GRADUATE SCHOOL OF EDUCATION

College of Social Sciences and International Studies

PGCE SECONDARY SCIENCE STUDY GUIDE

ACADEMIC YEAR 2018-2019

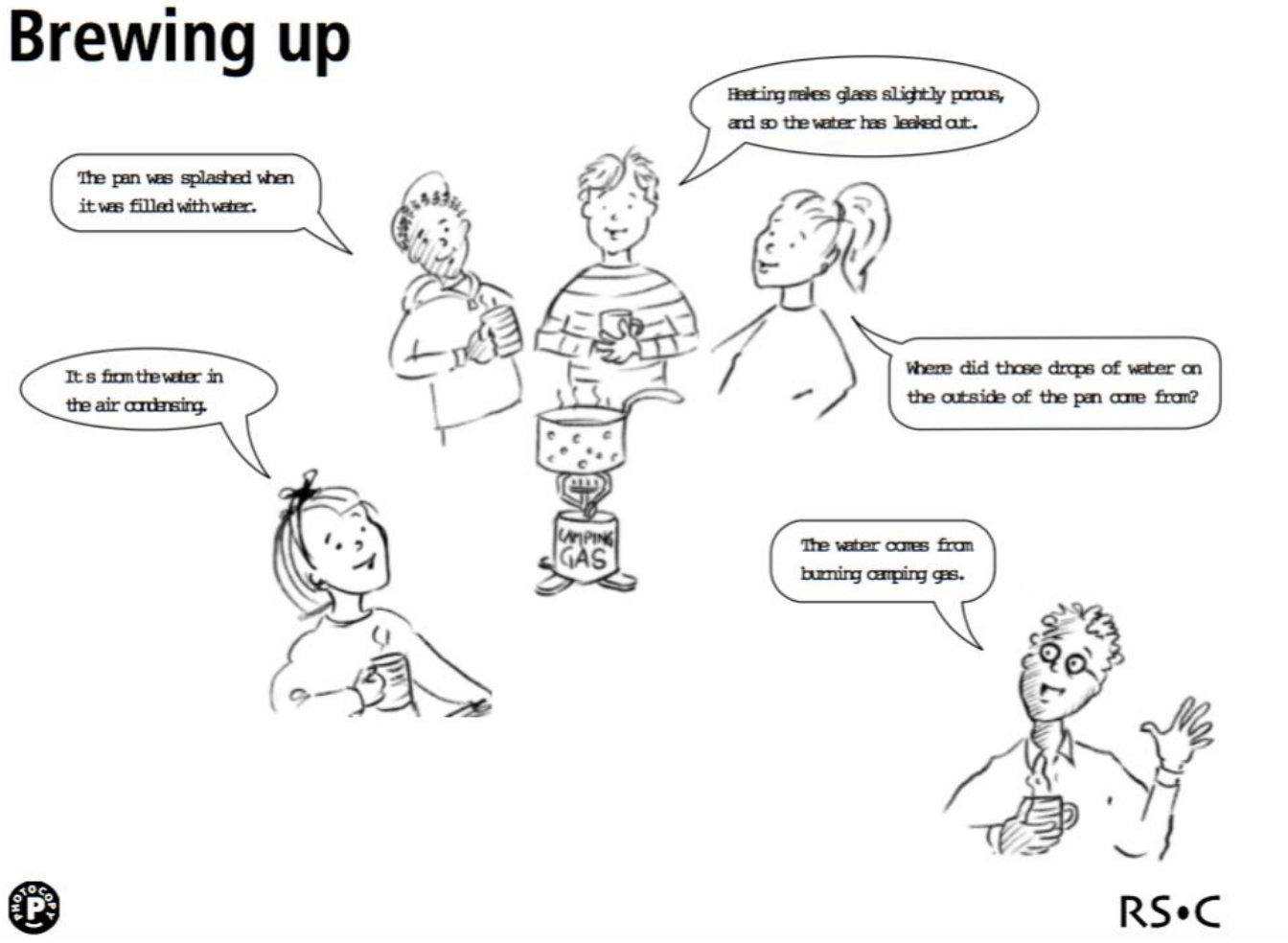

Illustration from 'The Nature of Science: Concept Cartoons' http://www.rsc.org/learn-chemistry/resource/res00001277/concept-cartoons?cmpid=CMP00002676

Contents

WELCOME

Welcome to the PGCE Secondary Science course. We hope you will enjoy what will be a challenging and exciting year. Our aim is to support you in your development as outstanding teachers. The PGCE secondary science course at Exeter is designed to help you to understand how pupils learn science and how you can teach it effectively, safely and in an interesting way to secondary school pupils of all ages and abilities. Both university-based and school-based elements of the course are essential in achieving this aim, and we encourage you to be analytical, creative and critical about what you are learning through both course components and how they relate to each other.

This Study Guide should be read in conjunction with the Secondary PGCE Programme Handbook and the EPS Handbook which contain detailed information about all aspects of your PGCE and information about University of Exeter procedures. Please refer to the Secondary PGCE Programme Handbook for everything other than subject specific guidance and to the Module Descriptors for the module aims and intended learning outcomes.

Education policy changes regularly and rapidly and we aim to prepare you to become adaptable teachers who are able to respond thoughtfully and creatively to such changes. Schools and teachers are adjusting to changes to GCSEs and A-levels and as new science teachers, you will need to participate in debates about these changes and others, and what they mean for pupils' learning science. Science is a core subject in the curriculum and is seen as being crucial to the UK's economy. However, uptake of Science in post-compulsory education remains problematic. We aim to train science teachers who will inspire all pupils to engage with science, whether they intend to be scientists or not.

The wide variety of taught sessions alongside the range of teachers you work with in schools will ensure you see and experience a range of different approaches to teaching and learning science. Some of these will deliberately model good school classroom practice, whilst others use approaches designed for University study. Please be thoughtful about these experiences and use them to think about *why* the material is being taught in these particular ways. This reflective approach underpins the 'Exeter Model' and we expect you to capitalise on all opportunities to reflect on teaching and learning. Critically reflective thinking to understand not just *how* to teach science, but *why* different approaches are effective, underpinned by research, is fundamental to your development as an independent, innovative science teacher who will continue to learn throughout their career.

We hope you enjoy a varied, interesting and exciting year and wish you luck in your learning.

