



ESCalate Developing Pedagogy and Practice 2010/11 Grant Project Final Report

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Supporting STEM: working with ITE trainees in STEM subjects to increase success

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Abstract

This article reports the findings of a research project which examines the reasons why secondary science, technology, engineering and mathematics (STEM), specifically mathematics and science, trainees may be unsuccessful on teacher training courses. It highlights a number of issues that trainees find problematic and identifies aspects of professional work which consistently challenge Initial Teacher Education (ITE) students' achievement in STEM subjects. Furthermore, building on analyses of 'tracking data' over several years, individual interviews and focus groups it makes suggestions for intervention strategies which can be implemented to improve the success of borderline students. The success and sustainability of these interventions is evaluated and discussed and the question asked as whether or not the interventions would be applicable across other ITE subjects.

Keywords

ITE, STEM, improving success

Aims

The aims of this study were two-fold: firstly, to establish the reasons why some ITE students from STEM (specifically mathematics and science) subjects struggle to meet the standards for Qualified Teacher Status (QTS); and secondly, to design and implement intervention strategies to support them. The outcomes of this research will inform the teaching on ITE programmes for the Higher Education Institution (HEI) involved in the study and, subsequently, will be used to inform teaching in other HEIs involved in ITE through targeted dissemination of findings from the study. The importance of the study lies in the need for current, and future, high levels of retention of mathematics and science ITE students to alleviate the shortfall in qualified teachers in these subjects, and promote longer-term economic strength underpinned by strong STEM teaching and learning.

Impacts on the original project plan, content and/or time-scale

Some minor changes to the proposed project plan were necessary. A group of trainees who had experienced a difficulty of some significant kind early on in the course were identified and asked to participate. This allowed us to track some of those who might potentially be unsuccessful later in the course. Not all trainees initially invited agreed to take part; as a result whilst some of the trainees involved in the project could be described as 'borderline' in that their early progress at the end of their first professional placement was below that expected at that stage of the course, this classification did not fit all who contributed.

The timescale between receiving approval for the project and the end of the course proved too short to implement the data collection, analysis and intervention originally proposed hence any designed interventions would be implemented for the mathematics cohort starting their ITE course in September 2011. This is described below.

Methodology

Three main methods were employed for the initial data collection: systematic analyses of documentary evidence in the form of 'tracking documents' on ITE students in the current and previous years, semi-structured interviews and focus groups. For the past five years, detailed 'tracking' has been undertaken of all Post Graduate Certificate in Education (PGCE) students at the University to highlight 'critical incidents' which may contribute to their lack of success on the course. Such data are now suitably longitudinal to provide key indicators of the factors specifically affecting mathematics and science pre-service teachers. A systematic analysis of these 'tracking' data was undertaken to provide information to answer some aspects of the main research question and inform the second. The sample for the study through semi-structured interviews and focus groups was the 2010-11 cohort of secondary PGCE mathematics and science pre-service teachers at the University, with a subset of those pre-service teachers across both subject specialisations identified at the end of their first school-based placement. Guided by a student's professional placement report (written by the school-based mentor in their first professional placement) University-based tutors identified which trainees might benefit had a series of interventions been available. These trainees were subsequently interviewed on a one to one basis and then took part in a focus group to try to identify if there were common threads linking them. The in-depth individual semi-structured interviews were undertaken in the pre-service teacher's placement school. Evidence of such interviews in situ in schools (Edwards, 2007) indicates that the workplace provides teachers with stimuli to trigger their recall of situations and incidents, resulting in rich data. The individual interviews were conducted by a research assistant to ensure consistency of approach. The pre-service teachers were encouraged through these interviews to reflect on their practice and identify individual targets and areas for improvement. Ten trainees from mathematics and ten from science were invited to take part in the project. Whilst all the trainees from mathematics agreed only one science trainee was involved.

At the end of their second placement in the final week of the course two focus groups were held; one of mathematics and one of science trainees. The same trainees were invited to be part of the focus groups and they were asked the same questions as those in their individual interviews and to discuss some of the common themes that had arisen from these interviews. Six trainees from mathematics and seven from science took part.

As a result of the findings a number of interventions were put in place for the 2011-12 cohort of secondary PGCE mathematics pre-service teachers at the University of Southampton. These are described below. The usefulness of these interventions were evaluated through feedback from school mentors at

a mathematics mentor meeting held at the University in October, a questionnaire completed by each of the forty secondary mathematics PGCE trainees half way through their first school placement and semi-structured interviews conducted towards the end of their first school placement with six of the participants. Those interviewed were selected to give a stratified sample across age, gender and length of time at the University (i.e. those who had completed a Subject Knowledge Enhancement course at the University and those who were direct entry). As previously, the interviews were undertaken by a research assistant in the pre-service teacher's placement school.

