

ATM Conference Thu, 7th April 2021

Subject specific mentoring:
Making mathematics the focus of
mentor-mentees conversations

Cosette Crisan
UCL Institute of Education
Mathematics Education Group [MEG](#)
c.crisan@ucl.ac.uk



Aims of this session:

1. To justify the focus on mentoring;
2. To justify the focus on subject specific mentoring;
3. To describe effective subject specific mentoring (research-informed mentoring);
4. To present and discuss the various components of a PD course, designed to support a research-informed approach to mentoring, with mathematics at the heart of mentor-mentees conversations.

Getting to know each other

Which of the following describe your professional role:

You may choose multiple options.

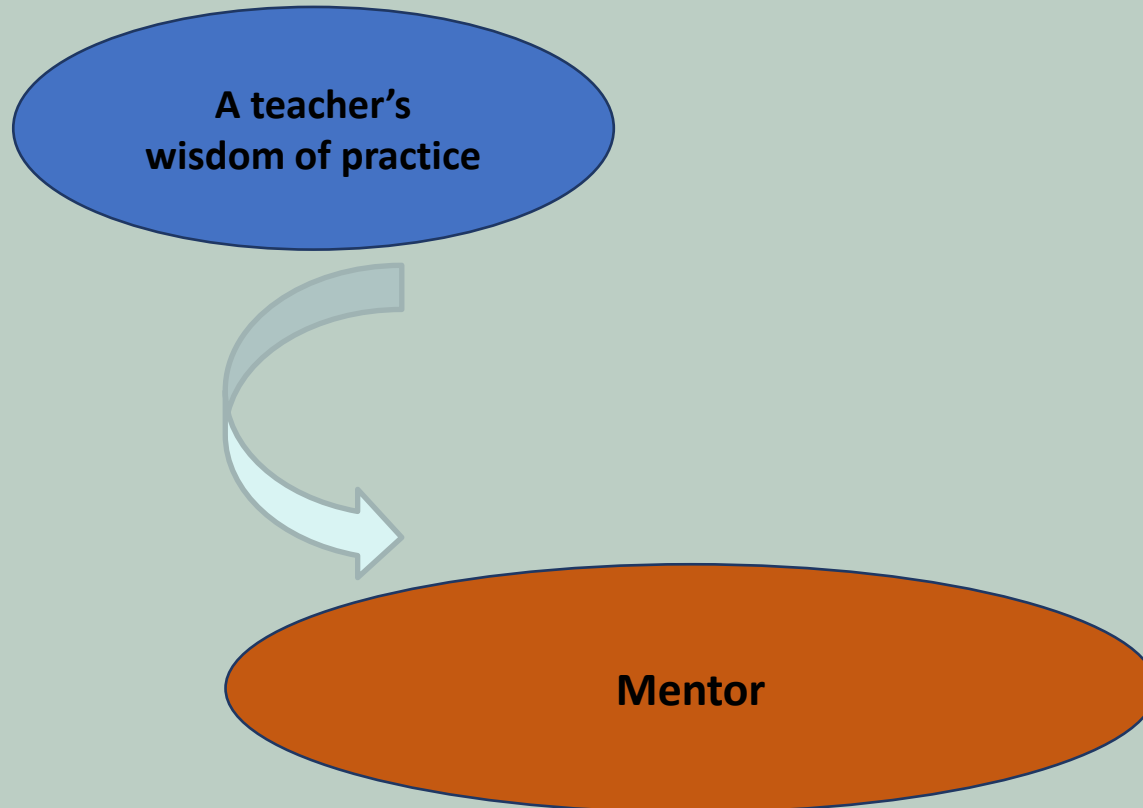
- Mentor (secondary school mathematics)
- <https://www.menti.com/gnh5airt42>
Mentor (primary school mathematics)
- Prospective mentor (secondary) ... thinking about taking on this role
- Prospective mentor (primary)... thinking about taking on this role
- None of the above

Aim 1: Why a focus on mentoring?

