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

# **Subject Mathematics Postgraduate Programmes**

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

# **(Links to Fluency/ Reasoning/ Problem Solving/ Mastery)**

**Curriculum Vision:**

Through our Initial Teacher Education Curriculum, it is our intention that all Edge Hill Primary teacher trainees will:

* understand that mathematics is the route to developing both accurate and fluent numeracy skills and the importance of this in relation to everyday life skills and financial literacy
* understand that this approach is supported by robust evidence
* understand the purpose of the three mathematics curriculum aims and how these can be addressed for all areas of the mathematics curriculum.
* develop their confidence and promote an enthusiasm and passion for mathematics and believe that all children can be successful mathematicians, regardless of social background or other circumstances and that this is their moral purpose as educators.

| **Phase 1** |
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| **University Based Learning** |
| **Learn That** | **Learn How** |
| **Component Knowledge** | There are three aims of the mathematics curriculum and they all relate to eachother. **LT3.1** | To plan, teach and assess a sequence of lessons developing both conceptual and procedural understanding of number, including counting, place value and both mental and written calculation. This will be consolidated whilst on professional practice. **LH2.3, LH2.7, LH2.9, LT3.5, LH3.3, LH3.7, LH3.8, LT6.1, LT6.3, LT6.4, LH6.1, LH6.3** | Intent |
| One of the key aims of the mathematics curriculum is for pupils to become fluent in the fundamentals of mathematics, including through varied and frequent practice with increasingly complex problems over time, so that pupils develop conceptual understanding and the ability to recall and apply knowledge rapidly and accurately. **LT3.1, LT4.8**This will specifically link to understanding of declarative and procedural knowledge. **LT3.3, LT3.5, LH3.11** | To plan, teach and assess times tables using effective strategies without just using drill and practice and use these strategies to enable pupils to make connections between this knowledge and the inverse operation of division. This may be consolidated whilst on professional practice. **LT2.1, LT2.5, LT2.7, LT2.8, LH2.9, LH3.3, LH3.11, LT4.2, LT6.1, LT6.3, LT6.4, LH6.1, LH6.3** |  |
| One of the key aims of the mathematics curriculum is for pupils to reason mathematically by following a line of enquiry, conjecturing relationships and generalisations, and developing an argument, justification or proof using mathematical language. **LT3.1** | To promote the use of mathematics specific vocabulary across all areas of mathematics. This will be consolidated whilst on professional practice. |  |
| One of the key aims of the mathematics curriculum is for pupils to solve problems by applying their mathematics to a variety of routine and non-routine problems with increasing sophistication, including breaking down problems into a series of simpler steps and persevering in seeking solutions.This will specifically link to understanding of conditional knowledge. **LT3.1** | To plan to utilise appropriate concrete and visual resources to support number sense and a conceptual understanding of calculation strategies considering the CPA approach. This may be consolidated whilst on professional practice.**LH2.3, LH2.9, LH3.12, LT4.3, LH4.8, LH5.9** |  |
| There are 5 counting principles. | To promote a mathematical mindset for pupils irrespective of background or ability. This may be consolidated whilst on professional practice. **LT1.1, LT1.2, LT2.1** |  |
| There is declarative and procedural subject knowledge required to plan, teach and assess the following areas effectively and confidently: counting, place value, common mental calculation strategies, common informal written calculation strategies, the formal written calculation strategies as defined in the **appendix of the National Curriculum document.LT2.2, LH2.3, LH2.7, LT3.3, LT3.5, LT4.2, LT6.1, LT6.3, LT6.4** | To plan, teach and assess a sequence of lessons following a mastery approach. This should be consolidated whilst on professional practice.**LT2.7, LH2.3, LH2.9, LH3.3, LH3.4, LH3.7, LH4.1, LH5.6, LT6.1, LT6.3, LT6.4, LH6.1, LH6.3** |  |
| Converting between fractions, decimals and percentages follows distinct strategies. Have a secure understanding of ratio and proportion and use this to teach these concepts in creative ways.- procedural knowledge **LT3.5, LT4.2** | To identify common “symptoms” of maths anxiety and propose strategies to support children with their learning with reference to the latest research and support networks (Maths Anxiety Trust). This may be consolidated whilst on Professional Practice. |  |
| There is a difference between an error and a misconception. **LH1.3, LT2.6** | To plan for pupils to have opportunities to learn and develop reasoning skills by including a variety of teaching and learning approaches.- conditional knowledge. This will be consolidated whilst on professional practice.**LT2.7, LH2.8, LT3.5, LH3.3, LH4.1** |  |
| There are strategies for addressing common misconceptions across all areas of the mathematics curriculum.**LH1.3, LT2.6, LH2.6, LT3.4**. | To assess reasoning skills through questioning, observation and scaffolded conversations. This will be consolidated whilst on professional practice.**LH2.8, LT3.5, LT4.6, LH4.14, LH4.15, LH5.12, LT6.1, LT6.3, LT6.4, LH6.1, LH6.3, LH6.6** |  |
| There are names and properties of common 2d and 3d shapes and the associated vocabulary – declarative knowledge and developing associated schema. **LH1.2, LT3.5, LT3.7** | To implement a problem-solving culture into every mathematics lesson where pupils are engaged by the challenge and demonstrate resilience.- conditional knowledge. This should be consolidated whilst on professional practice. **LT1.1, LT1.2, LT3.2, LT7.4** |  |