Darren Moore, Lindsay Hetherington, Luke Graham, Jill Noakes, Justin Dillon

PGCE SCIENCE TEAM

The course is taught by a team of experienced University staff, specialising in a wide range of science subjects. The core University team is ably supported by associated University Visiting Tutors who are all experienced teachers of science who led departments in previous roles.

Name	Role	Biography	Contact
Dr Darren Moore (DM)	PGCE Secondary Science Course Leader and Psychology tutor	Darren taught Psychology at an FE College for 6 years. He joined the PGCE team while completing a PhD in Education at the University of Exeter researching the transitions of hard to reach pupils at the end of Secondary School. Since completing his PhD in 2011, Darren has combined contributing to the PGCE programme with research work at the University of Exeter Medical School and more recently in the Graduate School of Education, primarily researching school mental health.	D.Moore@exeter.ac.uk 01392 727405 NC135
Dr Lindsay Hetherington (LH)	PGCE Secondary Science Course Leader, Secondary PGCE Programme Director and Chemistry tutor	Lindsay taught science in state comprehensive schools for 5 years and was Head of Chemistry and Deputy Head of Year, before moving to Exeter University to join the PGCE team and complete a PhD in Education, researching teachers' responses to curriculum change using complexity theory. She is currently researching creativity within Inquiry Based Science Education.	L.Hetherington@exeter.ac.uk 01392 725826 NC124
Luke Graham (LG)	PGCE Secondary Science and Biology tutor	Luke has spent over 20 years working in schools and colleges along the south coast. He has been a science teacher, head of department and deputy head in that time. Luke has worked with the University of Exeter for the last 7 years. He is an associate for the exam board AQA and serves as an appointed member to the National College for Teaching and Leadership.	L.Graham@exeter.ac.uk 01392 724789 NC125
Jill Noakes (JN)	PGCE Secondary Science and Physics tutor	Jill taught physics and maths for 7 years after completing her PGCE here at Exeter. She began her career at Bodmin College and was a deputy faculty leader and STEM co-ordinator at Truro College. She has also worked for the Institute of Physics delivering professional development workshops in schools around Cornwall. Jill has been working on the PGCE programme for the last 3 years while working on her PhD, researching the problematic nature of project-based STEM enrichment activities.	J.Noakes@exeter.ac.uk NC124

Professor Justin Dillon (JD)	PGCE Secondary Science tutor	Justin taught science in six London schools before joining King's College London in 1989 as a teacher educator and researcher where he spent 26 years. Justin is currently President of the National Association for Environmental Education and a trustee of the Council for Learning Outside the Classroom. He has written many chapters aimed at trainee teachers	J.S.Dillon@exeter.ac.uk 01392 724912 BC109
Dr Nasser Mansour (NM)	PGCE Secondary Science tutor; Science, Technology, Engineering and Mathematics (STEM) Research Centre coordinator	Nasser qualified as a teacher in Egypt before going on to study Education at Tanta University, Egypt and at the University of Exeter. His research is focused around Science teachers' beliefs about education and he leads the STEM research group at Exeter.	N.Mansour@exeter.ac.uk 01392 722842 BC108
Mr Chris Smith	Science Technician	Chris worked at the Central Veterinary Laboratory, Surrey, as an analytical chemist for the Ministry of Agriculture for 17 years as a Scientific Officer. He worked as a school technician for two years, before moving to the University of Exeter to work initially as a chemistry technician then as overall science technician.	C.S.Smith@exeter.ac.uk 01392 724933 NC06D
Simon Beard	University Visiting Tutor	All our associated UVTs have had substantial experience teaching science and leading science departments in the UK. Working to support trainees in schools for between 4 and 10 years, they have a great deal of wisdom to share.	s.beard@exeter.ac.uk
Maggie Bointon	University Visiting Tutor		m.bointon@exeter.ac.uk
Andrew Maxwell	University Visiting Tutor		a.maxwell@exeter.ac.uk
Willie Young	University Visiting Tutor		w.j.young@exeter.ac.uk

COURSE STRUCTURE

The PGCE secondary science course has several distinct but related elements:

Education and Professional Studies Programme (EDUM036).

The Secondary Programme Handbook and Education and Professional Studies Handbook provide details of this module. It includes both university and school-based work for all secondary trainees. You are asked to engage in self-study by listening to some audio lectures with associated tasks before they are either built upon in science sessions or followed-up in peer-led EPS seminars. You will need to access these via ELE here https://vle.exeter.ac.uk/course/view.php?id=896. It is crucial that you engage with the audio lecture and tasks **before** the associated science session. The date by which you should have completed each audio lecture and tasks are shown on page 19. There are also some EPS sessions to attend which are detailed in the timetable on pages 9-10.

Secondary Science Subject Knowledge and Pedagogy (EDUM037, EDUM038, EDUM039, EDUM048).

The sessions in science are designed to help you to teach broad and balanced science in Key Stage 3 and Key Stage 4 and your specialist subject at post-16 level. It has the following elements:

Science Big Theme Workshops	The programme during the Autumn Term includes sessions on general issues in science teaching.
Science Workshops	There are other workshops, typically on Monday mornings, where invited guests, often teachers, will share some of their teaching and learning approaches on different topics.
Main Subject Sessions	A series of workshops will address issues connected with teaching topics within your own science specialism. In addition to developing your subject knowledge, you will learn about a range of teaching approaches and strategies to use in the classroom to promote effective learning.
National Curriculum Sessions	You will follow a National Curriculum course in each of your non-specialist science subjects. For example, a chemistry specialist will study biology and physics. In these courses, you will have the opportunity to review and refresh your science subject knowledge as well as developing ideas for teaching science to pupils.
Peer Teaching	You will begin to familiarise yourself with the Exeter Model of Teacher Education through teaching 10 minute episodes to a group of your peers in which you focus on a particular aspect of teaching using an 'Agenda'
Subject Support Groups	Subject support groups are peer-led sessions to consolidate and extend your specialist science subject knowledge through peer teaching some A Level topics.
Peer-led EPS seminars	In these sessions you will consider science specific implications of many of the broad EPS topics which you will have met in audio lectures. Pairs of trainees will take turns leading these sessions.
Tutorials	You will meet your personal tutor to discuss your progress twice during the Autumn term and they will support you pastorally throughout the year.
Directed Tasks	There are particular directed study tasks to complete, as well as working on your subject knowledge development and independent study towards the M-level assignments.
Seminar Days	At intervals during your main blocks of school-based work, you will return to the university for an intensive training day when you will reflect upon your progress and consider developments in your practice as a teacher. It is also a chance for you to share experiences with other members of the secondary science group.

