Studying the Institute of Physics' continuing professional development programme for Physics Teacher Educators

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Contents

Summary

In 2022, the Institute of Physics (IOP) implemented a programme intended to support experienced physics teacher educators, which includes those who design, lead and coordinate professional development activities, coaches, mentors and initial teacher educators, to further develop their knowledge, skills and expertise.

The IOP wished to gather evidence about the quality and impact of the programme in its first two years of delivery. This evidence will be used to shape the programme as it develops and to gain information to demonstrate its credibility and effectiveness. The IOP commissioned Sheffield Hallam University to support this gathering of evidence through a two-year mixed methods study.

We carried out surveys and interviews with participants. We found that participants typically enjoyed their engagement with the programme. The content and delivery models were generally seen as appropriate and useful. There were some concerns about the communication of the programme's aims and content, the use of varied online platforms and the varied levels of experience and confidence of different participants. The participants felt that the programme's leads were expert and responsive, and that the programme offered flexible routes to participation. They found it beneficial to reflect on their practice, engage with research and learn from other participants.

To improve the programme for future cohorts, we recommend that the IOP considers how to support all participants' engagement in all aspects of the programme, including: maintaining what is working well, such as offering flexible and varied content and opportunities for engagement; improving communications about the programme's aims and structure; simplification of online engagement; providing additional support, structure or guidance for particular programme activities; considering whether and how to group participants with varying levels of experience or different contexts; and maintaining and further supporting the team of expert programme leads and facilitators.

Introduction

The IOP's Physics Teacher Educator programme is intended to support experienced physics teacher educators, which includes those who design, lead and coordinate professional development activities, coaches, mentors and initial teacher educators, to further develop their knowledge, skills and expertise.

The IOP wished to gather evidence about the quality and impact of the programme in its first two years of delivery. This evidence will be used to shape the programme as it develops and to gain information to demonstrate its credibility and effectiveness.

To support this aim, the IOP commissioned Sheffield Hallam University to support this gathering of evidence through a two-year mixed methods study.

This report into the study of the IOP's Physics Teacher Educator programme includes:

- an overview of the programme
- the aims of the study
- our approach to data collection and analysis
- the findings of the study, including:
- a programme theory of change
- participants' roles
- participants' intentions for the programme
- participants' experiences of the programme
- enablers and barriers to engagement in, and positive experiences of, the programme
- a set of programme theories which illustrate how the programme generates to its outcomes
- recommendations for the future development of the programme

We are grateful to the Institute of Physics for funding this study and to the participants and of the IOP's Physics Teacher Educator Programme who gave up their time to participate.

The IOP's Physics Teacher Educator programme: Overview

The IOP's Physics Teacher Educator (PTE) programme aims to better equip physics educators for running meaningful professional development. It considers both pedagogy and knowledge. The programme is intended to extend teacher educators' understanding of physics teacher education, professional development and learning, with the potential to lead to accreditation either as 'badging' or ultimately at MA or similar level.

The programme works through a hybrid approach including a mix of in-person and online sessions over several months. It is guided by five areas of inquiry:

- What does effective professional learning look like?
- Equity, diversity and inclusion in the context of physics teacher education.
- What knowledge do teachers of physics and their educators need?
- Which design features underpin effective professional learning and practice development?
- Evaluation and evidence of professional learning.

In response to early findings from the study of Year 1 participants, IOP made some minor changes to the programme's structure and content for its second year.

Aims of the study

In order to gain understanding of the IOP's Physics Teacher Educator (PTE) programme, we investigated, over the first two years of the programme's implementation:

- IOP colleagues' intentions for the programme
- participants' intentions for engagement in the programme
- participants' engagement in the programme, including enablers and barriers to this
- changes in participants' knowledge, confidence and understanding of key issues relating to physics teacher professional development
- areas of the programme which are working well, and which could be improved

The research questions which framed this study were:

- What are the intentions and goals of IOP colleagues in designing and delivering the PTE programme?
- What are the motivations and intentions of participants for engaging with the PTE programme?
- What factors (enablers and barriers) influence participants' engagement in the programme?
- How does participation in the programme impact participants' knowledge, confidence, and understanding of key issues related to physics teaching and professional development?
- Which aspects of the programme are perceived to be successful, and what areas could be improved to better support participants' needs and objectives?

Our approach

We used mixed methods, including focus groups, surveys and interviews, to collect data from participants in the first two years of the programme (Table 1).

Data collection	Purpose	Timing
Focus group with programme leads	To understand the programme's structure and intentions, including the creation of a theory of change.	Year 1
Participants' initial survey	To gather initial information about participants' intentions for joining the programme.	Years 1 and 2
Participant interview	To explore the impact of the programme on their knowledge, confidence, and teaching practices, and identify enablers, barriers, and areas for improvement.	Years 1 and 2
End of programme survey	To assess changes in participants' knowledge, skills, and confidence, and explore their learning intentions and engagement with other professional development activities.	Years 1 and 2

Table 1. Data collection

We used established protocols for data analysis, including:

- descriptive statistics from survey data
- recording, using secure methods, of online interviews and focus groups
- transcription of interviews and focus groups
- thematic analysis of interviews and focus groups using the research questions as a framework for analysis
- discussion between researchers to check emerging findings and refine emerging themes as they developed from the research questions
- comparison of emerging findings from Year 1 and Year 2
- development of a set of programme theories to describe the ways in which the programme is achieving its aims and the enablers and barriers to this

The study followed Sheffield Hallam University's ethics protocols, including:

- approval by the university ethics committee (application number ER45812838)
- participant information sheets and privacy notices
- informed consent gained by all participants at each stage of data collection, including the right to withdraw
- anonymity for all participants in their contributions
- data stored on secure, password protected university servers, only accessible by the project team and university administrators.

Logic model

To develop a logic model for the programme (Figure 1), we:

- held a focus group discussion with the PTE programme leads at IOP
- reviewed PTE programme documentation
- drafted a logic model to show the programme's intended outcomes, its inputs, including resources and activities, and its contexts: the factors which support or hinder achievement of the intended outcomes
- refined the draft logic model following feedback from programme leads at IOP
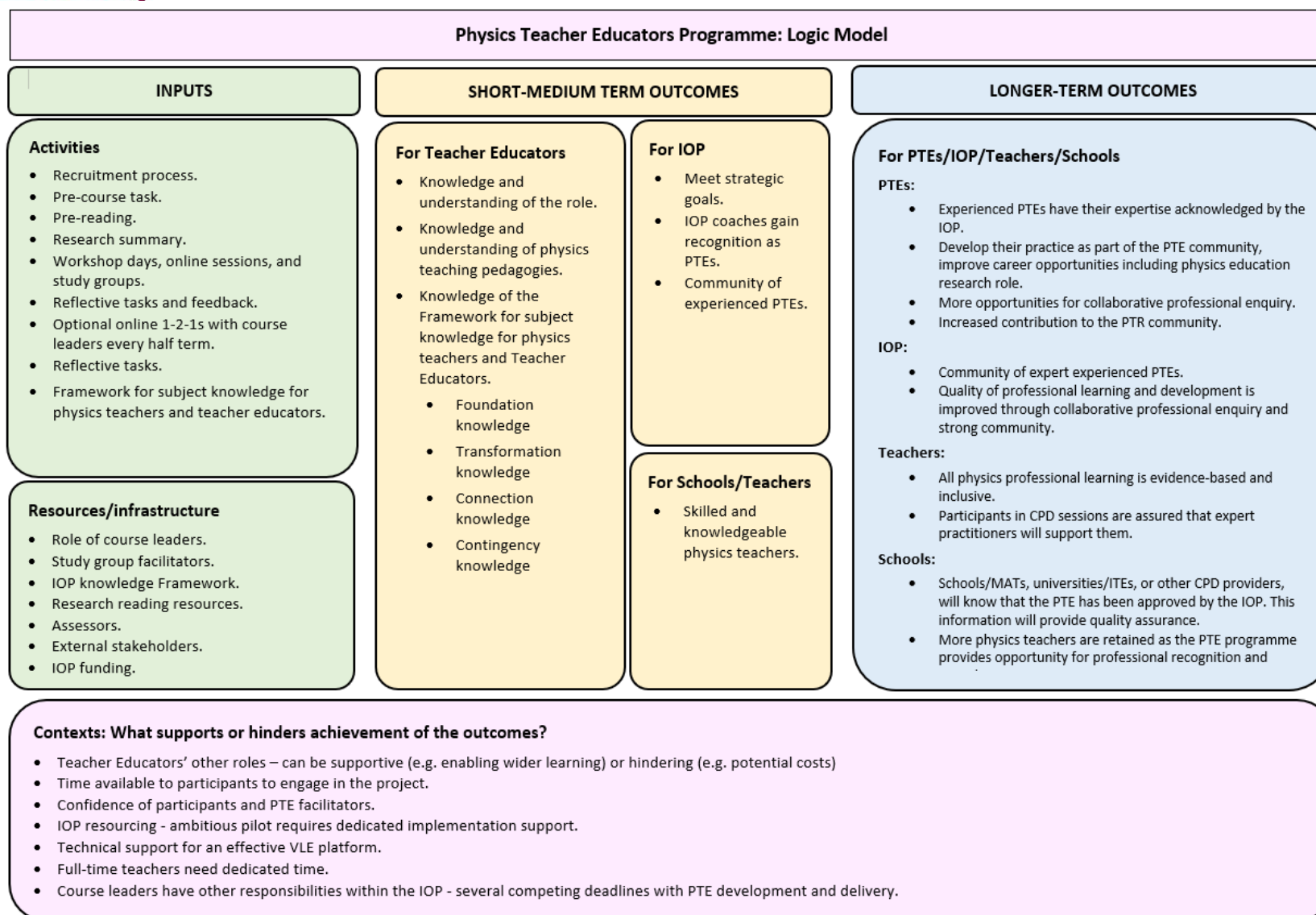
Physics Teacher Educators Programme: Logic Model

INPUTS	SHORT-MEDIUM TERM OUTCOMES		LONGER-TERM OUTCOMES

Activities

- Recruitment process.
- Pre-course task.
- Pre-reading.
- Research summary.
- Workshop days, online sessions, and study groups.
- Reflective tasks and feedback.
- Optional online 1-2-1s with course leaders every half term.
- Reflective tasks.
- Framework for subject knowledge for physics teachers and teacher educators.

