Key difficulties for teaching and learning percentages

What are the key difficulties experienced by pupils and teachers when the topic of percentages is being taught?

This essay will discuss several key difficulties and common misconceptions experienced by pupils, as well as teachers when the topic of percentages is being taught. It is important for teachers to be aware of these errors, so they are capable and prepared to explain them to children who may not understand. Killen and Hindhaugh (2018) supports this by stating that primary teachers should consider errors associated with percentages before teaching them to a full class. The teacher then needs to address them in their teaching, to ensure that children will not act in response to these misconceptions.

There are several key difficulties surrounding the topic of percentages. Research has shown that there has been one difficulty which is more common than others; the meaning of the terms *' of'* and ' *out of'* . Hansen (2011) states that both terms represent an operator which needs explaining. Teachers need to address these before the topic is introduced to stop any confusion. *' Of'* represents the multiplication operator, for example: 60% of 70 means 0. 6 multiplied by 70; *' out of'* represents the division operator, for example 30 out of 50 means 30 divided by 50. The teaching of these terms needs to be clear prior to teaching, so that children are confident in what these terms represent.

Killen and Hindhaugh (2018) believe that once children understand that 1/10 is equal to 10% they will be able to use their knowledge of fractions, to determine other multiples of 10. For example; Find 40% of 200. If children are aware that 10% is 20, then it will become obvious to them that 40% must be 80. This method enlightens many other practical ways to find other percentages of a quantity. Once children know 10%, they may also start finding half percent's, such as; 5% or 25%. However, Killen and Hindhaugh (2018) state that a difficulty could occur when they are asking for a percentage of a quantity. If children are being asked to find the percentage, they may believe that the answer is always in percent. For example; find 60% of £480. Children may be capable of calculating the answer of 288 but instead of writing down £288, they may write down 288%. Teachers will need to explain this issue and address to children that once calculating the answer, it must be in the same units as the given quantity.

Hansen (2011) also comments that the key to succession in the understanding of percentages is the relationship and understanding the children have with fractions and decimals. For example: they should be aware that 50% is equivalent to ½ and 0. 5, and 25% is equivalent to ¼ and 0. 25. Teaching these topics in isolation of each other should be strictly avoided as this may destroy a child's deep mathematical understanding. Killen and Hindhaugh (2018) agrees with this as they noted that children need to continually link decimals, fractions and percentages to their knowledge of the number system and operations that they are familiar with. Reys, *et al* (2010) believes however that percentages are more closely linked with ratios and proportions in mathematics and how important it is for teachers to teach these other topics to a high level. This is to later reduce the amount of errors a child has over percentages. However, these theorists also agree that understanding percentages requires no more new skills or concepts beyond those used in identifying fractions, decimals, ratios and proportions. Reys, *et al* (2010) states that an effective way of starting these topics is to explore children’s basic knowledge of what percentage means to them.

Barmby *et al (* 2009) noted that a misconception occurs whenever a learner’s outlook of a task does not connect to the accepted meaning of the overall concept. Ryan and Williams (2007) state that it is more damaging for children to have misconceptions of mathematical concepts than difficulties calculating them. Killen and Hindhaugh (2018) begin to talk how the use of rules and recipes are commonly used more so by teachers that are not fully confident with percentages. The main point of the argument is that if children are taught these rules linked to percentages, misconceptions can occur. This could be caused if the child forgets or misapplies the rule to their working out. This method is not the most reliable to children but can be a quick alternative for teachers to teach their class, if they are not fully confident in the topic themselves. This links to one of the most common misconceptions in the primary classroom. Killen and Hindhaugh (2018) state that it is the teacher’s responsibility for their children’s successes in that subject area. If the teaching is effective, then the child will become more confident and develop more links revolving the topic of percentages. This will result in the child having a high level of understanding. However, if the teaching is not up to standard the child may lose confidence in themselves and end up being confused with the simplest of questions, for example using the rule; ‘ *denominators become the decimal’* such as 10% = 1/10. Children may then apply this to questions with 12% or 8% believing that they are equal to 1/12 or 1/8, which is incorrect. Cockburn (1999) also takes an extract from Dickson, Brown and Gibson (1984). The example given in the extract shows that Percy was given a picture of 12 children and 24 lollies and was asked to give each child the same number of lollies. Percy's response was to give each child a lolly and then keep 12 himself. Misconceptions such as these two examples may occur if the child is confused about what is being asked of them in the question. Teachers need to have a strong expertise not only in this subject matter but how they communicate with their class and how they create a positive learning environment.

The construction that teachers use in explaining the concept of percentages needs to be more meaningful to the children. If only one method is being used in identifying the answer, then confusion and poor performance will follow as there is no discussion or thinking aloud on an appropriate answer to the question. Reys *et al* ., (2004) agree with this and believe that teachers should encourage students to think of perceptible and creative ways of achieving the answer. Ratio or equation calculations are difficult and can be taught by one single method, however research states that percentage equations should use a flexible approach and avoid focussing on one single, individual method.

Reys *et al.,* (2004) note that children who understand that percent is parts out of one hundred and have a strong pictorial representation of this, are more successful in solving percentage problems, for example; asking them to shade in a grid which represents 50% or 60%. They link these questions to their prior knowledge that the word ‘ percent’ means ‘ to every hundred’. However, children that find it difficult to memorise diagrams or struggle with visual representations of these concepts might find it more difficult to understand. These children will forget easily what percentages mean and therefore become confused. Lembke and Reys (1994) highlights the importance of teachers using a wide range of pedagogical approaches to suit the learning styles of each child, and therefore result in a positive and effective influence that may reduce any misconceptions. Lamon (2005) also disagrees with using pictorial diagrams such as shading grids. He suggests that shading grids are not the most effective way of teaching children percentages because children should be capable of achieving the answer more quickly in their heads. Teachers should encourage children to solve percentage problems mentally, using their prior knowledge of common percent benchmarks (Reys *et al* ., 2004). Lembke supports this and believes that the use of benchmarks comes naturally when calculating percent equations (Lembke and Reys, 1994). Killen and Hindhaugh (2018) agrees with this and believe that teachers should mentally know all the links between the conversions. If teachers can calculate these in their heads instantly, they can teach children to do the same. Converting between fractions, percentages and decimals enables children to calculate faster and more precisely.

Hansen (2008) brought forward another misconception that is common within the primary classroom. Researching two separate case studies in this text has shown children exploring why dividing by a fraction produces a larger number. This challenges children’s prior knowledge taught on the topic of multiplication and division. They believe that multiplication always produces a larger number and division always produces a smaller number.

Teachers need to address this issue before it becomes a problem and impacts on the child’s ability to grasp the concept of both fractions and percentages.

In conclusion, I have realised that fractions, decimals, ratios and proportions all have links with percentages. These connections need to be taught in line with each other instead of different individual topics. Cotton (2010) comments that it is obvious how fractions, decimals and percentages are all simply different ways of writing numbers. Chapman agrees with this and states that children need to be taught effective ways of these ideas in a varied and practical context. The links between these need to be more explicit in learning to develop a child’s understanding.

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