COURSE MATERIALS

Teaching resources

There are a range of teaching resources in the Labs and can be used throughout the Autumn Term – please sign them out with Chris Smith and return them after use. If you need any practical materials for your peer teaching, these can be requested from Chris Smith, with sufficient notice.

The Exeter Learning Environment (ELE)

This is Exeter's Virtual Learning Environment. All course documents and information regarding science taught sessions will be uploaded here http://vle.exeter.ac.uk/course/view.php?id=919. Please get into the habit of checking it regularly and before and after all taught sessions so that you can access preparatory and follow-up materials.

Other useful materials can be found on the following pages:

EPS ELE site http://vle.exeter.ac.uk/course/view.php?id=896

PGCE Primary and Secondary Core Documents http://vle.exeter.ac.uk/course/view.php?id=2516

Various evidence tools and forms (username and password both: exeterpartner)
http://socialsciences.exeter.ac.uk/education/partnership/handbooksreportsanddocuments/secondary/

Library resources

See http://libguides.exeter.ac.uk/gettingstarted

THE TAUGHT COURSE

Timetable for first teaching week – w/b 01/10/18

	9			10		11		12		13		14		15		
Monday	09.00-12.30 Induction Morning DM, LH, LG, JN Labs								12.30-13.00 Welcome Talk NC12			14.00-16.00 Preliminary Experience Share DM, LH, LG Labs				
Tuesday			09.30-11.00 Workshop: Why teach science LG Labs				11.30-13.00 Active Engagement LH Labs			13.00-13.30 Action Planning Labs			14.30-16.00 Curriculum Change - Mike Morley Labs			
Wednesday			09.30-10.00 NQT Advice Labs	10.00-10.30 SSG & EPS Labs	10.30-11.30 Assoc for Science Ed Labs		11.30-13.00 Workshop: Explaining Science LH Labs					14.00-14.30 Academic Mis NC12	14.30-15.00 Assignment Labs	15.00-16.00 Optional Library intro DM Labs		
Thursday			09.30-11.00 Royal Society of Chemistry Labs				11.30-13.00 Workshop: Misconceptions JD Labs					14.00-15.30 Planning - Jim Lodge Labs			15.30-16.30 Meet your tutor Staff House	
Friday																

Timetable for weeks 2-6 and 9-11: 08/10/18 to 09/11/18 & 26/11/18 to 14/12/18

	9		10		11		12		13		14		15	
Monday			09.30-11.00 Science Workshops See below SC 3.06				11.30-13.30 Main Subject Physics (JN) - Labs Main Subject Chemistry (LH) - Labs Biology/Biology with Psychology SSG - BC 03,06,08,217,SC1.23						14.30-16.00 Big Theme Workshop See below BC114	
Tuesday*		09.15-11.15 National Curriculum Physics Group 1 (JN) - Labs National Curriculum Chemistry Group 1 (LH) - Labs					11.30-13.00 Peer-led EPS seminars BC 03, 201, 202, 217, 218				14.00-16.00 National Curriculum Physics Group 2 (JN) - Labs National Curriculum Chemistry Group 2 (LH) - Labs			
Wednesday		Various - see below												
Thursday~		09.15-11.15 Main Subject Psychology (DM)					11.30-13.30 Main Subject Biology (LG) - Labs Chemistry/Physics SSG - BC 07, 09, 101				14.00-16.00 National Curriculum Biology (LG) - Labs			
Friday		Optional First Aid Course £65 - 19th October, 26th October, 2nd November Optional Apple Store Sessions FREE - 19th October, 2nd November												

*Optional M Level Writing Workshop 14.00-15.00 on Tuesday 4th December, Science and PE cross curricular 16.00-18.00 on 6/11, 27/11, 04/12

~Field Trip to Forest School on Thursday 25th October, EPS lecture 13.30-14.30 on Thursday 13th December

Science workshops

Mondays 09.30-11.00 - SC3.06

08/10/2018	Institute of Physics - Alastair Cuthbertson
15/10/2018	Technology for Science Teaching & Learning - Rich Osborne
22/10/2018	Classroom Presence - Liz Jones
29/10/2018	Using Data - Jim Lodge
05/11/2018	Becoming a Teacher - TBC
26/11/2018	Working Memory in Science - Mel Bourne
03/12/2018	Cooperative learning in science - Andy Pemberton
10/12/2018	Assessment and Progress in Science - Stuart Ruffle

Big theme Workshops - Monday 14.30-16.00

08/10/2018	Dialogic Teaching and Questioning - LH
15/10/2018	Practical Science - JN
22/10/2018	Science and Literacy - JD
29/10/2018	Inclusion and differentiation in Science - AB
05/11/2018	Science and Numeracy - LG
26/11/2018	Science out of the classroom - JD
03/12/2018	Values and Ethics in Science: Teaching controversial issues - LG
10/12/2018	Inspiring Pupils in Science: Science capital - JD

Peer-led EPS seminars

Tuesday 11.30-13.00

09/10/2018	Talk About it
16/10/2018	Theories of Learning
23/10/2018	Classroom and Behaviour Management
30/10/2018	Assessment for Learning and the Use of Data
06/11/2018	Psychology of Teaching and Learning
27/11/2018	Challenging Notions of Ability, Intelligence and Potential
04/12/2018	Theories of Motivation
11/12/2018	British Values and the PREVENT Strategy

Wednesday schedule

10/10/2018	
17/10/2018	09.30-13.00 Peer Teach Group 1 - Labs (DM&LH); 14.00 -16.00 EPS e-Safety session - NC12
24/10/2018	09.30-13.00 Peer Teach Group 2 (DM&JN) - Labs
31/10/2018	09.30-13.00 Peer teach Group 1 - Labs
07/11/2018	11.30-12.30 Optional Preparing for School (DM); 13.00-16.30 Peer teach Group 2 - Labs
28/11/2018	10.00-12.00 EAL Workshop (NM); 13.00-16.30 EPS Teachers and professionalism - Alan Newland - NC12
05/12/2018	09.30-15.00 Interview preparation and practice - Labs
12/12/2018	11.00-12.30 Research Evidence for Science (DM); 13.30-15.30 Joint PST session with Kevin Burden on Mobile Technologies

Seminar Days

Five Seminar Days occur on Fridays during your school-based work, where you will return to St Lukes for the day. They provide an opportunity for you to reflect on practice in school with tutors and peers, review taught content in light of working in school, develop understanding of how to conduct school-based research. The content of the seminar days have some flexibility in order to enable us to respond to your developing needs as well as any changes in national education policy and practice. Below is our initial plan for content on each of the seminar days.

