CASE STUDY

Preparing Tutors for Mathematics Learning Support

Olivia Fitzmaurice, Department of Mathematics and Statistics, University of Limerick, Ireland. Email: olivia.fitzmaurice@ul.ie
Anthony Cronin, School of Mathematics and Statistics, University College Dublin, Ireland. Email: anthony.cronin@ucd.ie
Eabhnat Ni Fhloinn, School of Mathematical Sciences, Dublin City University, Ireland. Email: eabhnat.nifhloinn@dcu.ie
Ciaran O'Sullivan, Department of Mechanical Engineering, Institute of Technology Tallaght, Dublin, Ireland. Email: ciaran.osullivan@ittdublin.ie
Richard Walsh, Mathematics Learning Centre, University of Limerick, Ireland. Email: richard.walsh@ul.ie

Abstract

This paper reports on a Mathematics Learning Support (MLS) tutor training programme implemented on a coordinated basis across three universities in Ireland in 2015 by the Irish Mathematics Learning Support Network (IMLSN). The training events were conducted in September near the start of the first semester of the academic year. Focus groups were conducted at the end of the semester in the three institutions with tutors who had participated in the training events to evaluate the workshops and their impact on the tutors' MLS teaching.

Keywords: Mathematics Learning Support, Tutor Training.

1. Mathematics Learning Support and the Importance of Good Tutors

The need for Mathematics Learning Support (MLS) in alleviating transition issues to higher education has been well documented in the UK (Hawkes and Savage, 2000) and Ireland (Ni Fhloinn et al., 2014; Gill et al., 2010). In 2012 it was estimated that MLS provision in the UK existed in over 85% of higher education institutions (Mac an Bhaird and Lawson, 2012). In 2015, a survey conducted in Ireland indicated that MLS is offered in 97% of higher education institutions (Cronin et al., 2016). Though the range of supports available is vast (Mac an Bhaird and Lawson, 2012), one-to-one tuition is offered in all drop-in centres and is the support most favoured by students (O'Sullivan et al., 2014, Cronin et al., 2016). In most cases MLS tutors comprise postgraduate students and/or faculty members (Cronin et al., 2016). As tutors are students' first exposure to MLS, it is important that they are trained in order to make their MLS centre an environment that, according to Mac an Bhaird and Lawson (2012; 10), should be 'welcoming, supportive and non-threatening'. One of the recommendations arising from the 2014 Irish Mathematics Learning Support Network (IMLSN) report on student evaluation of MLS (O'Sullivan et al., 2014: 14) was that "(p)riority should be given to bespoke training and development of all MLS staff to ensure the optimal student experience." Leading on from this, in 2014 IMLSN members designed a suite of workshops to address this recommendation and, in 2015, secured funding from the *National Forum for the Enhancement of Teaching and Learning in Higher Education* to deliver the training in multiple locations.

2. Workshop Content and Delivery

In 2015 the IMLSN conducted its tutor training programme in three institutions, with invitations extended to all MLS tutors across all institutions. Forty-two tutors from six institutions participated. Three focus groups were conducted with volunteers ten weeks after the training. Some of the findings from the focus groups are reported in this paper.

The training programmes were facilitated in three similar MLS centres i.e. the support offered is mainly on a drop-in, one-to-one basis, is open to all students of the university and promotes a model

of self-directed learning. The training programme content comprised an amalgamation of tutor training materials designed by members of the IMLSN and **sigma** (Croft and Grove, 2011). The training took place over a half day period and comprised four one-hour workshops which were adjusted as appropriate to take account of local issues. Workshop 1 detailed the importance of the work of tutors in MLS. The mathematical background of students attending the MLS centres was discussed using appropriate local data, in the form of either diagnostic testing data or MLS tutor generated feedback based on the previous six years of MLS visits. This introductory workshop also discussed the initial visit of a student to MLS and what tutors should do, as well as methods of teaching for understanding and issues relating to mathematical language and jargon. Workshop 2 covered listening, explaining and questioning skills with associated exercises and role play. Workshop 3 covered the concept of individual student needs and differences. It also covered non-mathematics skills such as counselling and empathy, dealing with maths anxiety and mental blocks. Workshop 4 related to Do's and Don'ts of MLS tutoring. **sigma**'s 'tutoring in a mathematics support centre; a guide for postgraduate students' was distributed to all participants and used throughout all sessions as a resource. The training programmes were delivered by the managers of the MLS centres at the start of the academic year 2015/16.

