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Learning to become a 'good' mathematics and science teacher at post-primary level: Insights from the *Learning to Teach Study* (LETS)

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Funded by the Department of Education and Skills

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Purposes of the study

- Understand the dynamics of learning to teach on consecutive model of initial teacher education (ITE) at post-primary level
  - **Learning to Teach Study (LETS)**
- Framed in terms of emerging new professionalism for teachers
  - Curricular (subject: **maths, science** & language) & cross-curricular (inclusion & reading literacy) competence

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Learning to Teach Study (LETS): Developing curricular and cross-curricular competences in becoming a 'good' secondary teacher: Executive Summary

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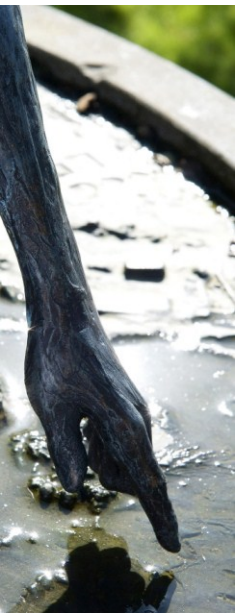
Funded by the Department of Education and Skills (DES)

Study context: reforming curriculum and ITE

- Changing context of teacher education in Ireland and elsewhere
  - 'Teacher education as policy' (Cochran-Smith, 2005), emerging policy on continuum
  - Reform in maths & science, e.g. Project Maths & STS-oriented approach to science education
- DES-funded study (2008-2010): Aims
  - Understand dynamics of learning to teacher on PDE
  - Collaborative programme level study of 'the Dip'
  - Strong STEM focus, i.e. maths & science… know more about maths than science teaching and little about both teacher education in Ireland, e.g. *Inside Classrooms* (Lyons et al, 2004)



Theoretical framework

- Socio-cultural theory
  - 'Mediation' as central (Vygotksy, 1978)
    - Talk and artefacts
  - Assisted performance (Tharp & Gallimore, 1988; Mewborn & Stinson, 2007)
  - Horizon of observation (Hutchins, 1996)
  - Representations, decompositions and approximations of practice (Grossman et al, 2009)
- Research on learning to teach (Beijaard, 2004; Darling-Hammond, 2005; Haggar & McIntyre, 2006)

Horizons of observation

- "...brought home to me the extent to which cognitive accomplishments can be joint accomplishments, not attributable to any individual computational accomplishments of navigation are mediated by a variety of tools and representational technologies" (Hutchins, 1996, p. 35)

- "Lines of observation and limits on observation of the activities of others have consequences for the knowledge acquisition process. Let us refer to the outer boundary of the portion of the task that can be seen or heard by each team member as that person's horizon of observation" (Hutchins, 1996, p. 52)
  - "computational dependencies"

Representations of practice

- Grossman et al (2009) re representations, decompositions and approximations of practice in cross-professional study [clinical psychology, teaching, religious/rabbinical]
  - Teaching has fewer opportunities for initial supported professional learning than other professions
  - On related theme see OECD TALIS re types of professional collaboration

Methodology

- Mixed methods study: Interview & survey
  - Interviewed 17 PDE students 3 times during 2008-09 (January, March & May)
  - Survey (n=133, 63% of cohort), 130 items
- Data collection
  - Based on collaboratively developed interview protocols informed by literature and collective experience as teacher educators
- Ethics
  - Written informed consent, anonymity, confidentiality, free to withdraw at any point, no student interviewed by own tutor

Interview domains

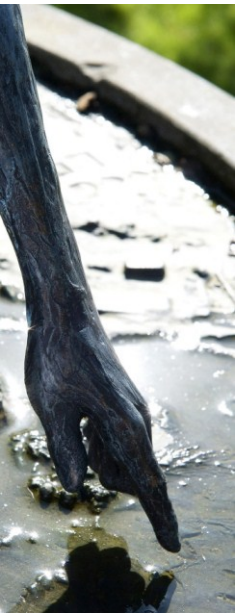
Part	January 2009	March 2009	May 2009
A	Background, previous experience, motivation to learn to teach	Update on progress learning to teach	Opportunity to learn to teach
B	Opportunity to learn to teach	Opportunity to learn to teach	Critical incidents in learning to teach and in school
C	Critical incidents in learning to teach and in school	Critical incidents in learning to teach and in school	Understanding of subject teaching, inclusion and reading
D	Understanding of subject teaching, inclusion and reading literacy	Understanding of subject teaching, inclusion and reading literacy	Future plans
E	Summary: SWOT 1	Summary: SWOT 2	Summary: SWOT 3

