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Investigating the Attitudes of Teachers to Science Education in the Irish Primary Classroom

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KEYWORDS: Science Education, Primary Education, Attitudes, Teaching

INTRODUCTION

This article aims to provide an insight into current attitudes to science education, which has been correlated from a larger research study conducted by the author. It will compare attitudes recorded in past studies to current primary teachers attitudes to science. It also aims to examine factors affecting teacher's attitudes to science education at primary level.

The motivation for this study originated from a large-scale investigation into teacher confidence in teaching science in 1995 (Harlen, 1997). This seminal report amongst primary teachers found that, when asked to rate their confidence in teaching each of the subjects, science faired poorly in eighth position (only music and ICT ranking below science). In 2007, in a revisited study ten years later by Murphy and Beggs (2007), half of teacher participants identified lack of confidence and ability to teach science as the major issue concerning their teaching of science. This identified lack of confidence could correlate with a poor attitude towards the subject. This research therefore prompted an investigation into what are current teachers attitudes towards the teaching of science in the primary classroom and why?

Currently the IDA markets Ireland as a world-class research system citing a government investment of 8.2billion for science technology and innovation, a robust intellectual property regime, a well-educated workforce and low corporate tax rate as inferences for investment (IDA, 2017). Investigating issues in attitudes towards science education is thus imperative to sustain growth in the science and research market in Ireland. Furthermore, despite important recognition and funding for science education, Ireland was marginally over the OECD average in science achievement in 2013. Irelands performance in PISA ranking and scores have not shown any discernible improvement in student's science achievement since 2000 (NCCA, 2013). This study wishes to uncover if these results are still apparent in the primary classroom today and if they relate to attitudes to the subject.

CONTEXT

The pace of scientific research is currently at its most accelerated rate, informing and questioning policy decisions in a wider sphere and affecting and educating the everyday decisions of the average citizen at ground level. Scientific and technical activities account for the employment of 39.3% of women and 49.5% of men in Irish society in 2013 (CSO, 2013). Such high employment rates have earmarked the Irish science industry as prosperous investment. This also reflected in the large amounts of financing allocated by government for science and technology research (IDA, 2017). Scientific literacy, DeBoer (1999) too claims, is not only important for the preparation of those entering scientific and technical careers but also has an essential, functional element to educating the everyday citizen in living life effectively with respect to the natural world.

Parker and Spink (1997) demonstrate that science, for many newly qualified teachers can prove problematic. This is highly influenced by their own attitudes and prior experience with such areas of knowledge and is also reiterated in the reflective practice of the researcher in this case. Evidence suggests that 'student teacher's beliefs and impressions of teaching and learning play an important role in decision making processes about their own classroom practices' (Murphy and Smith, 2012). This study demonstrates that increased collaborative, discussion, discovery and reflective two-term science education did effectively reverse some prior negative views previously conceived. The National Curriculum (NCCA, 1999) does require that 'scientific investigation play a fundamental role in children's development', which creates concern as to why this was not foundational in student teacher science education previously (Parker and Spink, 1997). Similarly, 'the possession of knowledge regarding nature of science does automatically mean that teachers will be able to implement enquiry-based learning' which is also an area of concern for higher education institutions to examine (Waldron et al., 2007).

This investigation was revisited ten years on, which again measured student teachers' attitudes and confidence with science in the classroom. Improvements were identified in 'some areas of primary teacher confidence' (Murphy et al., 2007, pp. 1023). However, half of teachers surveyed still expressed confidence issues

in ability to teach science. It was claimed that 'higher education institutions need to enhance the preparation of new primary teachers' and 'increase their partnership work with schools and other continuous professional development (CPD) providers, in relation to primary science.' (Murphy et al., 2007). Some areas of pre-service primary school teacher education (PPST) have advanced to reduce and prevent conceptual understanding and misconception in science. Lectures adopted a 'constructivist approach' which 'modelled active teaching and learning methodologies, required … for the development of both PPST subject matter knowledge and pedagogical content knowledge' in line with teaching council guidelines (Liston, 2016). The results of such 'conceptual understanding lectures' were successful in 'challenging conceptually, questioning their scientific thinking and allowed time to reflect on their misconceptions' (Liston, 2016). However, often such misconceptions are person specific and can be difficult to acutely identify and rectify in such a widespread curriculum (Liston, 2016).

