The Technology, Pedagogy & Education Association
Influencing Policy & Practice

LEAD ORGANISATION

Technology and Pedagogy in Education Association (previously The Association for IT in Teacher Education)

On behalf of partners forming a National Computing SCITT Consortium (See Annex A)

NOTE: This information is provided on a Commercial in Confidence basis.
The partners request a meeting with DFE colleagues to discuss the opportunities for implementing the proposals.

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1. SETTING UP A NATIONAL COMPUTING SCITT

a. What approach or strategy would you propose a SCITT take to achieve national reach ahead of recruitment opening in autumn 2019?

The Consortium behind this proposal (Annex A lists the partners) consulted first on what were the gaps in national reach of current computing ITT provision and then what a National 'Super' SCITT might provide to complement and enhance what exists already. We drew on the experience of the existing National SCITTs and advice from NASBTT.

Our consultation confirmed the findings reported in the RSA (2017) report *After the reboot: Computing Education in Schools*:

"...computing education across the UK is patchy and fragile. Its future development and sustainability depend on swift and coordinated action by governments, industry, and non-profit organisations. Neglecting the opportunities to act would risk damaging both the education of future generations and our economic prosperity as a nation...There is much to celebrate and there are many pockets of excellence. "

Our proposal brings together these partners to provide practical solutions to the challenges the report identifies. The proposal is unashamedly national in scope and ambitious but is of an order that many of our members who have experience leading national and international change initiatives are used to.

Following our widespread consultation, the proposal here is for an innovative form of National Computing SCITT (NCS) which does not destabilise existing strong provision but builds on existing strengths and which brings benefits of economies of scale and profile.

Our proposal puts the case for the National Computing SCITT to take a different approach to both the other National SCITTs and previous models of teacher training. The approach has been designed to support new ways of working to benefit *all* schools training computing teachers that wish to participate. As you might expect we harness the power of digital tools to provide a cost effective model for a National 'Super' SCITT benefitting children and teachers nationally in both metropolitan and rural areas.

As requested, below we list strategies for achieving national reach of the SCITT by autumn 2019.

Outline concept

We note the DFE definition of a SCITT:

"Networks of [approved] schools...are known as SCITTs. They provide practical, hands-on teacher training, delivered by experienced, practising teachers based in their own school or a school in their network. 'SCITT' is also a type of school-led course....SCITT courses generally last one year, with many including a postgraduate certificate in education (PGCE) and/or Master's-level credits. Training as part of a SCITT gives you the opportunity to learn 'on the job' from the very beginning."

We propose an innovative flexible National SCITT network which brings together organisations with national reach which can contribute in specific areas to support the goals of the National Computing SCITT (NCS). These include:

- professional associations and national networks
- SCITT and other school networks
- accrediting institutions (HEIs: independent and other)
- researchers from HEI computing science and teacher training departments,
- industry (specifically industries located in specific regions), and;
- specialist providers of distance education, online course software and networking software.

All of these have specific roles to play in promotion and recruitment as well as ensuring latest research-based and industry-relevant materials are available to the NCS.

The proposal draws on strengths in the existing system and focuses on addressing the gaps in the provision of sufficient high quality computing ITT provision.

We have identified economies of scale and opportunities for national reach which can only be achieved through a flexible, innovative National Computing SCITT.

Achieving national reach ahead of recruitment opening in autumn 2019

The findings from the consultation provide a foundation for the NCS strategy to achieve national reach of computing ITT provision in by autumn 2019.

We found there is already extensive national reach of teacher training provision for computing teachers but not enough applicants to fill places. Distributed across the regions in England, there are already 412 providers of Computing ITT: (School Direct Providers (294, 20 salaried), Computing SCITTs (75) HEI Providers (43) (Source: Gttr:https://goo.gl/ffmdZb). DFE data show, as of November 2017, there are, 470 trainee computing teachers out of a target of 723, of these, 215 are in SCITTs or School Direct routes.

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So with 470 trainees to 412 providers, many providers are very small. There is a risk that the National SCITT could destabilise existing provision by spreading numbers more thinly so that existing provision ceases to be financially viable. So the Consortium proposes a main goal for the NCS is to partner with existing providers, address gaps in provision and focus on increasing numbers of applicants.

The Consortium strategy therefore has five main components:

- **recruitment:** co-ordinating new and innovative recruitment efforts, targeting hard to reach groups via a national publicity campaign and helpline focused on new ideas identified by the Consortium and regionally sensitive. Social media, radio and TV, professional associations and networks all have a role to play. *The current DFE publicity team would be an obvious partner in the publicity campaign*.

- **flexible routes:** developing new online flexible personalised routes to teaching for example, for those having to stay in employment while training, for those in areas where no approved SCITTs exist. Of the 24,281 schools in England there are 3,408 secondary and 2,297 independent schools so it is anticipated new flexible arrangements in areas with no easy access to ITT may engage some schools and communities in meeting the challenge of identifying candidates for teacher training. *The Open University in collaboration with SCITTs could lead in this role with specialist tutors seconded part time from Consortium partners.*

- **building quality and sharing:** working to benchmark effective practice and share resources across existing providers who join the National ITT Computing consortium - *see the example of the NAACE Self Review Framework below. The partners have extensive resources already.*

- streamlined and targeted recruitment: Some individual SCITTs have difficulty recruiting trainees, so the provision for a central engagement point could streamline the recruitment and application process for potential trainees. Such provision, or portal, could provide accurate and current information. *For the individual SCITTs, there is the opportunity to promote their offerings to a wider audience.*

- knowledge services: co-ordinating online national knowledge services including online training materials (text, video, webinars) open to partners for their trainee teachers and tutors which is kept up to date and evidence-based through engagement with teacher-researcher networks, academic researchers and industry. Access to leading international and national computing education journals could be negotiated for partner schools. *The FutureLearn platform provides a good pedagogical model for online courses - see Annex A.*

- **online communities:** this consortium has significant knowledge and experience about online networking for ongoing professional support and knowledge sharing for each cohort *KHub.net provides a solution designed for the public sector - see Annex A.*

The justification for the strategy is that we found:

- Local, close to home, post-graduate provision attracts a considerable number of applicants. Typically these applicants for family and other reasons will not train to teach if provision is not local, face to face, flexible and personalised to accommodate individual circumstances.
- Online ITT by distance study has a place for those needing to stay in work while retraining coupled with flexible school placements e.g. around holiday entitlements or perhaps in areas where the local school is not in a SCITT network.
- Being able to keep up to date has a major role to play in supporting teacher confidence and therefore retention at trainee, QTS and experienced teacher level.

To address these major challenges the Consortium found there is much to be gained by sharing, across a national consortium of existing ITT providers' effective practice on:

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- Subject Knowledge Enhancement (SKE)
- Conversion courses
- Motivations of mature entrants
- Undergraduate routes to computing QTS
- Industry liaison and input.

The online knowledge services envisaged by the Consortium would also support SKE, conversion courses for teachers with degrees in other subjects as well as undergraduate routes for computing QTS.