Analysis

- Phenomenological (Huntly, 2008 who undertook similar study in Australia)
- Theoretical sampling across data collection time points
- Collation of files based on emerging themes
  - Paragraph level
- Team met regularly to discuss emerging findings

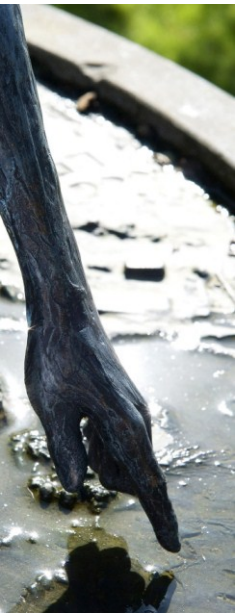
Claims: Dynamics of support

- **I. Mentors & observation**: Despite the fact that over 90% of PDGE students in our survey had one or more of the three kinds of mentor we identified, (school coordinator, assigned mentor or sought-after mentor), by comparison very few had opportunities either to observe experienced teachers or be observed by these same teachers during teaching practice
- **II. Support**: The level of support received within schools varies widely in terms of the type of mentoring support and nature of that support
- **III. Support focus**: Mentor support tended to focus on out-of-class support with limited engagement with pedagogy



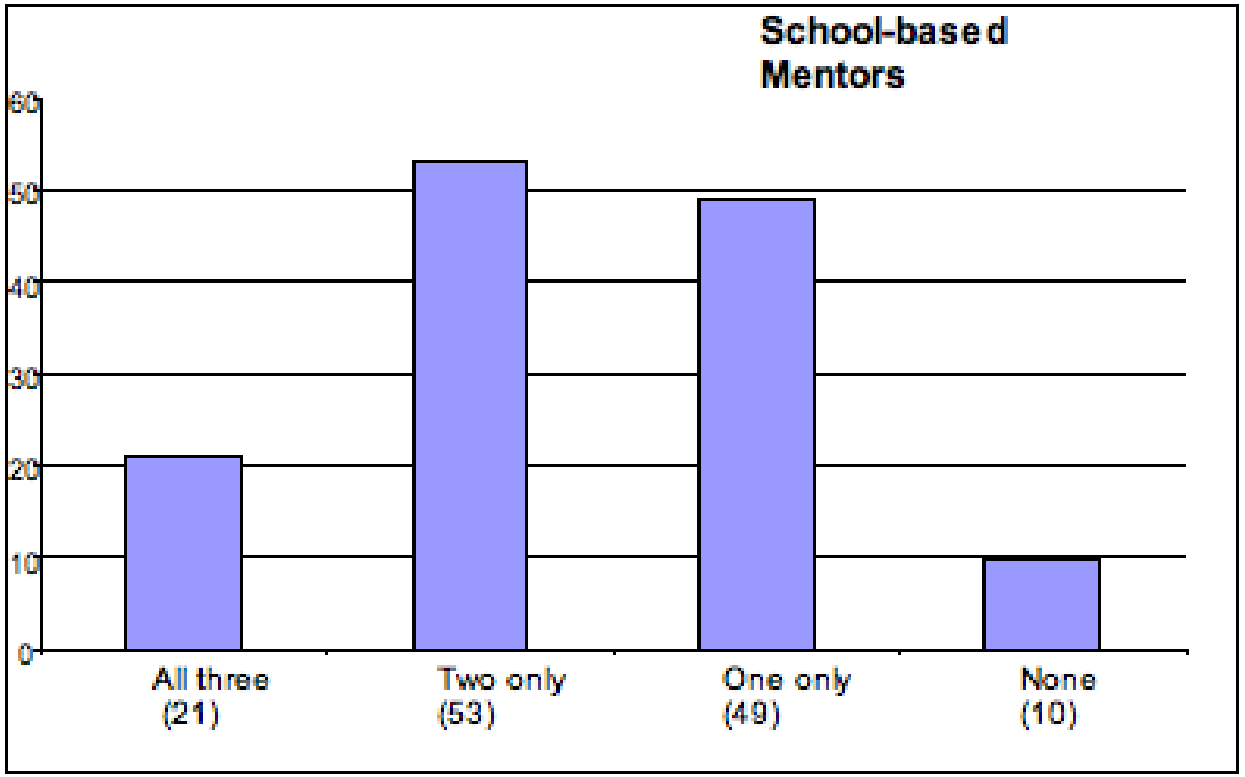
Claims: Subject specific

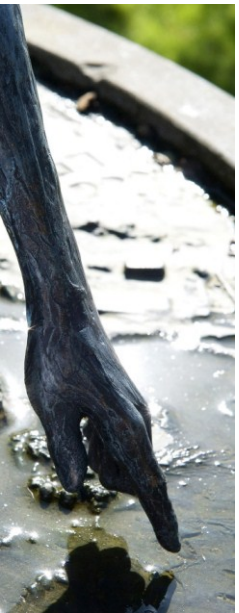
- **IV. Reform-oriented maths challenge:** In both maths and science, proposed reforms were seen as a big step from student teachers' own experience of these subjects in school.
- **V. The resource challenge:** Using resources in a subject such as maths was more challenging than in the case of science
- **V. Framing 'real' and 'realistic':** 'Real' as tangible and concrete rather than an "expansion of reality"
  - More of a challenge in maths than in science
  - BUT interpreting the 'real world' proved challenging in both subjects



I. Many kinds of mentors

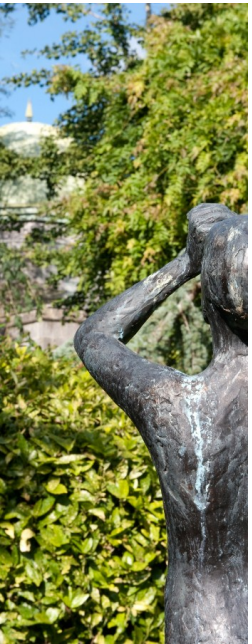
Fig. 1: School-based mentors available to PGDE students in TP schools (n=133)





II. Seeking out mentors

