

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

Introduction

The following essay aims to initially critically analyse and discuss the current literature based upon teacher subject knowledge and its relationship between effective learning and teaching in the primary school context. I will synthesise and discuss the main ideas amongst the relevant literature, exploring similarities and differences within. With my findings I will then, analyse and evaluate my own subject knowledge as a trainee primary school teacher and the implications of this on effective learning and teaching in the classroom, in accordance with the current developing curriculum in Wales. This will be based on the recent Professional Teaching Experience in my first placement school. To conclude, I will summarise key points discussed throughout and specify key steps for my personal development for the upcoming stage of teacher training.

Throughout this essay, for the purpose of safeguarding and confidentiality, in accordance with BERA's *Ethical Guidelines for Educational Research* (2018) I have kept the identity of the school which will be referred to as 'school X', its staff and pupils anonymous. School X is a community primary school with 424 pupils on roll between the ages of 3 and 11, located within Rhondda Cynon Taff (My Local School, 2018). Approximately 10% of pupils are eligible for free school meals, which is considerably lower than the average for Wales of around 19% (My Local School, 2018). Only 11% of pupils have additional needs which again is significantly below the average of 21% and very few pupils have statements of special educational needs (My Local School, 2018). No pupils speak Welsh within their households and very few pupils speak English as an additional language (My Local School, 2018).

Within school X, I was placed in the predominantly younger of the two Year 4 classes with 25 pupils (13 male, 12 female) aged 8-9 years old. The class teacher did not have any support teachers or volunteers within the class.

A consideration of the literature

Educational research in recent decades has demonstrated convincing evidence that the role of the teacher and the quality of the learning opportunities they create affects pupils' learning and motivation (Hattie, 2009; McCaffrey et al., 2004). In particular, exploring teachers' knowledge of subject matter and its relationship with effective learning and teaching in the classroom (Kleickmann et al., 2012). Key within the exploration into teacher knowledge is Shulman's (1987) article where he discussed how richly developed portrayals of expertise in teaching were rare, and the broad belief of a requirement that teaching deserves professional credibility and an acquirable knowledge base that should inform teacher education and practice.

There were characterisations available to what makes a teacher effective but most revolved around the teacher's management of the classroom. Shulman (1987) felt that not only the management of the pupils in the classroom is important, but also the management of ideas within this classroom. The teacher has the ability to formulate these ideas into something the pupils can understand when they did not have the ability and knowledge to do so before. Fenstermacher (1986), stated that teaching begins with the teacher's understanding of what is to be learnt and the process of it being taught. This is achieved through a series of activities where the pupils are given specific instructions and opportunities to learn, but the learning remains the pupil's responsibility. Teaching then ends with comprehension by both the teacher and pupils. Shulman (1987), argued that teaching is more than the enhancement of understanding which has often been assumed in literature (Berliner, 1986; Leinhardt & Greeno, 1986) and as a result, developed the 'Knowledge Base' (see Appendix A). This comprises of seven underpinning knowledge categories, which include content knowledge (CK) and general pedagogical knowledge, which all combine to promote comprehension among pupils.

Suggesting that the teacher's knowledge base should not be restricted to CK solely, Shulman (1987) placed particular importance on pedagogical content knowledge (PCK) where the teacher must blend subject specific content with pedagogy of primary education purposes and values into an understanding of how topics are organised, represented and adapted to suit the differences in individuals needs and abilities within the classroom to present for instruction. Therefore, facilitating the

subject knowledge to be accessible to the pupils. Using his own research alongside existing research (Berliner, 1986; Leinhardt & Greeno, 1986) taken from observations made of challenging topics being taught by veteran teachers, and in contrast, novice teachers, Shulman (1987) was able to find support for the various types of knowledge and skills required to teach academically challenging topics effectively. This supports the multifaceted knowledge base proposed by Shulman (1987) that he considers is necessary, for effective teaching and learning.

