et al.* strongly believe that the most effective teachers have profound knowledge and understanding of the subjects that they teach which positively affects students' academic achievement. They say that the evidence to support a sound subject knowledge for effective teaching is strong, at least in the core curriculum subjects of maths, English, and science.

During the 1980s, education reformists wanted to improve teaching as a profession and develop it to become a more respected and rewarding career for teachers. One way that these education reformists believed that teaching could be improved was through teachers having a secure knowledge base of what they were teaching as well as being able to convey it to their students in a way that they understood (Shulman, 1987). This demonstrates that teacher subject knowledge has been identified as extremely important within the profession for over 30 years. Teacher subject knowledge is still being written about in more recent years as Professor Graham Donaldson, who undertook a review of the curriculum in Wales in 2015 reported that teacher education still has room for improvement in order to advance professional development (Donaldson, 2015). In their study, Kleickmann *et al.* (2013) indicated there is a lack of research about how teachers' education affects the development of subject knowledge, therefore it is less commonly known whether this directly affects the attainment levels of pupils. The recommendations that Professor Graham Donaldson made in his report have influenced the new curriculum for Wales that is currently being composed by the Welsh Government. Although this new curriculum will not be followed by all schools in Wales until at least 2022, trainee teachers are being prepared now for what the new areas of learning and experience will likely entail and how they will affect the teaching and learning experience within the primary school.

Shulman (1986) believes that teacher subject knowledge is essential to effective teaching and learning. However, he does not think that this is the only area that requires attention. He created seven categories of teacher knowledge. He thought that these seven categories were so fundamental that successful teaching cannot take place if any of these are absent in a teacher. The seven areas are general pedagogical knowledge, knowledge of the learners, knowledge of the context, knowledge of the purposes of teaching and learning, subject matter knowledge, pedagogical content knowledge, and curriculum knowledge. Coe *et al.* (2014) concur, saying that as well as a strong understanding of the subject matter being taught, teachers need to also understand the means by which students think about the subject matter and be able to identify classic misunderstandings that students may have about the subject matter.

Whereas some writers have focused on teacher subject knowledge across the entire curriculum, some have concentrated on the importance of teacher subject knowledge within certain subjects and areas of learning. Kleickmann *et al.* (2013) carried out research on maths teachers in Germany at different stages in their teaching careers. Due to what they discovered, they acknowledged that teacher subject knowledge is a vital element of teaching that significantly affects student progress. This is supported by the research carried out by Hill *et al.* (2005) who explored the significance of teachers' subject knowledge in mathematics. They looked at a variety of studies that discovered that how successfully students learn maths is down to the level of understanding that the teacher has in what they are teaching. Haylock (2014) points out it sadly appears that much of the adult population within Great Britain have a lack of confidence with even the most basic mathematical concepts used in everyday life. Research by Coben *et al.* (2003) reveals this lack of confidence seems to be due to feelings of anxiety and incompetence in the subject

that is extremely widespread amongst adults in this country. When it comes to primary school teachers, research shows that many carry around different types of emotional baggage from their experiences of maths during their school days, which are mostly negative (Briggs & Crook, 1991). These feelings of insecurity and anxiety can 'rub off' onto learners, and therefore affect their feelings towards the subject and their overall performance in the subject (Ashcraft & Kirk, 2001 & Ashcraft & Moore, 2009).

Rowland *et al.* (2003) aimed to identify the ways in which trainee maths teachers' subject knowledge came across when teaching their students. Their results were arranged into four stages that belong to what is known as the knowledge quartet. The knowledge quartet was created by Rowland and is an effective means for thinking about the ways that subject knowledge - when looking at the subject of mathematics comes across in teaching within the classroom. Nevertheless, the knowledge quartet can be adapted and used by teachers for successful teaching in all subjects. The four stages of the knowledge quartet are foundation, transformation, connection, and contingency. During the foundation stage, teachers begin to know and understand the content of what they will be teaching in the classroom. Also, at this stage teachers are expected to start developing an understanding of how children learn and the ways in which they can be taught, through the use of appropriate and accurate terminology. It is also imperative that teachers realise where pupils are likely to make errors and know what these errors are likely to be so that they can prepare for them in their planning of lessons.