Aisling: There is one maths teacher all right that I go to a lot and she has sat down with me and gone through her file for 1st to 6th years so she shows me how it is all laid out and she just seems particularly forgiving that I am a student teacher and don't really know what I am doing and she remembers her PGDE so she is very good, I can go to her with anything really. (Interview, 1 p. 5)



II. Opportunities to observe

Table B: PGDE students' opportunities to observe a teacher teach at least once during PGDE 2008-09, (n=133)

	Frequency	Percent
Yes	52	39.1%
No	81	60.9%
Total	133	100 %

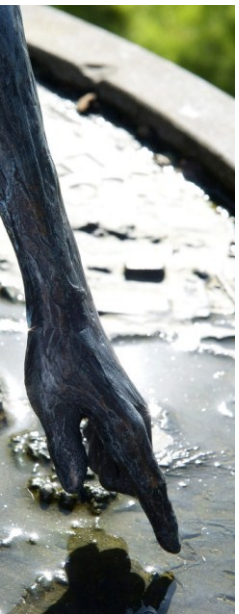
II. Observation: a rare opportunity

- **Kevin:** The first two weeks we went into the school we were more or less told that you would be sitting in the class watching your class teacher and I mean I thought that was brilliant because not only do you get to know the class from sitting at the back of the room but you just get a small bit more confident. I mean this particular day I saw what the teacher was doing and I thought, yes I can do that. It helped me just to build my confidence more than anything else. ... I didn't know what to expect first when I sat at the back of the class, but now, yes I know what is going on, I know the processes that go on in the room and stuff, so that first two weeks was a big help. Even though it was junior classes and even though there was a drawback in terms of you were recognised as a student going back to the classroom, that kind of wore off. One of the people in the school said to me, 'this could be a disadvantage sitting at the back of the class because the students will recognise and cop on that you are a student and take advantage of it.' But I didn't get that. (Interview 1, p.6, emphases added)

II. Limited engagement with pedagogy

Table D: Extent to which PGDE students were able to discuss teaching matters with staff in their teaching practice school (n=133)