Resources/infrastructure

- Role of course leaders.
- Study group facilitators.
- IOP knowledge Framework.
- Research reading resources.
- Assessors.
- External stakeholders.
- IOP funding.

For Teacher Educators

- Knowledge and understanding of the role.
- Knowledge and understanding of physics teaching pedagogies.
- Knowledge of the Framework for subject knowledge for physics teachers and Teacher Educators.
  - Foundation knowledge
  - Transformation knowledge
  - Connection knowledge
  - Contingency knowledge

For IOP

- Meet strategic goals.
- IOP coaches gain recognition as PTEs.
- Community of experienced PTEs.

For Schools/Teachers

- Skilled and knowledgeable physics teachers.

For PTEs/IOP/Teachers/Schools

PTEs:

- Experienced PTEs have their expertise acknowledged by the IOP.
- Develop their practice as part of the PTE community, improve career opportunities including physics education research role.
- More opportunities for collaborative professional enquiry.
- Increased contribution to the PTR community.

IOP:

- Community of expert experienced PTEs.
- Quality of professional learning and development is improved through collaborative professional enquiry and strong community.

Teachers:

- All physics professional learning is evidence-based and inclusive.
- Participants in CPD sessions are assured that expert practitioners will support them.

Schools:

- Schools/MATs, universities/ITEs, or other CPD providers, will know that the PTE has been approved by the IOP. This information will provide quality assurance.
- More physics teachers are retained as the PTE programme provides opportunity for professional recognition and .

Contexts: What supports or hinders achievement of the outcomes?

- Teacher Educators' other roles – can be supportive (e.g. enabling wider learning) or hindering (e.g. potential costs)
- Time available to participants to engage in the project.
- Confidence of participants and PTE facilitators.
- IOP resourcing - ambitious pilot requires dedicated implementation support.
- Technical support for an effective VLE platform.
- Full-time teachers need dedicated time.
- Course leaders have other responsibilities within the IOP - several competing deadlines with PTE development and delivery.

Figure 1. Physics Teacher Educator programme logic model

Participants

As mentioned above, participants were drawn from the first two years of the programme (Table 2). The start of programme survey gathered information about participants' intentions of the programme and requested, optionally, their availability for interview. All participants who were interviewed completed the start of programme survey.

	Year 1 participants	Year 2 participants
Start of programme survey	16	16
Interviews	8	8
End of programme survey	14	20

Table 2. Participant numbers

Participants' professional roles and contexts were quite varied (Table 3).

Participants' roles spanned the breadth of teacher education	Some participants worked in initial teacher education, some in professional development, some in both
Participants held varying multiple roles	Most participants worked in multiple roles, e.g. freelance work and working for organisations; many participants combined roles with classroom teaching and/or middle leadership
More participants had a role in school in Year 2 than Year 1	In Year 2 70% of participants stated they had a role as classroom teacher and 45% as middle leader, in combination with other roles; in Year 1 42% and 21%
Participants were mostly from England	Participants were from regions across England; a few worked in Wales and Scotland
A few Year 1 participants were IOP employees or associates	In Year 1 only we surveyed and interviewed some participants who also had a role in programme delivery as "study group facilitators"

Table 3. Information about participants

Findings

Participants' overall experiences of the programme

Participants' experiences of the PTE programme were positive. In general, they appreciated:

- being part of a community of people with similar roles
- the programme focus on teacher education rather than teaching
- the skills and expertise of the facilitators
- the varied, flexible delivery model of the programme, with a mixture of in-person and online sessions, and/or group and individual activities

Participants wanted to support the development of something which they felt was beneficial for the system and were sympathetic to the programme being a pilot. They recognised the complexity of offering a programme for teacher educators rather than teachers. Overall, participants enjoyed the delivery model with varied opportunities for engagement, although they expressed some concerns about programme communication, both in terms of operations (e.g. online platforms) and logistics, and the intentions of different parts of the programme.

Several participants expressed concerns about programme organisation and communication. These were addressed both during the programme in Year 1 and in planning for Year 2, although some participants still felt that more clarity was needed over the programme's structure and content. In Year 2, some participants experienced difficulties allocating time for the programme within their working schedules.

> *Year 1 participant: It's been a very supportive environment, and also when it's been recognised that things haven't gone well within the admin or the logistics, then there has been adjustments made to timescales or expectations. So I think that there has been a very listening ear to how it's going, especially considering it's a pilot.*

> *Year 2 participant: I think that some of the communication to start with might have been a bit clearer, but again it's that teething problems of anything new, of knowing what it is ... I think that it's clarity of what the outcomes could be. The problem is though … there isn't a clear outcome. At the end of the day it's about doing some research, metacognitive, thinking about your own process. So for everyone the outcome would be slightly different and some people find that very, very difficult to understand really.*

Where experiences varied from Year 1 to Year 2 (Table 4), these often came about because of changes made to the programme as a result of feedback.

In the sections which follow, we provide more detail from each strand of data collection, presenting findings from Year 1 and 2 together and highlighting differences only where they were significant.

	Year 1					Year 2				
	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
The programme met my expectations	-	-	14%	57%	29%	-	5%	20%	50%	25%
I enjoyed the programme	-	7%	-	50%	43%	-	-	15%	55%	30%
I am glad I participated in the programme	-	-	7%	29%	64%	-	-	10%	40%	50%
This programme provided opportunities for learning I can't get elsewhere	-	14%	-	36%	50%	-	-	10%	55%	35%
I would recommend the programme to other people in similar roles	-	-	14%	29%	57%	-	5%	5%	45%	45%
The IOP should continue to offer this programme for future cohorts	-	-	7%	43%	50%	5%	-	5%	30%	60%

Table 4. Participants' overall experiences of the programme

[1] This question is from the end-of programme survey. It was answered by 14 participants in Year 1 and 20 in Year 2.

Participants' intentions for the programme

We asked about participants' intentions for the PTE programme in each strand of data collection. Overall, we found that many participants wanted to:

- engage with research and theory relating to their practice
- reflect on their practice
- build connections and collaborate with other physics teacher educators

While there were no major differences between Year 1 and Year 2 participants, participants in Year 2, there appears to be slightly less positivity about participating in the programme, and a shift away from the IOP's aims for the programme.

Participants' intentions in relation to the IOP's areas of inquiry

In the start-of-programme survey, we asked participants to consider the importance of the IOP's five areas of inquiry for the programme (see above) for their participation in the study. All the themes were seen as important (very or fairly) by most or many of the participants in both years (Table 5). The most important for participants appeared to be: Which design features underpin effective professional learning and practice development. The least important themes in both years were equity, diversity and inclusion, and evaluation.

Overall, the IOP's five themes appeared to be less important for the intentions of the Year 2 participants than the Year 1 participants (Table 6).

	Year 1	Year 2
Which design features underpin effective professional learning and practice development?	46%	43%
What knowledge do teachers of physics and their educators need?	31%	29%
What does effective professional learning look like?	15%	21%
Evaluation and evidence of professional learning	8%	0%
Equity, diversity and inclusion in the context of physics teacher education	0%	7%

Table 6. Participants' intentions – the most important of the IOP's areas of inquiry[2]

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[2] This question ('Overall, which theme is most important to you in relation to your participation in the programme?') is from the start-of-programme survey. It was answered by 13 participants in Year 1 and 14 in Year 2.

	Year 1				Year 2			
	Very important	Fairly important	Slightly important	Not important	Very important	Fairly important	Slightly important	Not important
What does effective professional learning look like?	69%	31%	-	-	50%	43%	7%	-
What knowledge do teachers of physics and their educators need?	77%	23%	-	-	64%	36%	-	-
Which design features underpin effective professional learning and practice development?	54%	46%	-	-	50%	29%	21%	-
Equity, diversity and inclusion in the context of physics teacher education	62%	23%	8%	8%	29%	50%	21%	-
Evaluation and evidence of professional learning	54%	46%	-	-	36%	50%	7%	7%

Table 5. Participants' intentions for the programme[3]

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[3] This question is from the start-of-programme survey. It was answered by 13 participants in Year 1 and 14 in Year 2.

Participants' other intentions for joining the programme

Participants identified various other reasons for taking part, including engaging with research and improving their careers (Table 7). Several mentioned the potential value of engaging in networks of other physics teacher educators, which reflects findings from previous studies (e.g. Perry et al., 2022) identifying the importance of providing these opportunities for those engaged in initial teacher education and professional development.