Previously, Shulman (1987) felt the belief by educators and policymakers was that practitioners were only required to have basic skills, CK and general content knowledge skills, which were only measured through basic skills tests and informal observations to assess their competency. Despite policymakers using the findings of appropriate empirical research (Brophy, 1986; Gage, 1986; Rosenshine & Stevens, 1986), Shulman (1987) felt vital aspects of teaching were dismissed such as the subject being taught, the classroom environment and often the diverse needs of the pupils in favour of measuring teacher effectiveness. As a result of how generalised measuring effective teaching felt, Shulman (1987) identified that the teacher's knowledge base is in fact far richer which he reflected in his framework, and its extensive scope should be accounted for during teacher training. Within Shulman's (1987) framework of a knowledge base for teaching, a key element is PCK, which was touched on earlier but is rich within the literature and merits more exploration. Shulman (1987) felt PCK is unique to teachers and is the integration of CK and general pedagogical knowledge, which represents a broader perspective in measuring effective teaching and learning. To elaborate, PCK is the coming together of the existing knowledge of the subject, with their teaching knowledge which satisfies the diverse needs of the classroom. This ensures the content is accessible and comprehensible by all the pupils by considering their interests and learning styles (Guerriero, 2017). Consequently, the teacher must demonstrate an understanding of what makes certain subjects easy or more difficult for certain pupils (Rahman & Scaife, 2005).

Stimulated by Shulman's (1987) framework, there has since been a growing body of research that has looked into CK and PCK (Ball et al., 2008; Park & Oliver, 2008; Woolfolk Hoy et al., 2006; Borko & Putman, 1996; Hill et al., 2005; Grossman, 1990), and despite slight differences in definitions there has been consensus on critical

aspects and theoretical developments. For example, Grossman (1990) who explored language, proposed two additional components which were knowledge of curriculum and knowledge of purposes for teaching. More current research conducted by Ball et al. (2008), based their model within mathematics and the model suggested the teachers' PCK is represented by knowledge of subject matter and of the pupils, which is in line with Shulman's (1987) argument that teachers must be able to adapt their CK to the pupils' needs. Additionally, Ball et al. (2008) also included knowledge of content and teaching, which demonstrates how teacher's general pedagogical knowledge allows CK to be interpreted by all pupils and finally, knowledge of curriculum.

Despite the clear distinction in Shulman's (1987) knowledge base where CK and PCK are separate elements within this framework, there has been difficulties in trying to measure them separately in teaching practice and they have often been merged together by researchers, which was the case within the work of Ball et al. (2008) within the one overarching category of knowledge. Additionally, curriculum knowledge which is again a unique element within Shulman's (1987) knowledge base, is combined with PCK within the model, which is similarly evident in the Grossman (1990) and Magnusson et al. (1999) models. Similarly, Hill et al. (2004) found that they merged into a single knowledge bank that they termed as 'mathematical knowledge for teaching' within their study. This has been further explored by Duggen-Hass et al. (2000) who offered further insight on how CK and PCK are intrinsically linked and teachers must be able to utilise other forms of knowledge unique to the subject being taught. It is clear that the more current research reviewing Shulman's (1987) ideas offers more clarity within the seven separate categories of the knowledge base, and how they facilitate the development of the teachers' PCK. Contrary to this, studies have found them to be connected but indeed separable and unique components of knowledge (Krauss et al., 2008; Phelps & Schilling, 2004). It is clear from the research that there is no obvious way to measure these components in isolation, but as Krauss et al. (2008) discussed, CK can often be a prerequisite for PCK to exist in the classroom. However, strong content knowledge has been shown to not always lead to the development of pedagogical content knowledge (Lee et al., 2007).