3. Evaluation – Data Collection and Analysis

Five tutor training attendees from each of the three institutions were sought and selected to take part in a focus group (see appendix for questions) at the end of semester to evaluate the training programme. A PhD student was hired to conduct the focus groups, collect and transcribe the data. Thematic content analysis involved analysing the focus group transcripts, identifying themes within the data gathered and collecting examples of these themes from the text. Ethical approval was granted for the collection and publication of data retrieved from these focus groups.

4. Results - The Impact of the Tutor Training Programme on the Tutors' Practice

Fourteen tutors, with a varied range of tutoring experience agreed to take part in the focus groups.

4.1 Benefits of the Training Programme

4.1.1 Empathy for Students

A key theme that emerged from the participants was the benefit of the training programme in helping tutors to become more understanding of students' situations. The immediate effect of this aspect of the programme was commented on by one tutor:

"… what struck me as most useful during it was I constantly remembered that a lot of the troubles that the students will have are not at all clear to us".

Other tutors commented on the longer term impact that highlighting this fact in the training programme had on their subsequent practice:

"… the main thing ….that I implemented while tutoring in the Learning Centre was we talked about like some students coming in, they might be under stress or under pressure. I thought I was trying to be a little more empathetic that way… just trying to understand where they were coming from".

4.1.2 Catering for Different Abilities

The main theme that emerged here was the benefit of the training programme for highlighting to tutors the broad range of abilities with which they would be greeted.

"I am well aware of people who have different learning abilities… but still it's useful … to bring that out and highlight it".

However, even with this, tutors were still surprised at some students' levels of knowledge.

"I always had the assumption that these people coming into college must have some sort of base knowledge but a lot of them actually don't … you … have to go back to ground zero".

4.1.3 Getting Acquainted with Other Tutors

The workshop was a good opportunity to meet other tutors.

"What I found most helpful was getting to see the other tutors here and knowing who they are because I didn't know the other tutors in the MLC and I think that's the most useful thing because it's a team".

This was not the case in all focus groups however; as one participant highlighted that in future the training should enable him to

"… meet all the tutors because I have never met X. Like we are in the same place now, we are in what? week 11".

To counteract this, they felt that the introductory workshop might include ice-breaker activities between tutors (both new and existing?) in future.

4.1.4 Tutor as 'Expert'

Some participants highlighted how the programme was beneficial in reassuring them that they did not need to know everything.

"I was really nervous because I'm good for maths but I'm not really good for stats for example so it was really good, you know, we don't really have to answer every single question that we have, you know, that we only focus on what we actually know so that was really helpful".

"I think for me the session beforehand was helping me understand that it's OK for me not to help others. … It's OK to not understand … Last year I felt so guilty".

The focus on tutors' content knowledge was a recurring theme and will be discussed later.

4.2 Teaching Strategies

The following subsections relate to findings from the focus groups with reference to tutoring in a one-to-one MLS drop-in setting, which was the focal point of the workshops. However, it emerged from some of the data that tutors want training to deal with a larger classroom teaching setting (e.g. tutorials). The development of further workshops to facilitate this is necessary so that they are available for use in institutions where that need is evident and not already fulfilled by other training.

4.2.1 Explaining

For some tutors, the training emphasised that the role of a tutor is to act as a facilitator and to draw the knowledge from the student.

