

The learning and teaching of place value education essay



**ASSIGN
BUSTER**

The application of number is an essential everyday skill necessary for the well being of individuals and for steering nations toward economic success. Therefore, the role of the primary school teacher is paramount to an individual's ability to learn mathematical skills, and all opportunities presented in the classroom should reflect best practise to enable success. However, there has been much debate on the teaching of mathematics over the years, whilst recent government reports suggest an overall decline in the standard of mathematical performance against the rest of the world (Total Politics 2013). Such statements will continue to drive forward Government reforms and guidance, which can at times be challenging for schools. Therefore, in addition to the National Curriculum (DfEE 1999a) and Government guidelines such as the Primary National Strategy for Numeracy (DfES 2006), it is important for teachers to consult wider professional opinion; drawing on a variety of classroom experiences for the greater benefit of the children and to cater for differentiated learning.

This essay will consider the role of 'place value'; a concept underpinning the decimal number system which is fundamental for successful problem solving. It will specifically consider the steps leading to the teaching of addition, which begin in Key Stage 1, and will examine how unfamiliarity of positional value may affect mathematical skills such as column addition during key stage 2. Professional and Government guidance on teaching these skills will be examined and compared to experiences found in the classroom, alongside practical solutions which may be used to help avoid such misunderstandings.

The Hindu-Arabic system comprises of the digits 0-9 to create any number and Thompson reminds us that "it took humankind such a long time to invent this important idea", emphasising that some children are likely to have difficulties with this concept. This statement suggests that a wide pedagogical approach to this topic is needed to support contextual learning and understanding of a decimal numeral system; the idea that each digit within a number represents either increasing or decreasing powers of ten (Thompson 2000: 291).

There are contrasting views concerning the most appropriate age to introduce positional value to children. Shuard advised that it should be taught early in primary school, whilst Thompson believed that if place value concepts were taught too early, it may cause confusion (Shuard 1985 and Thompson 2000). Despite these contrasting views and in line with the National Curriculum, children are introduced to the notion of place value from Key Stage 1 to include: the value of digits, the use of zero as a place holder, order and rounding of number (DfEE 1999a).

Personal observations, reveal that Key Stage 1 pupils are currently taught these concepts using multiple embodiment methods; to support the idea that numerals are not just simply symbols or labels (nominal aspect), but that they can relate to a value and position. Gradually, children's knowledge is deepened towards understanding these latter cardinal and ordinal aspects of number, through many counting activities and manipulative experiences using 'one on one' matching and the ordering of objects; all of which contribute towards the notion of number conservation, which is essential for developing positional value concepts (Haylock 2010). In addition to this, <https://assignbuster.com/the-learning-and-teaching-of-place-value-education-essay/>

number lines, bead strings and number squares are resources used to develop the order and rounding aspects of number, thereby extending and deepening children's understanding towards addition and subtraction.

To develop simple addition calculations an ability to read number is required. One common Key stage 1 error is that the 'teen' numbers are frequently recorded the wrong way round. For example, sixteen can be recorded as '61' because the number 16 is read as 'six...teen', and it seems logical for a child to think that six should go first (Hansen 2011). Equally, the child may not have fully understood the idea of positional value for each digit. In this instance I have observed professionals introducing more practical investigations to consolidate the idea of grouping objects into tens; establishing the number of units which are 'left over' to help develop number sense. Other underlying issues such as Dyscalculia or Dyslexic tendencies may be diagnosed if errors remain prevalent, and are preventing further progression, despite an apparent understanding of physical grouping and number conservation.

