THE NATURE, IMPACT AND POTENTIAL OF EXTERNAL MENTORING FOR TEACHERS OF PHYSICS AND OTHER SUBJECTS IN ENGLAND

SUMMARY REPORT

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1. INTRODUCTION

This brief report summarises the main findings of the 'Modes of Mentoring and Coaching' (MoMaC) research project, an investigation into the nature, impact and potentially broader applicability of the work of regional, subject specialist mentors associated with three national support programmes for teachers of secondary science in England, which are briefly outlined below.[1]

The Physics Enhancement Programme (PEP)

PEP, which was first introduced in its pilot phase in 2004, aimed to support graduates who do not have a traditional physics degree and to equip them with the necessary skills and subject knowledge to become specialist physics teachers. It began with a six month physics enhancement course (PEC) provided by a higher education institution (HEI), after which those who successfully completed the PEC went on to undertake a programme of initial teacher preparation (ITP). During the pilot phase of PEP, the Institute of Physics (IOP) appointed a number of experienced teachers of physics to act as part-time, regionally based providers of what has been described as 'light touch' mentoring (Shepherd, 2008). Participants could access this for up to two years after the completion of the PEC, which normally took them to the end of their first year in teaching and the completion of their newly qualified teacher (NQT) induction period. Physics Enhancement Courses (without the external mentoring component of PEP) now form part of a wider government-funded national programme of Subject Knowledge Enhancement (SKE) courses covering mathematics, physics and chemistry.

The Science Additional Specialism Programme (SASP)

SASP, launched in 2007, was an accredited programme of continuing professional development (CPD) designed to enhance practising science teachers' knowledge of either physics or chemistry where this was not their original specialism. Again the courses were led by HEIs and supported by the IOP, and also in this case by the Royal Society for Chemistry (RSC). The mentoring component of SASP was, as for PEP, envisaged as 'light touch', with contact intended to be periodic rather than intensive and to have an element of flexibility and a '*greater component of school-based visits*' (Shepherd, 2008: 5). Contact between mentors (Regional Advisors) and mentees was envisaged as continuing for two years. SASP became nationally available in 2009 and, as with PEP, now forms part of the wider SKE programme for new, existing and returning teachers.

The Stimulating Physics Network (SPN)

The SPN, funded by the Department for Education (DfE), is a support network for teachers and pupils of physics in England, set up and run by a partnership of the IOP and the Science Learning Centres. One of the major components of the SPN is provided through the work of 23 Teaching and Learning Coaches (TLCs). Each TLC is employed on a part-time basis to provide bespoke programmes of support for the teaching and learning of physics in each of 12 schools in their region. The schools were identified as in need of support on the basis of criteria such as a low take-up of A-level physics and the absence of specialist[2] physics teachers. The role

[1] For further information about the MoMaC research, please contact Professor Andrew Hobson (Sheffield Hallam University): A.Hobson@shu.ac.uk

[2] It should be noted that there is presently no agreed definition or usage of the terms 'specialist' and 'non-specialist' teacher (SCORE, 2011). For the purposes of the MoMaC research, subject specialists were considered to be those who had studied the subject in question as a major component of an undergraduate and/or postgraduate degree, though this working definition may not have been shared by all of our research participants.

of TLCs is thus quite broad and includes 'whole-department' and 'whole-school' support, but our interest for this study relates to TLCs' support for teachers' continuing professional development (CPD), and in particular any one-to-one or group coaching or mentoring that they undertake.

We refer collectively to PEP Regional Support Mentors, SASP Regional Advisors and SPN TLCs as 'external mentors' (EMs), to signal the contrast between this support role and that of the more usual school- or institution-based (internal) mentors. For the purposes of this study, mentoring was taken to refer to the support provided by '*a more experienced practitioner (mentor), designed primarily to assist the development of the mentee's expertise and to facilitate their induction into the culture of the profession*' (Hobson *et al*., 2009: 207). This definition encompasses the narrower concept of coaching, which we see as relating more specifically to support for assisting mentees' skill development (Malderez & Bodoczky, 1999; Hopkins-Thompson, 2000).

