# **Primary Initial Teacher Education: Curriculum Plan**

# **Subject/Strand: Science Postgraduate Programmes**

# **Links to Practical knowledge, Substantive/theory, Disciplinary**

**Curriculum Vision:**

| **Phase 1** | | | | | | |
| --- | --- | --- | --- | --- | --- | --- |
| **University Based Learning** | | | | | | |
| **Learn That** | | | **Learn How** | | | |
| **Component Knowledge** | That the science national curriculum provides a programme of study for the knowledge (physics, chemistry and biology) and skills (working scientifically) which children learn aged 5-11 and that the spiral structure provides a minimum requirement and enables progression of substantive and disciplinary knowledge. **LT3.1** | |  | | Intent |
| * That expertise in science is built through developing two forms of knowledge:   Substantive - Scientific knowledge and conceptual understanding Disciplinary - Working scientifically. **LT3.2**   * That disciplinary knowledge involves knowledge of methods scientists use to answer questions, Knowledge of apparatus and techniques, data analysis and knowledge of how science uses evidence to develop explanations. **LT3.2** * That disciplinary knowledge needs to be taught explicitly rather than absorbed through practice and needs to be revisited. **LT3.5, LT3.6** * That working scientifically is embedded within the NC and should be taught explicitly and alongside the substantive content. **LT3.1**   That disciplinary knowledge must be sequenced and connected with substantive content that most appropriate to teach and develop this knowledge. **LT3.2** | | * Select appropriate disciplinary knowledge to be taught through substantive content. LT3.2, LT3.5, LT3.6 | |  |
| The 5 types of enquiry - observation over time; pattern seeking; identifying, sorting and classifying; comparative and fair testing and research using secondary sources. LT3.2 | | * Perform the 5 types of enquiry (Observation, pattern seeking, sorting and classifying, fair testing and secondary sources). **LT3.2** * Use a planning board to carry out a fair test. **LT3.2, LT4.3** | |  |
| That secure subject, pedagogical and curriculum knowledge as a primary science teacher is important and its role in planning for effective science learning. LT3.2 | | To use available resources to develop and deepen their own subject knowledge and take ownership of this process. LH8.2 | |  |
| * The research that supports learning in science including SPACE, AKSIS, OFSTED: Maintaining curiosity and Research Review: Science. LT8.2   The different pedagogies used to support learning in science including direct instruction; first-hand experience; modelling; analogies; simulations; role play; multi-sensory approach. LT4.4 LT4.6 | |  | |  |
| * The key principles of planning for learning and teaching and the importance of careful sequencing of components of learning to facilitate progress towards composite outcome within a lesson and sequence of lessons. **LH2.1, LH2.3, LT4.2** * that knowledge in science should be connected with what children have previously learned and pupils should be supported to make connections between different concepts that will support retrieval and application to problem solving. **LH2.2, LT4.2** * That engaging children in their science learning is important but learning activities are carefully selected in order to also develop deep understanding of the associated concepts. **LT4.2** * **That in high quality science curriculums knowledge is carefully sequenced to build on prior learning and reveal the interplay between substantive and disciplinary knowledge. LT4.4** | | Plan a short teaching sequence to include teacher subject knowledge, resources, key vocabulary and assessment with peer/ tutor support. **LH2.1, LH2.3, LT4.2**  To identify important components of learning required within a lesson and sequence these effectively to support pupils to make progress towards composite outcomes in science with peer and tutor support initially. **LH4.1 LT4.2**  Plan a science lesson using a range of teaching approaches which encourage children’s curiosity with peer and tutor support. **LH4.1 LT4.2**  Plan a sequence of learning in science using a range of teaching approaches which enable all children to make good progress towards composite substantive and disciplinary outcomes with peer and tutor support initially. LT4.2 | |  |
| * The different pedagogical approaches used to support science learning and how to employ these effectively including: questioning, first-hand practical experiences, models, analogies etc. **LT4.3 LT4.6** | |  | |  |
