Mentors' views on the role of e-mentoring in the development of mathematics student teachers' mathematical and pedagogical knowledge in further education

Natheaniel Machino

University of East Anglia

Mentoring has become established as a central feature of initial teacher education (ITE) programmes in the English further education and training sector (FE) yet there is lack of clarity about its purpose and role. The education systems globally had to change when COVID 19 struck and there was no choice but to go online. Mentoring had to go online as well and became what could be referred to as COVID 19 triggered e-mentoring, which was a reaction to the unprecedented situation. In this paper, I report findings of the analysis of ten questionnaire and seven follow up interview responses that included questions about mentoring and hypothetical classroom situation from mentors of mathematics student teachers in FE colleges. Thematic analysis was employed as the analytic tool and key themes - correcting student teachers; observing experienced teachers; discussing generic issues; working mathematics questions and discussing how to teach specific topics - emerged.

Keywords: electronic mentoring; mathematical and pedagogical knowledge

Introduction

In this paper, I report findings of the analysis of ten questionnaire and seven follow up interview responses that included questions about mentoring and hypothetical classroom situations from mentors of mathematics student teachers in further education (FE) colleges. I am interested in the views of mentors of FE mathematics student teachers on the role of electronic mentoring (thereafter called e-mentoring) in the development of mathematics student teachers' mathematical and pedagogical knowledge. I briefly describe the context in which the study is situated and discuss the relevant literature. Specifically, I describe the FE sector and initial teacher education (ITE) in the sector and discuss mentoring and e-mentoring of mathematics student teachers in FE. This is followed by discussing the methodology of the study before a detailed report of the themes that emerged from the analysis.

Context and relevant literature

The FE sector in England (sometimes referred to as the post-16 sector, Lifelong Learning Sector, or Post-Compulsory Education and Training Sector) is extremely diverse; it includes FE colleges, sixth form colleges, adult and community learning providers, prisons, work-based learning providers, and private training companies (Lingfield, 2012). Historically, FE was synonymous with vocational education and training, providing communities with courses that tended to be in practical, non-academic subjects and many FE lecturers came from industries, such as construction and engineering, and were vital in providing the subject knowledge needed by colleges to enable them to offer a wide provision of courses (Burnell, 2017). The

sector has undergone radical changes in recent years, and FE colleges are offering vocational courses and academic subjects at GCSE and A-Level.

Since 2001, the New Labour Government began a barrage of reforms that overhauled (and often confused) FE including ITE. Until relatively recently, teacher educators in FE had considerable autonomy in the design and implementation of ITE teaching programmes, and course outcomes and accreditation requirements were framed by awarding bodies such as City & Guilds or by universities at postgraduate level (Tedder & Lawy, 2010).

While a high proportion of teachers in primary and secondary schools are trained in a pre-service university setting, FE colleges train the majority of their teaching staff on an in-service, part-time basis (Kentzer et.al., 2019). FE student teachers often undergo ITE as part of a career change or add a part-time teaching role to an existing technical profession (Greatbatch & Tate, 2018). In contrast to entry into school teaching, around 90% of FE teachers are employed untrained and complete their ITE at the average age of 37 (Greatbatch & Tate, 2018). This means only around 10% of the teachers are trained at university. The student teachers in FE have a more diverse background in terms of education and professional or vocational experience than is the case for those training to teach in schools (Greatbatch & Tate, 2018).

ITE in FE is mostly generic; meaning it focuses on the application of generalised pedagogies which can operate across subject boundaries (Lucas et al., 2012; Maxwell, 2014). The subject specialism relies on trainees' ability to contextualise their learning to their own specialism with the support of subject mentors (Lucas et al., 2012), and this makes mentoring an integral part of ITE in FE.

Mentoring can be conceptualised as a developmental activity in which mentors adopt a range of supportive roles to empower mentees and support their professional learning and development, and wellbeing (Hobson & Malderez, 2013). Mentoring can also be conceptualised as judgmental where mentors are explicitly evaluative and judgmental and practice directive forms of mentoring where mentors are (over) reliant on the strategy of observing and providing mentor-led 'feedback' on student teachers' lessons (Hobson & Malderez, 2013). During the COVID 19 pandemic, like all activities in education (and in other sectors of the economy), mentoring moved online to what is referred to as e-mentoring.

Methodology

This paper is part of a study which seeks to gain insight into the role of mentoring in the mathematical and pedagogical knowledge development of mathematics student teachers in FE colleges. The methodology of my study is qualitative, established on an interpretative research methodology that values the participant's views and reflections and looks for meanings within the participant's environment (Merriam & Tisdell, 2016). For the research reported in this paper, data were collected from mentors using an anonymous questionnaire and interviews. The questionnaire was distributed by the Education and Training Foundation (ETF) to 162 FE colleges in England, and ten responded and seven out of the ten, consented to be interviewed. I employed thematic analysis as the analytic tool, and the themes which emerged are discussed below.

Themes that emerged from the analysis

Themes emerged when analysing anonymous survey responses and interviews about a hypothetical classroom situation where a student teacher gave mathematically

inaccurate explanation and the formula for *Area of the circle* as π times diameter while revising an examination question. The themes are discussed below.