2. RESEARCH DESIGN AND METHODS

The MoMaC research employed a *sequential mixed method design* (Tashakkori & Teddlie, 1998), beginning with a scoping phase (in early/mid 2010), which informed a 'qualitative' research phase (2010-11), which in turn informed a 'quantitative' research phase (autumn 2011). The ***scoping phase*** began with a review of existing literature, analysis of existing datasets and informal interviews with relevant stakeholders associated with the programmes under investigation.

The first strand of the ***qualitative phase*** of the research involved part-structured interviews with:

- external mentors from the PEP, SASP and SPN programmes, and
- mentees from across the same programmes, to elicit these participants' experiences and perceptions of external mentoring; and
- PEP and SASP participants who had not had access to an external mentor, to explore their views about the potential value of external mentor support which was not currently available to them.

The second strand of the qualitative research phase comprised case studies of the work of six external mentors of teachers of physics (2 PEP, 2 SASP, 2 SPN), involving:

- direct observation of a sample of face-to-face mentoring, and/or the collection of data relating to 'remote' mentoring – notably email communication between mentor and mentee;
- follow-up, part-structured interviews with mentors and mentees.

Table 1 below provides a summary of all interviews conducted for the qualitative research phase.

Table 1 Interviews conducted

	PEP (including case study interviews)*	SASP (including case study interviews)	SPN (including case study interviews)	**Total (including case study interviews)**
Mentors / TLCs	5 (6)	6† (7)	8 (11)	**19 (24)**
Mentees	19 (22)	9‡ (14)	19 (26)	**47 (62)**
'Unmentored' PEP and SASP participants	6	4	N/A	**10**
				Total 76 (96)

* Some mentees who took part in the case study work had not previously been interviewed, whereas all case study mentors/TLCs had previously been interviewed.

†Two of the SASP mentors were supporting teachers of Chemistry.

‡Two of the SASP mentees were being supported for their teaching of Chemistry, the remainder for Physics.

Data for the ***quantitative research phase*** were generated via the Teacher Voice Omnibus (online) Survey, administered by NFER in autumn 2011. Informed by the emergent outcomes of our qualitative analyses, and in collaboration with NFER colleagues, the MoMaC research team developed a number of questions to be included in the survey of a national panel of primary and secondary teachers. These questions were designed to explore:

- the extent to which teachers of physics and other sciences were typical or untypical of those of other subjects nationally, in relation to the matters explored in our research;
- the extent to which teachers of other subjects and at different stages of development might benefit from the kinds of 'external mentoring' support associated with the PEP, SASP and SPN programmes; and
- the factors which might encourage or discourage teachers from accessing such support, were it to be available.

The survey was completed by practising teachers from 1210 schools in the maintained sector in England. The teachers were drawn from the full range of roles in primary and secondary schools, from head teachers to newly qualified class teachers. Of the total number of respondents to the survey (1558), 54 per cent were from primary and 46 per cent from secondary schools. Further information about the sample is provided in Table 2 below.

Table 2 The survey sample

	Total sample	Achieved sample	Response rate (per cent)
Primary teachers	4054	849	21
Secondary teachers	3527	709	20
Total	**7581**	**1558**	**21**

Survey data were analysed via SPSS software, using both descriptive and inferential statistics. In presenting descriptive and aggregated statistics, we report both actual and weighted percentage responses to particular questions, where the latter figures could be considered to be more representative of the national population of primary and secondary teachers.[3] Regarding the use of inferential statistics, standard non-parametric tests such as the chi-square test were employed to investigate whether emergent findings, such as associations or differences between different variables or categories of respondent, were likely or unlikely to have occurred through chance alone, and whether such findings within our sample might reasonably be inferred to the wider population of teachers in England. A probability or p-value of less than five per cent ($p<0.05$) suggests that the finding is statistically significant or unlikely to have occurred by chance alone.

3. TYPES OF SUPPORT PROVIDED BY EXTERNAL MENTORS

Types and frequency of contact

Across the PEP, SASP and SPN programmes, the most common forms of contact between external mentors (EMs) and the student or qualified teachers (mentees) they were supporting took place on a *face-to-face* basis and via *e-mail*.

- Some mentoring and support also occurred through telephone conversations.
- A minority of mentors and mentees communicated via text messaging and/or social networking sites such as Facebook.
- Face-to-face contact included both one-to-one meetings between the mentor and mentee (often at the mentee's school, occasionally at the mentor's) and group meetings.
- Group meetings were sometimes formal occasions such as school-based workshops for groups of physics teachers, and sometimes more informal get-togethers such as evening meals or visits.
- Other opportunities for face-to-face contact between mentors and mentees occurred at various events, including regional and national conferences, such as the Association for Science Education (ASE) annual conference.