| There are advantages of talk and language in mathematics lessons. **LT4.7** | To identify their developmental needs as mathematical educators and independently address these. This will be consolidated whilst on professional practice. |  |
| Teachers can influence pupils’ resilience and beliefs about their ability to succeed, by ensuring all pupils have the opportunity to experience meaningful success in mathematics avoiding Maths Anxiety (key research here) **LT1.1, LT1.2** | To plan and assess mathematics lessons involving number, calculation and geometry. This my be consolidated whilst on professional practice. **LH2.3, LH2.7, LH2.9, LT3.5, LH3.3, LH3.7, LH3.8, LT6.1, LT6.3, LT6.4, LH6.1, LH6.3** |  |
| There are cognitive factors leading to mathematical difficulties. **LT2.4**.  | To promote resilience and perseverance when problem solving, whist considering the role of long term memory, working memory and CLT- conditional knowledge. This should be consolidated whilst on professional practice. **LT1.1, LT1.2, LT7.4** |  |
| Polya’s 4 step process supports problem solving. |  |  |
| The term fluency relates to mathematical progression and the declarative and procedural knowledge associated with number and calculation. **LT3.1, LT3.3, LT3.5, LH3.11** |  |  |
| There is a progression sequence through calculation and place value. **LT2.2, LT2.6, LH2.3, LH2.7, LT3.7** |  |  |
| Fluency is not just rapid number recall it is developing a sense of number.**LT2.5, LH3.11** |  |  |
| There are specific areas of mathematics that do require mental recall – number bonds, times tables and how this links to working memory and long term memory.**LT2.3, LT2.4, LT2.5, LH3.11** |  |  |
| There is specific technical vocabulary used within counting, place value, calculation and statistics**. LH1.2** |  |  |
| That mental strategies inform the informal and formal written strategies to calculation – procedural knowledge **LT2.6, LH2.7, LT3.5, LT3.7, LH3.8, LT4.2** |  |  |
| It is important to develop an understanding of mathematical mindset in relation to the work by Carol Dweck and more recently, Jo Boaler. **LT2.1** |  |  |
| Lessons can be adapted using the Concrete, Pictorial, Abstract (CPA) approach, in relation to Bruner’s principles of enactive, iconic, symbolic and the value of dual coding. **LH3.12, LT4.3** |  |  |
| There is conditional knowledge required by pupils to reason mathematically and problem solve in relation to number and calculation**. LT2.1, LH2.7, LT4.2** |  |  |
| There is a progression sequence through Fractions, Decimals and Percentages (FDP) **LH2.3** |  |  |
| There is specific technical vocabulary used within fractions, decimals and percentages, and geometry, **LH1.2** |  |  |
| Both procedural and conceptual variation are required to support mastery. |  |  |
| Subitising can support the development of counting skills. **LT2.2, LT3.5** |  |  |
| There are a number of types of problem solving, not just word problems. |  |  |
| There are a number of skills required to become an efficient problem solver. **LH2.3, LT3.5** |  |  |
| There are different stages to the problem-solving process. |  |  |
| There is conditional knowledge required by pupils to reason mathematically and problem solve across all areas of the mathematics curriculum.**LT2.7, LT3.7, LT4.2** |  |  |
| Their own mathematical schema have developed over time, particularly in relation to calculation strategies. **LT2.9, LT3.7** |  |  |
| The term “maths anxiety” can relate to cognitive load theory and the possible impact this can have on learning and progress. **LT1.1, LT1.2** |  |  |
| **Assessment** | **Assessment** |  |
| * No formal assessment as this is a non- assessed module.
* All students are required to complete the National Numeracy Challenge (NNC) and achieve a score of 70+before PP1 and 80+ before PP2 which indicates they possess the fundamentals of mathematics.
* All sessions contain opportunities for students to model the teaching and practice objectives contained in the session.
* All sessions begin with an informal retrieval activity.
* Mid point opportunity to model calculation procedures to other students.
* Mid point review of PSKR and evidence collected.
 | 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:*** |
| * A range of strategies to support pupil understanding of how to calculate successfully, using mental, informal and formal written methods, including the relevant declarative and procedural knowledge associated with number and calculation. **LT2.2, LT2.7, LT2.8, LT2.9, LH2.3, LH2.7, LH2.9, LT3.3, LT3.5, LT3.7, LH3.8, LT4.2, LH4.3**
* Common misconceptions within number, place value, calculation and geometry. **LH1.3**
* The relevant declarative and procedural knowledge associated with extended number and geometry. **LH1.3, LT3.4, LT3.5, LT4.2, LH4.3, LH6.4**
 | * That a secure knowledge of place value underpins the ability to calculate both mentally and use formal written methods and the role of long term and working memory in this process. **LT2.2, LT2.6, LT2.7, LT2.8, LT2.9, LH2.3, LH2.7, LT3.2, LT3.7, LH3.7, LH3.8, LT4.2**
* How to address common misconceptions related to number, place value and calculation and strategies to address these, including support with cognitive overload. **LH1.3, LT2.6, LH2.6, LT3.4, LH6.4, LH6.5, LH6.7**
 | * Model effective practice in the teaching of number and calculation. **LH2.9, LH3.3, LH3.7, LT6.1, LT6.3, LT6.4**
 |
| **Research** | **KEY RESEARCH****That Trainees will know that informs teaching and learning in Mathematics** |
| * **Mathematics explained for primary teachers (6th Edition), Derek Haylock & Ralph Manning, 2019**
* **Research Review: Mathematics, Ofsted, 2021**
* **Ready to Progress materials, DfE and NCETM, 2020**
* **NCETM Progression maps, NCETM, 2021**
* **NCETM videos**
* **NCETM Mastery materials**
* **CPA approach as proposed by Jerome Bruner 1966**
* **National Curriculum, 2014**
* **Nrich website**

