JUMP evaluation
Executive Summary

In the 2013/14 school year, the Junior Undiscovered Math Prodigies (JUMP) programme was piloted in a sample of Irish primary schools. JUMP was developed by Dr John Mighton in 1998 for Canadian pupils who were struggling with mathematics. It became a registered charity in 2002, its resources for teachers and pupils became available from 2003, and its core philosophy is outlined in Mighton's books, *The Myth of Ability* (2003) and *The End of Ignorance* (2007). Further information on the programme itself can be found at https://jumpmath.org.

The sample for the pilot comprised 569 Third class pupils and their teachers, in 22 primary schools (all located within the catchment areas of Athlone and Galway Education Centres). The implementation of the pilot was evaluated by the Educational Research Centre, and outcomes published in a report released in December 2014 (*An evaluation of a JUMP Math pilot programme in Ireland* by Eemer Eivers, Emer Delaney and Seán Close).

Participating schools were assigned either to JUMP or to another intervention, the Professional Development Service for Teachers' IMPACT Maths programme, under development at the time. IMPACT was introduced to take into account the Hawthorne effect (the phenomenon whereby people modify their behaviour once they are aware that they are being studied). As IMPACT builds on the social constructivist approach of the Irish Primary School Mathematics Curriculum (PSMC), and encourages less reliance on textbooks than is the norm in Irish classrooms, it was more than a simple "control group". However, programme effects were expected to be diluted by the fact that IMPACT materials were available only for some strands.

Key features of JUMP are that it is supposed to improve pupils' mathematical achievement, promote positive attitudes to mathematics, and improve teachers' mathematical knowledge for teaching. The aims of the evaluation, therefore, were to assess if these key features were apparent, to establish the programme's suitability in an Irish context, and to assess how well JUMP was implemented during the pilot study.

Are JUMP Materials Suitable for use in Irish Classrooms?

Overall, the content and pitch of JUMP materials was a good match for PSMC content objectives applicable to Third class. The five strands around which JUMP materials are based correspond closely to the five strands of the PSMC, although there are some differences in how topics are classified by strand. The PSMC lists 70 content objectives for Third class, of which JUMP addresses 63 fully, six partly, and only one not at all (develop an understanding of the relationship between fractions and division, an objective not typically addressed by Irish-produced materials either). However, while the content covered in JUMP material was appropriate, some language and terms needed to be culturally adapted for Irish use (e.g., the language associated with money).

JUMP pupil workbooks were compared with three Irish pupil textbooks, selected as they had previously been in use in the participating schools. Page counts were used as an indicator of relative coverage of PSMC strands. JUMP aligned more closely with the strand emphases in the PSMC than did *any* of the Irish materials. JUMP placed less emphasis on the Number and Algebra strand, and more emphasis to Shape and Space than did any of the Irish

materials. Also, despite JUMP's emphasis on repetition and guided practice, isolated computation made up a smaller percentage of JUMP pupil workbooks (16%) than of any of the Irish materials. Of the three Irish textbooks examined, one was used far more widely than others in the participating schools. It was the *least* similar to the strand emphases in the curriculum (e.g., 24% of PSMC objectives address Shape and Space, compared to 8% of pages in the textbook), the most heavily targeted at Number and Algebra (65% of pages), and at isolated computation in particular (29% of pages).

While content is a good match, the philosophy and general approach underpinning JUMP differs from that of the PSMC. The PSMC endorses a social constructivist approach and the use of guided discovery. JUMP also uses the term "guided discovery", but the meaning is somewhat different to that used in Ireland, and JUMP would probably be considered to lean more towards a didactic approach. However, both the PSMC and JUMP emphasise the need to develop positive attitudes to mathematics and an appreciation of its "beauty". The importance of continuous assessment activities is a key element of both JUMP and the PSMC, although from an Irish perspective, JUMP might not emphasise formative assessment sufficiently.