- the shortage of mathematics teachers and the increasing non-specialist phenomenon;
- teachers coming into the profession through other current routes such as: *Returns to Teaching, Early career teachers, NQTs, School Direct (unsalaried), Overseas teachers, Career Changers, etc.* will also benefit from unlimited access to specialist mentors in their department;
- practicing mathematics teachers are expected to contribute to the CPD of their less-experienced colleagues;

- the shortage of mathematics teachers and the increasing non-specialist phenomenon;
- teachers coming into the profession through other current routes such as: *Returns to Teaching, Early career teachers, NQTs, School Direct (unsalaried), Overseas teachers, Career Changers*, etc. will also benefit from unlimited access to specialist mentors in their department;
- **practicing mathematics teachers** are expected to contribute to the CPD of non-experienced colleagues – **but are they supported in this role?**

Assumptions about the mentoring role



Wisdom of practice ...and what else?

However, even when mentor teachers are experts in mathematics teaching, they *are not necessarily able to conceptualize their view of the knowledge required for mathematics teaching* (Asikainen et al., 2013), and most frequently they *do not articulate the principles that underlie their pedagogical reasoning to their preservice teachers* (Hudson et al., 2013).

CPD opportunities?

The *limited professional development* afforded to experienced teachers who undertake the role of a *subject-specific mentor* has been recognized to be an obstacle to the quality of mentor preparation.

Coldwell, M., Greany, T., Higgins, S., Brown, C., Maxwell, B., Stiell, B., ... & Burns, H. (2017).

Evidence-informed teaching: an evaluation of progress in England. Research Report. Department for Education.

Poll

What PD opportunities were available to you to develop as a maths mentor?

Short answers are recommended. You have 250 characters left.

250

<https://www.menti.com/iftc69m8hm>

Aim 2: What do we know about the **subject-specific mentoring** provision in England?



there is an ever increased demand of new mentors in schools, a demand for support for mentors that is **subject specific**;

subject-specific (CPD) that focuses on enhancing teachers' understanding of the subjects they teach; how pupils learn in those subjects; and how to teach them, is more effective in terms of its impact on pupil outcomes, than generic pedagogic CPD;

subject-specific school-based mentoring by mentors who have a deep understanding of the specialist subject required for high quality teaching of the subject and understanding of how teachers develop this knowledge;


Cordingley, P., Greany, T., Crisp, B., Seleznyov, S., Bradbury, M., & Perry, T. (2018). *Developing Great Subject Teaching: Rapid evidence review of subject-specific continuing professional development in the UK. London: Wellcome Trust.*

The gap

- the CPD opportunities for mentors are limited;
- most of the courses 'out there' are of generic nature, where the subject specific needs of teachers are not addressed;
- in schools that work in partnership with teacher training institutions, mentors are offered CPD support that is subject specific. However, this training is limited to one or two twilight sessions in a year;
- the ever increasing routes into teaching has also led to an increased demand of mentoring in schools;
- the commitment to introduce a strengthened QTS means that a stronger mentoring provision for all new teachers will be needed.