While the balance between the different forms of contact outlined above varied to some extent across individual mentors within each of the programmes, there were also general differences of emphasis across these, partly reflecting the intended aims of the programmes and the particular briefs of the PEP mentors, SASP regional advisors and SPN TLCs. For example:

- SASP mentors tended to undertake more school visits to work with individual mentees than their PEP counterparts;

[3] The weightings were applied to the data to compensate for an under-representation of teacher respondents from schools judged to have lower socio-economic status, based on pupils' eligibility for free school meals. Further information is provided in the accompanying full report.

- PEP mentors were more likely to engage in email communication and informal get-togethers with their mentees;
- TLCs were much more likely than the other EMs to engage groups of physics teachers in school-based workshops, and less likely to support individual mentees via more remote forms of communication such as email.

The *frequency of contact* between EMs and mentees varied over time, according to need, and depending on the type of contact involved.

- While some teachers who were eligible for EM support did not take this up, for those who did, the contact typically ranged from once a week to once a term.

Across all three programmes, contact could be – and was – *initiated* by both mentees and EMs, though EMs would tend to make contact with and offer support to individual mentees (PEP and SASP) or through the school coordinator (SPN) if they had not heard from them for some time.

Types of support provided

The MoMaC study data suggest that the majority of (if not all) PEP, SASP and SPN mentors tailored the support they provided to the individual needs of their mentees and the schools in which they were based. In general, though, EMs were found to address seven main kinds of support need amongst mentees, namely:

(1) support for subject content knowledge;
(2) support for subject pedagogy – how to teach physics, or particular aspects of the physics curriculum in schools;
(3) support for general pedagogy or teaching methodologies;
(4) support for mentees' emotional wellbeing;
(5) support for building mentees' confidence as teachers of physics;
(6) support for developing mentees' resilience;
(7) support for mentees' career progression.

In seeking to address these broad kinds of support need, EMs employed a large number of more specific support strategies as they saw appropriate[4], including:

- modelling teaching and practical work;
- providing or facilitating access to teaching resources;
- helping mentees to use specialist equipment;
- helping mentees with lesson planning;
- help with planning schemes of work;
- team teaching with mentees;
- observing and having follow-up discussions about mentees' lessons;
- providing 'a shoulder to cry on' and enabling mentees to share confidences;
- helping mentees deal with specific problems;
- cultivating, and encouraging mentees to engage with, a peer network;

[4] Not all external mentors employed all of these strategies. For example (as we explain in our full report) not all mentors felt it appropriate to observe mentees' lessons.

- encouraging mentees to become part of the broader science community, for example through engagement with the ASE and IOP.

Variation in support provision across the three programmes

Apart from the general tendency for TLCs to work mostly with groups of teachers of physics in particular schools and for PEP and SASP mentors to work more with individual teachers, which reflects the differing aims of the programmes, in other respects the biggest variations in support provision occurred between PEP mentors on the one hand and SASP and SPN mentors on the other. In particular, PEP mentors tended to provide relatively less support for their mentees' subject content knowledge, and relatively more support for:

- general pedagogical knowledge;
- building mentees' resilience;
- mentees' career progression, notably through 'careers advice'; and
- the facilitation of peer networking amongst their mentees.

4. THE TAKE-UP OF EXTERNAL MENTORING

PEP, SASP and SPN teachers who had access to an EM

Across each of the PEP, SASP and SPN programmes, there was variable take-up of the EM support from eligible teachers and schools, while those who did engage with an EM did so to differing degrees.

- Most external mentors we spoke to indicated that between one third and two thirds of eligible teachers and schools had taken advantage of the support.

Our data suggest that:

- some participants who did not take up the offer of EM support did not really need it because, for example, they already had appropriate support in their schools; while
- others were amongst those who needed it most but either did not recognise or did not feel able to admit to their support needs.