| * The benefits of learning outside the classroom in terms of learning, closing the attainment gap and supporting mental health and the importance of H&S and risk assessment in maintaining a safe learning environment. **LT1.1 LT3.2** | | * Use resources effectively to explore learning of science concepts in a variety of topics including electricity, evolution and inheritance, digestion; materials and particle theory; forces including air-resistance and friction and relevant science issues. **LT4.2** | |  |
| * Strategies for formative assessment in science. LT6.4 | | * Use a variety of formative assessment strategies to assess learning in science. **LT6.4** | |  |
| * The importance of language in conceptual development in science including talk for science and the understanding of scientific vocabulary. **LT4.7** | | * Plan opportunities for children to talk in science in order to share ideas and build conceptual knowledge. **LH4.1,** **LT4.7** | |  |
| * Adaptive learning approaches to support learning in science including children with SEN and EAL. **LT5.3, LT5.7** | | * Adapt learning and teaching to support children’s individual needs. **LT5.3, LT5.7** | |  |
| That misconceptions are children’s ideas which are based on their experience, prior learning and science capital. **LT2.2, LT2.6, LT3.4** | | * **Identify a range of approaches to elicit children’s ideas. LT2.2** * Use concept cartoons to promote conceptual change * Address misconceptions through planning and teaching. **LT2.2, LT2.6** | |  |
| Health and safety considerations related to the activities they carry out and the importance of risk assessment, particularly in relation to LOtC. **LT1.1, LT3.2** **LH8.2** | | * **Identify the risk associated with an investigation and the safety measures to be implemented to ensure a safe learning environment. LH7.1** * Construct a risk assessment for an outdoor science activity. **LH7.1** | |  |
| **Assessment** | **Assessment** | | | |  |
| **Assessment pertaining to phase 1**  Assessment will take the form of the science audit at the start of the phase. · Assessment in each session through peer discussions, tutor questioning, peer modelling. Common misconceptions are built into each session. The importance of working memory and long term memory are discussed in relation to students own experiences as well as in relation to the pupils they will teach.  Students will complete short, focussed formative assessment tasks at the end of each taught session. Students will complete a computer based test to assess the module content. Which will inform the interventions offered in phase 5. | | | | Impact |
| **Composite Knowledge** | **Composite knowledge/understanding/skills** | | | |
| *By the end of this phase trainees will* ***know:*** | *By the end of this phase trainees will* ***understand:*** | | *By the end of this phase trainees will* ***be able to:*** |
| *By the end of phase 1 trainees will* ***know:***   * key substantive and disciplinary knowledge and pedagogical approaches required to support learning and teaching of science. | *By the end of phase 1 trainees will* ***understand:***   * How learning theory and pedagogical approaches apply to practice and influence how we teach in science and how this is adapted to enable all children to make good progress. | | *By the end of phase 1 trainees will* ***be able to:***   * Plan a quality science lesson with support of tutor and peers that integrates working scientifically and considers prior learning, adaptive teaching, subject specific pedagogy and assessment and risk assessment. |
| **Research** | **KEY RESEARCH****That Trainees will know that informs teaching and learning in Science** | | | | |
| * Primary Science Knowledge & Understanding, Peacock, Sharp, Johnsey, Write and Sewell, 2021. * Primary Science Theory & Practice, Sharp, Peacock, Johnsey, Simon, Smith, Cross and Harris, 2021. * Research Review: Science, Ofsted, 2021 * The Teaching of Science in Primary Schools, Harlen and Qualter, 2017. * Maintaining Curiosity, Ofsted 2013 * ASE: Guide to Primary Science, Serret and Earle. 2018 * ASE materials * STEM learning centre materials * National Curriculum, 2014 | | | | |

| **Phase 2** | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **School Based Learning – Introduction/Developmental** | | | | **University Based Learning** | | | | | |
| **Learn That** | | **Learn How** | | **Learn That** | | | **Learn How** | | |
| **Component Knowledge** | The needs of learners within their school-based placement and how their science teaching could be adapted to ensure the progress of all learners with mentor support initially. **LH5.5, LT4.2, LT5.3**   * Discuss cohort’s requirements and science needs with class teacher | Adapt teaching to consider the science needs of leaners with support of the class teacher. **LH5.2, LH5.5, LT5.2, LT5.3** | | It is important to have secure science subject knowledge in order to teach effectively and make informed decisions about planning teaching and assessing learning in science at KS1 and KS2. **LT3.2** | | To build and develop their subject knowledge further through independent study using available resources. **LT8.2 LT8.7** | | Intent |