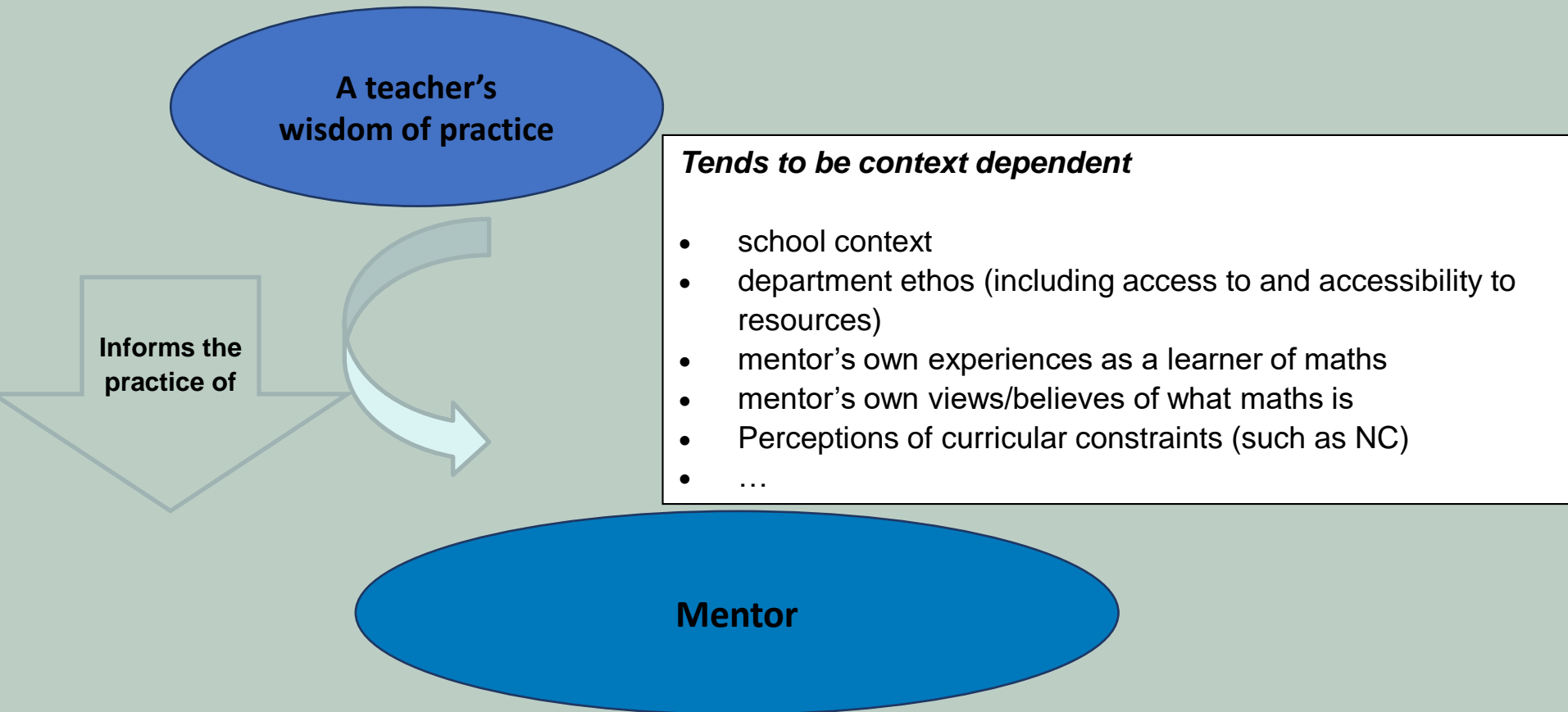
The gap

- the CPD opportunities for mentors are limited;
- most of the courses 'out there' do not address the needs of teachers are not addressing the needs of teachers
- in schools that work in partnership with UCL, CPD support for mentors is limited to one or two twilight sessions
- the ever increasing role of mentors into teaching has also led to an increased demand of mentoring in schools;
- the commitment to introduce a strengthened QTS means that a stronger mentoring provision for all new teachers will be needed.