The contributions from industry (see below for summer schools etc.) could also be used to upskill and provide continuing professional development for existing teachers. Clearly there would be opportunities in the international market via FutureLearn's involvement.

Long term, the NCS would be:

- open to all providers to join via subscription based on recruited student numbers
- managed through a central hub providing services to SCITTs organising industry and researcher input, online materials, ITT staff CPD and recruitment, providing accurate information to potential trainees. This would allow schools to take on more trainees supported by facilities and resources shared from stronger institutions. SCITTS may come together for services on offer in their region by specialist groups.
- providing support for partners 1, 2, 3 and 4 year courses, conversion courses, SKE and CPD.
- governed by a National Board of key stakeholders (See Annex A)
- potentially, able, through partners, to support primary and subject ITT.

The DFE also have a call out for proposals for a National Computing Centre which seems to complement much of the work through resource sharing we see a National SCITT would undertake. The two would have to work together. The Institute for Coding may also provide complementary services allowing the NCS to focus on teacher training, recruitment and retention.

b. What role do you see industry playing in a National Computing SCITT?:

Industry plays a key role in the NSC and the British Educational Suppliers Association is in support of this approach.

Without central coordination it is currently hard for those training computing teachers to keep up to date with the applications being developed and the knowledge required by different IT industries.

To teach well and confidently, computing teachers need easy access to the latest knowledge. An extra benefit of making such knowledge services available to trainees and those training them is that materials could also be available for ITT by distance study courses, Subject Knowledge Enhancement courses (SKE) as well as CPD and conversion programmes. Such access is likely to boost retention as teachers feel supported in their teaching being up to date.

Therefore the NCS would support development of materials covering the diverse strands of knowledge specific to the needs of local IT industries. For example, London leads the world in FinTech (financial services technology) and startups in technology; in Sunderland local IT industries have strengths in the areas of visual effects, gaming, accountancy software (SAGE). In other areas, robotics is a strength of local industry. Partners to this bid already have business links supporting their computing and ITT courses (undergraduate, postgraduate and PGCE) and central co-ordination through the NCS would facilitate distribution of existing local knowledge from specific industries to the whole network of computing teachers through webinars, podcasts and so on.

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We see the need for a national industry/education liaison role which could facilitate the following activities with industry partners:

1. Field trips e.g. to large firms such as Sage, Oracle, Microsoft, Google, games development companies and small businesses in regional technoparks. Many technology companies employ educational liaison managers. Commercial sensitivity e.g. in the games market means visits to firms may not be possible but the companies can be engaged in developing other resources.
2. Residential Summer schools with input from industry
3. Podcasts, webinars, talking head videos, teaching materials, research summaries and updates could be produced with industry as part of the portal of resources
4. Competitions and prizes for inspiring trainees/teachers
5. Week long secondments for trainees to update skills and knowledge in industry (in half term holidays or for pre-course preparation)
6. Industry partners could market their industry to trainee teachers so they can advise students Cyberpark in Malvern is keen to engage with HEIs because of recruitment of staff as is Software City in Sunderland. The NCS would facilitate access to teachers.
7. The TPEA/Mirandanet, iCatalyst industry/education teacher research programme could be extended: teachers as co-researchers engage in the exploration of edtech products and services to find evidence of impact on learning and workload reduction. These professional development programmes are often funded by the edtech industry, others by government and charities and the EU. http://mirandanet.ac.uk/icatalyst/professional-development-approach/

c. What part do you see the independent sector playing in a National Computing SCITT?

As well as the specialist advisory roles of the Independent Schools Council Digital Strategy Group and the University of Buckingham (which is a partner in the National Maths and Science SCITT and which works on recruitment with Premier Pathways), there are several roles to be played by the independent sector.

Members of organisations supporting this proposal are from the independent and maintained sectors and the experience of the proposers is extensive in both sectors.

We see the independent sector being full partners in the NCS, with representation on the Board so that needs of the sector and contributions from the sector are taken into account. Consortium partners include independent sector organisations and universities which already train computing teachers for and with independent and maintained sector schools.

The Headmasters Conference (with members from many independent schools) has expressed an interest in being engaged and in taking the ideas for engagement to other independent sector organisations through the Independent Schools Council.

The University of Buckingham, a consortium member, is an independent private university which not only trains teachers for the maintained and independent sectors but which also has a reputation for innovation in higher education. We believe that innovative approaches will be developed by the partnership as knowledge and ideas are shared in the period up to September 2019 and thereafter as provision develops.

Partnerships between independent schools and universities training teachers with and for the independent sector are common across HEI providers of teacher training. For example Durham and Barnard Castle independent schools are partners in teacher training with Sunderland University. This model will be further developed for example to areas not currently well served with flexible ITT routes and local provision.

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The consortium proposes flexible partnerships to maximize recruitment and provision of teachers in these hard to reach areas. Such partnerships may include rural independent schools working with local schools. The focus of the consortium is on every child getting the best teaching.

Another form of flexible partnership would enable the placing of trainees with local schools of the trainee's choice (independent or maintained). This is necessary in instances where trainees experience transport restrictions or child care arrangements restrict choices.

In discussions for this proposal, both independent and maintained schools have said they are having problems in recruiting computing teachers so the flexibility of provision and different forms of partnership being adopted by the consortium are intended to maximise recruitment. The portal will support high quality training and as a spin off, high quality CPD for existing teachers in independent or maintained schools..

d. What part do you see HEIs playing in a National Computing SCITT?

HEIs have a number of roles which are different to those in schools.

Schools participating will normally already manage ITT and this would continue for example, training mentors and tutors, ensuring training covers the main forms of knowledge for teaching (curriculum, assessment (and exam boards), knowledge of learners, general pedagogy, TPACK, aims of education). Partners may wish to share their approaches to these elements.

The NCS however would specifically focus on developing, identifying and sharing computing pedagogic knowledge and emerging subject content knowledge as well as liaison with industry, recruitment and so on as set out elsewhere.

For this new subject where pedagogies still have to be developed and where subject knowledge is rapidly changing, quality provision can be best obtained by schools, universities (computing departments and teacher education departments) and industry working together through providing personnel on both sides to develop approaches and resources that are both flexible and rigorous and up-to-date. HEI staff have as part of their jobs, specific remits to keep up to date with international research in their area and to research and write so as to advance knowledge. The input of these staff into the ongoing research and the writing of materials will accelerate development. Specifically, HEIs contribute as follows:

Computing ambassadors to schools (plus podcasts/videos): The Consortium would work with all HEIs to set up and run outreach schemes such as the University Ambassador Scheme (https://uas.ac.uk/), which place undergraduates into local schools as part of an accredited module. HEI education departments can help focus placements into areas of need. SCITTs will then actively recruit students from these schemes.