"[What] I took from it basically was to try and get them to do the work and not feel under pressure that you are supposed to just like give them solutions to homework or anything like that".

One tutor compared his explaining prior to the workshop and now this year since engaging in the tutor training as follows:

"… there were a couple of instances even last year you know in the Maths Learning Centre where people asked you to explain something, and you would go and show them an example of how to do the questions instead of explaining the stuff really simply and I think the workshop kind of addressed that".

Students' expectations of tutors was a recurring theme in all three focus groups. Participants discussed how it was difficult to remain enthusiastic for students that were only there to get the answers from you. All interviewees maintained that the students that came to the MLS Centres at the same time every week wanted to understand and got the most from the support facility. However, those who were not there regularly and just arrived when an assignment was due viewed it as the tutors' job to give them the solution. One tutor portrayed a similar sentiment highlighting that some students appeared to have the attitude "*yeah, why would I [do the question], you're here".*

4.2.2 Questioning

Predominantly the feeling that emerged from participants was that this aspect of the training programme was rushed and not interactive enough. As one tutor commented:

"I mean tutor training for me like there was no like one on one experience. You weren't actually doing anything in it and you were just being given advice".

Similarly, another recommended:

"[m]aybe make it a little more interactive as well".

"It was kind of rushed … It was five minutes of 'oh yeah this is how you do it' and it was me and X [looking] at each other, oh yeah that's how you do and that's it".

Another tutor did indicate the importance of questioning to identify the gap in the students' knowledge. She stated:

"… one of the things they [the tutor training programme] mentioned is trying to find the root of the problem and as you X were saying sometimes it can be a really basic thing".

5. THE ROLE OF THE TRAINING PROGRAMME IN PREPARING MLS TUTORS

5.1 Value of the Training Programme

The overall verdict from participants in each interview was that the training programme was very worthwhile. This was illustrated in one focus group interview by participants suggesting that it should be mandatory for anyone that is teaching a module and that this should be examined at a departmental level.

Other tutors were also very much in favour of the training with one stating:

"I would like to say now that I actually thought the [training programme] was a great idea and I was delighted I was there … the very fact that there was [a training programme] was great and, you know, a very good start".

5.2 Content Knowledge

A recurring theme across each interview was the matter of tutor content knowledge. For some, this was a major concern and left them feeling 'guilty' or 'inadequate'. One tutor alluded to negative student responses if they came to the MLS Centre and nobody there was capable of helping them. Another tutor also highlighted this negative response when the tutor is not entirely sure of the content and is trying to understand it themselves before attempting to teach it. He stated:

"…sometimes you will get a situation where you don't know the stuff instantly and they will take out their notes and they see you reading the notes and trying to figure things out as you go and they will just take the response of 'he doesn't know what he is talking about so he is useless to me".

However, the interviews uncovered strategies tutors employed to overcome this obstacle and presented ideas how this could be developed in future.

5.3 Role of the Training Programme in Developing Tutors' Content Knowledge

One tutor felt that the training programme did not prepare her sufficiently to help with more difficult mathematics. She stated:

"…I'm at a loss in the Maths Learning Centre when someone comes in with … 2nd or 3rd year Actuary or something like this and I didn't get enough from the session to enable me to know what to do so I have struggled in that regard".

The participants in that focus group interview were of the opinion that workshop hours developed to upskill tutors in certain topics would be a beneficial addition to the training. They all agreed that it would be impossible to be specialised in every area, but a revision workshop on certain popular areas such as algebra and statistics would be very helpful. Three participants at one of the focus groups all stated that they believed that they would be better tutors if they were able to help a greater number of students by developing their content knowledge.

Another tutor disagreed with this view as regards the role of the training programme. He felt that it was not the duty of the programme to upskill tutors in mathematics but instead the tutors' own responsibility. He highlighted that their mathematics was at the requisite level to help a certain portion of students but if they engaged in other activities such as working together or tutoring a module, as suggested by another tutor, then they would develop their content knowledge.