Findings

Analysis of the tracking information held on trainees who suspended or withdrew from the course over the last five years revealed that these trainees fell into two broad categories; those who felt that teaching was “not for them” and trainees who had other difficulties, such as poor organisational skills, were reluctant to respond to advice from staff, or had not formed a successful relationship with their school mentor.

The records indicate that the trainees in the first group tended to have had little experience of schools prior to starting the course, were mature students following a change in career, or had encountered problems with classroom management. Tutor comments indicating personal characteristics such as “lack of assertiveness” and “lack of suitable personality for teaching” were common in those who struggled in the classroom. Roughly half of the trainees in this group had left the course prior to their second school placement, those that did continue longer with the course tended to be mature trainees who were following a change in career.

Trainees described as having poor organisational skills also demonstrated a poor self-awareness of themselves as teachers, a lack of understanding of the need for a range of classroom management strategies, an inability to form positive relationships with pupils, were unable to reflect on their progress and had weak subject knowledge. Trainees in this group had predominantly been a cause for concern since their first placement, however, despite support from school mentors and University tutors, they did not progress sufficiently to be able to complete the course.

Four common themes were identified through the individual interviews as having a major impact on the progress made by trainees; isolation on teaching practice, difficulties with lesson planning and access to resources, presence in the classroom and consistency of support from mentors in school.

Trainees felt ‘alone’ when they were the only PGCE student in a school; in particular when the mentor was perceived to be inexperienced. When comparing their two placement schools trainees felt they had been more successful in a school where there were trainees from the same or another Higher Education Institution than when they had been alone. Trainees reported that having someone in the same position as themselves, or

someone who had recently completed a PGCE was helpful, providing support in organisation, completion of paperwork and monitoring of their own progress. Trainees did not need to be from the same subject area to provide this support and opportunities to spend time with other trainees in the school were welcomed. Knowing trainees who had been in the school previously was also identified as being useful.

Isolation on teaching practice is, in part, linked to the structure of the PGCE course. Whilst some trainees have previously completed the mathematics Subject Knowledge Enhancement course run by the University and have established friendship groups the same is not true for students who have direct entry to the PGCE; in particular mature students and those whose first degree was at another institution. Trainees spend only a few weeks in University sessions before going into school and have had insufficient time to form a common support group. Social network groups being used by some trainees were not all inclusive and Blackboard, the University's Virtual Learning Platform which features a discussion board was seen to be restrictive in developing a support structure, as were organised social activities. It was however noted that the group work activities organised as part of the taught University sessions did encourage trainees to set up limited support networks.

Whilst it was not possible to change the course structure of the whole of the secondary PGCE the following interventions were implemented to try to reduce the impact of isolation on teaching practice and increase the support available:

- Promote and develop the use of group work activities in University taught sessions to encourage the development of support networks
- Develop a social network 'virtual staffroom' using Facebook which all trainees on the course are invited to join
- Invite experienced ex-trainees to join the Facebook 'virtual staffroom' to offer additional support and guidance

Difficulties involved with lesson planning and access to resources were common to all trainees interviewed. Trainees reported not fully understanding how to reference the National Curriculum and whilst the need for this was emphasised during University sessions this was not always seen as a high priority in school. Some trainees identified particular difficulties with setting individual learning objectives. They felt they more support in early lesson planning was needed, in particular with choosing appropriate resources for pupils at a given level. Trainees acknowledged the need for detailed lesson planning, despite observing experienced teachers not explicitly doing this, and recognised that for themselves, the time spent looking for resources formed a lengthy part of the process.

The trainees interviewed recognised that planning with their school mentor was invaluable. They were aware of a range of strategies to support lesson planning that they had either experienced directly or had knowledge of second hand. These included being given the resources and the topic and then left to

work out how they all fitted together, sharing the planning and teaching of a lesson (or series of lessons) with the school mentor, planning a lesson which the mentor then teaches or planning a lesson with another trainee or group of trainees, and then teaching and evaluating the lesson in a way similar to the lesson study model. Trainees acknowledged that lesson planning became easier with practice and suggested ways that future PGCE students might be supported. These included taking learning objectives directly from the National Strategies, using 'level ladders' available on the Internet or using examples from text books and past papers to ensure the level was correct. They felt a resource sharing session at the University would be helpful, as would a lesson plan checklist, which they could use to support planning and subsequent evaluation.

During the first weeks of the mathematics PGCE course all trainees have a session dedicated to lesson planning. The following interventions to support trainees with lesson planning were initiated within this session:

- Trainees worked in groups to plan a lesson on a particular topic at a given level. Each trainee then took the 'joint' lesson plan into their placement school and discussed it with their mentor. It was anticipated that shared ownership of the lesson plan would make any negative observations made by the mentor less threatening. The trainees subsequently returned to the University and shared with the others in their group any comments made by the mentors.
- All trainees were asked to share resources by uploading them onto Blackboard or directing others to them via the Facebook 'virtual staffroom'.