**The effects of maths anxiety in primary students, Theodosia Prodromou & Nick Frederickson, 2018** |

| **Phase 2** |
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| **School Based Learning – Introduction/Developmental** | **University Based Learning** |
| **Learn That** | **Learn How** | **Learn That** | **Learn How** |
| **Component Knowledge** | There are key elements required to plan, teach and assess a sequence of lessons developing both conceptual and procedural understanding of number, including counting, place value and both mental and written calculation. **LH2.3, LH2.7, LH2.9, LT3.5, LH3.3, LH3.7, LH3.8, LT6.1, LT6.3, LT6.4, LH6.1, LH6.3** | To plan, teach and assess a sequence of lessons developing both conceptual and procedural understanding of number, including counting, place value and both mental and written calculation.This may be consolidated whilst on professional practice **LH2.3, LH2.7, LH2.9, LT3.5, LH3.3, LH3.7, LH3.8, LT6.1, LT6.3, LT6.4, LH6.1, LH6.3** | They should apply their previous knowledge to link different areas and skills of mathematics - conditional knowledge **LT2.2, LT3.5, LT4.2** | To plan, teach and assess a sequence of lessons following a mastery approach, developing both conceptual and procedural understanding of all areas of the mathematics curriculum. This may be consolidated whilst on professional practice.**LT2.8, LH2.3, LH2.8, LH2.9, LT3.3, LH3.3, LH3.4, LH3.7, LH4.1, LT6.1, LT6.3, LT6.4, LH6.1, LH6.3, LH8.3** | Intent |
| There is mathematics specific vocabulary in relation to calculation, number facts, counting and place value. **LH1.2** | To plan to utilise appropriate concrete and visual resources to support number sense and a conceptual understanding of calculation strategies considering the CPA approach. This may be consolidated whilst on professional practice.**LH2.3, LH2.9, LH3.12, LT4.3, LH4.8, LH5.9** | There are conversion procedures for common measurements.- procedural knowledge **LT2.2, LT3.5** | To plan and assess using a mastery approach, supported by the NCETM materials. This may be consolidated whilst on professional practice.**LT2.8, LH2.3, LH2.8, LH2.9, LT3.3, LH3.3, LH3.4, LH3.7, LH4.1, LT6.1, LT6.3, LT6.4, LH6.1, LH6.3, LH8.3** |
| Using appropriate concrete and visual resources supports number sense and a conceptual understanding of calculation strategies considering the CPA approach. **LH3.12, LT4.3** | To promote the use of mathematics specific vocabulary in relation to calculation, number facts, counting and place value. | There is declarative and procedural subject knowledge required to plan, teach and assess the following areas effectively and confidently: measure, statistics and algebra. **LH1.2, LH2.3, LT3.5, LT4.2** |  |
| There are strategies to promote a mathematical mindset for pupils irrespective of background or ability. **LT2.1** | To plan for pupils to have opportunities to learn and develop reasoning skills by including a variety of teaching and learning approaches.- conditional knowledge. This will be consolidated whilst on professional practice.**LT2.7, LH2.8, LT3.5, LH3.3, LH4.1** | There is a progression sequence for measure, statistics and algebra. **LH2.3** |  |
| Conditional knowledge is required by pupils to reason mathematically and problem solve in relation to number and calculation**. LT2.1, LH2.7, LT4.2** | To assess reasoning skills through a use of formative assessment strategies adapted to the needs of each pupil. This will be consolidated whilst on professional practice.**LH2.8, LT3.5, LT4.6, LH4.14, LH4.15, LH5.12, LT6.1, LT6.3, LT6.4, LH6.1, LH6.3, LH6.6** | There is specific technical vocabulary used within statistics, measure and algebra. **LH1.2** |  |