At the transformation stage of the knowledge quartet, teachers use their knowledge and understanding of the subject content and their appreciation of how their students learn and the methods by which to teach them in order to be able to teach effectively within the

classroom. Teachers are now expected to be able to explain and model the subject knowledge that they want their students to learn in a way that they can understand. In order to do this successfully, teachers should select appropriate examples to demonstrate and have suitable materials to support the lesson. Teachers also need to ensure that concepts and procedures are understood by the learners so that they can carry out their work effectively and have a good understanding of the subject matter themselves.

During the connections stage, teachers make connections between different concepts and processes. They build on their prior learning and knowledge to be able to make connections with their current and future learning. Teachers should be able to understand progressive steps and understand when it is appropriate to make progressive steps at this stage.

Finally, during the contingency stage teachers are now able to respond to learners' ideas and questions, including any difficulties they are having. Teachers should be able to stray from lesson plans if essential to guarantee valuable learning and are able to utilise opportunities to take full advantage of learning. Lastly, they can offer alternative explanations and examples to learners and change the tasks to be completed if necessary.

Pearson & Gallagher (1993) developed an instructional model for teaching reading in literacy lessons. The model could also be adapted to teach all other aspects of literacy. 'The Gradual Release of Responsibility' is made up of four levels. The first level is modelling or direct instruction. At this level, the teacher models the reading to the class while the pupils listen to and observe the teacher. The second level is guided instruction. At this level, the teacher asks the pupils to read with them. The third level is collaborative learning where the teacher offers help and support as needed to the pupils to ensure success. The fourth stage

is independent practice. At this stage, the pupils are expected to be largely independent with the teacher only providing support and encouragement as necessary.

As they believe that teacher subject knowledge is so vital to successful teaching due to the large quantity of supporting research, Coe *et al.* (2014) consider that teachers who lack subject knowledge and understanding of what they are teaching are ineffective and a substantial barrier to successful learning. Morrison (2014) and Grigg (2015) agree.

There are a minority of researchers who have found results on the contrary of those previously mentioned. A study by Rockoff *et al.* (2011) found little to no correlation between teacher subject knowledge and student performance. This is also supported by Eisenberg (1977), Begle (1979) and Askew *et al.* (1997) all cited in Rowland *et al.* (2009) who all found no direct relationship between teacher knowledge and effective teaching of a subject.

Although there are those that have produced results that seem to contradict the belief that teacher subject knowledge has a direct impact on the students ability to reach their full potential, the overwhelming majority of evidence appears to suggest that this is not the case with some claiming that teacher subject knowledge is above all the other features of good teaching.

During my PTE experience, it became clear to me straight away how important teacher subject knowledge is. As someone who has never been confident in the subject of mathematics, I was filled with dread when told during my observation week that I would be teaching a whole week of maths lessons during my first week of teaching practice. I was expected to teach inverse addition and subtraction up to 10 or 20 – depending on ability to my class of year 2 children. The maths itself was not difficult and I understood what I had to

teach. However, because of my lack of confidence in the subject due to an absence of good mathematical understanding and not having a positive experience of the subject whilst I was at school, I found it challenging to be able to explain it in a way that the children would understand - especially the lower ability children. This corresponds with what Haylock (2014) and Briggs & Crook (1991) write about mathematics anxiety in teachers due to their previous experiences with the subject and their attitudes towards it, and how they can inadvertently pass these concerns onto their learners which will affect their performance in the subject. I also had not spent much time with the children up to this point and was still getting to know what they were capable or incapable of. Therefore, I was seriously lacking in one of Shulman's seven categories of teacher knowledge – knowledge of the learners (Shulman, 1986). This was inevitably going to have a negative effect on the children's learning of this topic.