Tutor comments relating to trainees who struggled in the classroom and had failed to complete the PGCE course included "lack of assertiveness" and "lack of suitable personality for teaching". Classroom presence was also discussed by the trainees interviewed who noted that they had either had conversations on this topic with their mentor in school or something had been written on one or more of their lesson observation forms. Trainees commented that they had not considered how use of voice or body language would be important in the classroom prior to starting the course. Professional themes sessions run by schools on classroom presence were not consistent across those interviewed.

The secondary mathematics trainees are videoed presenting a starter activity during the first few weeks of the course. This was seen to be a useful way of looking at how they present themselves. Additional interventions were to:

- Run a session on voice coaching/body language/classroom presence for the whole secondary PGCE cohort.
- Show and discuss with the mathematics trainees a video on body language techniques for teachers.

Consistency of support given by mentors was mentioned by each of the trainees interviewed as was differences in personality. In some instances trainees did not form a good relationship with their mentor, whilst another on

the same paired placement did. Trainees were concerned that some mentors were unable to dedicate themselves sufficiently to the role as they were not full time members of the department or were already stretched as they had the dual role of head of department or Leading Mathematics Teacher. Other problems had arisen when the mentor had taken leave from school due to paternity leave or family problems. It was recognised that, whilst the University does not have a direct role in the appointment of mentors, schools should be reminded as to the advice given by the University on the requirements of the role and greater monitoring of schools in this respect should take place. The findings outlined above were shared with the mathematics mentors at their meeting with University tutors in October. They were specifically asked to discuss the strategies they used in relation to:

- Difficulties with lesson planning and access to resources
- Presence in the classroom
- Providing support

Impact of interventions

Promote and develop the use of group work activities in University taught sessions to encourage the development of support networks

Results from the questionnaire showed that trainees felt that working as part of a group during University sessions was helpful in particular being able to share ideas. Those interviewed who had been on the Subject Knowledge Enhancement course at the University prior to starting the PGCE indicated that they had already formed friendship groups and felt that group work was not particularly necessary to develop support networks. Others new to the University reported mixed responses which tended to reflect the effectiveness of a particular group due to group dynamics.

Develop a social network 'virtual staffroom' using Facebook which all trainees on the course are invited to join

Thirty nine of the forty mathematics trainees joined the 'virtual staffroom' on Facebook. It was unanimously seen as being useful although there were concerns from some that their contributions were being monitored by University tutors. Some trainees were more active participants on the page whilst others silent observers. The Facebook page was used in a range of different ways; organising group discounts for participation in a child protection course, asking others on the course for help, clarification of course requirements, ideas, and sharing links and newspaper reports. Trainees interviewed commented that it was helpful because they could communicate with others and that it was comforting to know how others on the course were progressing. One trainee interviewed commented "It gives you a bit of relief to see that other people are suffering as well, and also people are enjoying it. I find that reading other people's comments about what they've enjoyed actually more reassuring than the negatives so it's quite nice to see other people's experiences".

Invite experienced ex-trainees to join the Facebook 'virtual staffroom' to offer additional support and guidance

Of the four ex-trainees invited to join the Facebook group, two agreed. Whilst it had been anticipated that they would have an active role on the site and offer advice to members of the group when required, their contributions were minimal. This was noted by the trainees themselves who commented on the lack of contribution by the ex-trainees to the extent that some of them did not realise that there was anyone in the group other than themselves.

Trainees worked in groups to plan a lesson on a particular topic at a given level. Each trainee then took the 'joint' lesson plan into their placement school and talked through it with their mentor.

Results from the questionnaire indicated that the trainees felt this activity was very useful. Whilst they noted that planning for an 'unknown' class was unrealistic the activity offered them the opportunity to share ideas and gave them something to refer to later on. One trainee interviewed commented that "I would have found it really hard to plan a lesson straight off by myself whereas doing a mock lesson with everybody else was quite a lot easier and broke you in gently". For most, having the structure of a lesson plan pro-forma to work with was helpful although some would have like to have more time considering lesson objectives and planning on their own. Discussing the lesson plan with their mentor highlighted finer details in their lesson plans such as activities that were perhaps inappropriate at a particular stage in a lesson.

This intervention was also discussed with the mathematics mentors at their October meeting. Mentors felt that generally the task formed a good tool for discussion and enabled them (the mentor) to get a better 'feel' for the strengths of their trainee.