Online materials: Online materials, for trainees, can be designed and created to support both knowledge of computing and pedagogical content knowledge. This knowledge goes beyond lesson plans and exam board materials. HEI staff have a contractual requirement to research and publish and are judged on the impact of their research: these requirements can work to the advantage of the National SCITT Consortium. These materials would incorporate the most current research findings as well as effective best practice in the classroom. To ensure they remain accurate and relevant, they can be updated to reflect developments in technology and changes in policy. The Consortium, through HEIs may have access to facilities and personnel with requisite skills to produce and maintain these materials. Such materials will promote consistency of provision. It will allow individual SCITTs to quickly and easily customise the provision that they offer. A single resource point for materials will streamline dissemination of knowledge. These materials are not intended to be constraining but to provide a foundation. This

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flexibility enables local experts to contextualise the computing curriculum with the demands of the exam board specifications at GCSE and A level.

Research-based knowledge services: collaboration between SCITTs and a range of validating HEIs provides an opportunity for consolidating knowledge across different providers and industries. Because HEIs and SCITTs already form well-connected networks, they offer the ability to maintain repositories of contact details for individuals or organisations that can provide expertise in either computing subject knowledge, pedagogy, and pedagogical content knowledge. Individual SCITTs could draw upon this repository to meet the needs of their trainee cohorts. HEIs, because of this connectivity and availability of facilities, could develop and coordinate opportunities for workshops, seminars, industry visits, and subject knowledge enhancement, as can SCITTs where they have networks. See the following sections on industry engagement.

Accreditation: The criteria for awarding QTS and PGCE are understood well. However, there may be a case for celebrating achievement in other ways. There could be endorsements for smaller units of work particularly when the results are published. For example, there could be endorsements for subject knowledge enhancement workshops or short courses, offered to trainees via HEIs. These could form part of the portfolio submission for the award of QTS or PGCE. In addition, the ITT staff, based in SCITTs could also benefit from this approach. There could be certification for attendance at CPD training sessions, offered by HEIs, to the ITT staff in individual SCITTs. Centralised training would promote consistency for both trainees and ITT staff.

e. What recruitment challenges are specific to computing and what approach could a national SCITT take to address them?

There are a number of recruitment challenges including: gross under- recruitment of computing teachers and longstanding lack of women going into computing yet women make up a large percentage of the education workforce.

Mentor Training: Current best practice and models in mentor training across SCITTs and HEIs could be consolidated and shared with all members of the National SCITT Consortium. This would provide consistency for all trainees, regardless of their school placements. This provision could be maintained and updated based on involving relevant research. In addition, mentors could take advantage of industry knowledge subject knowledge enhancement provision offered across the Consortium.

Less access to GCSE and A level computing: The Roehampton annual computing education report (https://www.bcs.org/category/19331) indicates that the removal of ICT and its replacement with computing has led to GCSE and A-level qualifications becoming more exclusive, in terms of gender, ethnicity and pupil premium. An important role for the NCS is to work to develop SCITT provision which focuses on schools where the need for computing is greatest, and within schools, that teachers are trained to engage students from a diverse range of backgrounds. Part of an approach to tackling diversity in the subject is having role models as teachers. This means that we must aim for a diverse teaching workforce.

Underemployed BME computer scientists: "The Destinations of Leavers from Higher Education (DLHE) survey, carried out by HESA each year, has for several years shown Computing Science has the worst unemployment level of the 19 subject areas." The last major of employment of Computing science graduates (CPHC study,
2013) (https://cphcuk.files.wordpress.com/2013/12/cs_graduate_unemployment_report.pdf) reports that computer science undergraduates are diverse with a large percentage of BAME students, and students attending post-92 universities and experiencing under employment. We need to work with universities to make undergraduates aware of employment opportunities as teachers, through direct recruitment events and through our support of undergraduate school placement schemes such as the University

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Ambassador Scheme (https://uas.ac.uk/). The NCS would also have a role alerting these students to the possibilities of teaching and there are various well tested models where school placements are provided through undergraduate years to ensure that potential applicants understand school life.

Other recruitment challenges which are specific to computing include:

Gender issues: Firstly, the ratio of male to female students in the subject at University level. According to HESA statistics (https://www.hesa.ac.uk/data-and-analysis/students/what-study) only 26% of Higher Education Computing students were female in 2016. At Undergraduate level the percentage of students identifying themselves as female and taking computing courses was under 16% in 2016. The percentage of students doing postgraduate taught courses who say they are female was above 27% in 2016. **This implies that women are likely to convert after a first degree so the consortium would have one focus on conversion and SKE courses.** This is significantly different to the figures for those studying education where the percentage of students undertaking Undergraduate Programmes who identified as female was over 86% in 2016. **This means that the pool of potential applicants for ITT in Computing is smaller than for other subjects.**

In order to attract more women to apply there may be greater emphasis placed on recruiting students who may have undertaken non-Computing degrees and who require a Subject Knowledge (SKE) course. The National Curriculum in Computing now covers three areas:

The emphasis has moved to computer science, strand 1, to such an extent that this has made those who were teaching Information and Communications Technology inadequate. See Freedman here for an analysis of the resulting challenges. Our small scale research suggests that most potential teachers, often women, are more attracted to curricula like Digital Media which offers the more creative elements in the Information Technology, Strand 2. In addition there is an acknowledged need for more digitally savvy citizens to ensure democracy remains viable. In this case, more research on Strand 3, Digital Literacy, is needed. We suggest attracting specialists in information technology and media who then undertake a Subject Knowledge course to develop their knowledge of the other strands may expand the numbers of individuals who consider entering the profession who are female.

Lack of CPD: Secondly, because the subject area has undergone profound change over the past 8 years, CPD is needed. This has impacted on the teaching undertaken in school as the subject has moved away from IT and toward Computing. This has impacted on teachers: many teachers of the subject had no training in Computing (according to the School Workforce Census 2017 only 34% of Computing teachers had a degree in the subject and 54.3% had no post-A Level qualification in the subject [https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/719773/SWFC_Tables.xlsx - table 13]. **This means that many schools require additional subject support for training and CPD.**

The Consortium member organisations include HEIs with specialisms in Computing (who have the pedagogical and subject knowledge required to link the expert knowledge of industry with the curriculum within schools), subject associations, industry and members who have between them, hundreds of years experience within schools. Drawing on these resources to produce a portal with research-based up-to-date knowledge services would be a priority.

Thirdly, there is a bursary that may attract people into teaching for financial reasons rather than a genuine interest in children. This bursary is not available in every subject. Some of the people who enter teaching for initial financial reasons may stay in the profession as they genuinely find they enjoy working with children, others may leave without going into teaching. However, the advantage of the bursary is that it does attract career changers who may otherwise be unable to undertake the programme. The interviews for entry have to be conducted with an awareness of the financial implications of the bursary in

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mind - resilience and the likelihood of completing training is already sought in Trainee Teachers but the likelihood of long term commitment to the profession also has to be considered.

Other factors inhibiting recruitment include

- a higher percentage of females do part time courses (HESA data).
- student debt is an inhibitor
- the heavy workload is well known linked with poor pay compared with other sectors (the knowledge services proposed here will lighten this load)
- the way teachers are treated negatively
- the plethora of routes for entering teaching
- few students taking A level computing which is seen as too technical

Case studies of career changers are available to illustrate these points as well as our research studies. A serious marketing campaign is required to change the negative perception of teaching that has grown up over the last few years, particularly the restricted approach to computing as a means to an IT career only.