| There are approaches to assess reasoning skills through questioning, observation and scaffolded conversations. **LH2.8, LT3.5, LT4.6, LH4.14, LH4.15, LH5.12, LT6.1, LT6.3, LT6.4, LH6.1, LH6.3, LH6.6** |  | The terms transitivity and conservation are commonly used relating to measure and how to use these concepts to assess children’s basic understanding of measure. |  |
| Collaborative learning and mathematical dialogue are effective approaches to developing reasoning skills and present effective assessment opportunities.**LT3.5, LT6.1, LT6.3, LT6.4** |  | The 5 big ideas promote the teaching of Mastery (NCETM). **LT3.3** |  |
| There is a purpose and how to present the Multiplication Tables Check (MTC) – declarative knowledge **LT3.3, LT3.5, LH3.11** |  | Mastery is misunderstood and not all teachers are clear about it what it actually means.**LT3.3** |  |
| There are different forms of questioning that can elicit different response. **LT4.6, LH4.14, LH4.15, LH5.12** |  | Mastery was popularised after its success in East Asia, but it was explicitly based on theories from around the world.**LT3.3** |  |
| There is specific vocabulary associated with reasoning that will develop as children progress through the curriculum. **LH1.2** |  |  |  |
| **Assessment** | **Assessment** | **Assessment** | Impact |
| * All students are required to complete the National Numeracy Challenge (NNC) and achieve a score of 80+ before PP2 which indicates they possess the fundamentals of mathematics.
* All sessions contain opportunities for students to model the teaching and practice objectives contained in the session.
* All sessions begin with an informal retrieval activity.
* Final session is an Assessment of Subject Knowledge review.
 | Students meet the subject knowledge requirements to proceed as set out on the interim placement progress report. |
| **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:*** |
| * The key components of a successful mathematics lesson.
* A range of strategies to support pupil understanding across all areas of the primary mathematics curriculum, including the relevant declarative and procedural knowledge. **LT2.2, LT2.7, LT2.8, LT2.9, LH2.3, LH2.7, LH2.9, LT3.3, LT3.5, LT3.7, LH3.8, LT4.2, LH4.3**
* Common misconceptions within measure, statistics, algebra. **LH1.3**
* The relevant declarative and procedural knowledge associated with extended number and geometry. **LH1.3, LT3.4, LT3.5, LT4.2, LH4.3, LH6.4**
 | * The value of questioning as an assessment tool and the value of talk and collaborative work to reduce cognitive load and develop working memory. **LT1.1, LT1.2, LH1.2, LT3.2, LT4.7, LT7.4,**
* How to build in opportunities to revisit learning ie links to place value and written calculation and consider the implications for long term memory. **LT2.4, LT2.8, LH2.11, LH3.10**
* How to address common misconceptions across all areas of the primary mathematics curriculum and strategies to address these, including support with cognitive overload. **LH1.3, LT2.6, LH2.6, LT3.4, LH6.4, LH6.5, LH6.7**
* The meaning of the term mathematics mastery**.LT3.3**
* How to adapt their mathematics teaching to meet the needs of all pupils. **LT1.3, LT5.1, LT5.2, LT5.3, LT5.7, LH5.2**
 | * Confidently plan, teach and assess a high-quality number (counting, place value, calculation) lesson, that takes into account common misconceptions and formative assessment strategies. **LH1.3, LH2.8, LH2.9, LT3.4, LH3.3, LH4.1, LH6.4**
* Confidently model and scaffold learning to support cognitive load. **LT2.4, LT2.8, LH2.11, LH3.10**
* Verbalise their approaches to teaching mathematics effectively across all curriculum areas, including consideration for equality and diversity. **LT1.3, LT5.1, LT5.2, LT5.3, LT5.7, LH5.2**
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| **Research** | **KEY RESEARCH****That Trainees will know that informs teaching and learning in Mathematics** |
| * Children’s errors in mathematics, Alice Hansen, 2020
* Mathematics explained for primary teachers (6th Edition), Derek Haylock & Ralph Manning, 2019