Current literature discussed thus far has backed up Shulman's (1987) claim that these two categories that have been explored within the 'Knowledge Base' and can in fact affect teachers' practice and their pupils progress despite them being difficult to split. Despite this, Baumert et al. (2010) found this is indeed the case, but even though high correlation between CK and PCK exist, CK had lower predictive power for measuring pupil progress in comparison. Furthermore, PCK was a decisive factor on key aspects of instructional quality within the classroom (Kleickmann et al., 2012). An abundance of research has demonstrated how PCK is developed over time through experience (Carlsen, 1987; Shulman, 1987; Gudmundsdottir & Shulman, 1987; Wilson et al., 1987; Carpenter et al., 1988; Grossman et al., 1989; Feiman-Nemser & Parker, 1990; Gess-Newsome & Lederman, 1993). Pertinent to this, Carpenter et al., (1988) found novice teachers use unmodified CK, extracted directly from the curriculum, without having their own coherent framework to present subject matter effectively. Often, pupil's prior knowledge, learning style and ability is dismissed within the novice's pedagogical decisions.

Relevant to this, newly qualified teachers often struggle to implement PCK in ways the pupils understand, despite having high levels of CK (Grossman, 1990). Teacher knowledge of subject matter can also come from various sources. Developing on Grossman's work, Friedrichsen et al. (2009) recognized three potential sources of subject matter knowledge:

1. The teachers personal learning experiences;
2. Teacher education and professional development programs; and
3. The teachers teaching experiences.

Visibly, these three types of learning opportunities are quite different in their levels of formalisation and intentional construction (Tynjala, 2008). Formal learning is usually intentional and is most often organised and structured by institutions with learning objectives in mind, which often lead to qualifications. In contrast, informal learning is usually highly contextualised and is often described as 'learning by experience' through mentoring or peer groups for example (Tynjala, 2008), and is not often driven by qualifications (Werquin, 2010). Considering the importance placed on teachers' PCK, the understanding around how learning opportunities available during teacher education and professional development affect the development of this PCK

is still limited (Cochran-Smith & Zeichner, 2005; Darling-Hammond et al., 2009). Therefore, better research around teacher education is a priority that must be considered (Cochran-Smith & Zeichner, 2005) to address what Wilson et al. (1987) found that the greater teaching time available during teacher training resulted in stronger positive relationships between CK and PCK decisions in the classroom.

Often, teachers have misconceptions and limited knowledge in certain areas which will therefore limit their ability to respond to pupils' engagement and exploration and setting challenging learning situations will suffer as a result (Haidar, 1997; Halim & Meraah, 2002; Van Driel et al., 1998). Research exploring PCK and the role of teaching experience, with the integration of CK, indicated that teaching experience in isolation was not enough (Friedrichsen et al., 2009). To be more effective teaching experience needs to be coupled with careful reflection on practice, with nonformal learning by interacting with co-workers and with purposeful formal learning opportunities (Brouwer & Korthagen, 2005; Park & Oliver, 2008; Van Driel, 2010). This ongoing analysis of teachers practice allows the impact, and therefore the quality of the PCK within the classroom to be recognised (Shulman 1986; 1987). The transformation of CK into PCK is through this critical reflection, and the teacher must have a depth of understanding in relation to the subject being taught, but also broad liberal education to act as a framework for old learning which would therefore facilitate new understanding (Shulman, 1987). The teacher has the responsibility of being the primary source of subject knowledge, that is passed on to the pupils to interpret. The manner of how subject knowledge is communicated and delivered is vital in catering for the needs of the pupils in the classroom. The teacher must therefore have a flexible comprehension, sufficient enough to deliver alternative explanations of the same idea to meet the needs of the learners, and to be able to challenge the pupils by having the depth of subject knowledge to answer confidently the questions that might arise through purposeful discussion.

With this in mind, the 'Knowledge Quartet' (KQ) framework developed by Rowland et al. (2003), when used in conjunction with Shulman's (1987) ideas, provides a comprehensive tool for analysing teachers' subject knowledge within the classroom by providing a method for reflection. This model is broken down into four dimensions:

1. Foundation (trainees' knowledge, beliefs and understanding acquired in preparation);
2. Transformation (knowledge-in-action in both planning to teach and teaching itself);
3. Connection (binding together of certain choices and decisions); and
4. Contingency (classroom events that are difficult to plan for and therefore the ability to deviate).