Whilst the ability to count objects is a specific outcome in the National Curriculum (1999) and the National Primary Framework (2006), the idea of using objects for wider practical experiences to consolidate the learning is not featured. In comparison, observations in school have shown that successful teachers will use practical "meaning making" strategies to help children identify number value and links within mathematics (Kay and Yeo 2003: 9). Many of these multiple embodiment methods used throughout Key Stage 1 and Key Stage 2 are briefly outlined in appendix A. The underlying reason for teachers using such methods, is that they recognise the <https://assignbuster.com/the-learning-and-teaching-of-place-value-education-essay/>

importance of cognitive learning methods and that without a thorough understanding of positional value concepts, further development in mathematics will most likely be thwarted. This idea of meaningful experiences to secure procedural understanding is endorsed by Kilpatrick et al:

“ there is some evidence that understanding is the basis for developing procedural fluency” (Kilpatrick et al 2001: 197)

Failing to recognise zero as a place holder, is another problematic area for calculation. If left uncorrected, this misconception is likely to cause further difficulties when introducing expanded and column methods of addition in lower Key Stage 2. Appendix B demonstrates the issue and how practical experiences using base ten blocks and place value grids are used in schools to support the partitioning of number, before introducing problem solving calculations. Additionally, ‘ expanded methods’ are invaluable for teaching the commutative and associative properties of addition, whilst affording the teacher a greater insight into children’s thought processes during calculations. By using a selection of equipment such as place value grids and visual aids such as Diene’s blocks or arrow cards during the learning, the notion of positional value will continue to be reinforced as seen in appendix A (points 6 , 9 and 21).

The expanded method of addition is usually introduced in Lower Key stage 2 but each teacher will place a different emphasis on this stage of the learning, depending on pupils’ progress (Ofsted 2011). School evidence suggests that as a precursor to the more efficient column methods, it is a crucial stage of <https://assignbuster.com/the-learning-and-teaching-of-place-value-education-essay/>

the learning. It serves to guide children towards columnar value concepts in preparation for more difficult algorithms, especially where numerals start to cross the boundaries of powers of ten and ‘exchanging’ is required. Whilst expanded methods of addition will naturally identify more able students who are ready to move on to column methods, most teachers would agree that for a few children, confusion is most likely to occur during this stage of the learning. Haylock (2010) and Hansen (2011) endorse the idea that children who are identified as being less confident should receive more practical intervention within the learning, whilst evidence across schools has demonstrated how visual and manipulative resources will positively support accurate written methods; helping to prevent “cognitive overload” in the calculation process which is often the issue (Ryan and Williams 2007: 13). Moreover, working with base ten blocks and place value grids will enable easier transition towards ‘exchanging’, as seen in appendix C (Diene 1960).

In contrast to current practises within schools, the 2012 review of the National Curriculum proposes that children in Key Stage 1 should be introduced to the “more efficient column methods” of addition in preparation for Year 3 (DfE 2012: 7). Although this is still in the draft stage, a reduction in expanded methods of calculation in order to accelerate the learning for Key Stage 1 standard attainment testing could be a likely outcome of this change. It could also be argued that a decline in practical investigative experiences, which would support deeper conceptual understanding, may also be a consequence. A

necdotal evidence collected in school placements has suggested that

learning procedural methods too early, would not necessarily enable children
<https://assignbuster.com/the-learning-and-teaching-of-place-value-education-essay/>

to generalise across wider contexts of problem solving, because they lack meaningful experiences which develop knowledge behind the method.

Appendix G presents a typical example of this.

Appendix D further highlights this concern of introducing procedural methods too early, before the notion of positional value has been fully established.

Whilst Child X and Y presented their written methods correctly for calculations A and B, verbal communication with the teacher had divulged that neither child X or Y were fully conversant with positional value, in terms of how numbers should be read and interpreted in different contexts. By comparison, child Z's lack of understanding was more evident in the written form (example C), demonstrating a lack of comprehension in terms of the role of the decimal point. Experiences such as these have shown that, on paper, a child's thought processes cannot always be deduced, so marking work alone would not necessarily inform the teacher of their learning. This supports the idea that " dialogic" talk in the classroom will divulge misconceptions and encourage higher order thinking through the sharing of ideas, especially when supported with physical manipulatives and " scaffolded" by a facilitating adult to encourage even deeper contextual understanding (Alexander 2004 and Bruner 1978). Decimal addition difficulties have been successfully supported specifically with the ' toast' analogy, as observed in appendix F1 and F2. This is an effective way to support the notion of rational number; deliberately avoiding the use of Diene's blocks, which are generally associated with whole number work and therefore preventing confusion.