Seminar Day	Themes/Sessions
1 18th Jan 2019	Evidence-based Teaching: Doing and using educational research. **(All standards, particularly S3)** *This seminar day will consider the use of research to inform practice, in particular your own research to be undertaken for the EPS Assignment.* ***You will need to bring your draft formative assignment for the EPS Assignment to this session.***
2 1st Mar 2019	Pupil Progress in Science **(S2, S5)** *This seminar day will consider strategies to ensure all pupils make progress in your lessons, and how you can judge what progress is being made. We will also share progress with the EPS SEN Task.*
3 22nd Mar 2019	High Impact, High Standards **(All Standards)** *This session is focused around an analysis of what makes excellent teaching in Science, drawing on a range of sources to discuss this question. This day will also include sharing of your EPS Assignment research at the annual GSE conference.*
4 24th May 2019	*Creative approaches for engaging science learning* **(S4)** *We will draw upon a research project involving a European network of scientists, teachers, artists and students to share ideas about creative approaches based on art for an engaging science classroom. This seminar day will also include sharing experiences of working with support staff, parents, tutees and EAL students. Recent NQTs will also offer advice for your NQT year.*
5 2nd July 2019	Looking ahead to a Teaching Career/Being an NQT **(All Standards)** *During this final seminar day, we will discuss your individual Career Entry Development Profiles (CEDPs) and consider the support you will need to continue to develop as a teacher during your NQT year.*

Main Subject Sessions

Physics, Chemistry and Biology students attend one Main Subject session per week in their specialism. Biology with Psychology students attend both Main Subject Biology and Main Subject Psychology. Main Subject sessions help to prepare you to teach in your subject specialism up to and including A Level. We expect that you will come to the sessions with some knowledge of the topics and how they fit the curriculum.

National Curriculum Sessions

You will attend National Curriculum Sessions in your two non-specialist subjects. Physics and Chemistry National Curriculum sessions take place in two separate groups, to which you have been assigned. National Curriculum sessions will often cover the same topics as Main Subject sessions, although only covering content in Key Stage 3 and 4. We anticipate that you might not be as confident in your subject and curriculum knowledge outside of your subject specialism.

We have timetabled the sessions so that if you wanted to attend both the Main Subject and the National Curriculum Sessions in your subject specialism this is possible, but you must let your tutor know in advance of the National Curriculum session and lack of space or equipment might mean this is not possible. We see reasons for attending both sessions to be where you have identified that you are less confident in that particular topic and would benefit from hearing the explanations and/or working with the practicals twice.

Main subject and National curriculum pedagogic focus

Each week in the main subject and national curriculum sessions there will be a pedagogical focus as well as a subject content area focus. The pedagogical topics are below.

Week 2 – Questioning

Week 3 – Health and safety

Week 4 – Misconceptions and planning

Week 5 – Differentiation (stretch and challenge)

Week 6 – Running practicals

Week 9 – Numeracy

Week 10 – Literacy

Week 11 – Assessment

Wednesday Peer Teaching

Wednesday peer teaching is the term we use for a 10-minute episode of teaching planned and delivered by you to others in the PGCE science group who act as your students. This is an opportunity to practice some science teaching strategies in front of a sympathetic and supportive group before you try them out in school. Aim to present your episode at a level suitable for a KS3 or KS4 class. The second sessions are attended by your university visiting tutors. They will give you feedback on your teaching and on the learning that took place.

Prepare a lesson plan as well as an 'Agenda' for each peer teaching episode. Guidance for how to do this will be given during the first week. There is additional guidance about constructing Agendas in both the Programme Handbook and on ELE. Please remember that you are not attempting to give a whole lesson, or need to start at the beginning of a lesson. The idea is to teach a short episode with a particular focus on the aspect of your teaching that you want to improve – see the Programme handbook for a list of possible areas to focus on. Although you will be teaching for only 10 minutes, you should aim for changes of approach and pace during your delivery. It is most important to avoid long monologues, so do not learn from a pre-written script or read from notes. It is essential to work to a 10-minute limit for the peer-teaching episode. Include estimated timings for the various activities of your episode, but remember that these estimates are to give you practice in developing an awareness of pace in a lesson, not a straightjacket to worry about. You will have to stop after 10 minutes whether or not you have completed your planned delivery. It is best to choose a science topic that you know thoroughly to avoid any anxieties about the adequacy of your subject knowledge. Scripting essential questions is helpful and clear notes of any board work will help the episode to run smoothly. You can use the computer, screen and 'visualiser' if you wish although this is optional. If you would like to practice or to try out the visualiser before your peer teaching session, feel free to do so whenever the laboratories are not in use for teaching – please liaise with Chris Smith, the Science Technician, over this.

If you need any equipment to support your teaching, please talk to Chris Smith. He will do his best to supply any reasonable requests, but do let him know **at least three days** in advance of your session.

Make two copies of your episode plan and Agenda. At the beginning of your session give one copy of your episode plan and Agenda to the person (your UVT in session 2) who will 'annotate' the Agenda. Your second peer teaching session will be recorded using a digital video camera - **please bring a 'memory stick' to this session so that you can take away a copy of this recording**.

You should also complete an agenda evaluation (page 2 of the agenda form) after the episode, you should think about any differences between what you planned to do and what actually happened. The annotated Agenda will be helpful here. The agenda and evaluation for your second Peer Teaching session form one of the directed tasks, see page 16.

Subject Support Groups

The subject support group sessions in weeks 2 - 6 and 9 - 11 are set up to provide the opportunity to carry out longer peer teaching focused on A Level content and share teaching ideas with fellow subject specialists in small groups.

The A Level peer teaching will involve using the lesson plan template in more detail and evaluating the lesson on the form you will use in school. You will select an area of the A Level specification to teach for 30 minutes. The main aims of the teaching session are to increase knowledge amongst the group, practice A Level teaching and to use a suitable activity that can then be shared with the group. As a group you should also take the opportunity to practice using the evidence tools used in school (the rest of the group will need to complete an observation form briefly).