| The subject knowledge required to make informed decisions about planning, teaching and assessing learning in science within the context of their placement. LH3.4, LT3.2, LT3.5, LT3.7 | Plan and teach at least one science lesson which considers children’s prior knowledge and supports them to make progress. LH4.1 LT2.2 | | Science specific pedagogical knowledge to enable them to plan teach and assess primary science. **LT3.2, LT4.1, LT4.2**  A range of pedagogical techniques to teach more conceptually challenging topics such as Earth and Space where opportunities for first-hand practical experiences are limited.**LT4.3, LT4.6, LT4.7** | |  | |
| That substantive and disciplinary knowledge are incorporated into lesson plans. **LT3.2** | To combine substantive and disciplinary knowledge within a science lesson with mentor support **LH3.3** | |  | | Evaluate learning and teaching of science. LT3.2 | |
| That each school will have a behaviour policy and how this relates to practical and outdoor science learning | How to apply the school behaviour policy to practical science sessions to ensure a safe and purposeful learning environment. **LH7.1** | |  | |  | |
| Each school will have an approach to managing risks in science. Discuss risk assessment requirements with class teacher or science subject leader. | How to apply the school’s risk assessment and health and safety measures to practical science sessions. **LH7.1**  How to manage risk appropriately within practical science lessons (and LOtC where appropriate) with mentor support. | |  | |  | |
| By observing an experienced mentor learn that secure teacher subject knowledge is essential for high quality science teaching. LT3.2 | To extend subject and pedagogical science knowledge as part of lesson preparation LH 8.2 | | The statutory requirements for assessment in science. LT6.1  The process of summative assessment in science including end of key stage judgements. **LT6.1, LT6.3, LT6.4** | | How to use the teacher assessment framework to assess exemplar materials. **LT6.1, LT6.3, LT6.4** | |
|  |  | | About the lives of a diverse range of scientists including female scientists, scientists of colour (Katherine Johnson – Earth and Space), those with disabilities (Stephen Hawking – Earth and Space) and the impact they have had on our everyday lives. **LT1.2, LT1.6** | |  | |
| **Assessment** | **Assessment** | | | **Assessment** | | | |  |
| **Assessment pertaining to phase 2**  Assessed throughout Professional Practice 1. Lesson observations, weekly development meetings and weekly focus tasks. | | | Assessed in final taught session through peer discussions, tutor questioning, peer modelling.  Assessed through peer and tutor discussion following student workshops in final session:  Students will plan and deliver a micro teach session to their peers and tutors to demonstrate their subject and pedagogical understanding. Within their micro teach students will consider how to sequence the learning into component steps towards a composite outcome. Students will consider cognitive load, adaptive teaching, common misconceptions and reflect carefully on the teaching approach selected and resources used in their session design.  *By the end of this phase trainees will* ***know:***   * How to use assessment techniques in science to inform future planning and the importance of planning for progression in subject knowledge and enquiry skills.   *By the end of this phase trainees will* ***understand:***   * How to sequence learning effectively to facilitate progression in subject knowledge and enquiry skills   *By the end of this phase trainees will be* ***able to:***  Plan for an effective sequence of science learning with peer and tutor support | | | |
| **Composite Knowledge** | **Composite knowledge/understanding/skills** | | | | | | |
| *By the end of this phase trainees will* ***know:*** | | *By the end of this phase trainees will* ***understand:*** | | *By the end of this phase trainees will* ***be able to:*** | | |
| How to plan for the needs of the learners within their school-based placement and the appropriate level of subject knowledge to make informed decisions about planning, teaching and assessing learning for the phase in which they are teaching. (feedback will be provided by class teachers/mentors/link tutors whilst on professional practice) | | How to plan for effective learning in science considering behavioural expectations and risk assessments. (feedback will be provided by class teachers/mentors/link tutors whilst on professional practice) | | Plan and teach a science lesson that is appropriate to the needs of the learners, that draws on children’s prior learning to develop subject knowledge and enquiry skills and assess the learning that has taken place. | | |