METHODOLOGY

This research utilized special purpose surveys amongst qualified teachers. Surveys relied on standardized questions that were analyzed statistically in accordance with quantitative methods. Such methods allow the researcher to collect a span of data samples and generalize conclusions that reflect a larger cohort of the sample population, reflective of the demographic and participant profile of those surveyed. Such work creates subjective data results based upon the sample surveyed but may seek to create more factual objective data by narrowing the demographic of sample participants (Fowler, 2014). As this research is conducted amongst qualified teachers all surveys contained an exact style of questioning within the surveys which will allow for cross comparable study of answers within the sample (Maxwell and Pearson, 2016). In total, 65 qualified teachers were contacted via email to complete the survey using on online link. Following distribution of this email, the researcher set a target of 40 participants, and 36 surveys were returned.

This study aimed to correlate results of previous studies (Murphy, 2007; Harlen, 1997) and act as a semi-replication study at points. With these studies having been conducted almost ten years ago to date, it is important that they are continually considered, updated and reflective of today's practice. In quantitative research, replication is important for strengthening cumulative knowledge and increasing the dependability of research findings (Funder et al., 2014; Makel & Plucker, 2014; Schmidt, 2009). However, this study presents as conceptual replication research rather direct replication, as the questions utilized in the previously mentioned research cases have in some cases become irrelevant, require modernizing or are not reflective of objectives of the study (Leavy, 2017, p89).

FINDINGS AND DISCUSSION

The participating teachers were asked to identify, from a list of common elements involved in delivering the science curriculum, what they felt comfortably confident to provide to their students. (Figure 1). The majority of teachers felt confident delivering elements of science education in their classroom, particularly in areas such as questioning (34 participants) and engagement (27 participants). Overall teachers felt most confident devising and posing questions during science lessons. The elements teachers felt most unsure about included explaining scientific ideas (18 participants) and assessing practical work (19 participants).

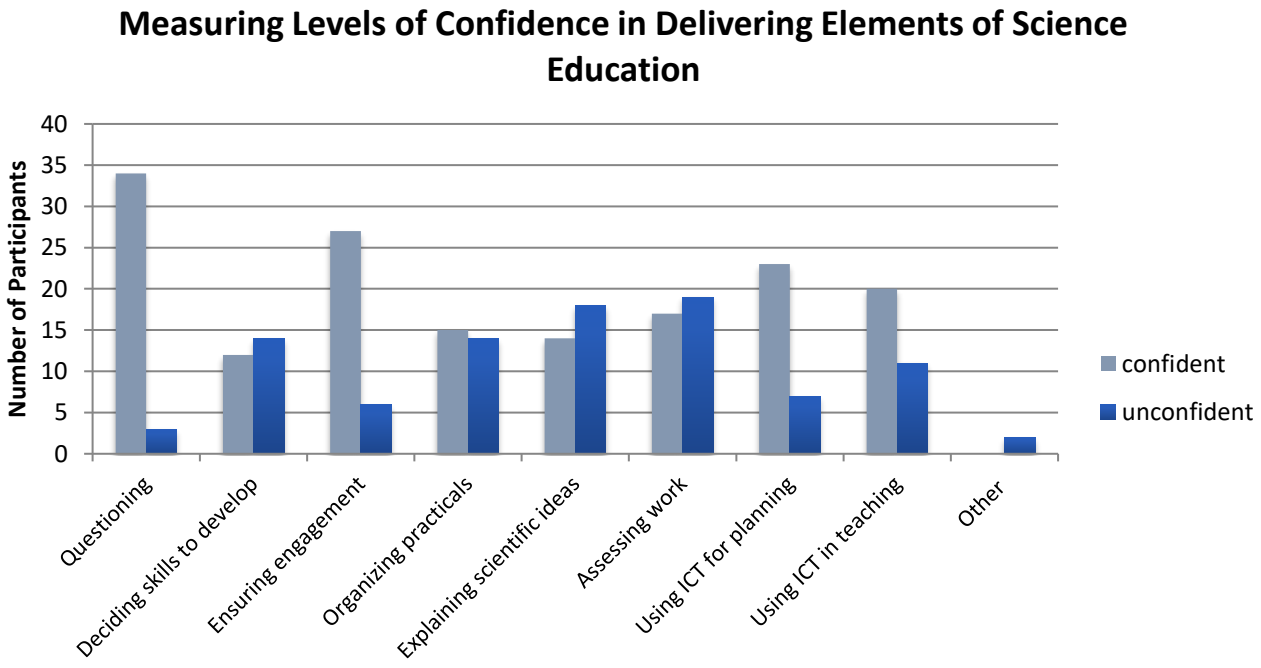

Figure 1 Participating Teachers Confidence in Delivering Elements of Science Education