The content and exact focus of the session is up to the teacher.

But your session should:

- Be pitched at A Level (2015 onwards specification)
- Have learning objectives
- Present information designed to increase knowledge of the topic
- Include at least one activity for your "students" to complete
- Check that learning has taken place
- Last for 30 minutes

Week 1 – Subject Support Group Planning session.

For this meeting, you will need to bring:

- Your own KS5 specialist subject knowledge audit and needs analysis (ask Darren if you have misplaced yours since sending).
- A specification for an A Level course (one per group; copies in the labs).
- An A level textbook or revision guide.

The aims of this session are for you to become familiar with the A Level specifications, match your subject knowledge strengths with these specifications and plan to address your subject knowledge needs with support from the group. You will allocate teaching sessions (at least two sessions per person) to take into account individual strengths and the needs of the group and elect a group representative who will keep the course lead informed about the subject support group arrangements.

Everyone should prepare and teach at least two sessions of 30 minutes during the term. For each session, start by telling the group your specific learning objectives (what you hope the group will learn). Use teaching strategies appropriate for a post-16 group - methods of delivery are likely to vary with different presenters. Keep your teaching resources simple. The rooms that you use should have a PC and screen available. Please let Darren know if this is not the case. ***Complete the planning sheet as a group and send a copy electronically to Darren before you start your teaching sessions.***

Subject Support Group meeting organisation

While you are free to organise the sessions in the way that best suits the group, please bear in mind that the rooms are booked for two hours and must be used each week until everyone has taught at least two sessions. A suggested format is for two topics to be addressed per meeting, each lasting 30 minutes, with a 10-minute discussion after each presentation. You should also plan for the group to give feedback to the 'teacher'.

Feedback from peers

After the session peers will give verbal feedback and complete a lesson observation form.

After the session

The presenter should reflect on the session using a lesson evaluation form. This reflection is one of the Directed Tasks (see below).

Peer-led EPS Seminars

In these sessions on Tuesday 11.30-13.00, you will be in a group of around 11 to discuss and apply topics covered generally in EPS audio-lectures to teaching secondary science. See the timetable for the order of topics which should be followed as they often complement other sessions during those weeks.

While all trainees must access the relevant audio lecture in advance of the session, a pair of trainees should plan for and lead each session and therefore direct how the class will "follow up" the EPS content. There is flexibility in how the sessions could be organised with a mix of additional learning, discussion and activities. Those leading the session should draw upon any of:

- A summary of key information from the audio lecture, particularly the information that will be expanded on.
- The activities associated with the EPS audio lecture, thinking about relevance for science.
- Science-specific activities provided – see Science ELE pages.
- Create your own activities and teaching ideas.

Preparing and delivering these sessions will provide more practice in planning and delivering teaching. It also provides an opportunity to work together with colleagues in planning and teaching, something that will happen during school placements.

In week 1 there will be the opportunity to plan a schedule for which trainees are leading each session. ***Complete the planning sheet as a group and send a copy electronically to Darren before you start your seminars in week 2.***

Directed Tasks

You will be set a number of tasks which will help you to further your understanding of issues raised in the taught course sessions or the EPS audio lectures. Some of these tasks will involve you doing preparatory reading and research for future sessions and could be set within the main subject or national curriculum courses. These tasks are a compulsory part of the course but they are not part of the formal assessment process.

There are eight specific PGCE Science directed tasks which are designed to help you make connections between taught content and classroom practice and receive feedback from your personal tutor on key aspects of the Autumn term content. Complete these tasks as appropriate throughout the term.

Task	Requirements
1	**Questioning Research Article:** Ahead of the focus on questioning and dialogue in week 2. Read the 2007 paper by Christine Chin (see ELE). Bring notes to the Big Theme Workshop on Monday 8th October.
2	**Subject Support Group Teaching:** Complete a lesson evaluation form for the first session that you taught. Use the lesson observation feedback from peers, guidelines about reflective practice on ELE and appropriate aspects of the 'Framework for Dialogue about Teaching' to help you complete this. Email the form to your tutor when complete, for discussion in a tutorial.
3	**Managing practical and group work:** Watch the introductory video on http://www.nuffieldfoundation.org/practical-work-learning. Choose one of the three suggested approaches to practical science (Argumentation, Model-based inquiry or Science in the workplace). Then using a practical of your choice, make notes on how you would plan an effective lesson around the practical activity and justify the decisions you make. Bring notes to the Big Theme Workshop on Monday 15th October.
4	**Behaviour and Class Management:** During week 4 the focus will be on making connections between ideas about behaviour and class management that are presented in EPS sessions. Complete the Behaviour Management Initial Needs Analysis (see Science ELE) and email this to your tutor by the end of week 4, for discussion in a tutorial.
5	**Peer Teaching:** Write up your agenda evaluation from your second Wednesday peer teaching activity. Guidance about reflective practice, evaluating teaching and the use of Agendas can be found on ELE. Email these to your tutor when complete, for discussion in a tutorial.
6	**Challenging the Gap Framework for Dialogue:** During your 2 week November placement, as part of the EPS task complete the Challenging the Gap Framework for Dialogue based on information you find out about the context of your school placement and how they work to support disadvantaged pupils, both generally and in Science. Bring this to your second personal tutorial.
7	**Literacy and Numeracy in Science:** During your 2 week November placement make notes on at least one example each of how teachers you observe are developing pupils' literacy or numeracy skills within science lessons. Bring these notes to your main subject sessions in weeks 9 and 10.
8	**Securing Employment:** During Week 10 the focus is on applying for and securing a teaching post. Prepare a personal statement (maximum 2 sides of A4) for an application for a teaching post advertised on TES for a job in the sort of school you are interested in working in. Email this to your personal tutor for feedback.

Electronic copies of tasks 2, 5 and 8 should be sent to your Personal Tutor as soon as they have been completed. The second tutorial of the term will consider tasks 2, 4, 5, 6, 8 which are likely to form part of your FRAP2 record.

ASSIGNMENTS

You are required to write two formative assignments (1500 words) and two summative assignments (6000 words). These assignments are assessed at Masters Level and the assessment criteria can be found on page 66 of the Secondary Programme Handbook. A brief outline of the subject knowledge and pedagogy assignments is given below. The Education and Professional Studies assignments are described in the EPS handbook. You will be given detailed guidance about each piece as the course progresses and the guidance will also be uploaded onto ELE. The assignments are intended to blend the theoretical and practical elements of the course.