"… the maths support has hired us at the level we are. I mean we are at a good enough level to handle a certain percentage of the students and that's the important thing and going beyond that is just up to ourselves I think".

Within each interview participants suggested ways of helping students in topics they (the tutors) were not overly familiar with. These are now discussed.

5.4 Overcoming the Obstacle of 'Content Knowledge'

5.4.1 Diagnosing Students' 'Actual' Problems

Despite their lack of content knowledge in some areas, tutors were in agreement that the root of the problem could often be something they could help with. One tutor highlighted an example of this *"… sometimes it's something to do with differentiation rather than the statistics of it*". Another tutor noted a similar experience with regard to mathematical physics which '… wasn't [her] strong point' but the student's difficulty "*was actually … differentiation*", which she could help with. Several tutors noted how they adopted the technique of getting the students to explain to them the topic they were doing. In that way they were in a better position to "*try and pinpoint where [the student's] problem is".*

5.4.2 Timetable

Participants in the focus groups felt that a better or "more rounded" timetable would enable them to cater for a broader range of students and get to know the mathematical competencies of other tutors.

"… If you had a list of names of who felt comfortable in a particular [topic], you could say that person is on at that time and come back with your problem then".

This practice seemed to be already in use in other centres however. One tutor noted that when students were looking for support with statistics, an area he was not comfortable with, he would respond *"no, you have to come back on stats day for stats*". Likewise, one tutor described his response when he was struggling to help a student:

"Like I always know X is the stats person … I'll basically just get X to come over and talk through the problems that I can learn as well".

He was confident in doing this as in that learning centre *"you are working with the same tutors every week so you know whose strong point".*

5.4.3 Access to Notes

A frequently aired opinion was the importance of the students bringing their notes to help the tutor teach "*using the same notation as the teacher*" and "*in the same terminology that they are using*". In one centre, participants agreed that due to the many platforms being used, such as Sharepoint, SULIS and lecturers' personal websites, accessing notes for modules was very difficult, but this was not an issue elsewhere.

5.4.4 Use of the Internet

It emerged that tutors regularly used the internet to help them while working in the centre if there was content they were unfamiliar with.

"… a few times I have actually walked away from some people going 'right I can't help' but I have then went straight on my phone and I actually started looking stuff up. It might be a branch of maths I have never seen before but I will start looking stuff up specific to their question and maybe then actually find something and go back to them and they'd be like oh this actually helped".

The workshop encouraged tutors to give students the tools to help themselves.

"I feel like I have so many students this semester and the most useful skill I've shown them is how to type something into Google".

6. CONCLUSION

The overall opinion shared by participants in the focus group interviews was that the tutor training programme was beneficial for their tutoring practice. Indeed many recommended making training compulsory for anyone involved in mathematics tutoring in Higher Education. While this is generally out of the remit of MLS managers, it is something that could be recommended to heads of department. MLS centres have the potential and experience to make a valuable contribution to such training. Further feedback attained from focus groups held with fourteen out of all forty-two training programme participants provided the IMLSN committee with ways we can enhance the training process for all practicing and prospective tutors.

One notable issue arising from the focus groups was tutors' feeling of isolation working in MLS. They made a request to facilitate them getting to know other tutors in a bid to feel part of a team. While difficult to do in larger MLS centres, any team building intervention should ideally take place at the start of the academic year where possible. Future training programmes should be designed with an induction/ice breaker session for tutors to get to know other members of their own MLS team and familiarise themselves with other tutors' areas of mathematical and/or statistical expertise.

The training programme was tailored to provide advice for tutors who give one-to-one tuition on a daily basis. They requested that, in future sessions, more time is dedicated to development of tutors' questioning and assessment skills. Some of the tutors interviewed also stated that they would like more training in teaching group/tutorial sessions.