Factors encouraging the take-up of external mentoring

Our evidence suggests that the following factors were most influential in encouraging student and established teachers of secondary physics to take up the support of PEP, SASP and SPN mentors:

(1) *limitations of existing support*, including a lack of appropriate support for teachers' subject content knowledge and/or subject pedagogy, sometimes because there were no physics specialists within their schools;

(2) the role of the EM as a *supporter* rather than *assessor* of teachers'/trainees' teaching, which enabled many mentees to be more open about their professional development needs than they felt they could be with school-based mentors, colleagues or line managers, or with some university tutors associated with PEC, SASP or PGCE programmes;

(3) the *personal attributes, qualities and characteristics* of EMs, including mentors' passion and enthusiasm for teaching physics, their knowledge, experience and expertise as teachers of physics, and their positive, encouraging, respectful,

supportive and non-judgmental manner;

(4) the fact that *EMs had more time available to them to support mentees*, relative to school based mentors or line managers, together with mentors' overt availability and mentees' ease of access to EMs.

When PEP and SASP participants who did not have access to an EM were asked what might encourage them to seek the support of an EM, were it to be available, the five most frequently mentioned responses related to:

- support to develop their subject content knowledge;
- additional support for their subject pedagogy;
- potential access to or help with teaching resources or equipment;
- a desire for an independent perspective on certain issues; and
- issues within their school making it hard to talk about any difficulties they were experiencing.

Factors restricting the take-up of external mentoring

Seven main factors help to explain why some trainees and teachers for whom EM support was available were not able or did not choose to take this up, or did so to only a limited extent;

(1) time constraints in general and/or a lack of space in participants' school timetables;

(2) geographical distance from the EM, which made visits and meeting problematic, especially given (1) above;

(3) school-based gatekeepers not facilitating mentors' access to teachers, or vice versa;

(4) mentees' satisfaction with existing means of addressing their needs;

(5) mentees' self-sufficiency or confidence about their subject knowledge and pedagogy;

(6) mentees' inability to recognise or reluctance to acknowledge particular support needs;

(7) teachers/trainees and mentors not 'clicking' or 'getting on'.

When those PEP and SASP participants who did not have access to an external mentor were asked what might discourage them from seeking access to an EM, should the opportunity become available to them, the most common responses resonated with two of the considerations outlined above, namely:

- satisfaction with existing means of addressing support needs;
- time or timetabling constraints.[5]

[5] While the findings summarized in this section relate only to secondary teachers of physics associated with the PEP, SASP and SPN programmes, in Section 7 below we outline the factors which might encourage and discourage the take-up of EM support amongst primary and secondary school teachers of all subjects.

5. THE IMPACT OF EXTERNAL MENTORING

Did teachers consider the support of the external mentor helpful?

Out of the 45 PEP, SASP and SPN physics teacher mentees whose interview transcripts we analysed and coded:

- 40 clearly indicated that they found the external mentoring support helpful;
- four had mixed feelings;
- only one considered that the support was not helpful.

For the five participants who did not give an unequivocal indication that the support of their EM was helpful, this can mostly be explained in terms of three of the factors identified earlier as discouraging some trainees and teachers from taking up EM support, namely:

- the opportunity to access existing sources of support, which they felt rendered the additional support of an EM superfluous;
- a lack of geographical proximity to the EM, tied up with time constraints; and
- a failure to 'click' with the EM.

The reported benefits of external mentoring

The MoMaC evidence suggests that there has been a significant positive impact of the work of PEP, SASP and SPN mentors on the teachers they have supported, and those teachers' schools. The main benefits of external mentoring include:

(1) Impact on mentees' professional knowledge and skill base, including

- Improved subject knowledge
- Improved knowledge of and ability to use technical equipment
- Increased commitment to professional development
- Increased awareness of regionally based opportunities for off-site learning for their pupils
- Increased reflection on practice

(2) Impact on teaching and learning, including

- Increased use of practical work in teaching physics and reduced reliance on textbooks
- More interesting, enjoyable and accessible lessons for pupils
- Increased focus on subject content by teachers[6]
- Enhanced pupil understanding and learning

(3) Emotional impact on mentees, including

- Increased confidence in their subject knowledge and teaching of physics
- Reassurance of having someone to whom they could turn in times of need
- Increased enjoyment of and enthusiasm for teaching
- Reduced anxiety or stress
- Overcoming isolation

[6] For some teachers, this includes a reduced avoidance of subject matter which they had previously not properly understood.