In the case of both assignments you need to ask yourself what you can draw from the literature, whether it be research, comment or reported good practice. Both assignments require evidence that you have consulted the literature available. Where you refer to books, journals etc. in an assignment you must use the **Harvard system for referencing**. Please see the guide on the Assignment Submission Information section of the Primary and Secondary Core Documents page on ELE (http://vle.exeter.ac.uk/course/view.php?id=2516).

Secondary Science Subject Knowledge and Pedagogy: Design and Critical Analysis of a Scheme of Work (Summative deadline Wednesday 8th January 2019)

All students will address standards S3, S4, S5 and S6 in this assignment, with further standards addressed depending on choices made in the summative assignment.

The assignment takes place in multiple stages which models a range of different assessment including peer feedback, tutor formative feedback and self-assessment. This means it is crucial to start the assignment early in the term.

1. **Select a Key Stage 3 or Key Stage 4 topic of your choice and design a way of teaching one lesson on an aspect of that topic to a group of students.** You should use a lesson plan to detail the teaching and learning that you have designed. You should use the input from the course to consider how theories of learning and any relevant ideas such as misconceptions, motivation, health and safety, differentiation and assessment inform the lesson. You may wish to design resources that you would use as part of the teaching and learning.
2. **Share your lesson plan and any resources with two peers to gain and offer peer feedback.**
3. **You may wish to revise your planning and resources at this point. Then write your formative assignment (1500 words) on the following area:**

   Analyse and explain the pedagogical rationale for your lesson plan, drawing on critical analysis of literature and reflection on peer feedback.

   With a limited word count, we suggest you focus on *three or four* key selected elements of the lesson (for example, lesson starts, assessment points, development activities, or explanations).

   This written account should be emailed to your personal tutor, along with an appendix that includes your lesson plan and any resources you wish to provide, by **Friday 2nd November 2018,** for formative feedback.

4. **Ahead of the summative assignment you need to select two different classes of learners and produce a general lesson plan (which may be the one developed for the formative), and two adapted lesson plans which tailor your general approach for their particular needs.** To make this as realistic as possible, we suggest you discuss with your PST during your November placement which two classes you have met (and/or may be teaching from January) to use for this assignment. With your summative assignment you need to submit appendices with three lesson plans (and any resources you wish to include). One lesson plan is the general plan, with the second and third plans tailored for your selected classes which should be briefly described using the Secondary PGCE Context Sheet proforma without using names.
   The descriptions of the classes should inform different pedagogical approaches that you would take to teaching these classes. It is important that the three lessons include different pedagogical ideas as the

summative assignment will ask you to contrast the different teaching and learning. To facilitate this comparison, we suggest you choose contrasting classes. To help you, we have identified potentially important topics from the course input and literature, where the classes you select *may* differ:

- Different ability levels between the classes, or different sets
- Different range of ability level within the classes
- Different levels of SEN needs
- Different literacy levels or amount of EAL pupils or pupils whose English is weak
- Different levels of numeracy skills
- Different levels of practical science skills
- Different levels of interest in science
- Different levels of motivation and engagement more generally
- Different class management needs or social dynamics within classes

5. **Summative Assignment (6000 words)**
   - **a.** *(approx. 1500 words)* Provide a rationale for the content of your general lesson plan, drawing on your subject knowledge, your curriculum knowledge, your pedagogical knowledge and your knowledge of likely difficulties in teaching and learning this topic.
   - **b.** *(approx. 4000 words)* Discuss the pedagogical decisions made in the two lesson plans that respond to the two classes you have selected and described with reference to differences across the three lesson plans. In doing so you should take the key pedagogical issues for the two classes and discuss **in depth** the relationship between the theoretical ideas from the Education and Professional Studies and Subject Knowledge and Pedagogy programmes, your reading of the education research literature and the practical realities of the classroom using your lesson plans to exemplify the points that you make.
   - **c.** *(approx. 500 words)* Provide a short **summary of the implications** of this assignment for your professional development – e.g. a summary of key things that you have learnt and of issues that you feel you now need to address.

Education and Professional Studies (EPS) Assignment: Critical Investigation of an Issue in Education

Refer to the EPS Handbook for details of this assignment. The EPS research series of audio lectures will also provide useful background.

TUTORING

You will have a **personal tutor** who will meet with you on three occasions in the Autumn term. In the first meeting you will get to know your tutor and fellow personal tutees. During week 1 you will be introduced to some of the evidence tools and begin to outline an Action Plan, focusing largely on the development of subject knowledge. Your tutor will support you with this during the Autumn Term. You will also be able to share any issues you may be experiencing on the course. In the second individual tutorial you will discuss the writing of your Formative Reflection on Achievement and Progress (FRAP) 2: Anticipating Practice. This document needs to be completed (after any revisions) by **Wednesday 12th December 2018** and emailed to exeterpartner@exeter.ac.uk

Please remember that we will be supporting you pastorally as well as academically. Don't hesitate to contact your tutor in between tutorials if you want to discuss anything.

When you move on to school based work you will have a University Visiting Tutor (UVT) as well as your personal tutor. Your UVT will observe you teaching in your placement schools and liaise with the school in connection with your progress whilst you are in school. Your UVT may or may not be your personal tutor – if not, then they will liaise closely to make sure you receive the support you need.

KEY TASK LIST WITH DEADLINES

Most school-based tasks have deadlines given in your quality assurance record.