The teachers were also asked to identify which skills they felt confident developing amongst the children in their class, as outlined in the primary science curriculum (NCCA, 1999). It was found that teachers felt relatively confident developing the scientific based skills of their class which included recording data, observation, fair testing, interpreting data and relating how science affects everyday lives. This is an interesting result as one of the main aims of the STEM education guidelines is to ensure children are equipped with such skills. This result may suggest that while teachers do feel confident developing these skills with their pupils, the quality of application and opportunity for such application may not be done as frequently as expected in the primary classroom (DES, 2017).

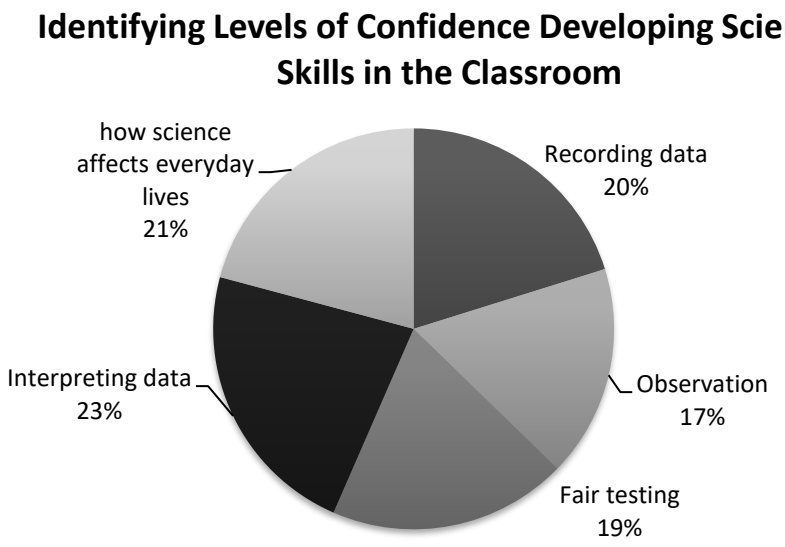

Figure 2 Participating Teachers Confidence Developing Scientific Skills in the Classroom

The participating teachers were also asked to detail what science concepts, outlined in the primary science curriculum content guidelines, that they felt most confident delivering to their class. Findings indicate that many teachers involved in the study feel confident teaching many areas of the science curriculum, especially the water cycle, the flowering plant, and basic life processes. It is interesting to note that many of these concepts would typically fall within the living things strand of the curriculum or be bracketed as life science study. It may be that teachers feel most confident teaching such concepts as they relate tangibly to everyday life and may have been studied by the participating teachers in biology to Leaving Certificate level, the most commonly studied science subject at second level in Ireland (CSO, 2016).

The Science in the Primary School Inspectorate Evaluation Study (2008), previously identified low confidence level among teachers teaching topics such as the flowering plant, forces, light and sound. It is positive to note quite high figures of teachers now reporting confidence delivering the concepts the flowering plant, light and sound in the primary classroom in 2018, within this study. Many teachers felt less confident teaching concepts such as how we see things (17 participants), insulators and conductors (11 participants) and temporary/permanent change (17 participants). There are a number of reasons to explain such results. One such deduction could be that these concepts involve abstract scientific ideas and knowledge which the teachers studied previously mentioned they found challenging to explain, as previously mentioned in the study. It could also be attributed to these categorical physics related topics, one of the least popular science subjects studied in Ireland at second level. These results, in relation to a lack of confidence surrounding physical science-based subjects, disappointingly reflect the results of a similar study conducted in by Harlen in 1997. The concepts chosen for investigation were informed by a previous study upon teacher confidence teaching the concepts to pupils in 2007 in a revisited study (Figure 3).