Correcting student teachers

When a student teacher's explanation is not mathematically accurate during an observed lesson, M20 (code name for a mentor) wrote that she would ask the student teachers to sit down during face-to-face lessons or take control of the presentation during online lessons and work the question with the students. M20 continued, "This is a significant error. I will have to intervene because this causes a lot of confusion." M14 wrote that he would tell the student teacher about the inaccurate explanation during the feedback meeting discussing the correct explanation with the student teacher. During interview, Paul, a mentor with more than ten years' experience, said he would ask the student teacher who makes mathematically inaccurate explanation while teaching to go and study the topic and then he would teach the student teacher the way he teaches students. When asked to give an example of addressing student teachers' inaccurate teaching, Alex, a mentor and a manager, said he observed his mentee teaching *Simplifying ratios* and the webcam was not working, and some students did not see the screen, and they complained. Mostly likely as a result of the technological problems while being observed, Alex said the student teacher was seen to be going too fast and not explaining clearly. Alex advised the student teacher to practice the technology before lessons to avoid such problems. He also advised the student teacher to be as enthusiastic in online lessons as in face-to-face teaching. After another observation, Alex said, "I asked the student teacher to change what he had planned to meet the needs of the learners; for example, one question was on quadratic factorisation. He did not put double brackets. I told him to create questions which work."

Observing experienced teachers

Mentors said they ask student teachers to observe them (mentors) and other experienced teachers teaching the topics which they find difficult to teach and/or have gaps in mathematical content knowledge. The experienced teachers would explain the teaching of the topic to the student teacher after the observations. Judy, a mentor with more than ten years experience, explained that "Student teachers come with their own methods – some are traditionalists who use the traditional methods." When prompted to explain further, Judy said in multiplication, some student teachers use traditional methods, and they could learn other methods like the grid and lattice methods from observing mentors and other experienced teachers, but she gave a cautious statement, "One has to be flexible in terms of methods." Darren and Esther, each with less than five years mentoring experience, support the idea of student teachers observing their mentors and other experienced teachers.

Discussing general mathematics issues

Discussing how they help their student teachers develop subject knowledge, Judy and Darren said they direct their student teachers to internet resources. Paul said he assesses his student teachers' subject knowledge by discussing different topics and self-evaluation. He explained that he asks his student teachers to do a self-evaluation on the topics in the GCSE mathematics specification, which is the examinations

board's detailed description on how to teach different topics which are examined. The specification includes the subject content for examination. Judy said she assesses her student teachers' subject knowledge using the Basic Key Skills Builder (BKSB). The assessment gives her the level of the mathematics knowledge of the student teachers, and this would help her plan their developmental routes, which include giving past examination papers and books. Besides the internet and paper resources, Martin, who is a mentor and a manager, and Alex said they discuss the GCSE mathematics specification with the student teachers on areas the student teachers most struggle with.

Working mathematics questions

During interview, when asked whether she works through mathematics questions with the student teachers, Judy said, "Yes" with emphasis. Martin and Darren said they work through mathematics questions with the student teachers explaining how to teach the questions and discuss any misconceptions. When explaining how he would assist a student teacher who is really struggling with the mathematics content knowledge, Don said, "Difficult, difficult situation again because, again, confidence. If you're confident in your subject that you're teaching, teaching is still can be difficult, but it's even more difficult if you're not confident in the subject that you're trying to teach." Don said he works through questions with the student teachers starting with the easy questions or topics. Paul said he works through mathematics questions with the student teachers the way he works with the students. He explained how he worked through a Venn diagram question (see Figure 1) with a student teacher who was struggling with the question. He shared the question with me through the chat.

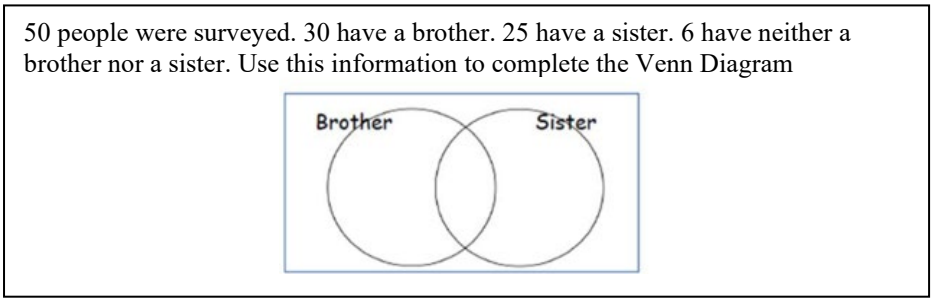

Figure 1: Paul's question on Venn diagram.

Paul said he displayed the question on the computer screen and worked through it with the student teacher. He said that he taught the student teacher that; "30 + 25 + 6 gives 61. Then 61 – 50 = 11. So, 11 goes into the middle." I asked Paul whether he could work the question using the algebraic method by writing the unknown; for example, x in the intersection and form an equation, which is 30 – x + x + 25 -x + 6 = 50 and solving the equation gives x = 11. Paul said, "I have never used that. To throw algebra makes it more complex." While Paul might want to avoid 'complicating' the question by using the algebraic method, he might be restricting his student teacher to only one method.