Year 1	Year 2
To be more heavily involved in academic research	Network/community
The impetus to engage more with PER [physics education rese arch] and also the chance to meet with members of the physics supporting community	Recognition, resources
	Be able to design better SK training
An opportunity to discuss professional learning and development with peers	Ideas to help teachers make physics teaching transformative - enjoyable, memorable and more significant to their students
Sharing of best practice with other PTEs	Understanding of what makes effective subject specific CPD to help canvas for better provision from employers
Opportunity to work collaboratively in a valuable ITE project with other participants, a nudge to keep going and do CPhys [Chartered Physicist] paperwork once the programme is finished	An opportunity to network and collaborate with peers for the betterment of Physics teaching
	Opportunities to network
	More awareness of my own practice

Table 7. Participants' intentions: reasons for joining the programme

Participants' intentions for the programme: looking back

In the end-of-programme survey and interviews, we asked what participants had hoped for in joining the PTE programme.

From the end-of-programme survey, the major themes were similar for both sets of participants: collaboration, engaging with research, reflection on practice (Table 8). Overall, the Year 2 participants appear somewhat less enthusiastic about participation. However, other responses both in this survey and in other strands of data collection offer no further insights into this finding.

	Year 1						Year 2					
	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	N/A	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	N/A
I was confident the IOP's Physics Teacher Educator programme would enable me to develop my practice	-	-	21%	29%	50%	-	-	-	5%	55%	40%	-
I wanted to collaborate with people in similar roles	-	-	-	21%	79%	-	-	-	20%	20%	60%	-
I wanted to engage with research and theory relating to my role	-	-	-	7%	93%	-	-	-	15%	30%	55%	-
I wanted to reflect on my practice	-	-	7%	7%	85%	-	-	-	-	50%	50%	-
I wanted to build a closer relationship with the IOP	-	7%	7%	35%	21%	29%	-	5%	20%	35%	40%	-

Table 8. Participants' intentions for the programme[4]

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[44] This question ('What did you hope for in joining the programme?') is from the end-of programme survey. It was answered by 14 participants in Year 1 and 20 in Year 2.

In interviews, participants' reasons for joining the programme were broadly similar to those identified elsewhere. Participants' reasons included:

- improving practice as a teacher educator and/or professional development leader
- engaging with research and theory about physics education and professional development
- building connections with other teacher educators

> *Year 2 participant: For me it's about the journey rather than the destination. What I mean by that is that it's the opportunity to network with other colleagues, look at the latest thinking and research in terms of teacher education, and collaboration working with other colleagues at the same sort of level really. That's what I want to get out of it. If there is certification at the end of it that's nice, but it's just the journey of working with other people really, and now I've started embarking on it, it's an opportunity to focus on one or two things that I want to develop in my own practice.*

Several participants identified other professional development they had engaged in previously, including working with the IOP and other organisations, accreditation through organisations such as STEM Learning and NCETM, and (in Year 2) specialist NPQs.

There were no significant differences between Year 1 and Year 2 participants.

Impacts on participants' learning and practice

We asked about the impacts of the programme on participants' learning and their practice in interviews and in the end-of-programme survey. We also explored whether participants' learning aligned with the IOP's five areas of inquiry for the PTE programme (see above).

Broadly, participants' learning can be categorised into:

- learning from and about current research
- reflecting on, adapting and updating approaches to supporting teachers
- learning from and about other participants' practice

Participants' learning broadly aligned with the IOP's areas of inquiry, although responses specifically relating to these were quite variable, especially in Year 2.

In addition to the learning described above, participants reported feeling more confident, and more connected to other people in similar roles and to the IOP.

Participants' learning: IOP areas of inquiry

Participants were asked what they had learned about during the PTE programme in the end-of-programme survey. Most participants in both years felt that they had learned something relating to the IOP's five areas of inquiry (Table 9). In Year 1 learning relating to the five areas appeared fairly consistent but was more varied for Year 2. Participants' response relating to equity, diversity and inclusion changed quite significantly from Year 1 to Year 2.

I have learned about...	Year 1						Year 2					
	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	N/A	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	N/A
what effective professional development looks like	-	-	7%	50%	43%	-	-	5%	15%	65%	15%	-
the knowledge that teachers of physics and their educators need	-	-	7%	50%	43%	-	-	5%	10%	55%	30%	-
the design features which underpin effective professional learning and practice development in physics	-	-	14%	50%	36%	-	-	5%	25%	45%	25%	-
equity, diversity and inclusion in the context of physics teacher education	-	-	14%	50%	29%	7%	-	10%	-	70%	20%	-
about evaluation and evidence of professional learning in physics	-	-	14%	50%	36%	-	-	10%	15%	60%	15%	-
other aspects of my practice	-	-	7%	57%	36%	-	-	-	25%	50%	15%	10%

Table 9. Participants' learning from the programme[5]

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[5] This question is from the end-of programme survey. It was answered by 14 participants in Year 1 and 20 in Year 2.

Similarly, in interviews participants broadly felt that their learning aligned with the IOP's five themes.

Focussing on equality, diversity and inclusion, participants appeared to have varied views about how well this was dealt with in the programme, as they did in the end-of-programme survey. Some took this as the focus for their inquiry-based activities, others identified different IOP professional learning activities in which this had been a focus, and one or two felt that the focus had not been explicit or strong enough.

> *Year 1 participant: [In my school] I am constantly battling the public perception of physics being for males only and so it's already quite high on our agenda, but I am also now looking even more so after this training at it's not just the male/female split but how do we make sure that everybody is included and feels that physics is for them. So thinking about the language that we're using in questions, the displays that we have, the message that we're sending out in assemblies, the careers information and so on.*

> *Year 2 participant: I think that if you're looking at [the programme] through an EDI lens you could say, 'Oh well yeah, that would be, that would be and that would be', but I think that if you're not coming at it with that perspective then I think you could just not see it. And so again I suppose for me I would like to see that surfaced and made more explicit.*

Participants' learning: other areas

In interviews, participants identified learning from the PTE programme relating to the following main themes:

- learning from and about current research
- reflecting on, adapting and updating approaches to supporting teachers
- learning from and about other participants' practice

A few participants mentioned the IOP's framework, suggesting that this offered a useful structure for thinking about their practice.

> *Year 1 participant: I think the way that the framework is broken down in to sort of different sorts of knowledge – I think that is really thought-provoking ... A lot of the reading and discussion has prompted me to sort of step away from the immediate problems that we're troubleshooting when we work with other colleagues and take a slightly more longer term view of how to build confidence and improve the quality of what people are able to do with their students and their physics, and that I think is rooted in the framework.*

> *Year 2 participant: It has helped me update on latest thinking about – from educational research which therefore impacts on my thinking of how I work. So the big thing I would say at the moment is pedagogy and andragogy and that it's slightly different than teaching. You know, teaching children and young people is different from teaching adults, so it's making me think about how do I develop, modify courses, work I do with adults, to make it more affective? So it's made me think in those terms.*

Although naturally all participants' learning is situated in the context of physics, there was only occasional specific mention by the participants of physics-related learning.

Participants' practice

In interviews, participants were asked what had changed as a result of participation in the PTE programme. Most participants in both years felt that they were more confident and had changed their practice (Table 10). Given participants' stated importance of relationship-building with other teacher educators, it is positive that most (though not all) felt they had become more connected.

When we held interviews the programme was still ongoing, so we did not gain much further information about changes to participants' practice. Where participants mentioned this, their comments largely reflected their learning: reflection on practice, using ideas from research or from other participants to enhance or adapt their approaches to working with teachers.

As a result of participation in the programme...	Year 1						Year 2				
	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	N/A	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
I am more confident in my role	-	-	29%	43%	29%	-	-	10%	25%	45%	20%
I have changed my practice	-	14%	14%	36%	36%	-	-	5%	25%	50%	20%
I have a better understanding of physics pedagogy	-	7%	7%	50%	36%	-	-	15%	15%	40%	30%
I feel more connected to people in similar roles	-	7%	14%	43%	36%	-	-	10%	15%	50%	25%
I feel more connected to the IOP	-	14%	21%	14%	36%	14%	5%	-	15%	65%	15%
I have shared learning with colleagues or others	-	14%	-	29%	57%	-	-	-	20%	35%	45%
I have identified new opportunities in my professional role(s) (Year 2 only)							-	5%	25%	40%	30%

Table 10. Changes in participants' practice[6]

[6] This question is from the end-of programme survey. It was answered by 14 participants in Year 1 and 20 in Year 2.

Enablers and barriers

We asked about the enablers and barriers to engagement and participation in the Physics Teacher Educator programme in interviews and the end-of-programme survey. We focussed on features of the programme including its organisation and communication, its content and delivery model.

Summarising findings from the interviews and survey, in terms of programme organisation and communication, participants appreciated the variety of ways to engage and the flexibility within the programme. However, they found some of the communication about the programme's aims and structures unclear and were challenged by the variety of online platforms.

In terms of the content and delivery model participants felt that the programme leads were skilful and responsive and enjoyed the variety of content and inputs to the programme. They appreciated being able to speak to people in similar roles, but felt that some online activities might be limited by different people's levels of experience, and conversations between participants focussed on teaching rather than teaching/supporting teachers. As with any programme of this type and for this group of participants, a busy workload outside the programme was a hindrance to engagement.

From Year 1 to Year 2, there was little difference between responses, beyond those that would be expected as a result of changes to the programme made by the IOP programme leads.

Programme organisation and communications

In the end-of-programme survey, participants expressed some concerns about the programme's organisation and communication in Year 1 (Table 11). Programme leads were aware of these issues and took steps to address them, leading to more positive responses overall from Year 2 participants. For both sets of participants, the online platform was not particularly well-received.