The KQ was first developed to broaden Shulman's (1987) theoretical concept as an empirically based classification (Huckstep et al., 2003), and has established itself as an effective tool to reflect on teaching practice and professional development (Kula & Güzel, 2014). Therefore, the following section will evaluate my own subject knowledge within the context of a trainee primary school teacher in Wales, using the KQ as a tool to reflect, demonstrating an understanding of how it can be used effectively.

Analysis and Evaluation of my Subject Knowledge

This section will use the 'Knowledge Quartet' (KQ) framework developed by Rowland et al. (2003) as outlined above to evaluate my own subject knowledge within the context of a trainee primary school teacher in Wales.

Foundation

The acquirement, and development, of foundation knowledge as a trainee teacher was based mainly on a block of approximately 8 weeks of university-based lectures. To support this, I had prior knowledge of working as a TA for two years, and we were provided with bridging days within this University based block to see the theory put into practise. Throughout this process, great expectation was placed on the statutory requirements of the current primary curriculum in Wales, alongside the upcoming curriculum changes which is heading in an exciting new direction. Professor Graham Donaldson has implemented the "*Successful Futures Report*" (Donaldson, 2015), which is well underway in many Schools throughout Wales. At the heart of this document are the four core curriculum purposes and key characteristics to prepare

children for working life (see Appendix B), developed through six areas of learning and experience: Expressive arts; Health and well-being; Humanities; Languages, literacy and communication; Mathematics and numeracy; and Science and technology. Underpinning these six areas are three cross-curricular responsibilities: Literacy; Numeracy; and Digital competence, that should be included throughout (Donaldson, 2015). The preparation block was therefore devised to give an understanding of theory developed through university-based lectures so that it can be transformed and delivered under the present and newly-revised future curriculum that could be interpreted by all learners throughout Foundation Phase and Key Stage 2.

The setting of my first teaching placement was within a year 4 class, which has been summarised in the introduction section in more detail. Throughout this placement I feel I have been able to deliver the National Curriculum (NC) with Donaldson's (2015) "*Successful Futures Report*", underpinning the lesson plans and delivery while still working within the Schools policies. My learning objectives and skills were specific to the six areas of learning where applicable and were tailored with the '*Literacy and Numeracy Framework*' (LNF) and '*Digital Competency Framework*' (DCF) in mind with a focus on what the pupils will learn. This placement provided the opportunity to develop age specific CK, and an understanding of the pedagogy needed to deliver this as effectively as possible through the core subjects and a range of others tailored to the mixed ability of learners within the class. This can be seen within my formative assessment reports (see Appendix C), where my CK was suitable to the learners and my delivery was adapted to the range of abilities and needs within the class.

These strengths mentioned must be continually developed, while weak areas must be targeted such as always ensuring all learners are being appropriately challenged, throughout all aspects of the lesson which is discussed in more detail in the subsequent sections.

Transformation

Central to Shulman's (1987) beliefs, CK must be transformed so that it can be

accessed and interpreted by all learners, with their differing ability and favoured learning styles in mind. I have had to therefore tailor my delivery through the placement to suit the varied pupils in the classroom.

Despite this being a skill, I feel I can develop, especially with the high ability (HA) group in the classroom, I was praised by my class mentor for setting unique differentiated tasks throughout the placement and extending the pupils learning as often as possible. This is clearly evident in the planning of an 'adverb' lesson (see Appendix D) where activities were varied and sequenced, while my CK was tailored throughout to suit the three different ability groups in the classroom to challenge and engage their learning during the lesson.