Discussing teaching specific topics

Mentors who responded to the hypothetical classroom situation about a student teacher who made a mathematically inaccurate explanation while revising an

examination question on *Area of the circle* said they would discuss how to teach specific topics with the student teacher. M17 wrote:

> I would advise the student teacher to use a starter to revise the formula for the area of the circle and parts of the circle. Start with easier questions first before moving to the 4-mark question. For example, a task on matching the parts of the circle, where students work in pairs. A mnemonic to remember the formula. Corbett maths videos and worksheets, Century nuggets, Barton diagnostic questions can be helpful for explanation or further practice.

M13 said he would like the student teacher whose explanation has mathematical inaccuracies in teaching a topic to start from the basics. This would help the student teacher learn the topic when planning. During interview, Judy said she discusses lesson plans and resources with her student teachers before delivery, and a questionnaire response from M13 reads "There should be clear structure and expectations in relation to lesson planning and prep. This should be reviewed prior to delivery of the lesson so it can be refined by the mentor and discussed [with the student teacher]."

A typical example of assisting student teachers to teach a specific topic online is given by Julie who said she explained to her student teacher that, "My students struggled with perimeter of a semi-circle. Grasping the perimeter of the semi-circle was really bad. I used a kitchen utensil (showing a water glass) (see Figure 2). I had this telling them where to measure. I told them you don't measure all around but the curve and the line across." Julie demonstrated how this could be explained using kitchen utensils and said, "It's difficult to have a semi-circle drawn on Zoom."

Figure 2: Julie showing how to find perimeter of a semi-circle using a glass of water.

Paul said he identified through lesson observation that one of his student teachers was unable to teach finding the centre of enlargement (see Figure 3 which Paul shared with me) by "doing diagonals from the vertices, when teaching transformations."

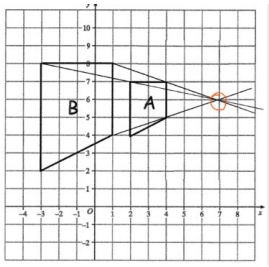

Figure 3: An example of a question on finding Centre of Enlargement

Paul said he explained how to teach the topic to the student teacher and advised him to go and learn it first before delivery. Paul goes on to explain that he would make a follow up to find out whether the student teacher had studied the topic.

Discussion and conclusion

In this paper I have reported the analysis of ten questionnaire and seven follow up interview responses that included questions about mentoring and hypothetical classroom situation from mentors of mathematics student teachers in FE colleges. Thematic analysis was employed as the analytic tool. Data shows that after observing student teachers, mentors correct the student teachers by addressing the inaccurate teaching. This is followed by asking the student teachers to observe their mentors and other experienced teachers. Mentors and student teachers discuss general mathematics issues and work through mathematics questions together. Data also shows that mentors and student teachers discuss how to teach specific topics. Findings show that mentors view e-mentoring as a practice that could play a significant role in the development of mathematical and pedagogical knowledge of FE mathematics student teachers.

References

Burnell, I. (2017). Teaching and learning in further education: The Ofsted factor. *Journal of Further and Higher Education, 41*(2), 227 237, DOI: 10.1080/0309877X.2015.111759

Greatbatch, D & Tate, S. (2018). Teaching, leadership and governance in further Education: Research report. *Social Science in Government*. Department for Education.

Hobson, A. J. & Malderez, A. (2013). Judgementoring and other threats to realizing the potential of school-based mentoring in teacher education. *International Journal of Mentoring and Coaching in Education, 2*(2), 89-108. DOI: 10.1108/IJMCE-03-2013-0019

Kentzer, N., Bracey, P. & Devecchi, C. (2019). Using activity theory and Q methodology to examine the experiences of in-service trainee teachers in the English further education sector. *Research in Post-Compulsory Education, 24* (4) 439-461, https://doi.org/10.1080/13596748.2019.1654711

Lingfield, R. (2012). *Professionalism in Further Education: Interim report of the independent review panel.* Retrieved from https://www.gov.uk/government/publications/professionalism-in-further-education-final-report-of-the-independent-review-panel

Lucas, N., Nasta, T. & Rogers, L. (2012). From fragmentation to chaos? The regulation of initial teacher training in further education. *British Educational Research Journal, 38*(4), 677–695. https://doi.org/10.1080/01411926.2011.576750

Maxwell, B. (2014). Improving workplace learning of lifelong learning sector trainee teachers in the UK. Journal of Further and Higher Education, 38(3), 377-399. https://doi.org/10.1080/0309877X.2013.831036

Merriam, S. B., & Tisdell, E. J. (2016). Qualitative research: A guide to design and implementation (4 ed.). Jossey-Bass.

Tedder, M. & Lawy, R., (2010) 'Passionate about teaching' – the role of mentors in implementing professional standards. *Teaching in Lifelong Learning 2*(2). doi: https://doi.org/10.5920/till.2010.2245