	Year 1					Year 2				
	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
The programme was well-organised	-	7%	21%	64%	7%	-	5%	15%	55%	25%
The programme's aims were communicated clearly	-	7%	29%	57%	7%	-	-	20%	50%	30%
The programme's structure was communicated clearly	-	7%	50%	36%	7%	-	5%	5%	60%	30%
The IOP's expectations of my participation were communicated clearly	-	7%	50%	21%	21%	-	5%	15%	50%	30%
The online platform was useful	14%	21%	21%	43%	-	-	-	45%	35%	20%
The programme handbook was useful	-	-	14%	71%	14%	-	-	15%	55%	30%
The programme's intended outcomes were communicated clearly (Year 2 only)						-	-	20%	50%	30%
The purpose of the programme's activities was communicated clearly (Year 2 only)						-	10%	10%	55%	25%

Table 11. Programme organisation and communications[7]

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[7] This question is from the end-of programme survey. It was answered by 14 participants in Year 1 and 20 in Year 2.

In interviews, participants appreciated:

- the flexibility within the programme, such as offering multiple options for online sessions
- the variety of different modes of engagement with the programme, including in-person and online sessions, reading and inquiry projects
- regular contact with the programme leads, including reminders about sessions and tasks

> *Year 1 participant: The leaders of the programme have made themselves available for one-to-one meetings and they are in regular contact with everyone, so if anybody is unsure or worries about progress and what to do, then they have this opportunity to have a one-to-one chat.*

> *Year 2 participant: I was sent an email yesterday nagging me saying 'Have you done this?' and I was like 'Ugh, I need to do this!', so I suppose that's a really good element of it, that they can be a big naggy, but in the right way, because again when you have got like a dozen balls in the air this isn't necessarily the highest priority, so they can be a big naggy but in a nice way.*

> *Year 2 participant: They have been really flexible, with the deadlines as well. Even though they have got the online sessions, they are more than one time and they are more than one day's available, so they have given an opportunity for us to pick and choose what suits us the most. So that is really good.*

Participants' engagement in the PTE programme was sometimes hindered by:

- the variety of online platforms being used for programme delivery, sharing information with participants and online collaboration
- a lack of clarity in communication about the programme, such as how different parts of the programme interacted with each other

> *Year 1 participant: We had quite a few challenges with the technology and we tried different platforms for where to store the content, where to upload our assignments, and it worked for some people and it didn't work for others, so there was a lot of trial and error and we ended up across multiple platforms which confused quite a lot of people, including myself – especially myself probably, so I was kind of thinking, "okay, where am I supposed to put stuff and where is the stuff I am supposed to look at?"*

> *Year 1 participant: Just make it as simple as possible. We are all busy people and if you are – I don't want to waste my time. I want to spend time on the PTE stuff, I don't want to spend time skirting about with 'What was my login? Where was it on the page, do I have to go in the shared files? Was it my name, or was it shared?' it got me close to just giving up at the start, in the first few weeks, because I just thought this is just too much effort for the outcome that I'm getting.*

> *Year 2 participant: I think again it was this inquiry cycle thing was coming up and I didn't really know what it was that I was meant to be doing. We all had busy jobs, I was feeling a bit overwhelmed with work anyway and … into something else where I didn't really know what was being asked and it felt a bit much.*

Programme organisation and communications

As mentioned above, participants were largely positive about the programme content and its delivery model. In terms of content, while most participants felt it was appropriate (Table 12), a few in both years expressed some negativity about the balance of physics to generic content, although, from the survey, we have no information about whether this meant too much or too little physics. In terms of delivery, in Year 2 more than Year 1, there was some negativity about the frequency and timing of the sessions.

Participants' engagement in the PTE programme was supported by:

- the knowledge and skills of the programme leads, who were responsive to participants' needs
- the variety of content and inputs within the programme, including the programme handbook, framework and the research shared
- being able to share ideas with people in similar roles across the country

> *Year 1 participant: I think the fact that [leader] has offered one-to-one sessions for people, so just short catch up and directing and shaping, I think that has been really, really, really helpful. Yes, and I think that the design of the course as a whole thing, the way that it's the mixture of reading, things to do on your own, and then reflect on and then sort of the online meetings, I think that works really well.*

> *Year 2 participant: I've got the research from the handbook and from the research, from the PTE programme, which is here. And I think that is quite good ... somebody has kind of quality assured the research, which is being linked through the handbook, so they know that is quite a good piece of research ... They are not long articles. They are shortish articles, which is important, because we aren't, as teachers we are not academic researchers, and we don't have the time to sit and go through all of these pieces of research.*

	Year 1					Year 2					
	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	N/A
The programme content was appropriate	-	-	7%	29%	64%	-	-	15%	50%	35%	-
The balance of physics-specific content to generic content was appropriate	7%	-	29%	36%	29%	5%	5%	5%	45%	40%	-
The timings of the sessions worked well for me	-	7%	21%	50%	21%	-	15%	20%	50%	15%	-
The frequency of the sessions worked well for me	-	-	14%	79%	7%	-	5%	35%	45%	15%	-
The study group (Year 1)/group (Year 2) sessions were useful	-	7%	14%	36%	43%	-	-	20%	45%	35%	-
The assessment (Year 1)/reflective (Year 2) tasks were useful	-	-	14%	50%	36%	-	-	20%	55%	25%	-
The coaching sessions were useful (Year 2 only)						-	-	5%	50%	40%	5%
The framework was useful (Year 2 only)						10%	5%	5%	55%	25%	-

Table 12. Participants' views of the Physics Teacher Educator programme content and delivery[8]

[8] This question is from the end-of programme survey. It was answered by 14 participants in Year 1 and 20 in Year 2.

Participants' engagement in the PTE programme was hindered by:

- their own busy workloads outside the programme
- a tendency of participants to focus their conversations on teaching rather than teaching/supporting teachers
- some participants' prior experiences, for example in working with the IOP, and their confidence in engaging in discussions

> *Year 2 participant: I think [breakout rooms] would be improved if one of the members of the breakout room had been given a pre-task or a pre-instruction as to how to leave the breakout room, because that's when the people just sit there and kind of go 'I'm not talking first, I don't want to talk first' and so on. And it can go off. It can be very waffly. But if one person was appointed to lead each of the breakout rooms then I think that would be more effective, to keep the session focused.*

> *Year 2 participant: We've had a few kind of hour sessions or so online. I found those less useful ... they tend to be how you would teach something rather than how you would train teachers to teach something ... I think the problem with the online sessions is that they tend to be quite large and I think that there is a lot of people who feel – how can I put it? I think perhaps they've got imposter syndrome. They don't feel confident in saying something publicly in case it's wrong, because they're not sure that they've got the right experience to be there and actually talking and making an opinion in front of experienced physics teachers about something to do with physics education ... I think that there needs to be a bit of a process to make people a little bit more comfortable with saying something, and so on, and contributing.*

Limitations of the study

This was a small-scale study focussed on the IOP's Physics Teacher Educator (PTE) programme.

Given the numbers of participants in the PTE programme, we did not attempt to gain statistical representation in our sample for data collection, instead simply asking for volunteers from the two cohorts. It is possible, therefore, that participants chose to engage in data collection because they had strong views (positive or negative) of the programme which they wished to share.

Because of the small scale of the study, we did not attempt to match types of participants (e.g. by role, experience or other engagement with the IOP) to compare responses either within or between the two cohorts. Therefore we draw no conclusions about participants' varying backgrounds or roles in relation to their experiences of the programme.

Overall, although we cannot be certain, the consistency of responses within and across the two cohorts of participants suggests that these responses are likely to represent those of the whole group of participants.

Discussion: Initial Programme Theories

In our findings we have presented the outcomes of the programmes and the enablers and barriers to achieving these outcomes. Building from this analysis we developed a set of initial programme theories. This realist approach (Shearn et al, 2017) is intended to identify how the programme leads to its outcomes, positive and negative (Pawson, 2013).

In this section, we present these initial programme theories. They are:

- based upon our small sample of participants
- supported by participant quotes from interviews
- not explicitly related to specific wider research on professional development
- related to positive outcomes and challenges for participants' engagement
- intended to provide insights as a starting point for consideration and further development, in combination with IOP programme leads' own experiences of the programme.

Programme theory 1: Facilitators – relationships

When participants are working in unstable schools/contexts that are subject to changes in professional demands during the lifetime of the project then strong relationships with facilitators support them to continue engaging, despite increasing outside pressure, because they are motivated to present their best self.

> *Year 2 participant: You don't want to let people down, so ultimately you are more likely to meet a deadline for someone else than you are for yourself, […] you're working for yourself but because a you have these people that are leading and you respect, I think that you're more likely to meet those deadlines and continue with the programme.*

> *Year 2 participant: It's a bit like I sometimes think, it's a bit like having people come to your home. Having people come to my home makes me tidy up and get very organised. It's something I want to do anyway but it makes life better for me.*

> *Year 2 participant: When you have got like a dozen balls in the air this isn't necessarily the highest priority, so they can be a big naggy but in a nice way.*

Programme theory 2: Facilitators – experience

If participants that are newer to leading professional development are supported by experienced mentors and coaches, who can respond quickly to the needs of the group, then they develop professionally in line with the programme aims because they experience increased confidence and clarity in their thinking about their own learning.

> *Year 1 participant: I think that [facilitated group discussions] are a really good thing to do with more experienced mentors and coaches because they will have certain things that they are working on at a certain time but the discussion in itself helps people to think more clearly about their own project as well as perhaps helping others a little bit.*

> *Year 2 participant: The people leading it are very experienced practitioners, very experienced and very enthusiastic as well about what they're doing and what the aim*

of this is and they are very knowledgeable, and I think that those are really important attributes to it.