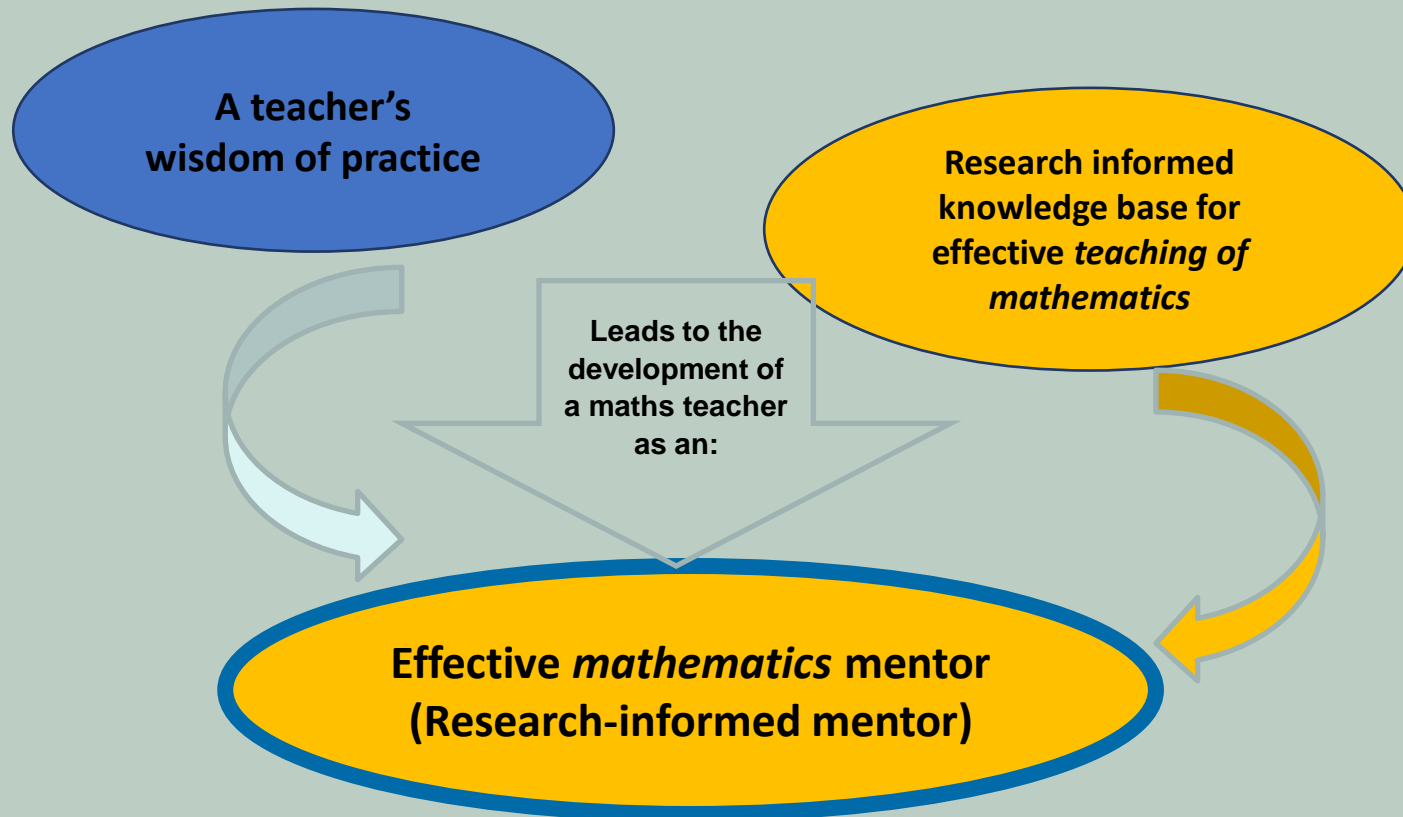


These new mentors need careful support and development opportunities to maximise their *effectiveness*.

Aim 3: What is effective mentoring?



Effective mentoring is research-informed



Research-informed teaching

The key finding at teacher level was that **most teachers valued research;**

Despite seeing it as potentially important, evidence-informed teaching was underused due to lack of time and **difficulty in interpreting and translating research findings into practice;**

Mentors have an important role to play in enabling Early Career Teachers or less experienced colleagues **to access, utilise and interpret robust educational research to inform their teaching.**

Coldwell, M., Greany, T., Higgins, S., Brown, C., Maxwell, B., Stiell, B., ... & Burns, H. (2017). ***Evidence-informed teaching: an evaluation of progress in England.*** Research Report. Department for Education.

About KIMMT

Key ideas in mentoring mathematics teachers

This short online course contributes to the development of experienced mathematics teachers as mentors of early career mathematics teachers or less experienced colleagues through engagement with robust and up-to-date mathematics education research.

Enhance your mentoring: towards a research-informed practice

- 5 weeks duration
- 4 hours of study time per week at your own pace
- 2 optional live taught sessions
- ✓ Led by experienced maths teacher educators and researchers
- ✓ UCL/[FutureLearn](#) certification

About KIMMT

Who is the course for?

This course is designed for:

- maths teachers with 3 or more years experience, aspiring to become mentors;
- mentors of mathematics teachers seeking research-informed professional development opportunities for their teaching and mentoring practices.

What will you achieve?

By the end of this course you will have:

- improved your subject knowledge for teaching mathematics to 11-18 year old students;
- engaged with relevant educational research and understood how it can be applied to your own teaching practice, and that of your mentees.



Course Content

The overarching aim of the course will be to promote:

- a) a view of school mathematics as a network of interconnected ideas, and
- b) pupils' engagement through and in mathematical reasoning.

The participants are engaged in four carefully chosen powerful pedagogical inter-connected themes:

- ***Fostering Algebraic thinking***
- ***Fostering Geometric thinking***
- ***Fostering Numerical Reasoning***
- ***Fostering Functional Thinking***



KIMMT – week 4

Working with negative numbers: language and notation

0 comments

Dealing with negative numbers in the school curriculum is particularly difficult in terms of both teaching and learning.