As I think about the PDE so far this year, I…	Agree *or* Strongly agree	Undecided	Disagree *or* Strongly disagree
Got a lot of help about planning lessons from the teaching staff in my school	24 (18%)	18 (14%)	58 (68%)
Had an opportunity to talk daily about how my lessons went with one or more teaching staff	67 (51%)	15 (11%)	31 (38%)
Felt I was supported in learning to teach by the teaching staff in my school	89 (68%)	21 (16%)	20 (15%)
Rarely had a chance to talk with teachers in my teaching practice school about professional matters	22 (17%)	11 (8%)	72 (75%)
Had easy access in my TP school to textbooks and other resources in planning my lessons	86 (65%)	11 (8%)	36 (27%)
Had someone in my school I could talk to on a daily basis about learning to teach	79 (59%)	19 (14%)	28 (26%)



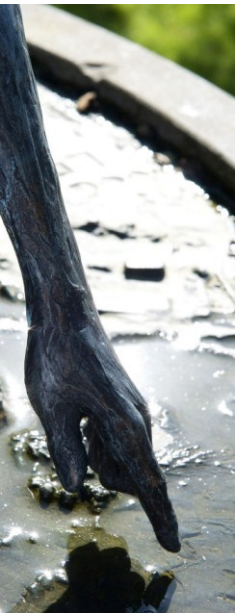
III. Variation in support

Table D: 'Support in Schools' for main and second PDE subject

PGDE Subject: Main & Second	Mean (Main)	n	Mean (Second)	n
Maths	14.2	10	9.9	31
French	8.5	9	7.7	5
Other language	12.6	3	11.0	5
Science (incl. Biology)	11.2	25	12.3	9

III. Variation in support

Aoife: It sounds awful but I am unfortunate enough that the older science teachers in my school, the ones that are there longer, aren't really willing to help you out that much and they are very territorial about even so much as moving lab equipment from one lab to another is a cardinal sin…in this school everyone kind of keeps to themselves unfortunately (8)ven the other H-Dips in the school have the same feeling, they are all told what to do but don't bother the teachers by coming back and asking more questions, unfortunately that is just the way that school is. (Interview 1, p. 4)



III. ‘Host model’ dominant: school & university

Appendix 2: Five models of school-university partnership

Box A1: Five models of university-school partnerships in ITE (based on a five-country cross national study)

Model A: WORKPLACE/HOST MODEL
In this model, the school is the location where the student teacher undertakes a placement. The tertiary institution provides all coursework. This model typically involves some coaching by supervising teachers.

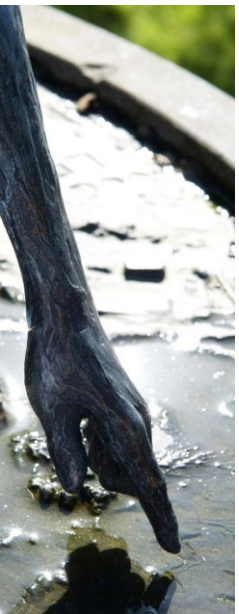
Model B: CO-ORDINATOR MODEL
In this model, the school has a central supervisor or liaison teacher with the tertiary institution. This model is a variation on Model A. The difference is that in this model the school takes on the task of supervising student teachers by appointing an experienced colleague to co-ordinate teacher education.

Model C: PARTNER MODEL
A teacher in the school acts as a trainer of professional teachers. The school is partly responsible for the course curriculum. In addition to coaching the student teacher, the school also provides some of the training itself.

Model D: NETWORK MODEL
In this case, the trainer in the school as the leader of a training team in the school. The school is only partly responsible for the course curriculum. The school has a teacher education training team consisting of one or more trainers at school and coaches who are trained in teaching methods.

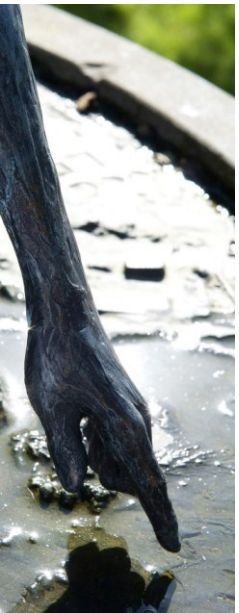
Model E: TRAININIG SCHOOL MODEL
In this model, the entire training course is provided by the school. The tertiary institution functions as a backup or support institution, focusing on training the trainers at school and developing teaching and training methods.