For my first lesson on this topic, I had prepared a PowerPoint presentation to introduce the new topic to the class. I then had three different tasks for the various ability groups to complete. I heavily relied on the information in the PowerPoint to be enough for many of the children to grasp the basics of the topic as there was no further knowledge of my own, I could add. I could only explain it using what I had learned about the topic specifically to be able to teach it and did not have any other ways to explain it to the children. The lesson did not go as I had planned. I went through my introduction quicker than I was supposed to due to nerves, I did not make the learning outcome explicit enough for the class and I did not go through a success criteria with them which meant that when the children left the carpet, most did not understand what we were going to be doing in that lesson. How much the children struggled with this lesson showed in my RAG ratings. Most of the higher ability and the middle higher ability children were rated red or amber, with only three of them rated

green. The class teacher reassured me that the tasks that I had set were appropriate for the age and ability of the children. As a result of this, I concluded that the children performed poorly as in the studies conducted by Ashcraft & Kirk (2001) and Ashcraft & Moore (2009) due to my lack of confidence and subject knowledge which resulted in me not being able to explain the topic in a way that the children understood.

The experience of my first day of teaching this topic lead me to go home that evening and look over my previously written lesson plan for the next day. I worked on changing parts of that lesson plan all night considering what had happened that day and looked to improve my subject knowledge in addition to my knowledge of the learner's capabilities within that day's lesson ready for the next day's lesson. I also completed an Assisted Reflective Conclusion (ARC) on that first lesson (appendix 1).

If I was to use the knowledge quartet to think about the ways that my subject knowledge in maths came across in my teaching that week, then there is considerable room for improvement during the foundation stage. Although I had begun to know and understand the content I had to teach, the way in which I introduced the topic and taught it could have been much better. I also did not know what sort of errors to expect from the children and how these could be overcome. By the end of that week, solutions to these issues started to become apparent which helped in my teaching of the topic. At the transformation stage, knowledge of how pupils learn and the ways they should be taught to achieve effective learning are vital. I was missing this knowledge at the start of this teaching week. Therefore, I could not explain concepts in a way that the children could fully understand. However, I did have suitable materials to support the lesson and appropriate examples throughout the week of teaching this topic. As a result, there was some success as well as some room for

improvement after that first lesson. At the connections stage of the knowledge quartet, I was able to understand progressive steps and I understood when it was appropriate to make progressive steps during the week of teaching that topic. For example, two of the higher ability children successfully attempted inverse multiplying on day 3 as inverse adding and subtracting became too easy for them. In addition, some of the middle lower ability children moved on from doing inverse adding and subtracting up to 10 to doing inverse adding and subtracting up to 20 in order to challenge them further. Finally, by the end of that first week, I was able to achieve the outcomes of the contingency stage. I was able to respond to some learners' ideas and questions and help them with some difficulties. I was not so worried about sticking to my lesson plan if it was necessary to move away from it for a valid reason and I could come up with alternative explanations and examples for learners if needed.

Another lesson where my explanation skills caused confusion in the class was during a literacy lesson where I was being observed by my mentor. The lesson was about explaining how headings and paragraphs go together in an information text. To demonstrate this to the class, I found an age appropriate piece of information text online about healthy eating. I talked with the children on the carpet about the features of an information text, and, in particular, the headings and paragraphs. I discussed with the children how we know headings and paragraphs go with each other using the information text I had up on the board, and some were able to tell me the answer. When I explained the learning objective of the lesson and what their focused task was going to be – to match headings and paragraphs together that were about the Queen (who was part of our topic for the half term), the children were already slightly confused due to the change in texts. I knew this when they left the carpet but hoped that when the children came to me or the TA to

complete their focused activity, things would become clearer. For some, it did but for others, it did not.