Programme theory 3: Facilitators – communication

If participants are busy professionals, with many other additional roles and responsibilities, then they may struggle to remember and act on the commitments of the programme, even where they have been provided with a detailed handbook, because they require a high degree of verbal signposting and reminder communications, and so are confused about the programme intentions, and unclear of how it may benefit them.

> *Year 1 participant: I haven't always had the clearest overview of exactly what I needed to do, where, and by when, and what the end result would be.*

> *Year 2 participant: Just that explanation of how it all connects together. It almost wouldn't need an awful lot I don't think.   And then I suppose it's reiterating that at points – because with the best will in the world, we read things and then six months later on I'm like, 'What do you mean the deadline's next week? What is it you want me to do?*

> *Year 2 participant: I suppose there is also something about if you do an extra thing on top of everything else, there needs to be some clear 'what was I getting out of it?'*

Programme theory 4: Facilitators – responsiveness and flexibility

If participants who are more experienced professional development leaders have the opportunity to communicate frequently, and at their own pace with responsive, knowledgeable programme facilitators, then they engage with the programme because they can make the work for them and ask questions as they arise and so gain confidence in their own abilities.

> *Year 1 participant: I just said, 'I'm stuck, I've sent the email, I'm stuck with this, am I on the right lines?' and they got back to me in a very timely manner and said either, 'yes, you're doing exactly right' ... 'Yes, but it would be even better if you thought about this and that' and gave me some constructive feedback. 'Yes', that I can do action research within my setting with a small sample and it can still be valid. Often as a scientist you think that you need a very large data set and, 'Well I don't have a control group, I don't have a group of similar teachers who aren't doing these sessions, how can I possibly look at the impact?'*

Programme theories 5a and 5b: Resources – framework

Here, we see that the same programme resource, the knowledge framework, is experienced differently by participants with different personal contexts.

If participants that have academic expertise and are confident with research terminology are provided with an academically grounded framework, then they engage with the programme intentions and resources because they respect the strength of the programme's academic foundation.

> *Year 1 participant: I think that the framework is really useful as kind of an academic document, which supports then the development of what we do in the classroom.*

By contrast, if participants that have limited academic expertise and are not confident with research terminology are provided with an academically grounded framework, then they disengage with the programme intentions and resources because they experience the methodological language as a barrier and become confused about the programme content.

> *Year 1 participant: I don't have the same familiarity with the knowledge framework that other people might have and I find it quite a difficult thing to get one's head around.*

> *Year 2 participant: The knowledge framework. That is kind of useful, but I'm really not keen on the language of the research around education, so that is one of my barriers.*

Programme theory 6a and 6b: Group working – collaboration

If participants who enjoy sharing professional experiences are part of a group that is given time to talk freely in breakout rooms, then they develop their understanding of the programme content because they feel supported by their peers and learn from each other's experiences.

> *Year 1 participant: I know I said [the group sessions] were an unexpected time resource, but I have found those to be the most useful bit because although we may have had one theme that the organisers wanted to talk about, going into breakout rooms and being able to speak to the other people about their projects really helped me to recognise that my project was appropriate.*

By contrast, if participants who are less experienced and/or socially-minded are part of a group that is given time to talk freely about their projects in breakout rooms, then they may be less satisfied with the group learning structure because they feel out of their comfort zone and experience the informal discussion as unproductive talk.

Programme theory 7: Group working – content

When participants that are less experienced in physics teacher education work collaboratively with other participants, then they may not engage with the intentions of the programme, because they become confused without direct instruction on talking points, and so their discussions turn to physics pedagogy rather than moving on to physics teacher education pedagogy.

> *Year 2 participant: They tend to be how you would teach something rather than how you would train teachers to teach something. So that is the difference between those two, because, if you get a group of physics teachers together, they will talk about how they would best teach such and such but that's not what we're doing.*

Recommendations

Drawing together our findings and programme theories, we present some recommendations for IOP to consider as the PTE programme moves into its next stages:

- Consider whether and how the programme theory of change reflects all participants' experiences, and therefore whether different participants, due to their different contexts, background and dispositions, may benefit from different approaches to engagement.
- Provide information to participants at the start of the programme, and reminders throughout, of expectations and content, and how different parts of the programme are intended to work together.
- Although participants' familiarity with online platforms is likely to carry on increasing, simplify the use of these so that participants need to engage only one or two different platforms and can find information easily.
- Consider whether or how to group participants, and/or manage group-based activities, so that all participants feel able to contribute, and that discussions focus on teacher education rather than teaching.
- Offer increased guidance for the inquiry project, to clarify its alignment with the overall aims of the programme and its coherence with the rest of the programme.
- Ensure that all participants are supported to engage with academic and research-focussed language used in resources and activities such as the framework, research summaries and the inquiry project.
- Programme leads and facilitators play essential roles in the programme's success. If new facilitators are brought in, ensure they bring the same depth of experience and expertise.

Concluding comments

In this two-year mixed methods study, we investigated participants' experiences of the IOP's physics teacher educator programme. Through focus groups, surveys and interviews, we developed a programme logic model, identified the benefits and challenges of participation, and devised a set of initial programme theories. Each of these is intended to help the IOP in the further development of the programme.

We found that participants generally had positive experiences of the programme. They were supported to engage through a range of activities, flexible approaches to engagement and experienced, responsive facilitators and programme leads. Where participants were less positive, this related to communication about the programme, the use of online platforms and the different experiences and approaches of participants in group-based activities.

To improve the programme for future cohorts, IOP might consider how to support all participants' engagement in all aspects of the programme, including: maintaining what is working well, such as offering flexible and varied content and opportunities for engagement; improving communications about the programme's aims and structure; simplification of online engagement; providing additional support, structure or guidance for particular programme activities; considering whether and how to group participants with varying levels of experience or different contexts; and maintaining and further supporting the team of expert programme leads and facilitators.

Appendices

Appendix 1. Participant information sheet and privacy notice

Participant Information Sheet

About the project

Staff of Sheffield Institute of Education (SIoE) at Sheffield Hallam University are carrying out research into the Institute of Physics (IOP) Physics Teacher Educator Programme, in order to investigate the effectiveness of the programme and inform its ongoing and future development. To do this we will be carrying out surveys, interviews and focus groups with participants in the programme and with IoP programme staff and facilitators. We may also carry out observations of programme sessions.

Do I have to take part in the research?

Participation in surveys, interviews or focus groups is voluntary. By completing the survey you will be agreeing to your data being used in an anonymous form in reporting. At the beginning of the survey you will be asked to confirm that you have read this project information sheet and the project privacy notice, and consent to participating and your data being collected and processed as outlined in the information documents. If you are asked to take part in an interview that is recorded, we will ask you to complete an online consent form.

We may observe programme sessions in order to better understand the structure and content of the programme. We may take notes during these sessions but will not identify any individuals in our notes. Any other data we may use in the research derives from project activities. If you prefer that we do not use this data, please notify any of the SIoE team.

You can withdraw your data, from any of the data collection methods, at any point until it has become fully anonymised and aggregated into the analysis at which point we would be unable to identify it. If you wish to withdraw your data please notify the SIoE Project Director, Professor Emily Perry (contact details below).

Will I be identifiable?

All project reports, and any academic research publications and presentations, will anonymise organisations and individuals so no individual participant will be identified or identifiable.

How will my data be protected?

All digital data will be stored in secure, password-protected computers in Sheffield Hallam University. Paper-based data will be stored in locked cupboards within secure offices. Any transfer of data will use secure portals.

SHU undertakes research as part of its function for the community under its legal status. Data protection allows us to use personal data for our work with appropriate safeguards in place under the legal basis of **public tasks that are in the public interest** (GDPR clause 6 (1) f). A full statement of your rights can be found at https://www.shu.ac.uk/about-this-website/privacy-policy/privacy-notices/privacy-notice-for-research.

If you have any queries about this information please contact the project team: Professor Emily Perry (details below).

Sheffield Hallam University | Sheffield Institute of Education

Project contacts

All University work of this nature is reviewed to ensure that participants are treated appropriately and their rights respected. This work was approved by the University Ethics Committee. Further information can be found here: https://www.shu.ac.uk/research/ethics-integrity-and-practice.

If you have any further questions about this project, please contact:

Professor Emily Perry (SHU Principal Investigator)

Sheffield Institute of Education

Sheffield Hallam University, S1 1WB

e.perry@shu.ac.uk

Or see below for details of university data protection and ethics contacts.

Data collection

To carry out the evaluation, experienced researchers from Sheffield Institute of Education (SIoE) staff will collect and analyse data.

Data to be collected	Participants	IoP programme staff and faciltators	
Survey Online surveys will collect data on the intentions and experiences of participants on the programme	x	x	The survey will be straightforward to answer, containing click-box responses and open comment sections. Responses will be collated and analysed by the research team at SIoE and reported anonymously. Surveys will take no more than 15 minutes to complete.
Interviews We may ask participants and IOP programme staff to take part in interviews (by telephone or online) to gather information regarding the programme	x	x	Interviews will be carried out by an experienced researcher from SIOE. With permission, these will be recorded using an audio recorder and may be transcribed. Anonymised interview transcripts will be shared between the SIOE team. Anonymised data will be thematically analysed to explore perceptions of the programme. Interviews should take no more than 45 minutes.
Programme sessions We may observe programme sessions and take notes	x	x	We will take notes to help us to understand the sessions and their content. No participants will be named in any notes. Your consent for us to take notes relating to your contributions to the meetings will be clarified verbally at each session. If you do not give consent, your data will not be used.