It is conceivable that similar errors such as those found with child Z (appendix D) could still be made by children who already having a good understanding of positional value. Conversely, it could also be argued that they would be better equipped to recognise and correct such errors; realising that the solution is not close to an original estimation. However, to be successful with estimation the ability to round numbers, to recognise number bonds and friendly numbers are all required; each of which rely heavily on knowledge of the place value system (Haylock 2010). This supports why experienced teachers value practical cognitive methods throughout the learning.

Whilst short algorithmic methods are efficient, it is important that pupils are given opportunities to learn constructively and are encouraged to link their ideas. For example, if children have already experienced the notion of exchanging units into tens; an adult could encourage investigations which exchange from the tens to the hundred columns. Experiences such as these will enable children to hypothesise, make conjectures, specialise and to ultimately generalise processes:

“ Surface level is principally behavioural, while the deeper level is more richly explanatory discursive” (Ryan and Williams 2010).

Therefore, learning to be accurate through a formulaic method rather than understanding the underlying concepts will not prepare children for more challenging mathematical calculations, as this next example indicates.

Appendix E, uses a more difficult mixed set of decimal numbers, and demonstrates how misconceptions need to be addressed early in the learning through practical analogies. If a child carefully followed a set procedure and successfully completed calculations A and B, it may seem logical to conclude that he could align any 3 digit number in the same way, regardless of whether they were whole or decimal numbers. This over generalisation is reflected in a number of possible errors, caused by a lack of comprehension concerning individual digit values.

Evidence in schools has revealed that, providing a child understands the concept of number conservation, multiple embodiment techniques such as the use of Diene's base ten blocks remain a powerful support for the learning of place value and the partitioning of numbers (DfEE : 1999b). By using apparatus Diene stated that students were more likely to internalise and reapply concepts to similar experiences (Diene 1960), whilst Skemp extended this idea by advocating:

“ Concepts of a higher order ...cannot be communicated to him by a definition, but only by arranging for him to encounter a suitable collection of examples” (Skemp 1971: 32).

Despite evidence of base ten apparatus positively supporting the partitioning of number, concerns voiced by Hart et al (1989) prompted Government warnings that children would not necessarily be able to transfer the practical experiences of exchanging into written calculations (Houssart 2000). This contributed to a temporary decline in the use of base blocks alongside

recommendations in the National Framework for Numeracy (DfEE1999b), which favoured resources such as arrow digit cards and number lines. This changed the emphasis towards mental strategies as opposed to procedural methods.

Thompson, questioned Government guidelines, suggesting a need for a review on teaching techniques. He suggested that the teaching of multiple base systems, such as the binary number system, should be introduced to widen place value notions (Thompson 2000). This has since been supported in the 2012 draft National Curriculum where the introduction of binary number in Upper Key Stage 2 is now being proposed. Furthermore, a recent OfSTED report which examined best practice in schools, confirmed a further change in guidelines where the use of base ten apparatus is now endorsed to specifically support exchanging notions in written calculations (OfSTED 2011).

Whilst it is evident that statutory guidelines are constantly being scrutinised, it is important that class teachers also reflect on their own successes within the classroom; utilising their experiences and knowledge from wider sources to benefit the children. It is imperative that professionals recognise the need for personalised learning, which will frequently involve working beyond the standard statutory guidelines; searching for appropriate methods and best practice in order to achieve success in the learning.

“...pupils will remember most aspects of mathematics more easily if they have made genuine sense of them” (Kay and Yeo 2003: 3)

2, 181 words