Retention needs more investment if all this work is not to go to waste. In brief, there are people who could become teachers who need financial and time support. Year-long MSc conversion courses exist - these could be **funded by government** and advertised. Insufficient people are applying so SKE is critical to recruitment to teachers. There is a role for government or the NCS to lead in this respect.

There are efficiency savings for providers if the NCS focuses on recruitment. We need to do something different. This proposal is about doing things differently.

f. What do you think would be the best approach to developing an evidence-based pedagogy for the teaching of computing?

There are a number of tried and tested models for developing evidence-based pedagogy from previous national change initiatives. Teacher- researcher networks are the way to generate new pedagogic knowledge. Many teachers will have been trained in these techniques: small scale studies which yield promising results can be scaled up across regions; reading groups can focus on research on a topic and share their synthesis and mini randomised control trials (a six week intervention methodology) can be used to test ideas. We recommend practice based research programmes which give the teachers ownership of the evidence and a stake in implementing the outcomes. We also like to involve parents and pupils in the projects where this is appropriate.

Computing in schools is still in its infancy so teachers need to have confidence in delivering the content in an appropriate way. There are approaches in other subjects which are similar, but there are some subject specific pedagogies which are supported by the literature e.g. paired programming; problem based learning; developing conceptual understanding through activities away from the computer (unplugged computing). These pedagogies may be similar to mathematical and scientific teaching strategies but are often enhanced by using a blend of different techniques. Trainees (and mentors) need to engage with this literature to inform their practice and to consider the best way to deliver the learning experiences. This is critical if mentors originally trained in another discipline and have migrated to ICT/Computing.

Computing has often been taught using a more traditional form of pedagogy and there are clear opportunities to improve this by making better use of new understandings from the science of learning. Action research can be used to explore a range of alternative pedagogical approaches e.g. the flipped classroom, spaced learning, personalising the curriculum, gamification, etc.

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Research groups can work together across schools and institutions to review the wide range of evidence developing through the scheme to learn about pedagogies in new ways e.g. in a national and a regional way. One topic may be a focus on individual children in particular situations. These can be shared through online seminars e.g. half an hour after school. Dedicated CPD times could provide a model for a once a month meeting e.g. webinar or hot seat which is then recorded and played when people have time to think about it.

TPEA and other Consortium members can provide many examples of these strategies in operation. The NCS networking would allow scaling up so significant findings could be quickly shared.

Access to research can be costly and a role of the NCS will be to provide free access to relevant research allowing teacher trainees and teacher trainers to support their own practice.
A bonus from the approach for the professional development of teachers would be accreditation through a CPD points system and M level credit for the teacher-researcher networks.

g. What do you think the key costs would be in setting up a National Computing SCITT, and the drivers for those costs?

In this model, the student funding would follow the student and the training organisation would then pay into the NCS for access to the services and networks. Start up funding would be needed for the portal and initial development. A long term sustainability model has been developed beyond start up costs which is based on subscription and CPD fees. The online flexible routes are anticipated to need an extra subsidy and may not continue to be offered in England if the pool of applicants is exhausted, needs have been satisfied and/or a subsidy ceases.

Key Costs for the hub (virtual) and spoke model proposed for the NCS are similar to traditional ITE programmes. Networking established ITT providers and using digital tools effectively should bring significant in-kind cost reductions and economies of scale.

Standard costs for ITT include

- Staffing: for in-school tutoring and mentoring, for assessment moderation, for internal and external quality assurance,
- Premises
- Teaching Resources: all partners have existing services and resources such as research and professional journal access.
- Placement and moderation visits
- Licences: Cost savings could be huge with the NCS able to negotiate access to research and professional journals and memberships of professional associations.
- Online support - hosting, web development, administration and moderation.

In addition the establishment of a centralised National SCITT requires the following additional costs:-

- Significant marketing overhead with a national profile
- Staffing: Hub management and administration, telephone helpline
- Quality assurance and standardisation
- Knowledge services including
    - pedagogic research coordination
    - online courses, podcasts, webinars and so on.

Online courses could be used in face to face provision as well as for distance learning. Savings in staff time could be expected through online tutoring of larger groups than would be found by participating providers. Premises costs would largely be met through sharing existing premises of partners and having

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a small central office for administration and editorial support supported by virtual working for meetings. Savings would be balanced by the opportunity to produce higher quality and more extensive resources than would be possible with a small provider.

Online materials: Some costs are optional but would bring multiple use advantages as a CPD courses, booster courses/conversion courses for teachers wishing to switch specialisms. The writing teams would be combining materials from existing providers and working with industry on new specialist modules.

The QAA standards for courses carrying university level accreditation ensure appropriate engagement of employers in the development of modules, their assessment, their revision and updating and the NCS programme would be designed to meet these standards. This approach carries costs.

As mentioned, flexible, personalised online and distance training for hard to reach applicants may carry an additional cost.

Detailed costs can be provided in confidence.

h. What challenges and risks do you think there are in setting up a National Computing SCITT and how could these be overcome/mitigated?

We have responded from the perspective of the successful party.

CHALLENGES

1. Tutor skill and knowledge: There is a need for tutors with expertise in subject specific pedagogy and up-to-date subject content knowledge in a rapidly changing sector. Our research indicates that too often the funders of this kind of teacher training initiative think the trainers already exist. This is not the case in our experience.

   Mitigation: The knowledge and skill base of the Consortium network is extensive - the network includes teachers, researchers in pedagogy for Computing and businesses requiring staff with high level skills. Online tutoring and hot seating could make expert knowledge available to all but would need to be carefully coordinated.

2. Will the school subject mentors be volunteers or conscripts. Will they have time released for support? How do you quality assure the subject mentoring?

   Mitigation - all SCITT subject mentors would need to undergo some rigorous mentor training and partners have successful models already. Mentors would need to be able to demonstrate their subject knowledge competence. The personal qualities required of a mentor are significant and would need to be assessed individually.

3. The National SCITT may have a negative impact on recruitment to current providers. The traditional SCITT model has focussed on small scale training within a local geographical area. Due to the increase of possible training routes, there has been a dilution of trainee numbers at specific institutions (SCITTs and HEIs) resulting in some of them becoming non-viable and closing. Will this national model accelerate this process?

Mitigation: The Consortium propose a model which should strengthen partners' trainee numbers as well as provide a route to training for those hard to reach by existing routes. The publicity campaign and the helpline coupled with clear communication about conversion courses, SKE provision, online flexible training, placements in schools of the applicant's choice (maintained or independent but subject to the school's capacity and willingness), ongoing support through the proposed portal are expected to boost numbers.

The Technology, Pedagogy & Education Association 27 Old Gloucester Street, London, WC1N 3AX
Chair: Prof. C. Preston, Christina.Preston@mirandanet.ac.uk;
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4. Sustainable recruitment - this is challenging for all providers at the moment. There may be some potential applicants who do not have easy geographical access to a training provider but once they have access online, the supply may be readily exhausted. This pattern is often seen when a new training provider appears in an area that was not previously catered for.