As well as having problems with the explanation of the topic and the subsequent task that the children had to complete, my task for the lower ability group – although differentiated was still not suitable for their ability. Their task was too difficult for them to do without adult support as many of them are unable to read. My mentor pointed out to me afterwards that it maybe would have been better to give them small paragraphs made up of 2 or 3 small sentences with an accompanying picture for them to better identify which heading belonged to each paragraph. I agreed that this would have been a better task for them to complete. The tasks for the middle lower ability, middle higher ability, and the higher ability groups were suitable according to the class teacher, however, he felt the higher ability group could have been challenged even further by being asked to write their own heading for one of the paragraphs. I did not feel this was the case at the time as the higher ability group struggled with the task I had given them and questioned my mentor on this which he appreciated. However, on reflection now that my PTE experience is over and now that I have a greater understanding of the children's abilities, I can see that the higher ability group would have been able to do what the class teacher suggested if my explanation of the original task had been much clearer to them. I completed an ARC for this lesson where I discussed what went well during the lesson, the parts of the lesson that did not go so well and what I planned to keep the same or change in future lessons (appendix 2).

For the duration of my PTE experience, I was conscious of my lack of subject knowledge in R.E. My knowledge of the subject overall is not to the highest standard, but as I was in a Catholic school, I was aware that the children probably knew more than me and I was

worried that during lessons they would bring up knowledge that I did not have. To overcome this, I made sure that when I was planning to teach my R.E lessons about Catholic baptism, I thoroughly researched what I was going to be teaching in the class so that I was better prepared. I feel that this is what helped the children perform well in their focused tasks. Without careful research before each R.E lesson, my confidence when teaching would have been very low which would have affected the children's performance in the focused tasks.

In conclusion, this assignment provided a critical analysis of the relationship between teacher subject knowledge and effective learning and teaching in the primary school. Firstly, I undertook a review of relevant literature which considered different perspectives on the relationship between teacher subject knowledge and children's learning. Coe *et al.* (2014) suggested six components of great teaching – teacher subject knowledge being number one on the list. Teacher education of sound subject knowledge is what is needed in order to enhance pupil performance according to Shulman (1987) and Donaldson (2015). Shulman (1986) proposed seven categories of teacher knowledge that should be present for effective teaching and learning to take place. Many studies into the subject knowledge of maths teachers have been undertaken over the years, with findings suggesting that strong subject knowledge is fundamental for pupils to make significant progress in their learning. Any anxieties held by teachers when teaching the subject of maths will unintentionally be picked up by pupils and their attainment will consequently suffer. The knowledge quartet established by Rowland is a useful tool for thinking about how subject knowledge comes across in the classroom during the teaching of mathematics. Each of the four stages is crucial and feed into the other stages. Through my PTE experience, I became aware of the implications of teacher subject knowledge. My first week of maths lessons provided me with

understanding about the areas of my teaching that needed significantly improving. Those areas were slightly developed by the end of that first week and were considerably enhanced by the end of the PTE experience. In a literacy lesson I taught my explanations were not entirely clear and the work set for the lower ability group was too difficult. After careful consideration, once my PTE experience ended, it was my lack of knowledge of what the learners could do in literacy that hindered effective teaching and learning in this instance. Finally, being in a Catholic school made me worry that the children would know more than me when it came to teaching R.E. My choice to research as thoroughly as I could the subject content that I was going to be teaching in each lesson, helped to improve my confidence in the subject. This helped the children to understand what the learning outcome of the lesson was and as a result, they performed well in the focused tasks.

It is clear from this assignment that teacher subject knowledge is imperative for good teaching and learning to take place in the primary school classroom. If a teacher does not have a clear understanding of the subject content they must teach, then the pupils they are attempting to teach are not going to demonstrate a sound understanding. This will inevitably result in pupils being limited in reaching their full potential.

Appendix 1

Assisted Reflective Conclusions (ARC) Model

Date: 05/11/2018

Critical incident (focus): Mathematical Development – Introduction to inverse adding and subtracting within 10 or 20.