(4) Enhanced recognition and career advancement, including

- Enhanced career progression or promotion prospects
- Becoming a 'leading light' within the department, to whom other teachers can go for support

(5) Impact on department, school and teaching profession, including

- The freeing up of some of the time of HoDs and other school-based subject specialists
- Increased discussion about Physics and teaching Physics within departments and schools
- Improved knowledge and expertise of laboratory technicians
- Enhanced teacher retention.

Variation in the impact of external mentoring across PEP, SASP and SPN

There were some variations across the three programmes with regard to the benefits of external mentoring. For example:

- PEP mentees were more likely than SASP and SPN mentees to report that EM support had helped them overcome isolation;
- PEP mentees were also more likely to report that external mentoring had influenced their retention and likelihood of remaining in the teaching profession;
- SPN and SASP mentees were more likely to report that external mentoring had helped bring about increased pupil understanding and learning. [7]

6. FACTORS INFLUENCING THE IMPACT OF EXTERNAL MENTORING

The MoMaC data highlight a wide range of factors which influence the impact of external mentoring. These include:

(1) mentors having reliable and effective means of gaining access to teachers who are potential beneficiaries of their support;

(2) support for external mentoring from heads of department and senior leadership teams in mentees' schools;

(3) individual teachers' openness to mentoring, and willingness and ability to learn and change;

(4) teachers' ability to find time to engage with the EM and protect agreed meeting times;

(5) mentors having credibility with mentees as experienced, passionate subject specialist teachers;

(6) mentors' independence from mentees' schools, and lack of involvement in or association with their assessment or appraisal;

(7) mentors' ability to build relationships and trust;

(8) mentors being empathetic, encouraging, supportive and positive;

[7] Possible explanations of the findings summarised here are provided in our full report.

(9) opportunities for one-to-one, face-to-face interaction between mentors and mentees;

(10) mentors having sufficient time to engage with teachers and flexibility to be able to respond swiftly to requests for support;

(11) mentors' geographical proximity to mentees;

(12) mentors' ability and willingness to tailor support to individual trainee/teacher needs;

(13) mentors' ability to facilitate and help mentees appreciate the importance of investing in peer networking and support;

(14) mentors' ability to facilitate mentees' access to a bank of appropriate resources for teaching;

(15) mentors' willingness and ability to be proactive in establishing and maintaining contact with mentees;

(16) the provision of appropriate opportunities for the preparation and support of mentors.[8]

7. THE POTENTIAL DEMAND FOR EXTERNAL MENTORING AMONGST PRIMARY AND SECONDARY TEACHERS OF ALL SUBJECTS

While the findings presented above all relate to EM support for teachers of physics, our analyses of data generated from a relatively small sample of mentors and mentees associated with the chemistry SASP programme suggest that that there were no substantive differences between the experiences of external mentoring of teachers of secondary chemistry and secondary physics who were following SASP programmes. In addition, the responses to our survey questions of a national sample of primary and secondary school teachers suggest that:

- there is a demand for external mentoring beyond secondary teachers of physics associated with the PEP, SASP and SPN programmes, and beyond secondary teachers of physics in general; and
- many of the factors which encouraged or restricted the take-up of PEP, SASP and SPN mentoring would be likely to attract or deter a wider population of teachers from doing the same, should the opportunity to access EM support become available to them.

The potential demand for external mentoring beyond secondary teachers of physics

As shown in Table 3, around half of both primary and secondary school teachers who responded to our survey questions said they felt they might benefit from the support of an external mentor for at least one of the subjects that they teach.

[8] A more comprehensive account of factors influencing the impact of external mentoring, together with supporting evidence, is provided in our full report.

Table 3 Did respondents feel they might benefit from the support of an external mentor?

	Yes for one or more subjects		No and/or not sure		Total no. of respondents
	%	Weighted %	%	Weighted %	
Primary	49%	49%	51%	51%	**814**
Secondary	49%	50%	51%	50%	**698**

Respondents who stated that they would like an external mentor for one or more subjects were treated as "yes" overall, while respondents who did not say "yes" for any subject were treated as "no and/or not sure" overall.

Amongst secondary teachers:

- teachers of some subjects were more likely than those of others to indicate that they might benefit from the opportunity to access EM support; and
- teachers of the main science subjects (physics, biology and chemistry) were amongst those least likely to state that they felt they might benefit; though
- no less than a quarter of respondents for any subject gave a positive response; while, for example,
- over a half of performing arts and ICT teachers indicated that they might benefit from the support of an EM.