Mitigation: The Open University had just this experience with their PGCE - there can be pent up demand which is then exhausted. The online flexible route can be expensive but can also provide opportunities to applicants who would otherwise be excluded. Numbers would need to be carefully monitored so that courses could be closed when saturation of the market is reached. The Consortium proposes more conversion courses so that if online numbers drop in time, the plan is that more applicants will be available through conversion courses.

5. Bursary tourists (those who want the bursary but are not planning to teach) - it will be important to track the progress made by the trainees through the course which is much harder to do in an online setting. The tutor/student relationship may not be as strong as it is in a traditional face-to-face setting.

Mitigation - The recruitment process and ongoing monitoring will need to be rigorous. Staff would be allocated to monitor/support/track the trainee's progress through the course. Engagement online can be mandatory as can a portfolio for them to submit evidence of their activities.

RISKS

1. Financial: Staff time will need to be accounted for in terms of planning, preparation and delivery. There will be expenses associated with hosting services such as webinars, VLEs, online portfolios or library access to journals.

Mitigation: The OU financial models will apply to online courses. DFE will need to consider subsidising, in the short term, more expensive routes which could attract applicants from areas where there is a shortage of provision e.g. in the East of England..

2. The expert staff with the required skills are limited. These people are probably fully employed and will not easily be available to support an online community during the working day. This will necessitate working outside normal working hours.

Mitigation: A major purpose of the Consortium is to pool resources for the benefit of all and to use digital technologies and partnerships to provide high quality specialist resources. Secondments may be used as well as out of hours working. The knowledge and skill base is not a risk for us as we have a number of ways of mitigating risks e.g. access to expert practitioners through the Computing At School network of excellence; academic support through HE Institutions;

2. INVOLVEMENT WITH NATIONAL COMPUTING SCITT

a. Are you interested in becoming the lead organisation for the National Computing SCITT? If yes, please provide an outline partnership proposal.

Yes, the partners to this proposal, who have formed a Consortium are interested in being the lead organisation.

A brief outline partnership proposal is attached as Annex A.

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b. Are you interested in being a partner of the National Computing SCITT partnership? (If yes, please provide an outline of what your organisation could offer as a partner)

Yes. The partners to this proposal, for a National Computing SCITT Consortium are interested in being a partner organisation. There would need to be a match of values. The consortium focus is on ensuring the highest quality of training is available to applicants everywhere. We would wish to see an online portal of research based resources open to all computing trainee teachers updated through industry/researcher/teacher educator partnerships to maximise access to emerging knowledge from researchers and companies.

The Technology, Pedagogy and Education Association has access to many resources for example:

- the Technology Pedagogy in Education Journal is focused on publishing research into computing pedagogy http://itte.org.uk/wp/itte-journal/.
- Online networks engaging 2500 educators
- Industry connections, goodwill and support
- The Association has invested in a knowledge mobilisation strategy focused on making the latest research available in a useful form (known as translational research) for teachers see www.meshguides.org for a model of new ways using digital tools to build a dynamic knowledge base
- The partners include international experts in edtech CPD from both the research and practice point of view. Their expertise has been developed through research funded by government and international agencies: DFID, OECD, British Council, Becta, TDA, DFE, EU. Examples of research and accredited development programmes as well as work with international governments, charities and multinational companies can be found here:

http://mirandanet.ac.uk/specialist-cpd-research/

https://mirandanet.ac.uk/external-publications/

NAACE has a particular offer, the Self Review Framework (SRF) which is well established in schools and could be adapted specifically support ITT in Computing. It would be valuable in providing a route for the trainees to take up on qualifying to improve quality in their schools. The SRF will enrich the foundations of educational technology and a school's capability to train teachers in Computing as well as having established approaches to "computing pedagogy".

c. Do you have industry links that would be of benefit to the National Computing SCITT?

The answer to this is yes, links with industry are too numerous to mention – across the regions, across large and small industries. ITT programmes for computing teachers will normally include field visits and input from companies and all ITT providers of computing training should be aware and in contact with the local industries. Such collaboration is essential if teachers are to keep up to date and to understand local employers needs and opportunities for students.

The Consortium links with industry provide two specific strands of support necessary to high quality training of computing teachers:

1) access to the latest subject content knowledge: This is both through direct contacts those training teachers already have plus those via HEI computing departments which ensure trainees access to the latest knowledge and research.

2) generation of new pedagogic knowledge through industry/teachers collaborative research: MirandaNet a TPEA partner has developed many practice-based research projects with companies since 1992. The value of these practice-based research project undertaken by teachers and leaders in schools is that they provide professional development funded by companies and teachers' ownership of change.

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Many UK edtech companies and multinationals have been involved in MirandaNet practice based research since 1992 including Oracle, Microsoft, Promethean and Toshiba. The current professional development projects funded by BrainPOP, Gaia Technologies, Just2Easy, IRIS Connect, Outset, SAM Learning and ThinkIT can be found here:

https://mirandanet.ac.uk/icatalyst/professional-development-approach/

https://mirandanet.ac.uk/about-associates/associates-research/

InnovateMySchool and the British Education Suppliers Association are also keen to partner with this project.

d. What ITT and/or computing experience do you have? Please provide details of the skills, experience and resources you have access to either in-house or through existing relationships.

The named organisations include individuals with hundreds of years experience in Teaching and Teacher Education as well as extensive experience in research. The engagement of the computing departments in the partner HEIs means their specialist resources, knowledge and industry contacts can be accessed.

Individuals named as contacts may have studied Computing or Computing Education at Undergraduate or Postgraduate Level. These individuals have extensive experience of ITT and many have experience of Computing directly (including of teaching Computing at Degree Level in HEIs). Many will have created Subject Knowledge Courses for an HEI or for a Professional organisation. Many have been and are consultants to industry and various governments.

The skills of the group are widespread. The group have knowledge of every aspect of the Computing Curriculum at Key Stages 3, 4 and 5 and a commitment to continually update knowledge as technology changes. This commitment to update skills and knowledge is manifested in the involvement of many participants in Subject Associations and Professional Organisations. Many of the group are active members of Computing at School, the British Computer Society and CSTA and are authors of online training materials as well as teacher training textbooks.

The non-pecuniary resources of the group are high. Individuals have strong social capital bonds predicated on a shared interest in both Computing as a Subject and in Education more generally. Strong links with maintained and independent schools are demonstrated through areas such as involvement in school governance, membership of school/HEI Secondary Partnership Boards, and direct relationships formed through many years experience of working alongside teachers in school. Links to HEIs would allow trainees to have access to resources both online and on-campus as well as resources available in school. The medium of instruction would be blended learning with trainees having the opportunity to receive instruction via a VLE, through tailored seminars and shared resources - and the group have extensive experience in this area.

As can be seen, we are a group that seek to be innovative and to utilise the experience and expertise towards a shared goal.

Please forward completed questionnaires or any questions regarding this soft market testing to: Contact.NCSCITT@education.gov.uk by 8am on 23 July 2018.