Tutors are hired for their strengths in specific areas be it mathematics or statistics and they are then required to help students according to what their particular needs are. They are not required to be expert across all mathematical disciplines and this was reinforced in the training programme but perhaps greater emphasis needs to be placed on this important issue at future training programmes. Tutor content knowledge was a recurring theme in all three focus groups. While participants stated that the training programme was useful in reassuring them they did not need to be expert in all mathematical areas, many stated that they would benefit from subject content sessions in future training programmes. This is something to be considered by all MLS practitioners - that tutors need to be supported throughout their MLS practice.

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8. Appendix

8.1 Questions for tutor focus groups:

8.1.1 How did the tutor training workshop impact on tutors' practice?

How much teaching in MLS had you done prior to the training workshop?

For those of you who had taught before, do you feel that the tutor training sessions impacted on your teaching in any way? How?

Can you give any example(s) of anything you did differently?

If there was no impact, why do you think this was?

The tutor training day focussed on issues relating to

- Your explaining,
- Listening,
- Questioning
- Catering for students with different levels of ability

What did you think of these?

Is there anything you were told during the training day that you would not have thought of otherwise with respect to mathematics instruction?

8.1.2 Did the training workshop prepare MLS tutors adequately for their role?

How well did the workshop prepare you for the semester that followed in terms of your MLS teaching?

Was there anything in the tutor training sessions that you disagreed with (or didn't think was useful) on the day? Why/why not?

Have your thoughts changed on this in any way? Why/Why not?

Are there any areas of teaching that you find particularly challenging or would like further training on?

How can the training be improved?

Is there anything you have learned from your tutoring/teaching that you feel would be important for new tutors to consider or do when they are starting out?

What would incentivise you to do more MLS training?

9. References

Croft, A. and Grove, M. eds., 2011. Tutoring in a mathematics support centre: a guide for postgraduate students. Birmingham: National HE STEM Programme. Available at: http://www.mathcentre.ac.uk/resources/uploaded/46836-tutoring-in-msc-web.pdf [Accessed 24 March 2016].

Cronin, A., Breen, C., Clancy, M., Cole, J. and O'Sé, D., 2016. Mathematics Learning Support in Ireland in 2016: a survey of 31 third-level institutions on the nature and extent of mathematics learning support and the associated challenges and developments. In press.

Engineering Council, 2000. *Measuring the Mathematics Problem*. [pdf] London: Engineering Council. Available at: http://www.engc.org.uk/engcdocuments/internet/Website/Measuring%20the%20Mathematic%20Problems.pdf [Accessed 24 March 2016]

Gill, O., O'Donoghue, J., Faulkner, F. and Hannigan, A., 2010. Trends in Performance of Science and Technology Students (1997 - 2008) in Ireland, *International Journal of Mathematical Education in Science and Technology*, 41(3), pp.323 - 339.

Mac an Bhaird, C. and Lawson, D., 2012. ***sigma*** *Guide: How to set up a mathematics and statistics support provision*. [pdf]. Coventry: Coventry University. Available at: http://www.mathcentre.ac.uk/resources/uploaded/51691-how-to-set-upfinal.pdf. (Accessed 17 Feb 2016).

Ní Fhloinn, E., Fitzmaurice, O., Mac an Bhaird, O. and O'Sullivan, C., 2014. Student perception of the impact of mathematics support in higher education, *International Journal of Mathematical Education in Science and Technology*, 45(7), pp.953-967.

O'Sullivan, C., Mac an Bhaird, C., Ni Fhloinn, E. and Fitzmaurice, O., 2014. *An Irish Mathematics Learning Support Network (IMLSN) Report on Student Evaluation of Mathematics Learning Support: Insights from a large scale multi- institutional survey*. [pdf] Available at: http://supportcentre.maths.nuim.ie/sites/supportcentre.maths.nuim.ie.mathsnetwork/files/uploads/docs/IMLSNFinalReportPrePrinters.pdf [Accessed 17 Feb 2016].