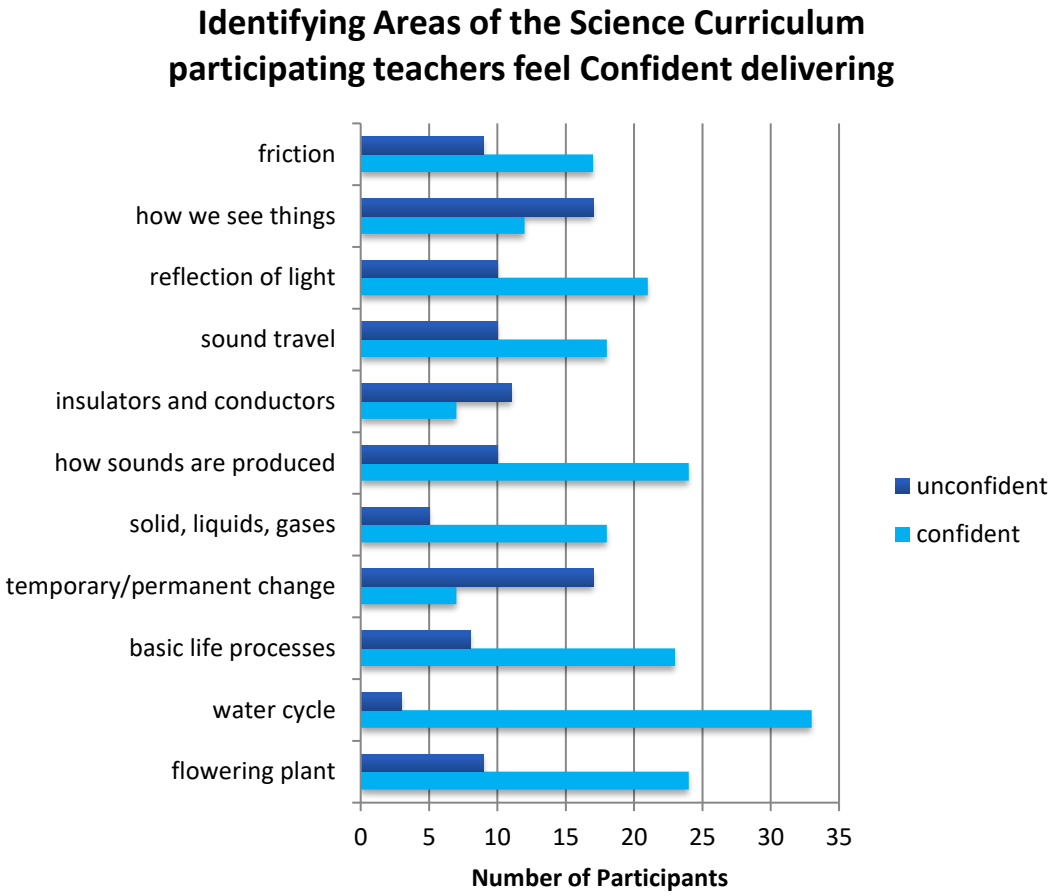

Figure 3 Areas of the Science Curriculum participating teachers feel confident/ less confident delivering

CONCLUSION

This research has demonstrated that teachers hold the value of teaching science at primary level in very high regard. Many teachers have studied science at second level, mainly Biology, which they rely heavily upon for explaining scientific knowledge to their class group. The concepts that teachers feel most confident teaching are those which are covered within the Biology curriculum. There are issues with teacher's confidence providing the primary science curriculum. Thankfully, teachers do feel confident relaying a scientific skill set to their class, which is a significant improvement upon results from previous studies (Harlen, 1997; Murphy and Beggs, 2007). Many teachers highlighted issues with their own scientific knowledge, preparing science lessons and assessing science work. Teachers' confidence levels teaching areas of science have improved in strand units such as the flowering plant but topics such as how we see things, insulators and conductors and temporary/permanent change are still stressed areas that many teachers do not feel confident delivering. It must be considered that the results presented are representative of the sample of participants only and cannot be generalized. Based upon the results of this study, teachers' confidence levels for the provision of science education at primary level have improved in recent years.

However, upon reflective review, there are still some critical issues that require employment and revision going forward.

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