Appendix A: The outline Partners and Associates proposal

Key national organisations which have expressed interest in being involved in the National Computing SCITT Consortium are listed below. Three specific roles have been identified:

- **Partners** with direct responsibility for the training of teachers would elect a small tightly managed Board governing the National Computing SCITT. Membership would include TPEA, with representatives from SCITTs from each region plus partners with specific expertise as well as DFE and OFSTED observers.
- **Core team:** A core management team of five would report to the Board. The Director would be responsible for ensuring regional needs were identified and addressed as well as SCITT/School Direct/HEI and Industry engagement. The Director would be supported by a Recruitment coordinator (including publicity), Web and content development co-ordinator, Pedagogy Research Network coordinator and an administrator (including Events). Publicity would be linked with current DFE contracts.
- **Associates** then would have and roles specific to their remits and work through sub-committees tasked with specific actions.

Partners and associates from across the regions, represent different types of providers of ITT and different types of stakeholders. Collectively their networks and their existing ITT partnerships link together an extensive network of schools, SCITTS, universities (researchers, computing departments, teacher training departments), subject professional associations (representing those engaged with training Computing teachers and research) and other associations with a national interest in teacher training.

Having secured agreement from organisations with significant leverage across the national scene to Board membership at this stage, we also have entered into discussions with individual SCITTs, individual schools, university computing departments and an additional group of stakeholders with whom ITTE members have professional contacts. These include the British Computer Society (and Computing at Schools), NASBTT and Innovate my school who are invite to contribute to the second stage of development.

NASBTT advice has been incorporated into this proposal.

The partners have regional and national coverage and long standing close links with industry, computing science departments and large professional networks. All partners have a vested interest in ensuring computing teaching is of the highest possible standard for every child and that every computing trainee teacher and teacher has the best support we as a nation can provide to help them in their teaching.

What we propose is not a copy of the current national SCITTs but is an innovative approach to ITT and recruitment. With the NCS as a national co-ordinating centre, we can stimulate recruitment across the regions, focus on gaps and challenges and also co-ordinate online resources drawing on the latest innovation and research and potentially online provision for students who are not able to access existing provision due to geography.

The management model is hub and spoke, with the hub managing central services and online provision with tutors/mentors from for the most part existing providers and spokes being the partner schools/SCITTs.

Consortium members through coordinating research into pedagogy and through industry and HEI links would be able to agree quality standards for the ITT curriculum linked to the latest developments in computing pedagogy as well as computing subject knowledge from industry and researchers.

Finally, as well as a 'co-ordinating' centre, we see the Consortium as a 'commissioning' centre commissioning resources, evaluations and teaching from other providers.

With so many ITT providers in the subject not recruiting, the financial risks of destabilising rather than supporting the teacher training sector are huge - a commissioning model will allow us to use the money to buy out staff to do jobs we think are worth doing and create resources that will probably outlive the SCITT itself! It could also financially support existing providers who have staff but not enough students to pay for them by providing part time online tutoring, research coordination, CPD and industry liaison roles.

PARTNER and ASSOCIATE LIST and specific expertise

1. **Professional Associations**

a. **Lead partner: The Technology, Pedagogy and Education Association** (Previously the Association for IT in Teacher Education incorporating the MirandaNet Fellowship): networking 1500 teachers, computing teacher trainers, researchers, ITT textbook authors and with links with industry.

b. **HeadMasters and Headmistresses' Conference:** a professional association of heads of the world's leading independent schools.

c. **ISC Digital strategy committee:** This group provide strategic digital skills and computing curriculum advice to the independent sector.

d. **NAACE:** The National Association for all those interested in technology in education.

2. **SCITTs/schools/school teachers**

a. **1st phase Innovators (SEPT/OCT 2018):** Innovative teachers from SCITTs and Computing at School (CAS) Master Teachers will work with the members of the Independent Schools Council Digital Strategy committee, industry, SCITT representatives, NAACE and TPEA members to develop and test the approach and the materials.

b. **2nd phase wider engagement:** A detailed plan, from the first phase, will be presented at an open conference in November 2018 to which specific groups will be invited: SCITTs, TSAs, researchers, specific industries.

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3. **Industry**

a. **British Education Suppliers Association:** the trade association for the UK education suppliers and providing the secretariat for the APPG Education.

b. **Raspberry Pi Foundation**

c. Companies invited to make specific contributions e.g. on FinTech, Visual Effects, animation, accountancy software gaming and so on.

4. Universities

a. The University of Buckingham: partner to the National Maths and Physics SCITT, successful track record in national school-based ITT and has grown to become the largest University provider within this ITT model. Premier pathways recruitment service.

b. **Open University:** for distance provision.

c. **University education and computing research departments and their SCITT partners**: for regional engagement, for the services listed above under HEIs: research, knowledge services, ambassadors, accreditation, CPD, undergraduate computing with QTS courses, conversion courses, specialist subject knowledge enhancement courses.

5. Online service providers

a. Future Learn: online course platform.

b. **Knowledge Hub:** provider of online communities of practice software specifically for the public sector benefit.

c. **MESH:** provider of online knowledge services including research summaries linking theory and practice for teachers.

PARTNER INFORMATION

1. Professional Associations

1a) Lead Organisation: The Technology, Pedagogy and Education Association (Previously the Association for IT in Teacher Education (www.itte.org) incorporating the MirandaNet Fellowship (mirandanet.ac.uk)

Contacts: Andrew Csizmadia: A.P.Csizmadia@staff.newman.ac.uk and the chair Professor Christina Preston christina.preston@mirandanet.ac.uk

ITTE Members contributing to this proposal, work across the regions, in the full range of ITT provision with trainees in independent schools or maintained schools. Other members are directly involved in validating qualifications across the range of routes. Members include those who write the main textbooks used for teacher training.

Members who contributed their experience to this proposal include: **Miles Berry, Rachael Blazewicz-Bell, Lynne Dagg, Benton Brown, Andy Connell, Ann Cook, Andrew Csizmadia, Terry Freedman, Joe Fort, Alex Hadwen-Bennett, David Hunt, Peter Kemp, Julia Lawrence, Marilyn Leask, Ellie Overland, John Owen, Christina Preston, Cynthia Selby, Chris Shelton, Carl Simmons, Sarah Younie.**

At the 2018 Winchester ITTE and MirandaNet conference June 8th June 2018, the Annual General Meeting of ITTE (founded in 1986) agreed to continue their existing partnership with MirandaNet (mirandanet.ac.uk - founded in 1992) under the new name Technology, Pedagogy and Education Association (TPEA). This name was chosen to align with our international journal, published by Taylor Francis, and one of the top-ranked international journals in Education and Educational Research.

TPEA's 1,500 members represent a wide range of edtech experts including HE, FE, advisors, schools, researchers and edtech companies who all share an interest in improving learning through the application of digital technology in teaching and through the effective teaching of Computing as a subject. Our concerns include: the pedagogical application of digital technology by all teachers; developing the teaching of computing and digital capability; attention to the strands of information technology and digital/media literacy; and the effective use of digital technology in initial teacher education as well as continuing professional development (CPD) programmes and research. We also work closely with a number of edtech companies in research and development. Using practice based research as a method of professional development, teachers and leaders work with our researchers and edtech companies as co-researchers in collecting evidence about the impact of technology.