SOURCE: Maandag et al, 2007



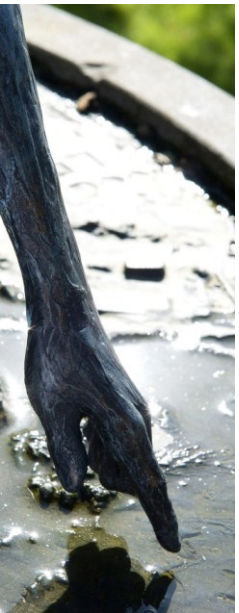
IV. Reform-oriented teaching

- **Reform-oriented maths & science challenge:** In both maths and science, proposed reforms were seen as a big step from student teachers' own experience of these subjects in school
  - "Mixed messages" and contested feasibility of reform-oriented teaching (Delargey et al, 2012 @ SMEC 2012)



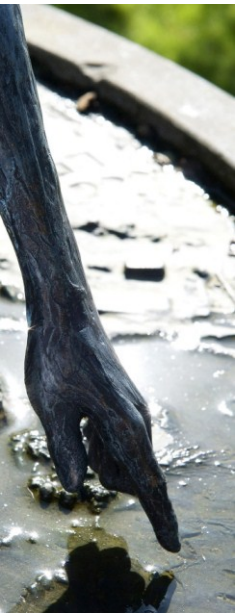
IV. Reform: Old & new images

- Interviewer: So you thought it was repetitive, semi boring, how did you come to that conclusion?
- Interviewee: The topics aren't exciting, like today we are doing statistics because that is the most exciting one I could come up with. But like today we are doing fractions which isn't going to get anybody jumping for joy. But I liked the way the other teacher, the one thing I got from her that was really positive was she really broke the class up into almost ten minute slots. Whereas I often find myself sliding in 20 minutes still doing the same thing and everyone has their heads down and they are bored. But she was very, 'ok we have done this, now let's move to the next thing,' and in the next few minutes you might go back to what you did initially. But all the kids were alert; she really broke it up which I found myself doing after that.
- Interviewer: And have you tried that since?
- Interviewee: Oh definitely and even if it just keeps them awake for longer of the class or more focused.



IV. Reform & solo teaching

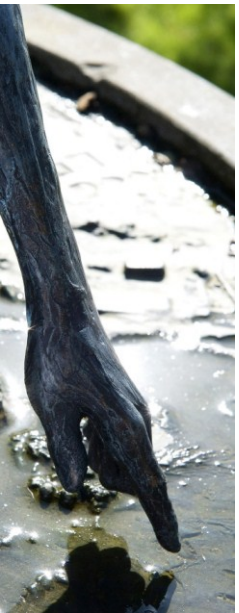
- Interviewer: So in terms of, in a way you have probably answered this already... in terms of teaching your subject to what extent is what you have learned in your school placement helped you in terms of how you teach?
- Interviewee: Well I think what I have learned in my school placement, you almost learn from yourself, from your own mistakes. Like as I said I don't have a lot of interaction with the other teachers there so I am only learning from my own mistakes and in that way I have learned an awful lot. When I think back to how I did things at the start of the year, I couldn't imagine doing it now but at the start of the year...
  - **(Aoife, Teacher of Maths)**



V. Resources, real and realistic

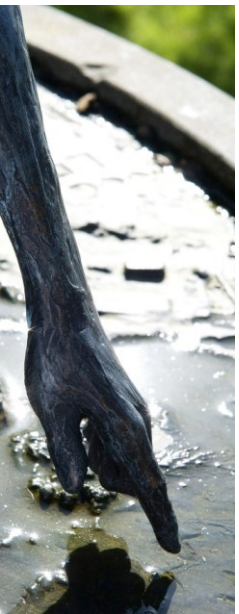
- Freudenthal (1991)
  - ‘Real is not intended to be understood ontologically… but instead commonsensically… it is not bound to space-time world. It includes mental objects and mental activities. What I called “expanding reality” is accounted for on ever higher levels of common sense and witnessed by levels of everyday language or various technical languages’ (p. 17).
- Goffree (1993, p. 89) explained that:

  “…reality does not only serve as an application area but also as the source of learning”



V. Resources, 'real' and realistic

- **Framing 'real' and 'realistic':** 'Real' as tangible and concrete rather than an "expansion of reality"
  - More of a challenge in maths than in science
  - BUT interpreting the 'real world' proved challenging in both subjects
- Julie: *There have been lots of times in maths anyway where I've gone in and my lesson plan is, so I will tell them this and we will do these examples and then I will tell them this and we will do more examples. And the telling them just doesn't get through.*
- Interviewer: How did Julie grapple with this? She recounts in a subsequent interview:
- Julie*: I decided to abandon the textbook…and I just said 'OK, let's just do the pie charts about your interests and lets do a bio graph of how you came to school. And I made questions about them…it captured their interest*.