Including ICT was not always effective due to the classroom having very limited equipment that was often not functioning properly, despite ICT being an area I feel very passionate about and key within the new NC. Regardless of this, I introduced the lesson with a personalised video that included staff from the school acting out a scene that linked to prior learning, where the pupils created a set of instructions for a table top volcano that we made earlier in the placement. This was praised as a good hook for the lesson and explained the use of adverbs in effective instructional writing.

Similar to this, due to the extensive range of abilities within the class particularly in numeracy, my class mentor would extensively model mathematical techniques and offer alternatives to allow all learners a way to interpret the delivery. This was something Shulam (1986) felt was positive when delivering to the needs of the learners. I therefore ensured that within my own teaching this was prominent, and I would always set appropriate examples to challenge the mixed abilities within the class. The level of challenge would be differentiated into two or three groups and pupils were not rooted to a group. I would set each group off on task when I felt they were ready to start independent work which helped ensure the pupils had less misconceptions, and as a result received the level of support necessary to start their own learning.

I feel moving forward I could demonstrate better PCK by tailoring my open-ended questioning to the needs and ability of the classroom. This would ensure the pupils are continually challenged and engaged, while allowing me to respond to questions that would facilitate extended learning. To achieve this I would need to have solid CK

as Shulman (1987) discussed in his research and is elaborated on below.

Connection

While planning and teaching I tried to make links to prior learning and find connections between concepts where suitable, to bridge knowledge and facilitate understanding for the pupils, thus moving their learning on. This was evident in my feedback from both my class mentor and university mentor, where I was praised for doing so. As mentioned briefly above, within literacy and the class topic of 'Extreme Earth' I made use of previously completed work, which investigated a natural disaster of the pupil's choice to produce a digital poster containing facts and images relating to the chosen disaster. This provided opportunities to develop I.C.T skills, despite a lack of equipment available to me. We then produced Papier-Mache table-top volcanoes which led onto instructional writing and as a result, the previously mentioned 'Adverb' lesson. The topic was then rounded off by planning a science investigation and producing eruptions, using the models through a chemical reaction, which we videoed in groups to act out as a TV news report.

In addition to this within numeracy, the LA group would often find concepts difficult even with differentiated work set, so in line with Haylock and Cockburn's (2008) connections model, I planned and taught with this in mind for this group in particular. I found that by using the class teacher in a TA role I could set interactive hands on work which included games, matching activities and challenges to suit each pupils' individual needs and styles within the small group. This was effective and I was praised by my class teacher for the use of this within the lessons, which I implemented within the majority of numeracy lessons as a result. I feel this will be particularly effective when I move onto teaching the Foundation Phase.

Despite these strengths, there was a lesson that stands out to me where I feel the lesson planned for the pupils was not suitable for their current ability and understanding of the topic. The pupils demonstrated very little prior knowledge of money and each ability group found the work difficult and I feel I did not have the PCK, in line with Shulman's (1987) findings, to effectively adapt the lesson to allow

the learning to progress at the planned rate. Such incidents require contingencies in place to allow for learning to be taken back to a level where it can be understood before again moving forwards. (Williams, 2003).

Contingency

Due to the differing abilities in the group, especially within numeracy, I have had to have contingencies in place for when learning is not progressing at the planned rate, or there are gaps in the pupil's interpretation and application. As touched on above, this was particularly evident using money and calculating change. I was aware that there were gaps in the pupils' prior knowledge, despite discussing this with my class teacher in the planning stage. My CK of how to break down this topic to effectively scaffold the learning was not as proficient as I would have liked. I therefore struggled to transfer the CK to PCK in a way the pupils could understand and apply to mathematical problems. Concerned with the progress made in the lesson, I deviated from the series of planned upcoming lessons and changed the focus to becoming more familiar with the value of coins and sorting them into manageable values, before revisiting calculating change afterwards. I felt, by taking a step back the pupils were able to achieve what was originally set out for them, by having a more solid understanding to then apply this new learning.