Our members, therefore, have the experience and knowledge in the field of technology and pedagogy to advise on edtech practice and policy and we are keen to work in partnership with other organisations in this field.

1b) The Headmasters' and Headmistresses' Conference
Contact: Membership secretary c/- Sue Gray (gensec@hmc.org.uk)
The HMC expresses provisional interest in this proposal. We would need to discuss this as HMC officers and possibly in conjunction with the other ISC associations. Should the DFE wish to meet with partners we should be pleased to be invited to discuss the possible roles of our independent school members.

HMC is a professional association of heads of the world's leading independent schools.

1c) Independent Schools Council Digital strategy committee
Contact: Ian Phillips (Phillips_I@habsboys.org.uk)
Our role is to share good international practice to help schools develop their pedagogy using technology. We completely endorse this initiative to develop a national super SCITT for computing as this would help develop the conversation of how we develop whole school pedagogy for the 21st century.

The Digital strategy group consists of heads and IT specialists as recommended by the associations. The group is focusing on ICT policy in schools including with controversial topics such as social networking.

The Digital Strategy Group's website

The next ISC Digital Strategy conference will take place on 29th November 2018 and aims to provide an effective digital strategy that impacts on policy, pedagogy and technology in the learning environment. The conference has 3 main elements: to establish where schools are; to determine what progress schools have made; to discuss the results of Action Research projects between schools and our technology partners, which took place this year.

1d) NAACE http://www.naace.co.uk/
Contact: Steve Moss, Chair: Steve.Moss@naace.co.uk
The National Association for all those interested in technology in education. This partner represents a community of 250 educators, technologists and policy makers who share a vision for the role of technology in advancing education. Our members include institutions as well as individual teachers, school leaders, advisors and consultants working within and across all phases of UK education. As a professional association, we represent an influential voice in the UK education technology community in the schools sector at a national and international level, as well as supporting one another across the sector through conferences, courses and the dissemination of resources, research and reflection.

2) SCITTs/schools/school teachers

2a) 1st phase Innovators (SEPT/OCT 2018): Innovative teachers from SCITTs, CAS Master Teachers, industry and two HEIs will work with TPEA members and members of the Independent Schools Council Digital Strategy committee to develop and test the approach and the materials. Members include Miles

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Berry (TPEA/SKE/ISC digital skills/HEI), Lynne Dagg (TPEA/SKE/HEI/industry liaison), Phil Hackett (CAS Master teacher/SCITT trainer), William Lau (CAS Master Teacher, examiner), Ian Phillips (ISC digital skills/Haberdashers' Aske), Dominic Preston (OTSA SCITT trained, representing new teachers, Cherwell School/industry/MirandaNet), Sue Sentance (industry).

Examples of the range of the 1st phase innovators' backgrounds:
Phil Hackett Computing at Schools Master Teacher, SCITT trainer, Lancaster.
I am a secondary school teacher (11-19) with ten years experience within the IT industry and ten years teaching experience, having taught A-Level / GCSE Computer Science for the past six years. I was designated as a CAS Master Teacher five years ago and I am also the Hub Leader for East Lancashire CAS Hub. I have delivered CPD sessions at conferences in my capacity as a Master Teacher at Manchester University, Edge Hill University and Lancaster University. I have also delivered a number of full-day training sessions aimed at A-Level Computer Science teachers at the National STEM Learning Centre in York. Over the past six years, I have supported and mentored PGCE and SCITT trainees. I also deliver CPD sessions each year to the trainees with a focus of 'Using Technology to Enhance Teaching, Learning and Assessment'.
I earned my degree in IT & Computing, through The Open University in 2008 – this gave me a sound understanding of distance learning as a student. I have now developed an understanding of *providing* distance learning, in my role as an Associate Lecturer at The Open University, for the past three years. I have also continued to study myself – I gained a Postgraduate Certificate in Computing last year, on my way to a Masters in Computing, which I should achieve within the next two years.
I am keen to be involved with the proposed National Computing SCITT as a 1st Phase Innovator.

William Lau Computing at Schools Master Teacher, examiner for OCR, London.
William Lau has taught Computer Science, ICT, Media Studies and Business from Key Stages 1 through to 5 in three London schools and in an International school in Seychelles. He started teaching in 2006 and is currently in charge of Key Stage 4 Computing at Central Foundation Boys' School. He was previously an assistant headteacher in charge of teacher development. In this role he was responsible for mentoring NQTs and PGCE students across the school. He also provided training in curriculum development, assessment and pedagogy within the school and at conferences, schools and universities across the country. As an examiner and moderator for OCR, William is experienced in marking and moderating GCSE and A-Level assessments. Furthermore, as a head of department, William has led and developed the subject knowledge and the pedagogical content knowledge of his colleagues. In July 2017, William received an award from CSTA, Infosys USA and ACM for excellence in teaching Computer Science. In October 2017, Routledge published William's first book, "Teaching Computing in Secondary Schools". His experience and expertise in teaching Computing led to him being recognised as a CAS Master Teacher and he was recently asked to advise the Korean ministry of education on the development of their Computer Science curriculum.

Dominic Preston, Computing teacher (new teacher), Cherwell School Oxford.
I came through the OTSA SCITT program run out of Cherwell school and have just completed my NQT year. I am now moving into my NQT +1 year, there will be more KS4 to teach (year 11) on my timetable and I will still be teaching KS3. Previously Dominic worked in the computing industry.
Cherwell is part of the Oxfordshire Teaching Schools Alliance SCITT programme.

John Sibbald, Assistant Principal, Manchester Communication Academy, Manchester.
John has nearly thirty years of experience teaching and leading in North Manchester secondary schools. Ten years were spent working at the North West Manchester City Learning Centre researching the effective use of new and emerging digital technologies and how these impact on teaching and learning. In April 2010 he joined the team at Manchester Communication Academy in Harpurhey, leading on the development of the new Computing curriculum, 21st century digital skills, the ICT strategy and staff effectiveness and performance in the use of technology.
Manchester Communication Academy is part of the Greater Manchester Academies Trust which is part of the North Manchester SCITT ITT Training Partnership.

Dai Thomas: **Director of Digital Services & e-learning, Sussex Learning Trust, Warden Park secondary Academy, West Sussex.**
Dai teaches computing & IT at a large state secondary school and leads one of the largest one to one Digital learning programs in the south east (1700 iPads). Dai has worked in many schools over a 30 year career mostly in the South of England and also has further experience working in the Caribbean as a class teacher in a state school. Advisory and consultancy roles have been part of his journey ranging from working as a school cluster facilitator for 14-19 technology based educational projects, advisory work with Mirandanet to the South African Government, lecturing on ITE at Brighton University, facilitating groups on comparative education with Sri Lanka's NIE at Sussex University.

2b) 2nd phase wider engagement: A detailed plan, from the first phase, will be presented at an open conference in November 2018 to which specific groups will be invited: SCITTs, TSAs, School Direct representatives, UG and PG course providers at HEIs, researchers, specific industries. From this a core group of Computing ITT providers across the regions will be selected for the first cohort partners of the NCS for September 2019.