Conclusions

- Reform-oriented teaching calls for both new types of support & rich portraits of ambitious practice
  - That is, representations, decompositions and approximations of practice (Grossman et al, 2009) congruent with proposed reforms
  - Importance of assigned, sought after and 'remote' mentors AND exposure to different settings in PDE (more likely in concurrent model)
  - Subject to be created not the created subject (Korthagen at al, 2006)
- Generative tensions: Virtues of cognitive dissonance (Festinger, 1957) or "optimal mismatch" (Kuhn, 1986)
  - Structured experiences that expect and address discrepancies between experience and aspiration (both personal and curricular)
- Deepening understanding of 'real' to encompass Freudenthal's (1991) expansion of reality" conception of realistic mathematics education (RME)
  - Value of design experiments as iterative model

Conclusions

- Horizon of observation limited due to type of access to mentors (despite over 90% with access) involving
  - None/one or few observation opportunities
  - Limited/no co-planning opportunities
  - So, consistent with TALIS study (Gilleece et al, 2009) which identified exchange & coordination rather than deeper pedagogy-focused collaboration in Irish post-primary schools
- Working in the third space & LETS @ UCC
  - Considering & negotiating new models of school-university partnership with focus on (Hall et al, 2012) 'what is available to be learned'
  - Beyond the mentoring mantra (Sundli, 2007)….Deeper engagement (Conway, Murphy, Rath & Hall, 2011) with pedagogy via 'uncovering practice' (Grossman et al, 2009) and wider professional engagement in teacher education with emphasis on deepening engagement with pedagogy

Thank you……..Go raibh maith agaibh!!

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References

- Conway, P.F., Murphy, R., Delargey, M., Hall, K., Kitching, K., Long, F., McKeon, J., Murphy, B., O'Brien, S., & O'Sullivan, D. (2010). ***Learning to Teach (LETS): Developing curricular and cross-curricular competences in becoming a 'good' secondary teacher***. (A study funded by the Department of Education & Skills.), pp. 1-407. Cork: School of Education, UCC
- Conway, P. F., Murphy, R., Hall, K. & Rath, A. (2011). Leadership and teacher education: Deepening engagement with pedagogy. In: O'Sullivan, H. and Burnham-West, J. (eds). ***Leading and Managing Schools***. London: Sage.
- Grossman, P., Compton, C., Igra, D., Ronfeldt, M., Shahan, E., & Williamson, P. (2009). Teaching practice: A cross-professional perspective. *Teachers College Record*, 111,(9), 2055-2100. Hutchins, E. (1996). Learning to navigate, In S Chaiklin and J Lave (Eds) ***Learning in doing: social, cognitive and computational perspectives***, New York: Cambridge University Press.
- Kang, N-H. (2008). Learning to teach science: Personal epistemologies, teaching goals, and practices of teaching. *Teaching and Teacher Education*, 24: 478-498.
- Maandag, D.W, Deinum, J.F.,Hofman, A., & Buitink, J. (2007). Teacher education in schools: an international comparison. *European Journal of Teacher Education*, 30,(2), 151–173. doi: 10.1080/02619760701275552
- Mewborn, & Stinson (2009). Learning to teach as assisted performance, *Teachers College Record*, 109,(6), 1457-1487 . http://www.tcrecord.org/Content.asp?ContentId=13496
- Russell, T & Martin, A.K. (2007) Learning to teach science. In Abell, S.K. and Hederman N.G. (eds.) *Handbook of Research on Science Education*. Pgs: 1152-1178, New Jersey: Lawrence Erlbaum Associates.
- Sundli, L. (2007). Mentoring: A new mantra for education? *Teaching and Teacher Education*, 23, (2), 201–214. doi:10.1016/j.tate.2006.04.016