TASK	DEADLINE
Watch EPS Recordings and complete associated tasks	See Table below for dates
Send 'Matching Expectations to Experience' from Science Preliminary Task and General Summary from Generic Preliminary Task and your CV to your Personal Tutor	Friday 5th October
Write up teaching evaluation of SSG peer teach for Directed Task 2	After teaching date agreed with your SSG group. Email form to tutor asap.
Directed Task 4 – Behaviour Management audit emailed to personal tutor	26th October
Directed Task 5 – agenda and evaluation from second peer teach.	Either after 31/10 or 07/11 depending on group. Email write up to your tutor asap.
Assignment 1 Formative emailed to tutor	**By end of Friday 2nd November**
Directed Task 8 – Personal Statement draft	7th December – email to tutor for feedback
Directed Task 6 – Challenge the Gap Framework Task (EPS)	Bring to your individual tutorial in December
Send FRAP 2 draft to Personal Tutor	Two days in advance of individual tutorial in December. Final completion of FRAP 2 by 12th December
Assignment 1 Summative – submit to BOTH turnitin AND eBart	**2pm 8th January 2019**

Table of EPS audio lecture and tasks deadlines

Topic:	**To be completed by:**	**Preparation for**
Educational Ideology: What is Education for?	5/10	Why teach science follow up
Cognitive Neuroscience and Learning	5/10	Active engagement follow up
Talk about it: The Role of Talk in Learning	8/10	Big theme workshop and Peer-led EPS seminar
Theories of Learning	16/10	Peer-led EPS seminar
Safeguarding and Child Protection	17/10	e-Safety session
Classroom and Behaviour Management	22/10	Science workshop and Peer-led EPS seminar
SEND 1: Organisation and Policy	29/10	Big Theme Workshop
SEND 2: Teaching and Learning	29/10	Big Theme Workshop
Do you know what they know? Assessment for Learning and the Use of Data	29/10	Science workshop and Peer-led EPS seminar
Child and Adolescent Mental Health	5/11	Science workshop
Psychology of Teaching and Learning	06/11	Peer-led EPS seminar
Challenging Notions of Ability, Intelligence and Potential	27/11	Peer-led EPS seminar
EAL 1: Understanding Theories of Additional Language Acquisition	28/11	EAL Workshop
EAL 2 : Connecting Theory and Practice	28/11	EAL Workshop
Addressing (in) Equalities and Overcoming Potential Barriers	3/12	Big Theme Workshop
Theories of Motivation	4/12	Peer-led EPS seminar
British Values and the PREVENT strategy	11/12	Peer-led EPS seminar
Evidence in Education: What can RCTs tell you – and what they can't?	12/12	Research Evidence in Science Workshop
Critically Engaging with Literature: Topical Research	Ahead of EPS assignment in Spring Term	EPS Assignment
Writing a Literature Review		
Ethics in Educational Research		

USEFUL REFERENCES AND WEBSITES

This is not a reading list. Titles are given under a range of headings to provide you with an entry into the literature for topics that you may want to follow up. In many of the sessions you will also be provided with references to appropriate journal articles. These provide access to the large amount of education research and specifically science education research that is available. When you are writing assignments it is important to read these journals because they provide details of recent ideas and developments which will not yet be found in books. Some of the journals contain mainly research based reports (e.g. International Journal of Science Education, Research in Science Education) whereas others are more professionally orientated with ideas for use in classroom settings (e.g. School Science Review). Many useful books are available through the library as 'ebooks'.

Some relatively recent titles that are aimed specifically at beginning science teachers that you may find helpful are:

Toplis, R. (Ed) (2015) Learning to Teach Science in the Secondary School (4th edition) (London: Routledge)

Kind V. & Taber, K. (2005) Science: Teaching School Subjects 11-19. (London: Routledge)

Bishop, K. & Denley, P. (2007) Learning Science Teaching: Developing a professional knowledge base (Maidenhead, Open University Press).

Liversidge T., Cochrane M., Kerfoot B & Thomas J (2009) Teaching Science: Developing as a Reflective Secondary Teacher (London: SAGE).

Wellington, J. And Ireson, G. (2012) Science Learning, Science Teaching (3rd edition) (London: Routledge).

Hollins, M. (Ed) (2010) ASE Guide to Secondary Science Education (Hatfield: Association for Science Education).

Titles that you will find very useful when writing assignments are:

Bryan H., Carpenter, C and Hoult, S. (2010) Learning and Teaching at M-Level: A Guide for Student Teachers. London, Sage.

Oversby, J. (Editor) (2012) ASE Guide to Research in Science Education, Association for Science Education, Hatfield: John Murray.

Somekh, B. and Lewin, C. (2011) Theory and Methods in Social Research (2nd Edition). London, Sage.

Wilson, E. (2013) School-based Research: A Guide for Education Students (2nd Edition). London, Sage.

https://www.stem.org.uk/secondary-science - this site is building a very large collection of resources for STEM subjects.

http://www.schoolscience.co.uk/ - resources for science teaching put together by the Association for Science Education (ASE)

The CLEAPSS website http://www.cleapss.org.uk/ provides a very useful set of resources with a particular focus on health and safety issues. To login to this resource use the current username: gold and the password: metal18 These log-in details will remain active until the end of January, 2019.

Professional organisations for science teachers

Association for Science Education (ASE): http://www.ase.org.uk/ "Teachers helping teachers to teach science"

What ASE offers ...

ASE is for teachers, advisers, technicians, industrialists and others contributing to science education. It has a membership of over 24,000.

ASE promotes, supports and develops science education from primary through to tertiary levels.

ASE is independent in its thinking and in its finance. It is a registered charity, financed by members' contributions and receives no government funding.

ASE provides a forum for the views of members on science education issues through its regional and national committee structures.

ASE is frequently and regularly consulted by those in authority and in government, industry and LEAs.

ASE offers support, advice and information for individual teachers, schools and local colleges.

ASE offers support, advice and information to those involved in industry and commerce.

ASE offers support, advice and information to other societies and associations with similar aims.

ASE provides many links with industry and arranges teacher secondments, visits to industrial sites, and it supports relevant curriculum support materials.

ASE provides its members with free journals, discount on books, and indemnity insurance.

ASE offers a special discounted membership scheme for trainee teachers. You will be given details and application forms during week 1.

Other Professional Bodies you might be interested in joining – all provide useful resources and journals for science teachers.

- The Royal Society of Biology: https://www.rsb.org.uk/teachers
- The Royal Society of Chemistry (RSC): http://www.rsc.org/learn-chemistry/
- The Institute of Physics (IoP): http://www.iop.org/education/teacher/index.html
- The Association for the Teaching of Psychology: http://theatp.org/

GLOSSARY OF TERMS

ACTION PLAN A specific plan of action to solve a problem, address a need, etc.

AGENDA A detailed statement of intended and observable actions during an episode or the whole course of a lesson. The sequence of events expected to take place is written out on the left-hand side of a sheet of A4 paper. An observer records non-evaluative annotations of what actually happens on the right-hand side of the sheet. The annotated agenda is then discussed by the trainee and the observer.

AIMS involve general statements about learning outcomes and are usually less detailed than objectives. An overall aim for a lesson is often expressed as an enquiry question.