3. Industry

3a) British Education Suppliers Association (www.besa.org)
Contact: Patrick Hayes (patrick@besa.org.uk)
BESA, the British Educational Suppliers Association, is the trade association for the UK education suppliers sector. We operate on a not-for-profit basis and are accountable to an Executive Council elected by member companies.

We would be very happy to be in the submission as a potential future partner – a SCITT such as this could be very powerful if there was sufficient government backing for it.

BESA provide the secretariat for the All Party Parliamentary Group for Education.

3b) Raspberry Pi Foundation
Contact: Sue Sentance (sue@raspberrypi.org**)**
The Raspberry Pi Foundation creates world class educational resources for computing and computer science used by millions of people each year, and has developed online courses that have supported tens of thousands of computing educators to develop their subject knowledge and pedagogy. It directly engages over 200,000 young people each week in their networks of free computing clubs and competitions, including a track record of effectively engaging girls, evidenced by the fact that 40% of the young people at Code Club are girls.

The Raspberry Pi Foundation has a globally recognised brand synonymous with computing education, a significant web and social media presence, with hundreds of thousands of followers in the UK; and a high profile in the mainstream media (5,000+ media stories last year). Hello World, the free magazine for computing teachers has over 21,000 subscribers of which 9,000 are UK-based educators. It runs PiCademy, a 2-day programme offering teacher training in pedagogy, physical computing and digital making to hundreds of teachers, and has extended this to initial teacher trainees at King's College London for the last two years.

(The Raspberry Pi is a series of small single-board computers developed in the United Kingdom by the Raspberry Pi Foundation to promote the teaching of basic computer science in schools and in developing countries.Their mission is to put the power of computing and digital making into the hands of people all over the world.)

4) Universities

4a) The University of Buckingham
Contact: Sir Anthony Seldon, vice-chancellor and Professor Geraint Jones
The University of Buckingham has a successful track record in national school-based ITT and has grown to become the largest University provider within this ITT model**.**

We are the university partner to the National Maths and Physics SCITT and can, therefore, bring experience of establishing a national SCITT to the consortium.

With the Computing Department at the University we are able to assist in developing an innovative curriculum for ITT in Computing.

We will also be able to assist in recruitment through our recruitment partners Premier Pathways.

4b) Open University
Contact: Steve Hutchinson steven.hutchinson@open.ac.uk, Eric Addae-Kyeremeh eric.addae-kyeremeh@open.ac.uk

The Open University is the largest University in the UK and one of the world's largest. For more than 40 years it has been a world leader in the provision of blended learning, and open and distance learning - including now through open education resources (OERs) and Massive Open Online Courses (MOOCs).
The school of Education, Childhood, Youth and Sport houses long-standing expertise in teacher education and leadership and management in education and offers courses for early years providers, teaching assistants, primary school teachers as well as school and College leaders.
The Science Technology Engineering Mathematics (STEM) faculty has extensive experience and expertise in teaching and research and house one of Europe's premier research centres in Planetary, Space and Astronomical Sciences, noted for its work on many space missions such as Rosetta. Also a team of OU materials engineers led the research consortium which built ENGIN-X, the world's first neutron diffractometer optimised for stress testing.
The STEM faculty have well established links with industry and currently involved in the following

- We are developing a range of low-energy, low-carbon systems for domestic and transport use, as part of the MK: Smart project to develop Milton Keynes as a model 'smart city'.
- Our researchers are pushing the boundaries of human-computer interaction by developing a range of wearable interactive technologies, with applications ranging from supporting patient rehabilitation to improving the performance of music students.
- · OU scientists have developed a system to provide real-time monitoring of active volcanoes from space.
- The e2v Centre for Electronic Imaging is a collaborative research centre between the University and e2v, producers of high-performance systems for space exploration. The Centre is creating new electronic imaging equipment for space missions which allows us to see deeper into the universe.

4c) University education and computing research departments and their SCITT partners
The universities listed here have been agreed to play a role in the National Computing SCITT. They have access to the latest knowledge internationally and nationally, and, of specific importance to this proposal, they have regional reach to industries, researchers on pedagogy and computing, SCITTs and schools not in SCITTs.
Bath Spa, Buckingham, Chester, Edgehill, Hull, Kings, Manchester Metropolitan University, Newman, Nottingham Trent University, Open University, Roehampton, Southampton, Sunderland, Wolverhampton, Worcester.

If the DFE was interested in proceeding to support this proposal, the other universities engaged in teacher training will be contacted about engagement and their contribution.

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5) Online service providers

5a) FutureLearn
Contact: Justin Spooner (justin.spooner@futurelearn.com)
FutureLearn is a leading social learning platform formed in December 2012 by The Open University and is now the largest online learning platform in Europe with almost eight million people signed up worldwide. FutureLearn uses design, technology and partnerships to create enjoyable, credible and flexible online courses and postgraduate degrees that improve working lives. FutureLearn's social learning platform encourages interaction between learner groups and is often used for CPD by groups of learners from the same profession. It currently has 40 courses aimed at teachers, and has had over 1m enrolments to courses in its teaching category. Over the whole platform, 23.5% of surveyed learners responded that their area of employment was 'teaching and education'. It partners with over a quarter of the world's top universities, as well as organisations such as Accenture, the British Council, CIPD, Macmillan Education, Raspberry Pi and the National STEM Learning Centre.

5b) Knowledge Hub www.khub.net
Contact Jason Fahy (jason.fahy@khub.net) and Liz Copeland (Liz.Copeland@khub.net)
Knowledge Hub is a digital collaboration and knowledge sharing platform for global public service providing online networking and communities of practice. Knowledge Hub's technology is an enabler for public service organisations to learn from each other, exchange ideas and solutions, and share good practice and innovation. It is UK-hosted, available for secure use over the internet and based on open source software. Originally launched by the Local Government Association for England and Wales in 2012, Knowledge Hub has been an independent small business since 2015, now delivering digital collaboration tools and services to more than 160,000 public servants within 2,500 communities of practice. 5,000 public service organisations are represented from across local and central government, health, emergency services, housing and, of course, education.

Knowledge Hub's digital collaboration service offer to organisations consists of a Digital Network – a branded channel enabling self-management of communities of practice and use of the full range of collaboration tools, such as discussion forums, shared document libraries, blogs, wiki pages, ideas generation, polls, event promotion and communication tools. Knowledge Hub also provides training to support the building, development, monitoring and effective functioning of online communities. Current network clients include: Government Commercial Function, Infrastructure and Projects Authority, Government Communications Service, Local Government Association, Health Education England, National Business Crime Centre. And from the world of education: SSAT, Cambridgeshire County Council education service, Worcestershire County Council education service, Education Futures Collaboration.

5c) MESH (www.meshguides.org)
TPEA is a founder member of MESH, the Mapping Educational Specialist knowhow initiative. MESH is a knowledge management and knowledge mobilisation initiative for the education sector. TPEA has recently invested in research into ways of summarising existing research and making it available to teachers. MESH is a provider of online research summaries linking theory and practice for teachers.

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