Does adding Mathematics to English language learners' timetables improve their acquisition of English?

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This enquiry based project set out to find out if adult English language learners, known as ESOL (English for Speakers of Other Languages) learners in the UK, might benefit, in terms of their acquisition of English, from studying maths. This research has been conducted at a medium sized FE college in the East Midlands where I teach. I evaluate this in two ways, firstly by analysing learners' results, and secondly by asking experienced ESOL teachers to observe and reflect on an ESOL Maths session. This project found a correlation between attending a maths class and improved English language exam results over 5 cohorts of students. In addition, ESOL teachers noted many and varied opportunities for English language learning in an ESOL Maths class, with higher levels of learner participation and confidence than seen in language classes. I recommend that we offer ESOL maths to ESOL learners, and that we reassess maths teaching for all learners, ESOL and English speakers, as a triad: conceptual understanding, procedural competence and language acquisition.

Keywords: adult mathematics learners; ESOL; Further Education College; language in mathematics; triad approach

Introduction

The learners involved in this project are all people who have voluntarily signed up for ESOL Maths, and may have just arrived in the UK, or been here for many years. They may have opted to come to the UK for work or family reasons, or been subjected to political or social persecution in their country of origin. The learners are all over 16 years of age; most are 19 or over. The primary motivation for many of the learners attending ESOL Maths classes is to improve their English, and this can be for a number of reasons, including improving their job prospects or helping their school aged children.

ESOL Maths learners form part of a number of wider educationally-based communities, namely mathematics learners in the UK, ESOL learners in the UK, and, globally, those whose first language (L1) is not English who are learning maths in English. They may come from many countries and cultures which can be very different, both from the UK and each other, in terms of the content of maths lessons and assessments, mathematical symbols and language, and the value placed on mathematics learning.

Methodology and methods

In order to ascertain whether adding ESOL maths to ESOL learners' timetables has an impact on their acquisition of English I compared the results of ESOL learners who have studied for maths qualifications with those who have not. This was small scale

quantitative analysis based on an ESOL intake of approximately 130 learners each year, 11% to 18% of whom enrol for ESOL Maths.

It should be born in mind that this is a small scale investigation based in one college which has one ESOL Maths teacher, namely myself, although some higher level learners do attend an English speakers maths class if it falls on a more convenient day for the learner. Entry level English learners are not encouraged to attend English speakers Entry level classes as they are deemed to need specialist help. As such I examined the results of the whole population of ESOL learners at this college, of whom the ESOL maths students can be seen as a subset of the total population (Cohen, Manion & Morrison, 2000).

I chose to analyse the data to see if these observations can be evidenced in some way by improved ESOL results, but in order to triangulate this information ESOL colleagues were asked to observe an ESOL Maths session and report back on their findings. This mix of quantitative and qualitative analysis can be seen as an opportunity for triangulation of data (Coben, 2003).

The analysis does not tell us why any correlation occurs, highlighting the limitations of data analysis (Bell, 1993) and a positivist approach (Stacey, 2013). It may be that the amount of teacher contact time has an effect, or that adult ESOL learners who opt for ESOL maths are more highly motivated than those who do not. A correlation might also be for reasons unrelated to ESOL Maths; that it may be that any subject taught, from sport (Hately-Broad, 2006) to flower arranging, could have the same effect, particularly if the learner has some prior knowledge of the subject.

Observers were given a three questions for consideration: Firstly, can they see any advantages of ESOL Maths, where the language is less overtly taught than in an ESOL class? Secondly, do the students exhibit skills that they were unaware of, or that surprise them for the level those students are at in their English? Finally, does it make the teachers reassess the learners' language skills levels? The questions are open-ended to draw full responses (Ribbins, 2006), but can be seen to be connected to allow for corroboration (Richards, 2009). A Likert scale was included to discover strength of feeling (Bell, 1993). I asked observers to rank the usefulness of ESOL Maths in improving English acquisition on a scale of 0 to 10, where 0 is 'of no use', and 10 is 'extremely useful'.

There is potential for any observer or interviewer to have an impact on a situation and peoples' responses, as observed in other investigations, where observers become aware that they are an acknowledged presence in the room, and that this is disturbing the normal flow in some way (Brown 2001). This is known as the Hawthorne effect, and it might affect both myself as the teacher or the students in the ESOL Maths class.

One of the negative issues with conducting this study myself is that the outcome might be affected by my involvement. For instance there could be an issue with learners and colleagues giving less than honest answers to the questions. This is known as the halo effect (Cohen et al., 2000), where the previous knowledge of the participants affects their judgements.

Quantitative Findings

The analysis of the data seems to clearly show a correlation between attending a maths class and English language acquisition at my college, as the percentage of ESOL Maths learners with ESOL passes varies from 87.5% to 100%. This compares with the performance of the group without maths classes of between 62% and 84.5%.

There is a consistent positive correlation between opting for ESOL Maths and passing ESOL exams, as there is a minimum of 10.5% and a maximum of 32% improvement in ESOL Maths students' performance compared to the non-maths cohort (Figure 1).