University contacts

For any concerns about Sheffield Hallam University:

You should contact the SHU Data Protection Officer (DPO@shu.ac.uk) if:

- you have a query about how your data is used by the University
- you would like to report a data security breach (e.g. if you think your personal data has been lost or disclosed inappropriately)
- you would like to complain about how the University has used your personal data

Postal address: Sheffield Hallam University, Howard Street, Sheffield S1 1WB Telephone: 0114 225 5555

You should contact the SHU Head of Research Ethics (Dr Mayur Ranchordas - ethicssupport@shu.ac.uk) if you have concerns with how the research was undertaken or how you were treated.

Privacy Notice

Introduction

This document outlines the responsibilities of Sheffield Hallam University (SHU) in handling personal data collected from participants as part of a research study into how to make sustained change happen in teacher professional development by looking at:

- the implementation of innovations and programmes in relation to policy and teacher entitlements;
- the mechanisms and processes within the school environment which underpin change.

Data protection legislation governs the way that organisations use personal data. Personal data is information relating to an identifiable living individual who can be identified directly or indirectly from that information.

Transparency is a key element of data protection legislation and this Privacy Notice is designed to inform participants in this research study about:

- how and why SHU will use personal data collected in this research
- what participants' rights are in relation to the use of your personal data, and
- how to contact us to exercise those rights

Participants' Rights

Data protection legislation gives participants the following rights in relation to their personal data:

- the right to be informed
- the right of access
- the right to rectification
- the right to erase
- the right to restrict processing
- the right to data portability
- the right to object
- rights in relation to automated decision making and profiling

For more information about these rights please see:

Sheffield Hallam University data subject rights
Information Commissioner's Office: Participants' rights

Participants can contact SHU at any time to:
- withdraw from the research and have their individual data deleted
- request copies of their own personal data held by SHU (a subject access request)
- exercise other rights (e.g. to have inaccurate data rectified, to restrict or object to processing)
- query how data is used by SHU
- report a data security breach (e.g. if there are concerns that personal data has been lost or disclosed inappropriately)
- complain about how SHU have used personal data.

Details of who to contact are provided at the end of this notice.

Why are we processing participants' personal data?

Under data protection legislation there must be a lawful basis for processing personal data. In this case, the lawful basis for processing participants' personal data is in order to meet our public tasks (learning and teaching, research and knowledge transfer). This includes carrying out the research for this research study to evaluate support for professional development leaders.

Retention

After the research is complete, SHU will retain participants' personal data for research and knowledge exchange purposes, including presentations at professional or academic conferences, and publications in professional or academic journals, for a period of ten years after the publication of the final report. SHU will remain as a data controller for the data used for this study during this period.

Confidentiality

In the production and publication of professional or academic publications or presentations, all data will be fully anonymised. No individual or school will be named except by agreement on an individual basis, for example in case studies. As far as possible personal identifiers will be removed from the data. However publications may include contextual information about participants' professional experience, backgrounds and roles, and so participants may be identifiable to those familiar with their work.

Which Personal Data will we collect and use?

In order to carry out this research we will collect and use some personal data from participants. Below is a list of what this may include.

Type of personal data	Participants of IOP's physics teacher educator programme; IOP programme leads and facilitators
Personal characteristics: name, gender[9], geographic location	X
Contact details: professional email address, telephone number	X
Professional characteristics: professional role(s), subject specialism(s), educational phase, years of experience	X
Interview, focus group and/or survey responses: opinions about, experiences of and learning from the professional development programme	X

Who will we share personal data with?

The privacy of participants' personal data is paramount and will not be disclosed unless there is a justified purpose for doing so. In order to carry out the research participants personal data may be shared between SHU and the following parties:

- Sheffield Hallam University staff who are involved in the research, including its administration

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[9] This information is classified as sensitive personal data / special category data under the data protection legislation and as such is subject to a greater level of control and protection.

- Transcribers, who we may ask to produce transcripts of audio recordings of interviews and focus groups

SHU NEVER sells personal data to third parties.

Security

SHU takes a robust approach to protecting the information we hold. This includes the installation and use of technical measures including encryption of data, firewalls and intrusion detection and prevention tools on networks and segregation of different types of device; the use of tools on University computers to detect and remove malicious software and regular assessment of the technical security of SHU systems. SHU staff monitor systems and respond to suspicious activity. SHU also has Cyber Essentials certification.

Alongside these technical measures, comprehensive and effective policies and processes are in place to ensure that SHU users and administrators of information are aware of their obligations and responsibilities for the data they have access to. Access to project data is restricted to the research teams and administrators associated with the project. Sharing of the data with other researchers would require approval by the SHU College of Social Sciences and Arts ethics committee who will ensure that all data protection requirements are met. Training is provided to new staff joining SHU. Existing staff have training and expert advice available if needed.

Data transfers between SHU and the other organisations involved in this research. will be conducted using a secure file transfer service. All files sent will be encrypted. All personal data will be stored in directory locations that are only visible to specified members of the project team.

Further Information and Support

For further information about how SHU uses personal data see:

SHU privacy notice for research participants

SHU information governance policy

The Information Commissioner is the independent regulator set up to uphold information rights under data protection legislation. The Information Commissioner's Office (ICO) has a website with information and guidance for members of the public: Your data matters.

If there are any concerns about the way personal data is processed in this research, please raise these with the contact details below.

Principal Investigator:

Professor Emily Perry
e.perry@shu.ac.uk
0114 225 5344

The SHU Data Protection Officer:
DPO@shu.ac.uk
0114 225 3361

If you have an ongoing concern, you can contact the Information Commissioner's Office, the body responsible for enforcing data protection legislation in the UK, using information provided at the ICO website: Make a Complaint.

Appendix 2. Year 1 data collection

A.   Start-of-programme survey: key questions

Your role

Q2.1 In relation to your participation in the Physics Teacher Educator programme, how would you describe your role(s)? (tick all that apply)

☐   Initial teacher educator, based in school, college or MAT

☐   Professional development leader, based in school, college or MAT

☐   Initial teacher educator, based in university

☐   Professional development leader, based in university

☐   Consultant or freelance professional development leader

☐   IOP employee or staff member

☐   IOP PTE programme study group facilitator

☐   Other (please specify) _____

Q2.2 What other roles, if any, do you have? (tick all that apply)

☐   Classroom teacher

☐   Middle leader

☐   School leader

☐   Work for professional bodies or third sector organisations

☐   Researcher

☐   Other (please specify) _____

Q2.3 In which regions do you carry out your role(s)? (tick all that apply)

☐ South England (South West, London, South East)

☐ Central England (West Midlands, East Midlands, East Anglia)

☐ Northern England (North West, Yorkshire and the Humber, North East)

☐ Northern Ireland

☐ Scotland

☐ Wales

☐ Nationally (across UK)

☐ Republic of Ireland

☐ Other (please specify) _____

Your intentions for the programme

Q3.1 The IOP has identified some themes for the Physics Teacher Educator programme. Thinking about your intentions for participation in the programme, how important is each of the themes to you?

	Very important	Fairly important	Slightly important	Not important	Not sure
What does effective professional learning look like?	○	○	○	○	○
What knowledge do teachers of physics and their educators need?	○	○	○	○	○

Which design features underpin effective professional learning and practice development?	◯	◯	◯	◯	◯
Equity, diversity and inclusion in the context of physics teacher education	◯	◯	◯	◯	◯
Evaluation and evidence of professional learning	◯	◯	◯	◯	◯

Q20 Overall, which one of these themes is most important to you in relation to your participation in the programme?

◯ What does effective professional learning look like?

◯ What knowledge do teachers of physics and their educators need?

◯ Which design features underpin effective professional learning and practice development?

◯ Equity, diversity and inclusion in the context of physics teacher education

◯ Evaluation and evidence of professional learning

◯ Not sure

Q3.2 What else, if anything, are you hoping to gain from your participation in the Physics Teacher Educator programme?

B. End-of-programme survey: key questions

Your role

Q2.1 In relation to your participation in the Physics Teacher Educator programme, how would you describe your role(s)? (tick all that apply)

- ☐ Initial teacher educator, based in school, college or Multi-Academy Trust

- ☐ Professional development leader, based in school, college or Multi-Academy Trust

- ☐ Initial teacher educator, based in university

- ☐ Professional development leader, based in university

- ☐ Consultant or freelance professional development leader

- ☐ IOP employee or staff member

- ☐ IOP PTE programme study group facilitator

- ☐ Other (please specify) _____

Q2.2 How long have you held a role or roles as a physics teacher educator?

- ○ 0-5 years

- ○ 6-10 years

- ○ 11-15 years

- ○ 16-20 years

- ○ Over 20 years

Q2.3 What other roles, if any, do you have? (tick all that apply)

- ☐ Classroom teacher

- ☐ Middle leader

☐ School leader

☐ Work for professional bodies or third sector organisations

☐ Researcher

☐ Other (please specify) _____

Q2.4 In which region(s) do you carry out your role(s)? (tick all that apply)

☐ South England (South West, London, South East)

☐ Central England (West Midlands, East Midlands, East Anglia)

☐ Northern England (North West, Yorkshire and the Humber, North East)

☐ Northern Ireland

☐ Scotland

☐ Wales

☐ Nationally (across UK)

☐ Republic of Ireland

☐ Other (please specify) _____

Q2.5 Do you have any qualifications relating to your role as a physics teacher educator, for example NCETM/STEM learning programme, MA, coaching or mentoring qualifications etc)

○ Yes – add details _____

○ No

○ Not sure

Participant experiences of the programme

Q3.1 To what extent do you agree or disagree with the following statements about the IOP's Physics Teacher Educator programme?