Amongst primary school teachers, there was little variation by subject, with just under two-fifths of respondents stating that they felt they might benefit from having an EM for each subject area considered – science, English and mathematics.

For secondary teachers, it might have been expected that respondents who had not studied a subject as a major component of an undergraduate or postgraduate degree level would be more likely than those who had done so to feel they would benefit from EM support for teaching that subject. Our analysis reveals that:

- this was the case for some subjects (e.g. performing arts, biology, history, ICT and mathematics) but not others (e.g. physics, chemistry, English, geography, and RE);
- overall, teachers who had not studied as a major component of a first or postgraduate degree a subject that they were teaching, were not more likely than those who had done so to indicate that they might benefit from the support of an external mentor for that subject.

Responses to the question of whether respondents felt they might benefit from the support of an EM were differentiated by:

- number of years in teaching – with both primary and secondary respondents who had been teaching for a maximum of five full years significantly more likely to state that they would like an EM for one or more subjects than those who had been in their career for a longer period; and
- gender – with women more likely than men to indicate that they might benefit from the opportunity to access external mentor support (though this is statistically significant for primary but not secondary teachers).

Factors which might encourage teachers to take up EM support

Table 4 shows the considerations listed as likely to prompt teachers to seek the support of an EM by both primary and secondary respondents who indicated they would like EM support for at least one subject. There were no statistically significant differences between the responses to this question of primary and secondary teachers. The most frequently stated responses, each given by over half of both primary and secondary respondents who indicated that they might benefit from an EM for at least one subject, were:

- I would welcome additional support to develop my subject pedagogy;
- I would welcome additional support to develop my subject content knowledge;
- I would welcome additional support to facilitate access to or help with teaching resources or equipment.

Amongst secondary respondents, teachers of physics who indicated that they would benefit from EM support were significantly more likely than those of other subjects to state that the *lack of a subject specialist in their school* would encourage them to seek EM support, were it to become available ($p<0.05$):

- almost three in five teachers of physics give this response, compared to an average of fewer than one in five teachers of other subjects.

Both secondary and primary school teachers who had been in teaching for no more than five full years were statistically more likely than more experienced teachers to state that they might be prompted to take up EM support by each the following factors:

- 'I would welcome additional support to develop my subject pedagogy';
- 'I would welcome additional advice or guidance regarding career progression'.

In addition, secondary teachers who had not been teaching for more than five full years were also statistically more likely than those who had been teaching for a longer period to state that they would *welcome additional support to develop their subject content knowledge*.

Table 4 Considerations that might prompt respondents to seek EM support (all subjects)

	Secondary (n=335)		Primary (n=420)	
	%	Weighted %	%	Weighted %
I would welcome additional support to develop my subject pedagogy	62%	62%	68%	69%
I would welcome additional support to develop my subject content knowledge	61%	62%	62%	63%
I would welcome additional support to facilitate access to or help with teaching resources or equipment	54%	53%	55%	57%
I would welcome additional support to develop general pedagogical techniques (teaching methodologies)	45%	48%	47%	48%
I would welcome an independent perspective on some issues	43%	43%	45%	45%
I would welcome additional advice or guidance regarding career progression	27%	28%	22%	22%
Lack of a subject specialist in school	22%	23%	33%	33%
I would welcome additional support for my emotional wellbeing	22%	21%	19%	20%
General lack of support in school	20%	21%	12%	13%
Lack of collaborative ethos in schools	17%	17%	13%	14%
Performance management and/or other issues can make it hard to talk about difficulties within school	17%	17%	12%	12%
Pressure to conform to the school's teaching and learning models	16%	16%	17%	17%
Issues with a school mentor or line manager	10%	11%	7%	8%

Includes respondents who stated that they would like an EM for one or more subjects.

Factors which might prevent or discourage teachers from taking up EM support

Survey respondents who indicated that they would not wish to seek the support of an EM, were it to be available, were asked what considerations might deter them from doing so. There were no statistically significant differences between the responses of primary and secondary phase teachers, amongst whom the most frequently given responses were:

- 'I am sufficiently confident about my teaching and subject knowledge'; and
- 'I am able to access any support that I need within my school and/or from other sources'; whilst
- around a third of respondents stated that they did not feel they would have sufficient time to engage with an EM, given existing commitments (see Table 5).