| **Research** | **KEY RESEARCH****That Trainees will know that informs teaching and learning in Science** | | | | | | | |
| * Primary Science Knowledge & Understanding, Peacock, Sharp, Johnsey, Write and Sewell, 2021. * Primary Science Theory & Practice, Sharp, Peacock, Johnsey, Simon, Smith, Cross and Harris, 2021. * Research Review: Science, Ofsted, 2021 * The Teaching of Science in Primary Schools, Harlen and Qualter, 2017. * Maintaining Curiosity, Ofsted 2013 * ASE: Guide to Primary Science, Serret and Earle. 2018 * ASE materials * STEM learning centre materials * National Curriculum, 2014 | | | | | | | |

| **Phase 3** | | | | | | |
| --- | --- | --- | --- | --- | --- | --- |
| **School Based Learning – Consolidation** | | | | | | |
| **Learn That** | | | **Learn How** | | | |
| **Component Knowledge** | the school’s MTPs and LTPs can be used to plan for an effective sequence science learning via mentor or science subject lead tutorial. **LH2.4, LT4.2, LT4.4** | | * Plan and teach an effective sequence of science learning that is adapted to the needs of the learners if appropriate within the school’s planned curriculum. **LH5.5, LT5.3** | | Intent |
| If appropriate, consider how schemes of work can be annotated or adapted to reflect best practice and the needs of learners within their class via mentor or science subject lead tutorial. **LH2.3, LH2.4, LH3.6, LT4.2 LT4.4** | | * To annotate and adapt schemes of work to meet the needs of the cohort class in science | |
| That science learning should be sequenced to consider planning to avoid cognitive load, interleaving and repeated practice. **LT2.4, LT2.7, LT3.7**  **Revisit:** The importance of considering the teaching order of components within a sequence of learning and how this links with supporting children to develop their knowledge and understanding within a specific context. **LT4.2, LT4.4** | | * To sequence components of science learning into a logical order that will support children to reach their composite outcomes across a sequence of lessons for a specific group of learners. **LH2.4** * To plan and teach a sequence of science lessons that draws on prior learning and uses formative assessment to inform future lessons. **LH2.1, LH2.4, LH3.6, LH4.10, LT4.6** | |
| Science teaching should be adapted for the science needs of the learners within their setting and that literacy and maths barriers should be removed to allow for success in science. **LT5.3, LT5.7** | | Adapt the direction of a lesson in response to pupil feedback. For example, making use of hinge questions. **LH6.1, LH6.4, LT4.6** | |
| **Assessment** | **Assessment** | | | | Impact |
| Assessed throughout Professional Practice 2. Lesson observations, weekly development meetings and weekly focus tasks. | | | |
| **Composite Knowledge** | **Composite knowledge/understanding/skills** | | | |
| *By the end of this phase trainees will* ***know:*** | *By the end of this phase trainees will* ***understand:*** | | *By the end of this phase trainees will* ***be able to:*** |
| * How to use a school’s long term and medium-term plans and schemes of work as a starting point to sequence learning. *(Feedback will be given by class teacher/mentor/link tutor during professional practice)* | * The importance of carefully sequencing learning to best facilitate transferal to long term memory. *(Feedback will be given by class teacher/mentor/link tutor regarding applying theory to practice when planning for learning in a logical order during professional practice)* | | * Plan and teach an effective sequence of science learning which uses science specific pedagogies to facilitate progression in subject knowledge and enquiry skills and integrates formative assessment. *(Feedback will be given by class teacher/mentor during professional practice)* |
| **Research** | **KEY RESEARCH****That Trainees will know that informs teaching and learning in Science** | | | | |
| * Primary Science Knowledge & Understanding, Peacock, Sharp, Johnsey, Write and Sewell, 2021. * Primary Science Theory & Practice, Sharp, Peacock, Johnsey, Simon, Smith, Cross and Harris, 2021. * Research Review: Science, Ofsted, 2021 * The Teaching of Science in Primary Schools, Harlen and Qualter, 2017. * Maintaining Curiosity, Ofsted 2013 * ASE: Guide to Primary Science, Serret and Earle. 2018 * ASE materials * STEM learning centre materials * National Curriculum, 2014 | | | | |