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# Developing primary science and student teachers according to an observe, process, teach cycle.

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Those involved in the education of primary-aged children would largely agree that in order to provide an effective foundation for children, there needs to be a broad and balanced curriculum. Over the last thirty years, since the introduction of the National Curriculum and Early Years Foundation Stage (EYFS) framework, there has been a concerted effort to ensure all children gain access to varied and integrated curricula that support their understanding of the world around them. However, subsequent to the introduction of statuary testing in primary schools (with the emphasis on mathematics and literacy) there has been significant evidence to suggest that the profile of other subjects has diminished (Ofsted 2013). This is clearly not the case in all schools but arguably the prominence given to school league tables, which are heavily based on attainment scores for mathematics and literacy at KS1 and KS2, has resulted in decreasing curriculum time being afforded to other subjects, including science.

In whatever form, delivery of the curriculum is dependent on proficient primary teachers. It is established that student teachers require a breadth and depth of training opportunities both in and out of the classroom, to develop their confidence and enhance their level of pedagogy (Byrne et al 2016). Of course, this could be said for any one of the primary curriculum subjects, but for science this is especially important, as the subject involves a high level of practical input. Scientific processes are best learned through a hands-on, collaborative approach. This can be daunting for student teachers to execute if they have not had sufficient opportunity to observe more experienced practitioners teaching science and build a confidence for themselves.

## University and school-based training opportunities

It is generally accepted (Akerson et al., 2014) that student teachers develop theoretical understanding of subject-specific knowledge, confidence and pedagogical ideas

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from their learning at university. In order to make this acquisition of knowledge meaningful, it is vital that access is provided to outstanding school-based science practices to secure confident, high quality primary science teaching (Ofsted, 2013). For example, both aspects of the process – theory and practice – are key components to becoming a competent teacher of primary science. However, the theoretical input needs to be linked in a meaningful and timely manner to real-life, hands on practice in schools otherwise it becomes more difficult for student teachers not only to process the connection between the two, but also to become confident in fulfilling this part of the curriculum.

Sadly, this is often not the case, findings from a study of primary PGCE students (Blackmore, Howard & Kington, 2018) showed over three quarters of student teachers (n= 116, 76%) felt that science had a diminished profile in schools when compared to mathematics and literacy. In a student teacher's words:

*I think teachers are so busy and that they think it is just another subject they have to fit in. I don't think it is seen as a core subject anymore now, it is not taught as much.*

Unfortunately, the overall impact of this on the PGCE students' perceptions was that science was not seen as an important core component of the primary curriculum. Student teacher responses also revealed the paucity of opportunities to teach or observe

primary science lessons. On the positive side, student teachers who were given the opportunity to observe or teach science during their practice, valued this aspect of their training highly:

*I think it is good seeing someone teach since it helps you model your own practice and it helps you reflect upon what they are getting right and how you can improve.*

The direct impact of this opportunity to teach science was an increase in both pedagogical knowledge and confidence. In contrast, those who observed and taught little or no science were left with feeling of uncertainty. Fortunately, the majority of student teachers (n= 29, 72%) on EYFS placements stated that there was a considerable amount of science being taught and planned for, impacting on their confidence positively:

*I will be proactive in bringing science into the classroom as the freedom for children to discover things about the world around them is very important.*

## Why is this important for primary science teaching and learning in schools?

In an ideal training scenario, student teachers would be afforded numerous opportunities to shape their developing values and beliefs (Izadinia, 2013). However, this research clearly suggests that this is far from the current reality for some student teachers. Thus, one of the most concerning aspects of this study was how student teachers' limited opportunities to observe science in schools influenced their pedagogical specific training and confidence. In contrast it was heartening to find that oases of enthusiasm given over to this subject were detected from teachers who felt

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confident about teaching the subject in agreement with Knaggs and Sondergeld (2015), who found high performing student teachers' self-confidence increased with greater teaching experience of science. Our research reinforces that it is essential that student teachers are provided with opportunities to engage with the full range of science opportunities and not just see a mainstay diet of literacy and numeracy. To fulfil this requirement and support less confident student teachers it is necessary perhaps to review and refine current training partnerships between universities and schools.

## What now? Towards a model of effective partnership for primary science preparation

Findings from Blackmore, Howard and Kington (2018) clearly portray how student teachers are placed at the centre of many influences in terms of their school-based practice, university training and the wider school context which is often buffeted by external societal influences.

There is a strong perceived association between the opportunity to observe, process and teach science lessons, and increased confidence to teach science to children. However, the link with curriculum priority reported here is only part of the picture. It is the responsibility of the profession as a whole to provide the necessary support to enable competent and confident teachers in all aspects

of the primary curriculum. It is true, though, that science comes with a unique set of theory-practice issues. Teacher mentors can and should shape the content of school-based practice to some extent, but this can be a difficult balance between putting theory into practice and the everyday needs of the school. It has to be acknowledged that this can sometimes be a trade-off depending on the priorities of the school, the experience of the class teachers, and the needs of the children.

This being said, using a simple model of experiential learning, effective science teacher preparation could be enhanced by involving all stakeholders (student teachers, teacher mentors, and university science specialists) in the following cycle:

### Observe

After specific modelling of teaching key science concepts in university, student teachers observe experienced practitioners (including school science coordinators and EYFS specialists) teach science/ Understanding the World lessons.

### Process

Using established reflective models and key pedagogy (embedded in university), student teachers analyse classroom practice and shape their own ideas of effective science teaching.

### Teach

Student teachers execute their new approaches or modifications to practice in a range of settings and reflect upon feedback from both class teachers and university specialists to support their on-going development.

The above cycle is then repeated during all three teaching experience placements with extensive

exploration and sharing of practice between stakeholders.

Clearly, this model relies on the development of a dynamic partnership between schools and universities and should be underpinned by a strong, shared vision which centres on staff involvement and engagement. This can maximise the advantages for both current and student teachers, with both working towards coherent shared goals. Additional benefits to schools would be on-going professional development that fits with teachers' individual needs and the wider organisational goals.

To further improve confidence and raise the profile of science in schools, student teachers supported by university specialists could be encouraged to engage children in extra-curricular skill building sessions. For example, the CREST award scheme by the British Science Association, where children are encouraged to think like real-life scientists and engineers. Similarly, teacher confidence may be supported by university led CPD sessions exploring access to high quality planning and assessment resources, such as PLAN by the Association of Science Education (ASE). Additionally, master classes given by STEM ambassadors on relatively new areas of the science curriculum (e.g. Inheritance and Evolution) could be offered as part of a reciprocal arrangement with schools and universities to share effective teaching strategies.

In summary there is much scope for an enhanced model of symbiotic partnership between school and university ITE providers; however, the key ingredients for producing confident and competent practitioners is exposure and critical engagement with effective science lessons delivered by experienced teachers in school.

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Weblinks

CREST awards by BSA: https://www.britishscienceassociation.org/crest-awards/project-ideas

PLAN by ASE: https://www.ase.org.uk/plan

STEM Ambassadors scheme: https://www.stem.org.uk/stem-ambassadors

## Pen Portrait

Dr Karen Blackmore is a Senior Lecturer in Science Education at the University of Worcester and leads the science components for both the 3-year BA Primary Education and 1-year PGCE programmes. As a former pharmaceutical scientist and Head of Department at an independent through school (3-16 years), her main focus is educating primary teachers to become confident science pedagogues.

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## The next Bulletin in this series will be published in September 2020

**In forthcoming bulletins, ASPE will be exploring the impact of Covid-19 within the primary school community from a variety of perspectives.**

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