Experience	
<i>Feelings</i> <i>“What are your feelings regarding the experience?”</i>	My initial feelings regarding this experience were mixed. I was excited to be teaching my first lesson, but I was also nervous. I was nervous to be teaching in front of the class teacher, and my worries about my lack of subject knowledge also affected how I felt. I was not pleased with how the lesson went at all. I let my nerves get the better of me, which meant I did not explain the topic and the focused tasks that were to follow very well.
<i>Remember and Understand</i> <i>“Can you list the aspects of the learning experience that went well?”</i> <i>“What were the elements of the learning experience that were disappointing?”</i>	The children were very responsive to questions I asked during the introduction and they listened intently to me. The focused tasks were difficult for some - but as my teacher had approved of the tasks I had planned, I knew that they were a challenge for the children but at the same time, not too difficult that they were inaccessible to the children. The children completed the tasks to a high standard within the allotted time frame. I failed to use any Welsh during the lesson. I did not have complete control of the class when they were being disruptive and when I asked them to tidy up at the end of the lesson. I did not have an awareness of what the whole of the class were up to while I was carrying out the focused task with my group. I did not keep an eye on the time, so the teacher had to tell me when it was time to tidy up eventually as I was running slightly over. This also meant I did not have time to do a plenary.

<i>Evaluate and Analyse</i> <i>“What will you keep the same to ensure effective teaching and learning in the future?”</i> <i>“What was the cause of the most important disappointing element?”</i>	The focused tasks were challenging, but appropriate for their level. This meant that the children were engaged in what they were doing. The cause of the most disappointing elements was ultimately my nerves. I was so nervous about the lesson that some important areas of my lesson went out of the window. I will need to think about how I will get over this to carry out tomorrow’s lesson.
<i>Conclusions and actions</i> <i>“What are your possible solutions to the disappointing issues identified?”</i> <i>“What will you do next?”</i>	I will remember to use basic Welsh during my introduction tomorrow to get into the habit of doing it on a regular basis. I will be more active in getting the children’s attention if I do not have it. I will go over to my additional adults who are working with groups to check how they are getting on with their tasks and will check on children who are carrying out independent tasks or who are on discovery time. I will keep an eye on the time to make sure my timings are better. I have altered my lesson plan for tomorrow’s lesson considering what happened today regarding what the children were able to do and not able to do. I have also extended my subject knowledge through more research and have the challenging but appropriate tasks that were previously planned for the groups to do.
<i>Transformed experience</i>	

Appendix 2

Assisted Reflective Conclusions (ARC) Model

Date: 20/11/2018

Critical incident (focus): Literacy Lesson – Headings & Paragraphs (Observation Lesson)

Experience	
Feelings <i>“What are your feelings regarding the experience?”</i>	My feelings regarding the experience are quite positive. I enjoy teaching literacy and am confident with my subject knowledge in the subject overall and in the topic I was teaching today. There were also some nerves today as my mentor formally observed my lesson.
Remember and Understand <i>“Can you list the aspects of the learning experience that went well?”</i> <i>“What were the elements of the learning experience that were disappointing?”</i>	I felt that there were some aspects of the lesson that went well. I managed to include some incidental Welsh. The children were engaged when they were sat on the carpet during the introduction and took part in discussion. My explanation of the tasks was not the best, so when the children got up from the carpet to do their focused tasks, they were slightly confused about what they were doing. Also, I had not differentiated the task I planned for the lower ability group enough. It was far too difficult for them, and even with adult support most really struggled.
Evaluate and Analyse <i>“What will you keep the same to ensure effective teaching and learning in the future?”</i> <i>“What was the cause of the most important disappointing element?”</i>	I will continue to plan tasks that are appropriate for the ability groups as I did largely manage to achieve this today with the middle lower ability group, the middle higher ability group and the higher ability group. I will also continue to improve my use of Welsh within the classroom. I think the cause of my most disappointing elements were that I did not realise that the task for the lower ability group would be too difficult as I thought they would be able to recognise which headings went with which paragraphs. I put this down to the fact that am still getting to know the

	children. This has been a good learning curve when it comes to helping me plan future literacy lessons. The children also became confused as on the carpet I talked about one information text, then got them to look at another one during their tasks. This affected their understanding of the task I wanted them to do.
<i>Conclusions and actions</i> <i>"What are your possible solutions to the disappointing issues identified?"</i> <i>"What will you do next?"</i>	I will continue to get to know the children's abilities better and I will think when looking at resources to refer to on the carpet during my introduction and resources to be used during the focused tasks. I will re-visit talking about headings and paragraphs when the children start to write headings and paragraphs for their own information texts that they will be writing in a couple of weeks' time. Hopefully, they will understand my explanations better than during today's lesson.
<i>Transformed experience</i>	