Whilst only a small minority of teachers gave the response 'It wouldn't look good to have to ask for help', respondents were also give the opportunity to list 'other' considerations in addition to the items listed, and the responses suggested that a concern for what others might think if they were to seek the support of an EM

was a serious issue for at least some teachers. According to one respondent:

In the current climate, the wrong sort of head might use this as evidence that I wasn't performing adequately.

Some respondents giving 'other' responses indicated that while they did not feel the need to access the support of an EM at the time of the survey, they might potentially do so at some point in the future, if for example, they were to teach the subject in question to a higher level. Others suggested that EM support could be beneficial for some of their colleagues:

I am not implying that I would not see the value in this, more that for me, at my stage in my career and with the links I already have in the teaching community I do not feel it is appropriate. I feel strongly there are teachers [for whom] this could be a really valuable CPD resource.

Table 5 Factors that might discourage respondents from seeking EM support (all subjects)

	Secondary (n=371)		Primary (n=440)	
	%	Weighted %	%	Weighted %
I am sufficiently confident about my teaching and subject knowledge	82%	81%	73%	73%
I am able to access any support that I need within my school and/or from other sources	60%	59%	63%	63%
I do not feel I would have sufficient time to engage with EM given existing commitments	36%	36%	32%	31%
It wouldn't look good to have to ask for help	3%	3%	2%	2%

8. CONCLUSIONS AND RECOMMENDATIONS

Teachers of secondary physics

The evidence of the MoMaC research suggests that external mentoring support for non-specialist teachers of physics in secondary schools has had a significant impact on those teachers, with related benefits for their pupils, schools and the education system. We have seen, for example, that external mentoring has helped produce more informed, more adventurous and more committed teachers of physics who are 'not just teaching by the book' and who are more likely to remain in teaching. The potential long term impact should not be underestimated: improved physics teaching and more engaged pupils today can lead to more able physicists and teachers of physics in the future.

All of this provides a strong case for funding programmes of external mentoring not merely for teachers following subject enhancement programmes such as PEP and SASP, but for non-specialist secondary teachers of physics (including trainee teachers) more generally. This argument is strengthened in relation to non-specialist teachers of physics who do not have access to the support of a subject specialist within their schools, though we have shown that teachers who do have such access can nevertheless also reap significant rewards from the opportunity to access specialist *external* support.

Other teachers and priority areas

While most evidence from the present study relates to non-specialist secondary teachers of physics, our analyses of data relating to a relatively small sample of chemistry SASP participants and a relatively large survey sample of primary and secondary teachers of a range of subjects, suggest that the potential demand for and benefits of external mentoring apply to a much wider audience. However, although the introduction of external mentoring for all teachers might well prove a profitable investment in teacher professional development, its widespread adoption does not seem feasible at the present time, given financial constraints. In these circumstances, we recommend that the following groups of teachers are regarded as priority cases:

(1) secondary teachers of physics and other *shortage subjects*;

(2) *non-specialist secondary teachers of all subjects* – i.e. those teaching a subject that they have not studied as a major component of an undergraduate or postgraduate degree course;

(3) *beginning (trainee, newly and recently qualified) teachers* in both primary and secondary schools;

(4) '*single person departments*' – i.e. teachers who are the only ones in their schools teaching a particular subject;

(5) teachers employed in *challenging secondary schools with a high staff turnover.*

While external mentor support could potentially help teachers in each of these categories to experience a wide range of benefits (see Section 5 above), particular kinds of EM support and impact would be particularly apposite for particular groups. For example, EM support:

- would help secondary schools in general to retain teachers of shortage subjects;
- would help secondary schools facing challenging circumstances to retain more teachers of any subject;
- would help non-specialist teachers of any subject improve their subject content knowledge and subject pedagogy;
- would help many beginner teachers and teachers working in single person departments to overcome professional isolation;
- would help beginning teachers to improve their general pedagogy, such as classroom and behaviour management, and support them in negotiating the demanding but important early career transitions from trainee to NQT and NQT to recently qualified teacher (RQT).[9]

[9] Further and more specific recommendations are provided in Chapter 8 of the accompanying full report.

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