Expectations of the programme and reasons for participation

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Not applicable
a. I was confident the IOP's Physics Teacher Educator programme would enable me to develop my practice	○	○	○	○	○	○
b. I was pleased to join the programme	○	○	○	○	○	○
c. I wanted to collaborate with people in similar roles	○	○	○	○	○	○
d. I wanted to engage with research and theory relating to my role	○	○	○	○	○	○
e. I wanted to reflect on my practice	○	○	○	○	○	○

f. I wanted to build a closer relationship with the IOP	○ ○ ○ ○ ○ ○	

Q3.3 Add a comment, if you wish, about your expectations of the programme and reasons for participation.

Programme organisation and communications

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Not applicable
a. The programme was well-organised	○	○	○	○	○	○
b. The programme's aims were communicated clearly	○	○	○	○	○	○
c. The programme's structure was communicated clearly	○	○	○	○	○	○
d. The IOP's expectations of my participation were communicated clearly	○	○	○	○	○	○
e. The online platform was useful	○	○	○	○	○	○

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Not applicable
f. The programme handbook was useful	○	○	○	○	○	○

Q3.5 Add a comment, if you wish, about the programme organisation and communications

Programme delivery and content

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Not applicable
a. The programme content was appropriate for the participants	○	○	○	○	○	○
b. The balance of physics-specific content to generic content was appropriate	○	○	○	○	○	○
c. The timings of the sessions worked well for me	○	○	○	○	○	○
d. The frequency of the sessions worked well for me	○	○	○	○	○	○
e. The study group sessions were useful	○	○	○	○	○	○
f. The assessment tasks were useful	○	○	○	○	○	○

Q3.7 Add a comment, if you wish, about the programme delivery and content

Learning from the programme

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Not applicable
a. I have learned more about what effective professional development looks like	○	○	○	○	○	○
b. I have learned about the knowledge that teachers of physics and their educators need	○	○	○	○	○	○
c. I have learned about the design features which underpin effective professional learning and practice development	○	○	○	○	○	○

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Not applicable
d. I have learned about equity, diversion and inclusion in the context of physics teacher education	○	○	○	○	○	○
e. I have learned about evaluation and evidence of professional learning	○	○	○	○	○	○
f. I have learned about other aspects of my practice	○	○	○	○	○	○

Q3.9 Add a comment, if you wish, about your learning from the programme

Programme impacts

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Not applicable
a. As a result of participation in the programme, I am more confident in my role	○	○	○	○	○	○

b. As a result of participation in the programme, I have changed my practice	○	○	○	○	○	○
c. As a result of participation in the programme, I have a better understanding of physics pedagogy	○	○	○	○	○	○
d. As a result of participation in the programme, I feel more connected to people in similar roles	○	○	○	○	○	○
e. As a result of participation in the programme, I feel more connected to the IOP	○	○	○	○	○	○
f. As a result of participation in the programme, I have shared learning with colleagues or others	○	○	○	○	○	○

Q3.11 Add a comment, if you wish, about the programme's impact

Overall experiences of the programme

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Not applicable
a. The programme met my expectations	○	○	○	○	○	○
b. I enjoyed the programme	○	○	○	○	○	○
c. I am glad I participated in the programme	○	○	○	○	○	○
d. This programme provided opportunities for learning I can't get elsewhere	○	○	○	○	○	○
e. I would recommend the programme to other people in similar roles	○	○	○	○	○	○
f. The IOP should continue to offer this programme for future cohorts	○	○	○	○	○	○

Q3.13 Add a comment, if you wish, about your overall experiences of the programme

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Q4.1 What is the one most significant thing you have gained from the programme?

Q4.2 If you could change one thing to improve the programme, what would it be?

Q4.3 Would you recommend the programme to other people?

○ Yes

○ No

○ Maybe

○ Add a comment if you wish

C.   Interview schedule: key questions

Participants

Your role, participation in the PTE programme and other professional learning

1.   What was it that attracted you to participate in the IOP's Physics Teacher Educator programme?

2.   How did you find out about the programme?

3.   What are you hoping to gain from the programme?

4.   And will this help you in your professional role(s)?

5.   In relation to this role, have you participated in any previous professional development or training? If so, what was it and what did you learn from it?

6.   (if not answered yet) Do you work for the IOP on any of their programmes? If so, which ones, and what do you do?

7.   And do you hold other professional roles? If so, what are the roles and for which organisations?

Experiences of the PTE programme

8.   Overall, how are you finding the programme so far?

9.   What do you think is working well?

10.   The programme contains multiple forms of support. Which aspects of the support do you think are most effective?

11.   (if needed) Can you explain what it is about those aspects of the programme that's working well for you?

12.   Are there aspects of the programme which are working less well for you? Which are these, and what is it that's not working so well about them?

13.   Will you continue to participate in the programme until the end?

Barriers and enablers to participation

14.   We know that participation in programmes like this can be challenging. Is there anything the IOP has done which has helped you to participate?

15.   Have you experienced other barriers to participation which you've not mentioned yet? If so, what are these and is there anything the IOP could do to help you overcome them?

Impact of the PTE programme

16.   Can you identify what you've learned from the programme so far?

17.   And have you been able to use this learning in your practice? If so, in what ways? What impact did it have? If not, why not?

18.   The IOP has developed the programme with equality, diversity and inclusion in relation to physics as an important learning outcome for participants. Can you identify areas of the programme where you have engaged with ideas about equality, diversity and inclusion?

Improving the PTE programme

19.   Looking at your experiences of the programme so far, are there things which you think could be improved?

20.   Are there things which you feel could be added or removed?

21.   Overall, is there one thing would you advise the IOP's programme leads to do to improve the programme?

22.   Before we end, is there anything else you'd like to say about the programme?

Study Group Facilitators

Your role and experience

1. Can you confirm your role for the IOP?

2. (if not answered in qu 1) Which (other) programmes, if any, do you work on for the IOP?

3. We have you listed as a Study Group Facilitator for this programme; is that right? If this isn't right, then use revert to the standard participant questions.

4. In relation to your work with the IOP, have you participated in any previous professional development or training? If so, what was it and what did you learn from it?

5. Do you hold other professional roles? If so, what are the roles and for which organisations?

Experiences of the PTE programme

6. Overall, how are you finding the programme so far?

7. What do you think is working well?

8. (if not answered previously) The programme contains multiple forms of support. Which aspects of the support do you think are most effective, for you or for the other participants?

9. (if needed) Can you explain what it is about those aspects of the programme that's working well?

10. Are there aspects of the programme which are working less well? Which are these, and what is it that's not working so well about them?

Study Group Facilitation

11. Can you tell me a little about how the study groups work?

12. What is your role in them?

13. Who decides what you should do in the study groups?

14. What do the participants gain from the study groups?

15. How does this relate to the rest of the programme?

Barriers and enablers to participation

16. We know that participation in programmes like this can be challenging. Is there anything the IOP has done which has helped you to participate?

17. Have you experienced other barriers to participation which you've not mentioned yet? If so, what are these and is there anything the IOP could do to help you overcome them?

Impact of the PTE programme

18. Can you identify what you think participants have learned from the programme so far?

19. And have the participants been able to use this learning in your practice? If so, in what ways? Do you know what impact it's had? If not, why not?

20. The IOP has developed the programme with equality, diversity and inclusion in relation to physics as an important learning outcome for participants. Can you identify areas of the programme where you have engaged with ideas about equality, diversity and inclusion?

Improving the PTE programme

21. Looking at your experiences of the programme so far, are there things which you think could be improved?

22. Are there things which you feel could be added or removed?

23. Overall, is there one thing would you advise the IOP's programme leads to do to improve the programme?

23. Before we end, is there anything else you'd like to say about the programme?

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Appendix 3. Year 2 data collection

A.   Start-of-programme survey: key questions

Your role

Q2.1 In relation to your participation in the Physics Teacher Educator programme, how would you describe your role(s)? (tick all that apply)

☐   Initial teacher educator, based in school, college or Trust

☐   Professional development leader, based in school, college or Trust

☐   Initial teacher educator, based in university

☐   Professional development leader, based in university

☐   Consultant or freelance professional development leader

☐   IOP employee or staff member

☐   IOP PTE programme study group facilitator

☐   Other (please specify) _____

Q2.2 What other roles, if any, do you have? (tick all that apply)

☐   Classroom teacher

☐   Middle leader

☐   School leader

☐   Work for professional bodies or third sector organisations

☐   Researcher

☐   Other (please specify) _____

Q2.3 In which regions do you carry out your role(s)? (tick all that apply)

☐ South England (South West, London, South East)

☐ Central England (West Midlands, East Midlands, East Anglia)

☐ Northern England (North West, Yorkshire and the Humber, North East)

☐ Northern Ireland

☐ Scotland

☐ Wales

☐ Nationally (across UK)

☐ Republic of Ireland

☐ Other (please specify) _____

Your intentions for the programme

Q3.1 The IOP has identified some themes for the Physics Teacher Educator programme. Thinking about your intentions for participation in the programme, how important is each of the themes to you?