References

- Ashcraft, M. & Kirk, E. (2001) 'The relationships among working memory, math anxiety and performance' *Journal of Experimental Psychology*, 130 (2) pp. 224-237.
- Ashcraft, M. & Moore, A. (2009) 'Mathematics anxiety and the affective drop in performance' *Journal of Psychoeducational Assessment*, 27 (3) pp. 197-205.
- Briggs, M. & Crook, J. (1991) 'Bags and baggage', in Love, E. & Pimm, D. (eds) *Teaching and Learning Mathematics*. London: Hodder & Stoughton.
- Coben, D., Colwell, D., Macrae, S., Boaler, J., Brown, M. & Rhodes, V. (2003) *Adult Numeracy: Review of Research and Related Literature*. London: Institute of Education.
- Coe, R., Aloisi, C., Higgins, S. & Major, L.E. (2014) 'What makes great teaching? Review of the underpinning research' Available at: <https://www.suttontrust.com/wp-content/uploads/2014/10/What-makes-great-teaching-FINAL-4.11.14-1.pdf> (Accessed: 2nd January 2019).
- Donaldson, G. *Successful Futures*. Cardiff: Welsh Government.
- Grigg, R. (2015) *Becoming an Outstanding Primary School Teacher*. 2nd edn. Abingdon: Routledge.
- Haylock, D. (2014) *Mathematics Explained for Primary Teachers*. 5th edn. London: Sage.
- Hill, H.C., Rowan, B., and Ball, D.L. (2005) 'Effects of Teachers' Mathematical Knowledge for Teaching on Student Achievement' *American Educational Research Journal*, 42 (2) pp. 371-406.

Kleickmann, T., Richter, D., Kunter, M., Elsner, J., Besser, M., Krauss, M. & Baumert, J. (2013) 'Teachers' Content Knowledge and Pedagogical Content Knowledge: The Role of Structural Differences in Teacher Education' *Journal of Teacher Education*, 64 (1) pp. 90-106.

Morrison, N. (2014) 'Subject knowledge is prime factor in good teaching, experts say' Available at: <https://www.tes.com/news/subject-knowledge-prime-factor-good-teaching-experts-say> (Accessed: 2nd January 2019).

My Local School (2018) [REDACTED] Available at: <http://mylocalschool.wales.gov.uk> (Accessed: 2nd January 2019).

Pearson, P.D & Gallagher, M.C (1993) 'The Instruction of Reading Comprehension' *Contemporary Educational Psychology Journal*, 8 (1) pp. 317-344.

Rockoff, J.E., Jacob, B.A., Kane, T.J., & Staiger, D.O. (2011) 'Can you recognize an effective teacher when you recruit one?' *Education*, 6 (1) pp. 43-74.

Rowland, T., Huckstep, P. & Thwaites, A. (2003) 'The Knowledge Quartet' *Proceedings of the British Society for Research into Learning Mathematics* 23 (3) pp. 97-102.

Rowland, T., Turner, F., Thwaites, A. & Huckstep, P. (2009) *Developing Primary Mathematics Teaching: Reflecting on Practice with the Knowledge Quartet*. London: Sage.

Shulman, L. (1986) 'Those who understand: knowledge growth in teaching' *Educational Researcher*, 15 (2) pp. 4-14.

Shulman, L. (1987) 'Knowledge and Teaching: Foundations of the new reform' *Harvard Educational Review*, 57 (1) pp. 1-21.