Difficulties with negative numbers

Negative numbers are notorious in that mathematicians themselves have historically struggled with accepting, understanding, and using them. In his treatise, 'Arithmetica', Diophantus (200-300 BC) stated that when solving quadratic equations, if more than one solution was yielded by whatever calculation, only the first was to be considered. Similarly he called the solution to the equation $4 = 4x + 20$ 'absurd' because mathematicians had not yet developed a way to understand numbers less than zero! Although known to Indian mathematicians in the 7th century, the concept of negative numbers was only accepted by Western mathematicians in 17th century.

Many centuries later, 12-14 year-old students in Mexico also had difficulties in accepting negative solutions when solving linear equations (Gallardo, 1995). Grade 7 students in Sfard's study (2007) also had difficulties in coming to grips with operations on negative numbers.

In the Discussion area of this step we would like you to consider the implications of language and notations used for negative numbers. In particular, we would like you to think about the many different ways you could orally communicate (read aloud) the expressions below:

7 - - 4

7 - -4

7 - (-4)

(+7) - (-4)

7 - 4

-4 - 7

Your task

Make a note of the pedagogical implications of the language involved and share your thoughts in the Discussion area. What difficulties do you envisage students having in their understanding of what they need 'to do' mathematically as a result of different terminology used in reading these expressions?

When you have responded, identify the answer of another learner and offer your views or opinions on what they have said.

References

Gallardo, A. (1995). [Negative numbers in teaching of arithmetic: Repercussions in elementary algebra](#). In M. Owens, M. Reeds, & G. Millsaps (Eds.), Proceedings of the 17th Annual Meeting of PME-NA (Vol. 1, pp. 158-163). Columbus, OH: PME-NA.

Sfard, A. (2007). [When the rules of discourse change, but nobody tells you: Making sense of mathematics learning from a commognitive standpoint](#). The Journal of the Learning Sciences 16(4), 565-615.

Aim 4: Hand-on activity

In the Discussion area of this step we would like you to consider the implications of language and notations used for negative numbers. In particular, we would like you to think about the many different ways you could orally communicate (read aloud) the expressions below:

$$7 - - 4$$

$$7 - -4$$

$$7 - (-4)$$

$$(+7) - (-4)$$

$$7 - 4$$

$$-4 - 7$$

Your task

Make a note of the pedagogical implications of the language involved and share your thoughts in the Discussion area. What difficulties do you envisage students having in their understanding of what they need 'to do' mathematically as a result of different terminology used in reading these expressions?

https://miro.com/app/board/o9J_IL79tVo=

Step 1: Tapping into wisdom of practice

Prior to engaging with each activity, participants are encouraged to share from their own pedagogical experiences related to the specific mathematics topic under scrutiny.

Here is [Mark](#)'s posting: *Negative numbers is very confusing for students. The issue is understanding that minus, subtract and negative have the same meaning. The minus minus they find it confusing, but they get better at it at GCSE and A level.*

[Samir](#) responds to [Mark's](#) posting, confirming that indeed, *Students struggle adding and subtracting negative numbers, especially when they see two operations next to each other (--, +-, -+). The challenge for students is figuring out what to do with the signs.*

Similarly, [Amos](#) shares from his experience: *Pupils will use a number of words and have numerous understandings of what they mean. So we have a mish-mass of minus, take away, less, remove, subtract, negative, less than etc. Students seem to be stuck with their previous learning as correct and struggle to move onto a wider understanding.*

Step 2: What does research say?

Working with negative numbers: language and notation, the participants are given the opportunity to familiarise themselves with a number of research findings (Vlassis, 2008 – about understanding the minus sign in three senses: unary, binary, and symmetric) and recommendations around implications of the language and notations around negative numbers (Bofferding, 2014).

<https://www.futurelearn.com/info/courses/key-ideas-in-mentoring-mathematics-teachers/0/steps/73630>

Research-Informed Pedagogy in Practice

Here is [Mark](#)'s posting after trading the research post:

It is better in my opinion to start with subtracting a negative number instead of minus minus. Only when they understand that we can move on to minus minus, then I will move on to rules: $--=+$, $-+=-$...