	Very important	Fairly important	Slightly important	Not important	Not sure
What does effective professional learning look like?	○	○	○	○	○
What knowledge do teachers of physics and their educators need?	○	○	○	○	○

Which design features underpin effective professional learning and practice development?	○	○	○	○	○
Equity, diversity and inclusion in the context of physics teacher education	○	○	○	○	○
Evaluation and evidence of professional learning	○	○	○	○	○

Q20 Overall, which one of these themes is most important to you in relation to your participation in the programme?

○ What does effective professional learning look like?

○ What knowledge do teachers of physics and their educators need?

○ Which design features underpin effective professional learning and practice development?

○ Equity, diversity and inclusion in the context of physics teacher education

○ Evaluation and evidence of professional learning

○ Not sure

Q3.2 What else, if anything, are you hoping to gain from your participation in the Physics Teacher Educator programme?

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B.   End-of-programme survey: key questions

Your role

Q2.1 In relation to your participation in the Physics Teacher Educator programme, how would you describe your role(s)? (tick all that apply)

☐   Initial teacher educator, based in school, college or Multi-Academy Trust

☐   Professional development leader, based in school, college or Multi-Academy Trust

☐   Initial teacher educator, based in university

☐   Professional development leader, based in university

☐   Consultant or freelance professional development leader

☐   IOP employee or staff member

☐   Other (please specify) _____

Q2.2 How long have you held a role or roles as a physics teacher educator?

◯ 0-5 years

◯ 6-10 years

◯ 11-15 years

◯ 16-20 years

◯ Over 20 years

Q2.3 What other roles, if any, do you have? (tick all that apply)

☐   Classroom teacher

☐   Middle leader

☐   School leader

□ Work for professional bodies or third sector organisations

□ Researcher

□ Other (please specify) _____

Q2.4 In which region(s) do you carry out your role(s)? (tick all that apply)

□ South England (South West, London, South East)

□ Central England (West Midlands, East Midlands, East Anglia)

□ Northern England (North West, Yorkshire and the Humber, North East)

□ Northern Ireland

□ Scotland

□ Wales

□ Nationally (across UK)

□ Republic of Ireland

□ Other (please specify) _____

Q2.5 Do you have any qualifications relating to your role as a physics teacher educator, for example NCETM/STEM learning programme, MA, coaching or mentoring qualifications etc)

○ Yes – add details _____

○ No

○ Not sure

Finding out about the programme

Q3.1 How did you find out about the programme (tick all that apply)?

◯ IOP email, newsletter or similar

◯ IOP website or social media

◯ Personal contact from IOP

◯ From another organisation

◯ Recommendation from colleague or similar

◯ Other (please add) _____

Expectations of the programme

Q4.1 To what extent do you agree or disagree with the following statements about the IOP's Physics Teacher Educator programme?

Expectations of the programme and reasons for participation

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Not applicable
I was confident the IOP's Physics Teacher Educator programme would enable me to develop my practice	◯	◯	◯	◯	◯	◯
I wanted to collaborate with people in similar roles	◯	◯	◯	◯	◯	◯

I wanted to engage with research and theory relating to my role	○	○	○	○	○	○
I wanted to reflect on my practice	○	○	○	○	○	○
I wanted to build a closer relationship with the IOP	○	○	○	○	○	○

Q4.3 Add a comment, if you wish, about your expectations of the programme and reasons for participation

Experiences of the programme

Q5.1 Programme organisation and communications

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Not applicable
The programme was well-organised	○	○	○	○	○	○
The programme's aims were communicated clearly	○	○	○	○	○	○
The programme's intended outcomes were communicated clearly	○	○	○	○	○	○

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Not applicable
The programme's structure was communicated clearly	○	○	○	○	○	○
The purpose of the programme's activities was communicated clearly	○	○	○	○	○	○
The IOP's expectations of my participation were communicated clearly	○	○	○	○	○	○
The online platform was useful	○	○	○	○	○	○
The programme handbook was useful	○	○	○	○	○	○

Q5.2 Add a comment, if you wish, about the programme organisation and communications

Q5.3 Programme delivery and content

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Not applicable
The programme content was appropriate	○	○	○	○	○	○
The balance of physics-specific content to generic content was appropriate	○	○	○	○	○	○

The timings of the sessions worked well for me	○	○	○	○	○	○
The frequency of the sessions worked well for me	○	○	○	○	○	○
The group sessions were useful	○	○	○	○	○	○
The reflective tasks were useful	○	○	○	○	○	○
The coaching sessions were useful	○	○	○	○	○	○
The framework was useful	○	○	○	○	○	○

Q5.4 Add a comment, if you wish, about the programme delivery and content

Q5.5 Did you carry out an inquiry project?

○ Yes, I have completed my inquiry project

○ Yes, I am still working on my inquiry project

○ No

○ Not sure

Q5.6 The inquiry project

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Not applicable
I understood the purpose of the inquiry project	○	○	○	○	○	○
I chose my own area of interest for the inquiry project	○	○	○	○	○	○
I was well-supported with the inquiry project	○	○	○	○	○	○
The inquiry project was relevant to my practice	○	○	○	○	○	○
I learned about my practice from the inquiry project	○	○	○	○	○	○
I enjoyed the inquiry project	○	○	○	○	○	○

Q5.7 Add a comment, if you wish, about the inquiry project

Q5.8 Learning from the programme

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Not applicable
I have learned about effective professional development in physics	○	○	○	○	○	○
I have learned about the knowledge that teachers of physics and their educators need	○	○	○	○	○	○
I have learned about the design features which underpin effective professional learning and practice development in physics	○	○	○	○	○	○
I have learned about equity, diversity and inclusion in the context of physics teacher education	○	○	○	○	○	○

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Not applicable
I have learned about evaluation and evidence of professional learning in physics	○	○	○	○	○	○
I have learned about other aspects of my practice (add an example or two if you wish)	○	○	○	○	○	○

Q5.9 Add a comment, if you wish, about your learning from the programme

Q5.10 As a result of participation in the programme...

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Not applicable
I am more confident in my role	○	○	○	○	○	○
I have changed my practice	○	○	○	○	○	○
I have a better understanding of physics pedagogy	○	○	○	○	○	○
I feel more connected to people in similar roles	○	○	○	○	○	○
I feel more connected to the IOP	○	○	○	○	○	○

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	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Not applicable
I have shared learning with colleagues or others	◯	◯	◯	◯	◯	◯
I have identified new opportunities in my professional role(s)	◯	◯	◯	◯	◯	◯

Q5.11 Add a comment, if you wish, about the programme's impacts

Q5.12 Overall experiences of the programme

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Not applicable
The programme met my expectations	◯	◯	◯	◯	◯	◯
I enjoyed the programme	◯	◯	◯	◯	◯	◯
I am glad I participated in the programme	◯	◯	◯	◯	◯	◯
This programme provided opportunities for learning I can't get elsewhere	◯	◯	◯	◯	◯	◯
I would recommend the programme to other people in similar roles	◯	◯	◯	◯	◯	◯

| The IOP should continue to offer this programme for future cohorts | ○ | ○ | ○ | ○ | ○ | ○ |

Q5.13 Add a comment, if you wish, about your overall experiences of the programme

Overall experiences

Q6.1 What is the one most significant thing you have gained from the programme?

Q6.2 If you could change one thing to improve the programme, what would it be?

Q6.3 Would you recommend the programme to other people?

○ Yes

○ No

○ Maybe

○ Add a comment if you wish

C.   Interview schedule

Participants

Your role, participation in the PTE programme and other professional learning

1. What was it that attracted you to participate in the IOP's Physics Teacher Educator programme?

2. How did you find out about the programme?

3. What are you hoping to gain from the programme?

   Refer to survey responses to check which themes they felt were important

4. And how will this help you in your professional role(s)?

5. In relation to this role, have you participated in any previous professional development or training? If so, what was it and what did you learn from it?

6. (if not answered yet) Do you work for the IOP on any of their programmes? If so, which ones, and what do you do?

7. And do you hold other professional roles? If so, what are the roles and for which organisations?

Experiences of the PTE programme

8. Overall, how are you finding the programme so far?

9. What do you think is working well?

10. The programme contains multiple forms of support. Which aspects of the support do you think are most effective?

11. (if needed) Can you explain what it is about those aspects of the programme that's working well for you?

12. If not mentioned yet: How are you finding the reflective tasks? In what ways are they helping you to extend or consolidate your learning?

13. In the programme you'll be carrying out a small-scale action research activity. What will you be focussing on, do you think? Why have you chosen this? What do you hope to gain from it?

14. Are there aspects of the programme which are working less well for you? Which are these, and what is it that's not working so well about them?

15. Will you continue to participate in the programme until the end?

Barriers and enablers to participation

16. We know that participation in programmes like this can be challenging. What has the IOP done which has helped you to participate?

17. Have you experienced other barriers to participation which you've not mentioned yet? If so, what are these and is there anything the IOP could do to help you overcome them?

Impact of the PTE programme

18. Can you identify what you've learned from the programme so far?

19. And have you been able to use this learning in your practice? If so, in what ways? What impact did it have? If not, why not?

20. The IOP has developed the programme with equality, diversity and inclusion in relation to physics as an important learning outcome for participants. Can you identify areas of the programme where you have engaged with ideas about equality, diversity and inclusion?

Improving the PTE programme

21. Looking at your experiences of the programme so far, are there things which you think could be improved?

22. Are there things which you feel could be added or removed?

23. Overall, is there one thing would you advise the IOP's programme leads to do to improve the programme?

24. Before we end, is there anything else you'd like to say about the programme?

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