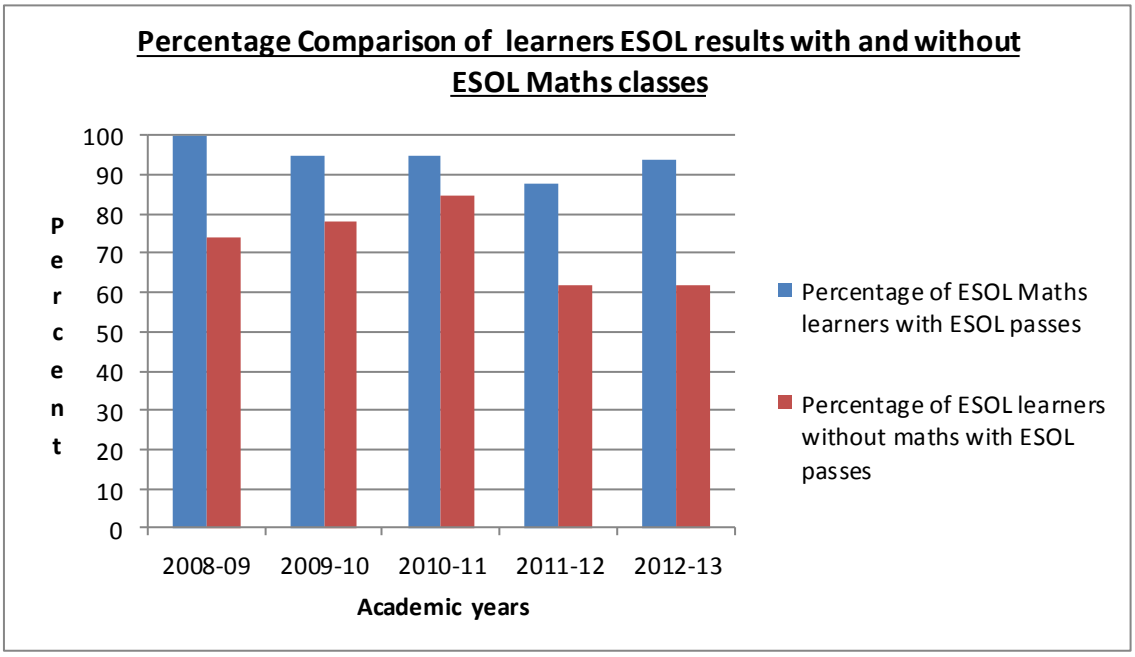

Figure 1: Percentage comparison of learning ESOL results with and without ESOL maths classes

In Figure 2 it can be seen that the impact on the cohort as a whole is low:

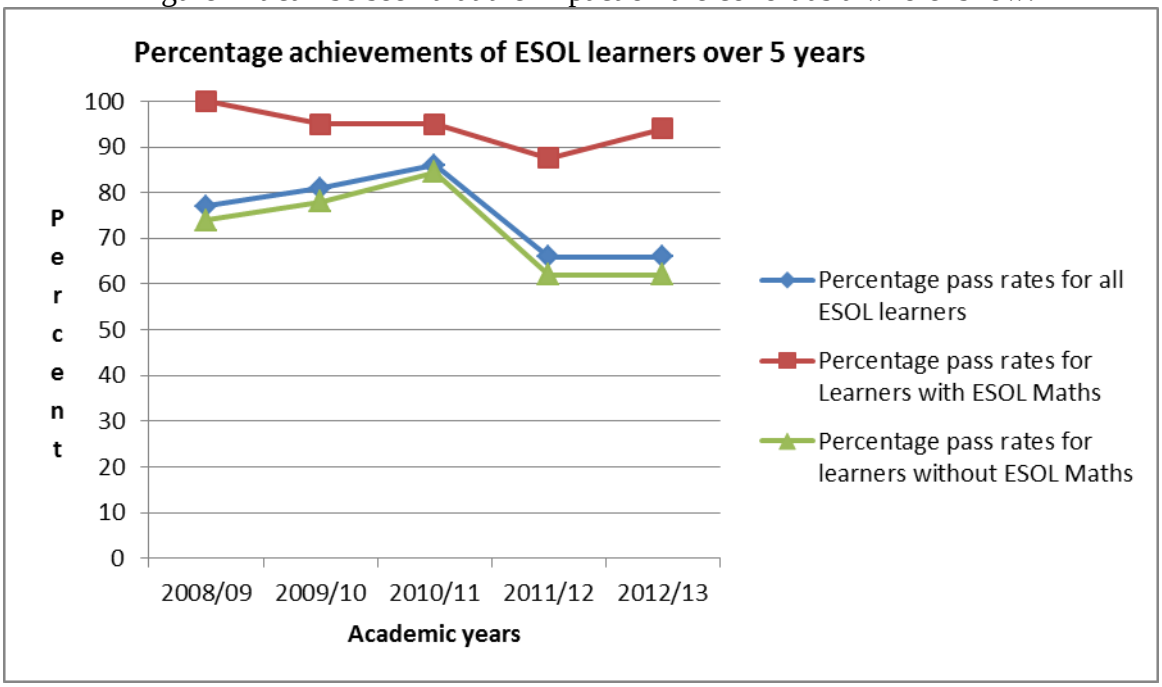

Figure 2: Percentage achievements of ESOL learners over 5 years

Qualitative Findings

Three of the four teachers who were able to observe classes were ESOL teachers, but the fourth was a Maths teacher. Interestingly the comments from the Maths teacher were very similar to those of the ESOL teachers, and I have felt it unnecessary to

differentiate between the two which will also help to preserve the anonymity of the teachers involved.