As a result of initial feedback, early in my placement from my class mentor, I have been developing my ability to use higher-order, open-ended questioning through all aspects of my teaching, not just in introductions and plenaries. This has been influential as a tool used to gauge the pupils current understanding and misconceptions within the topic. It has also been valuable in tailoring and extending learning throughout the range of abilities in the class. Despite this, in certain areas, my lack of CK has demonstrated lower levels of PCK as proposed by Carlsten (1987) and as a result, my ability to extend learning through questioning has not been so effective.

Conclusion

The purpose of this essay was to critically analyse and discuss the literature surrounding teacher subject knowledge and its relationship between effective learning and teaching in the classroom within a primary school. I paid close attention to Shulman's (1987) conceptualisation of the knowledge base, in particular, the role of PCK within this. With this in mind, I synthesised the relevant literature surrounding the knowledge base, looking for key similarities and differences to discuss. To reflect on my own practice, I used the 'Knowledge Quartet' model (Rowland et al., 2003) which when used in conjunction with Shulman's (1987) ideas, provides a comprehensive tool for analysing teachers' subject knowledge within the classroom by providing a method for reflection. By reflecting on my experiences, I was able to identify strengths and areas to work on within my first teaching practice in line with the developing curriculum in Wales.

The areas I feel I should focus on developing in my upcoming phase of teaching experience are:

1. Using appropriate differentiation so all learners are being challenged in all aspects of the lesson.
2. Using higher-order, open-ended questioning tailored to the needs and ability of the pupils, to continually challenge and engage all learners in the classroom, not just during introductions and plenaries.
3. Continue to develop contingencies for when learning is not always moving at the planned rate, to ensure the experience is still positive.

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Appendices

Appendix A: Shulman's (1987) 7 categories of the knowledge base for teaching.