[Nishi](#)'s summarises his learning in terms of how he would use this knowledge when mentoring others: *Teachers should be very careful with terminology if students are learning about negative numbers for the first time. The idea that minus and negative are equivalent will mature with time in their minds. In the beginning, visualizing minus and negative separately will help them a lot.*

Step 5: Applying research

A scenario: “A beginner teacher seeks your advice on how to tackle some frequently-occurring mistakes he has noticed his pupils make when checking the answers to the homework. Pupil A is surprised by the teacher’s feedback on his incorrect answer. “But sir, I am right. $-3 - 2$ does equal 6 because minus and minus makes a plus and since there is nothing left between 3 and 2, you times them together.”

Samir explains: *Pupil A is very confused, possibly using a combination of binary and symmetric understanding. I would suggest changing the language to Negative 3 Subtract 2 and displaying how this would work on a number line. I would suggest that the first number is your starting point,*

while **Mark** replies to Samir’s contribution and suggests: *First of all, I would ask the BT [beginner teacher] to clarify the vocabulary to be used (where to use ‘negative’ and ‘minus’) and the functions of ‘-’ sign in this case (unary, binary and symmetrical).*

About the learning on the KIMMT course

I have a clearer idea about what a mentor should do and [how] I need to use backed-up advice, check some key areas understanding, continue to be enthusiastic about my teaching, continue to read up-to-date research (Imelda, 20 years of teaching experience)

Becoming explicit about one's teaching practice

As a mentor, I'd like to be able to provide help that is grounded on effective theories and principles. I'd like to be the kind of mentor that really gives an impact on other's teaching and be able to contribute in improving the teaching of mathematics (Amelia)

Mentors are a source of experience for sharing this knowledge to new teachers and are able to guide them during their development. I believe that mentors should expose mentees to many different aspects of teaching mathematics so that they develop their own style. New teachers need to be able to critique and reflect on their performance and challenge old techniques in order to improve. Mentors play a major role in guiding them through this process (Darren)

An international Study: Focus on *Subject Specific* Mentoring



3 research groups:

ROSE - University of Karlstad, Sweden

HuSoEd - University of Helsinki, Finland

SSRG – UCL Institute of Education, England

KOSS Network - Knowledge and Quality across School Subjects and Teacher Education

Research questions

Research questions

- **What knowledge for teaching a specific subject do (experienced) mentors foreground when supporting novice subject teachers?**
- **How is that knowledge negotiated between mentor-mentee?**