All of the observers noted language teaching taking place in the observed sessions. One teacher expressed surprise at "the amount of language that was used in Maths and therefore it was a language lesson based on maths" and also said that the session was "very interesting and definitely beneficial to the learners as they were exposed to a different type of language use."

Another was surprised by the level of English and fluidity of the language use: "I was surprised by the good level of English used by the students, the vocabulary was very fluid and the student's understanding of maths on the whole was of a very good standard". The teachers also commented on the opportunities available to learners to practice pronunciation, such as in a place value recap session all learners practiced using the 'th' sound with tenths, hundredths and thousandths. One commented that "time was given to reinforcing pronunciation, spelling of numbers and vocabulary."

Three out of the four teachers when asked to rate the usefulness of maths sessions in improving English acquisition on a simple Likert scale, where zero was 'of no use' and ten was 'extremely useful', rated the usefulness at 10, extremely useful. One teacher did not use the scale, and commented that "It would be more useful if the group was not of such differing levels, so language could be more easily structured", that "some of the language used was more advanced than might be expected for some of the learners", but did note that the learners "were engaged and attentive".

Paired work involving verbal problem solving was taking place between learners who would not normally speak to each other during a session, one of whom had previously refused to participate in paired work during ESOL sessions. One teacher said "Student X does not speak in English, but spoke here with other students she does not normally interact with". Another commented that the session gave "non-speakers" "a chance to participate". A learner with extremely low verbal language skills was clearly prepared to attempt questions and to make mistakes which had not been seen before. "Student Y really tries and has a go, not seen that in an ESOL class" and "I could see some students were very timid but these still participated".

The positive response to set tasks was noted by all observers and surprise was expressed at the level of maths attempted and achieved during the sessions: One commented that "maths skills…can build confidence" and "The confidence the ESOL learners gain in tackling mathematical problems will allow them to gain confidence in learning other subjects". It seems that in this class we do not have an issue with maths anxiety, as identified by many researchers, but that we may have an issue with English anxiety for ESOL learners. It may be that those learners who opt for ESOL Maths classes are those who are maths confident.

Observers commented on the increased level of participation compared to ESOL classes, and how beneficial this was for learners, as paired work "fostered greater communication in English". Even those with confidence issues "still participated" in the paired work: "The shyest learner in the group from the lowest level language class clearly…felt able to answer the teacher because the focus was on maths not English". Learners "responded well and found the experience useful and relevant", even those "with strong educational backgrounds in maths". Observers noted that "learners clearly felt more confident and more able to answer questions" and that the learners both responded well to the tasks set and performed well in their completion. There was "good interaction with resources/activities…working individually or in pairs".

Observers were generally surprised to note the level of language performance shown by the learners, and felt this was improved compared to ESOL classes. One observer noticed that "the focus is on maths where some learners who may be weaker in language are able to do better" than in an English class, as they are using other skills, not just English. Two students performed consistently better, according to one observer, than they would have done in an ESOL class in terms of speaking and listening skills. All of the students seemed to be performing at a "good level of English" according to one observer.

Observers did not feel that any change to ESOL exam levels set was needed, but some did feel more confident that learners might achieve.

Conclusion and recommendations

Whilst caution is required due to the statistical insignificance of the sample size (Cohen et al., 2000) the implication here is that ESOL learners' English acquisition might be further enhanced by placing them in ESOL maths classes, based on their English language level. This adds to the current knowledge in my college and perhaps elsewhere in the UK, and might be useful when considering maths provision for ESOL learners. It contrasts with a recent change of practice in the USA (Kersaint, Thompson & Petkova, 2013), where current thinking is that English language learners be placed in maths classes according to their level of mathematics knowledge.

Observation of ESOL Maths classes did seem to cause teachers to refine and extend their thinking about ESOL Maths and its usefulness in developing language skills, which can be seen as evidence of increased levels of language activity in mathematics in many countries, including the UK (Brown, 2001; FitzSimons, 2002).

The observations seem to support the idea that although mathematical language should be the focus of maths classes (Barwell, 2002; Fletcher and Barr, 2009; Monaghan, 2009), there is enough other language occurring for learners to benefit in terms of English acquisition (Adler, 2001; Clarkson, 2009).

Observers noticed the importance of the teacher interface with learners, and this supports the need for specialist maths teachers to enable learners to make progress with their maths (Brown, 2001; FitzSimons, 2002).

The benefit of resources developed for use with English language learners benefitting all maths learners has been previously examined (Adler, 2001), and I too have found these resources useful with all maths learners, hence the recommendation that we consider the importance of maths language teaching in maths classes and move to a triad approach: conceptual understanding, procedural competence and language acquisition.

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