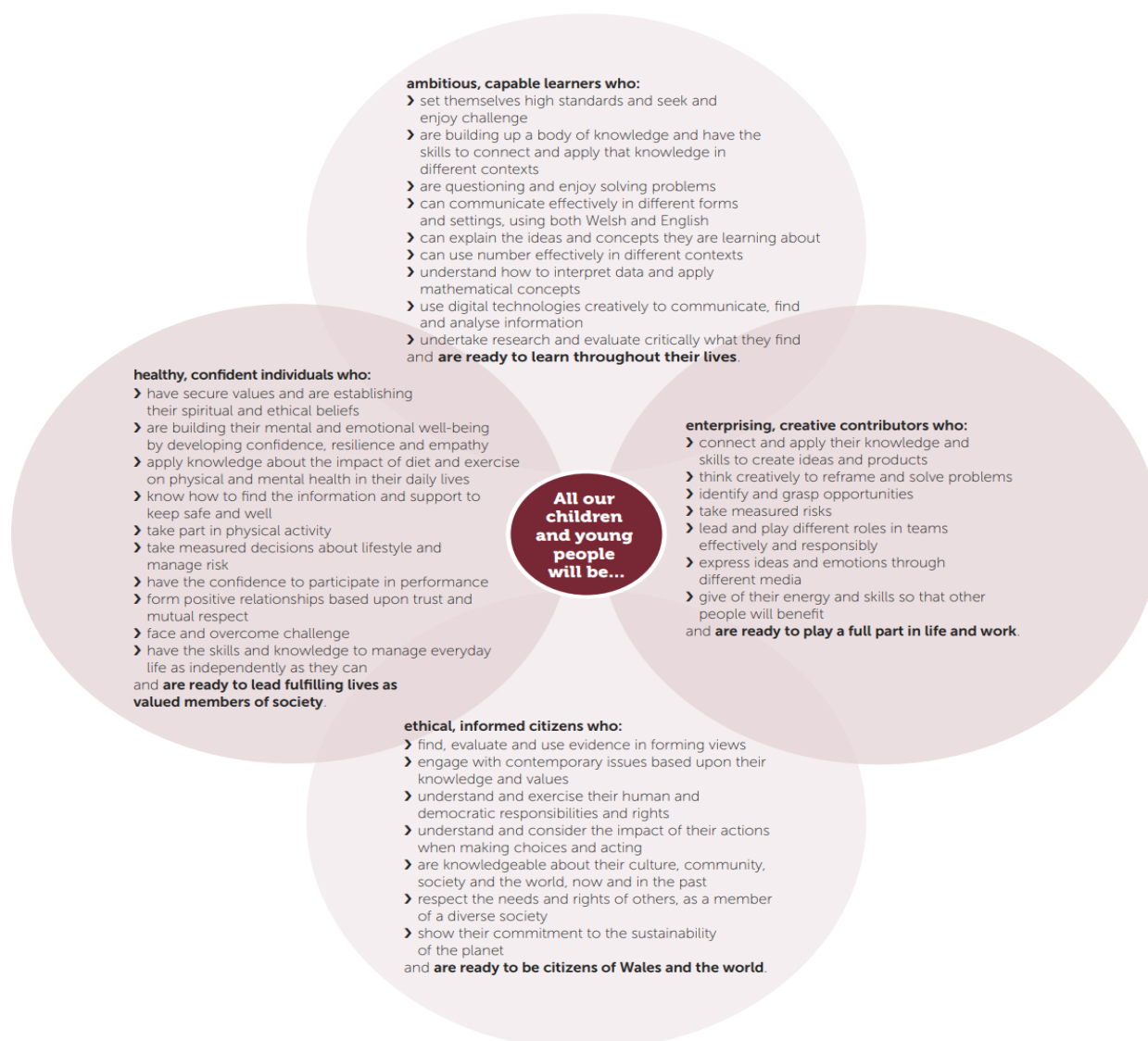
Categories of the Knowledge Base

If teacher knowledge were to be organized into a handbook, an encyclopedia, or some other format for arraying knowledge, what would the category headings look like?* At minimum, they would include:

- ✓ – content knowledge;
- ✓ – general pedagogical knowledge, with special reference to those broad principles and strategies of classroom management and organization that appear to transcend subject matter;
- ✓ – curriculum knowledge, with particular grasp of the materials and programs that serve as “tools of the trade” for teachers;
- ✓ – pedagogical content knowledge, that special amalgam of content and pedagogy that is uniquely the province of teachers, their own special form of professional understanding;
- ✓ – knowledge of learners and their characteristics;
- ✓ – knowledge of educational contexts, ranging from the workings of the group or classroom, the governance and financing of school districts, to the character of communities and cultures; and
- ✓ – knowledge of educational ends, purposes, and values, and their philosophical and historical grounds.

Source: Shulman (1987)

Appendix. B: The four core purposes of the curriculum and the key characteristics outlined by Graham Donaldson.



Appendix. C: Extract from mentors' formative assessment reports.

Quality of trainee's oral and written English language as appropriate. Please comment

Joe shows good ability to articulate expectations clearly in language that all the children understand. Joe demonstrates/models appropriate use of subject and age/ability-specific vocabulary. He demonstrates a good standard of written and oral communication for a wide range of purposes with few errors.

Quality of trainee's oral and written English language as appropriate. Please comment

Joe demonstrates and models appropriate use of subject and age/ability-specific vocabulary and pays attention to the pupils' use of appropriate language within subjects/areas of learning. He demonstrates a good standard of written and oral communication for a wide range of purposes with few errors.

Appendix. D: Extract from adverbs lesson plan.

20-45	<u>Main activities</u> <u>Main activity - These sentences will be handwritten into their books.</u> LA - Activity based on choosing the correct adverb for each sentence that is based around topic. AA - Insert a suitable adverb to complete each sentence that is based around topic. There will be a box of adverbs to choose from. HA - Insert a suitable adverb to complete a sentence that is based around topic. The pupils will have to think of their own adverbs. As an extension the pupils can make up their own sentences based on any topic that contain an adverb. There will be an extension poster on the wall to show this task.
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