ANNOTATE To write notes on an agenda – see AGENDA. The aim of an annotation is to establish an objective record for later discussion rather than to pass judgements.

ASSESSMENT The attempt to analyse what learning has taken place.

- **Formative Assessment**
  informs the pupils about the standard of their work as it unfolds; it is diagnostic and informs the work as it progresses. Assessment for Learning (AfL) is a widespread and important, evidence-based approach to the use of formative assessment in schools.

- **Criteria-Referenced Assessment**
  makes the criteria by which pupils will be judged explicit; goes hand-in-hand with formative assessment and enables the pupil to be judged against objective standards.

- **Norm-Referenced Assessment**
  is a form of assessment which relates a pupil's performance in a comparative way to other pupils in the group; the opposite of criteria-referenced assessment.

- **Summative Assessment**
  is carried out at the end of a course or scheme of work; it sums up the achievement of the pupil.

CLASSROOM MANAGEMENT The way a teacher manages the transactions and activities of a class.

COGNITION A general term covering all aspects and modes of knowledge; the process of knowing.

COGNITIVE MODELLING is used to describe the creation of a mental model of a situation that they can then use to explain that situation. In teaching it enables the teacher to understand what is involved in a teaching strategy, and then adapt that model to his or her own teaching circumstances.

COGNITIVE PROCESSES The synthesis of cognitive resources and strategies which enables individuals to situate their cognition to solve a variety of problems.

CONSTRUCTIVISM The school of thought that believes that human understanding is built or constructed through cognitive processes. Social constructivists add the all-important social dimension to this process.

CURRICULUM A course of study.

DIFFERENTIATION describes the method of teaching for the needs of different pupils by modifying learning outcomes for different groups or individuals; can be thought of as judging what must be learned, what should be learned, and what can be learned. Differentiation is usually achieved by task, outcome, support (both teacher and peer) and extension.

EAL English as an additional language.

EPISODE refers to a part of a lesson.

EVALUATION The process by which someone reflects on their performance - teachers evaluate lessons; pupils evaluate their performance on a scheme of work - should not be confused with assessment.

FRAP Formative Reflection on Achievement and Progress.

INDIVIDUAL DEVELOPMENT PORTFOLIO (IDP) This file shows both trainee progress and attainment. It is central to identifying and meeting individual training needs and in assessing progress against the Teachers' Standards.

ITE Initial Teacher Education.

ITEC The Initial Teacher Education Co-ordinator oversees all aspects of trainees' work in schools.

KEY STAGE The term used to describe an age group in the National Curriculum: **Key Stage 1** 5-7 years, **Key Stage 2** 7-11 years, **Key Stage 3** 11-14 years, **Key Stage 4** 14-16 years, **Key Stage** 5 16-18 years.

LEARNING HOW TO LEARN involves methods of teaching that put the highest priority on developing meta-cognitive skills in pupils; good teaching methodology should lead to learning how to learn - autonomy.

LEARNING OUTCOME A planned outcome for a course of learning; the expected change in a person's skills, knowledge and understanding that a scheme of work or taught course might bring about.

LEARNING STYLES The variety of styles by which people learn.

LEARNING TARGETS Negotiated and recorded by pupils on the basis of evaluating existing performance.

MENTOR AND MENTORING Within the Exeter Model, a mentor is the teacher who carries out supervisory conferences and maintains an overview of a trainee's professional development. Mentors have a vital role to play in the induction, supervision and assessment of school-based work.

META-COGNITION Can be simply put as thinking about one's own thinking. Meta-cognition refers to the processes used to plan, monitor, and assess one's understanding and performance. Meta-cognitive skills increase students' abilities to transfer or adapt their learning to new contexts

METHODOLOGY A set or system of methods, principles and rules for regulating a given discipline (e.g. research methodology; teaching methodology).

NCTL National College for Teaching and Leadership. Government agency responsible for ITE (formerly the Teaching Agency).

NVC [Non Verbal Communication] The channel of inter-personal communication that depends upon body language: facial expression, gaze, gesture, posture, smell, spatial relationship.

OBJECTIVE A description of the intended outcome of a lesson; usually short term and a much more detailed statement of intent than an aim.

OFSTED Office for Standards in Education; the current form of inspection of schools.

PEDAGOGY The study of teaching and learning methods.

PROGRAMME OF STUDY The overall programme of study for a Key Stage.

PST The principal subject tutor (PST) looks after the trainee's day to day development within the subject area during school based work.

PUPIL LEARNING STORY Is a selected collection of evidence that you are having an impact on pupil learning, taken from your IDP and Teaching files in relation to one student/group/class you are teaching, which you bring to UVT meetings and Supervisory Conferences as directed by your UVT and Mentor.

QUALITY ASSURANCE A term used to refer to the process of monitoring, maintaining and improving the overall quality of a programme of study.

QAR Quality Assurance Record – The sheet that the trainee and PST uses to monitor the completion of programme elements.

RESOURCES A term used to describe all the components and equipment needed for teaching and learning.

SCHEME OF WORK a planned course of work to include attainment targets, lesson plans, assessment outcomes, and other components. Can be called unit of work.

SCHOOL BASED WORK This refers to a trainee's work in school. It is defined by the location of the work, not by its nature or function. Thus, school-based work can and does involve more than simply teaching practice.

SEND Special Educational Needs and Disability.

SPIRAL CURRICULUM A way of planning learning so that concepts and skills are re-visited and reinforced; particularly useful for less able pupils, but important for all learning.

SUBJECT SPECIFICATIONS The knowledge, understanding, skills and assessment objectives in a given subject.

SUPERVISORY CONFERENCE A planned meeting between a trainee teacher and either a mentor or a university tutor at which the trainee's progress is discussed. In general, one or more annotated agendas will provide material for discussion and the participants will try to reach agreement on the trainee's current levels of attainment and about the next steps to be taken.

SYLLABUS A list of the contents of a teaching programme, usually of a subject.

TARGET SETTING Identifying specific individual goals for pupils - with a clear indication of how they can achieve their targets.

TEACHERS' STANDARDS The Government's requirements for all teachers.

UVT is a University Visiting Tutor. The UVT oversees the trainee's progress during their School Based Work. The UVT monitors the training provided by the school and works to support the trainee where appropriate.

ZONE OF PROXIMAL DEVELOPMENT Term used by Lev Vygotsky to describe the new learning territory that the teacher should be scaffolding so that pupils can develop new understanding and knowledge.