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* CPA approach as proposed by Jerome Bruner 1966
* National Curriculum, 2014
* Nrich website
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| **Phase 3** |
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| **School Based Learning – Consolidation** |
| **Learn That** | **Learn How** |
| **Component Knowledge** | There a specific components required to plan, teach and assess a sequence of lessons developing both conceptual and procedural understanding across all maths curriculum areas appropriate to the key stage they are placed in. **LH2.3, LH2.7, LH2.9, LT3.5, LH3.3, LH3.7, LH3.8, LT6.1, LT6.3, LT6.4, LH6.1, LH6.3** | To plan and assess a sequence of lessons appropriate to the key stage they are placed in, using a mastery approach, supported by the NCETM materials or similar. This should be consolidated whilst on professional practice.**LT2.7, LH2.3, LH2.9, LH3.3, LH3.4, LH3.7, LH4.1, LH5.6, LT6.1, LT6.3, LT6.4, LH6.1, LH6.3** | Intent |
| There are specific components required to plan, teach and assess a sequence of lessons following a mastery approach appropriate to the key stage they are placed in. **LT2.7, LH2.3, LH2.9, LH3.3, LH3.4, LH3.7, LH4.1, LH5.6, LT6.1, LT6.3, LT6.4, LH6.1, LH6.3** | To promote resilience and perseverance when problem solving, whist considering the role of long term memory, working memory and CLT- conditional knowledge. This should be consolidated whilst on professional practice. **LT2.3, LT2.4, LT2.5, LT2.7, LT7.4** |
| It is important to promote the use of mathematics specific vocabulary across all areas of mathematics appropriate to the key stage they are placed in . | To plan a sequence of lessons that take into account spaced learning and consider appropriate points to revisit knowledge and check understanding. **LT2.4, LT2.8, LH2.11, LH3.10** |
| It is important to plan for pupils to have opportunities to learn and develop reasoning across the mathematics curriculum appropriate to the key stage they are placed in, by including a variety of teaching and learning approaches.- conditional knowledge **LT2.7, LH2.8, LT3.5, LH3.3, LH4.1** |  |
| Many schools now plan and assess using a mastery approach, supported by the NCETM materials or similar, appropriate to the key stage they are placed in. **LT2.8, LH2.3, LH2.8, LH2.9, LT3.3, LH3.3, LH3.4, LH3.7, LH4.1, LT6.1, LT6.3, LT6.4, LH6.1, LH6.3, LH8.3** |  |
| Mastery is an approach to teaching mathematics ensuring all children achieve to their full potential. |  |
|  | Spaced learning can benefit cognitive load, working memory and long term memory. **LT2.4, LT2.8, LH2.11, LH3.10** |  |  |
| **Assessment** | **Assessment** | Impact |
| Students meet the subject knowledge requirements to proceed as set out on the end of placement progress report. |
| **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, teach assess, lessons across all areas of the mathematics curriculum, taking into account prior learning and the needs of all pupils. **LT3.5, LH3.3, LH4.1, LT6.1, LT6.3, LT6.4**
 | * The declarative and procedural knowledge pertinent to each child developing an ability to relate mathematics to real life and to problem solve. **LT2.2, LH2.3, LH2.7, LT3.3, LT3.5, LT4.2, LT6.1, LT6.3, LT6.4**
 | * Confidently and effectively plan, teach and assess children’s mathematics skills and understanding through a series of lessons using a mastery approach. demonstrating the elements of good practice indicated in the EHU ‘Lesson Observation Prompts’, and adjusting plans in response to assessment. **LT3.5, LH3.3, LH4.1, LT6.1, LT6.3, LT6.4**
 |
| **Research** | **KEY RESEARCH****That Trainees will know that informs teaching and learning in Mathematics** |
| * **Children’s errors in mathematics, Alice Hansen, 2020**
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