All trainees were asked to share resources by uploading them onto Blackboard or directing others to them via the Facebook 'virtual staffroom'

Trainees understood the value of having access to a wide range of resources. For some, their placement school provided a rich supply of resources and they did not feel the need to search elsewhere. Comments provided on the questionnaire indicated that the trainees did not value Blackboard as a useful repository for resources as it was too time consuming to upload materials and difficult to navigate. At first, trainees shared links of useful websites through the Facebook page. This was superseded when one of the trainees set up a Dropbox account via the Facebook page. This was quickly taken up by many of the group with trainees placing resources into their Dropbox in a haphazard manner. At this point some of the trainees stopped using the Dropbox as they felt that it now took too long to find the materials they required. As a result the group ordered their Dropbox so that resources were filed by topic and key stage.

Run a session on voice coaching/body language/classroom presence for the entire secondary PGCE cohort.

The trainees felt that the session run at the University on voice coaching was informative but not particularly helpful. Some of those interviewed said that they would rather have had the session after they had had some experience in school as it was difficult to relate theory to practice and it was difficult to remember what was covered during the session.

Show and discuss a video on body language techniques for teachers with the mathematics trainees

The body language video was seen by the trainees to be helpful with a number of them attempting to put into practice some of the techniques they had witnessed in the video. One of those interviewed referred to being videoed during their University session and felt that this was more useful as it was individual to them.

Consistency of support given by mentors

During their October mentor meeting the mentors were asked to discuss the strategies they used in relation to difficulties with lesson planning and access to resources, presence in the classroom and providing support. The teachers involved had a range of experience of mentoring. Mentors worked in groups and then shared best practice with each other in each of the identified areas. Notes were taken from the meeting which were subsequently disseminated to all the mathematics mentors in the partnership.

Project impact

The most significant impact of this project has already taken place for the current cohort of mathematics PGCE trainees. Setting up the Facebook 'virtual staffroom' has enabled trainees not only to communicate with each other more effectively but has instigated them to set up their own repository for teaching resources through Dropbox. It is anticipated that the self-support system which has been established by the group will continue to develop throughout their training year and be maintained during their first year of teaching and beyond. A similar 'virtual staffroom' group has subsequently been set up for the trainees who left the course last year and are now in their first year of practice. It is interesting to note however that this group, having been established after they left the course is currently little used. Additional groups have been planned for future cohorts such as those students currently enrolled on the Subject Knowledge Enhancement course.

Linked with the 'virtual staffroom' is the use of Dropbox for sharing resources which will be promoted in future years. It will be interesting to see if there is an improvement in the quality of lesson planning and range of resources used as a result of this.

The project has highlighted the need for greater emphasis on specific aspects of lesson planning and implications for the whole cohort in relation to the balance and timing of school placements and University taught sessions to enable trainees to make better links between theory and practice. The final findings will be shared with the secondary PGCE steering group at the University of Southampton. The roll-out of positive outcomes through a re-designed course structure will positively impact on achievement of those secondary PGCE students in other subjects who, in lesser numbers, experience the same difficulties in achieving QTS standards.

Outputs

The final data for this project have only been collected within the last week and the researchers intend to continue work on the project throughout the current academic year and beyond. It is the intention to collect longitudinal data to investigate the long term impact of the interventions on the current and subsequent cohorts of PGCE students. The interim findings have been shared with the secondary PGCE steering group at the University of Southampton and there has been dissemination of these findings to school-based mathematics mentors at their subject-based mentor meeting in October 2011.

Details of any future planned dissemination activities

Presentation of findings at a Teaching and Learning staff development forum at University of Southampton

Dissemination of findings at relevant conferences, initially at the Association of Mathematics Education Tutors (AMET) and Escalate.

Journal articles (to be decided). It is anticipated that the findings will lead to changes in current pedagogy and course structure/design.

References

Edwards, J (2007) Primary Trainees' Reflection-in-action. British Society for Research into Learning Mathematics, 27(1), 30-35.

Does online social networking have an impact on student outcomes?

Online social networking may help support the success of initial teacher education (ITE) trainees researchers from the University of Southampton have found. Ruth Edwards and Rosalyn Hyde, ITE tutors from the Southampton Education School, have been working on an Escalate funded project which looks at the reasons behind students withdrawing from teacher training courses in science, technology, engineering and mathematics (STEM) subjects. Two of the factors they identified, isolation in school and difficulty in locating teaching resources may be lessened through social networking. Following interviews and focus groups with a sample of mathematics and science trainees last year the pair set up a series of interventions for the current cohort of mathematics students. Creating a Facebook page was just one of these, giving their trainees easier access to interact with each other when on school placement. Initial findings from the project indicate that interaction through the site has helped reduce feelings of isolation and encouraged the trainee teachers to establish their own resource sharing facility using an online dropbox. The researchers admit that there is still much to do on this project and intend to continue studying the groups' usage of the Facebook group and its effectiveness throughout their ITE training year and into their first year of teaching.