Reflections on own mentoring – generic in nature

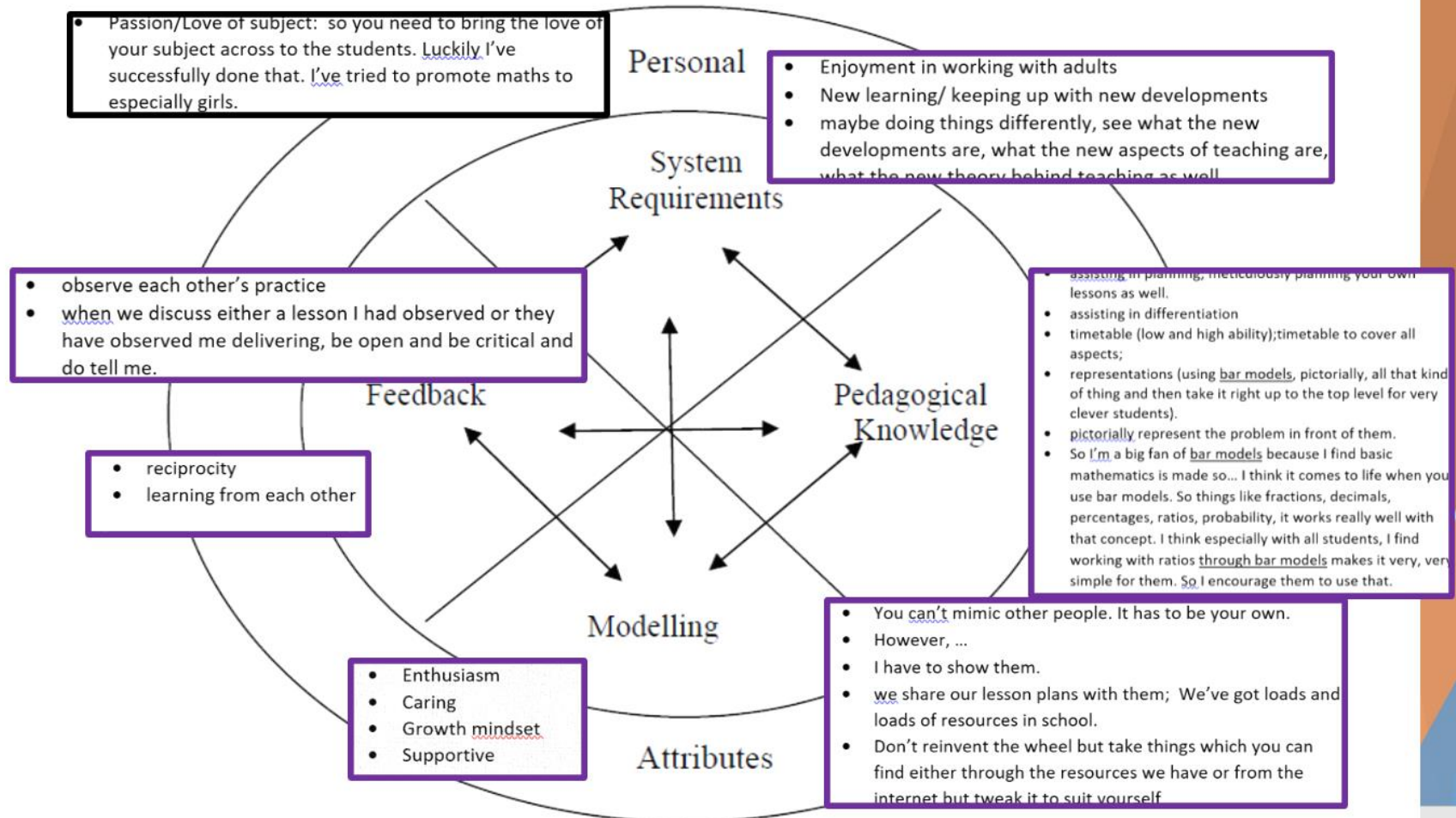
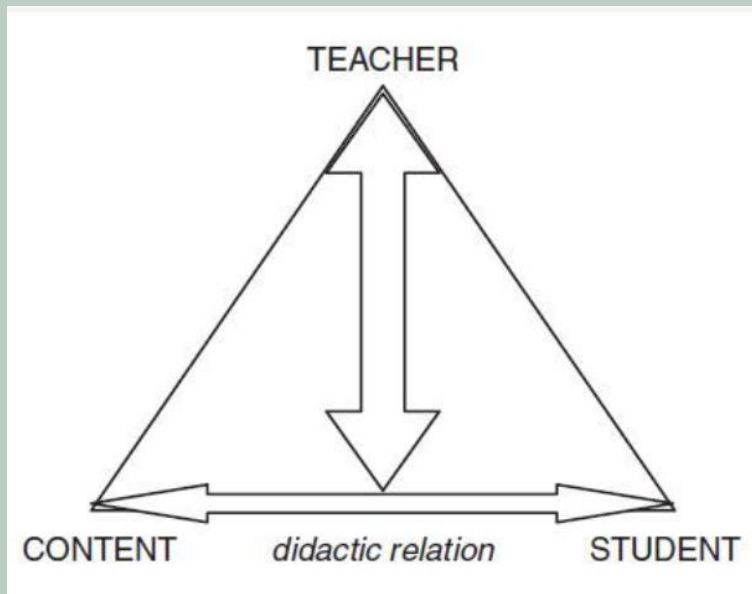


Figure 1. Five-factor mentoring model

Towards subject-specific reflections



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Related references

Crisan, C. (2021). **Mentor-Mentees conversations: Making explicit the teaching and learning of mathematics**. *Proceedings of the British Society for Research into Learning Mathematics* 40(3) November 2020, 30 (3). UK.

Crisan, C. (2020). **Making mathematics the focus of mentor-mentee conversations**. Presented at: BSRLM British Society for Research into the Learning Mathematics.

The KIMMT course: **<https://www.futurelearn.com/courses/key-ideas-in-mentoring-mathematics-teachers>**