JUMP *teacher* materials are also quite different from the teacher materials that typically accompany Irish textbooks. They contain very detailed lesson plans, with clear and concise guidelines for guiding teachers through each step of a lesson (an aspect of the programme that was very popular with teachers). However, the general introduction and guidelines in the JUMP teacher manuals did not adequately introduce JUMP philosophy or methods. In contrast, Irish-produced materials tend to provide a "big picture" view of an approach to a topic, but not to provide detailed lesson plans.

Was JUMP Implemented Properly?

An issue with part of project funding contributed to a delay in project initiation. This in turn caused some organisational problems, most notably relating to the provision of initial CPD. Consequently, nearly half of JUMP teachers did not attend the initial professional development day that introduced teachers to the main features of the programme they were to implement during the year. This partly explains misunderstandings about how to use JUMP materials generally, and the JUMP Confidence Building Unit in particular.

Based on advice from JUMP staff, the amount of CPD provided over the course of the pilot was also relatively limited (one introductory day and two short "webinars", with IMPACT CPD modified to match the amount provided for JUMP). However, this is well below what research (e.g., Guskey & Yoon, 2009) would indicate is typically needed to effect behaviour change in the classroom. Participating teachers expressed dissatisfaction with the amount and format of CPD provided, and anecdotal evidence suggests that both JUMP and IMPACT suffered by association with organisational problems involved in the pilot rollout. This may have contributed to reluctance in some parts to fully adopt JUMP (or indeed IMPACT) methods.

Data from classroom observations suggest most teachers demonstrated *some* adherence to the relevant lesson plan or programme principles, but few demonstrated very close adherence. Teacher-led instruction and solo work was more prominent in JUMP than IMPACT, but IMPACT is based on a social constructivist model whereby pupils construct meaning as a group, so teacher-led instruction and solo work would be expected to be less common than in mathematics classes *generally*. Observations also suggested that use of some aspects of JUMP tailed off during the course of the year, and that some teachers followed JUMP

lesson plans but missed the spirit of the programme (e.g., repetition without any reference to the larger mathematical ideas behind the repeated steps).

Did Mathematical Achievement Improve?

The mathematical achievement of pupils was measured at the start and end of the year, using the Drumcondra Primary Mathematics Test (DPMT). Baseline mean achievement scores in September 2013 were almost identical for JUMP and IMPACT groups (102 scale score points in each case). By the end of the school year, the scores of pupils in *both* groups improved: JUMP pupils by 7 points, and IMPACT pupils by 5 points (or, almost a half of a standard deviation, and one-third of a standard deviation, respectively). Both increases are statistically significant, but not sufficiently different *from one another* to conclude that the mathematical achievement of JUMP pupils improved significantly more than that of IMPACT pupils.

Achievement gains did not differ significantly by gender. In both JUMP and IMPACT groups, pupils who achieved low scores at the start of the year improved by slightly more than did those who achieved high scores at the start of the year, but numbers involved are quite small, meaning that caution should be exercised. Examined by content and process, the end of year scores for JUMP pupils were higher than for IMPACT pupils on the Data strand and on the process of Integrating and Connecting. These differences are largely attributable to pupils' performance on a few linked items relating to pictogram interpretation. An explanation may be found in the analysis of pupil textbook materials, which suggests that JUMP covers the topic in more depth than any of the three Irish textbooks examined (IMPACT materials did not address Data).

As noted, achievement gains were found in both groups, despite being underpinned by very different philosophies. It is probable that at least some of the gains may be attributed to a Hawthorne effect – for example, teachers being more reflective about their mathematics teaching practices. In addition, pupils in this evaluation received 30 to 40 minutes extra mathematics instruction over the course of an average week than did the Fourth class pupils in the most recent nationally representative study, TIMSS 2011 (Eivers & Clerkin, 2012; Mullis, Martin, Foy, & Arora, 2012). Average mathematics instruction time may have increased, nationally, since then due to the launch of *Literacy and numeracy for learning and life*. If this is the case, then national performance on the DPMT might also have improved, meaning that the gains found here might reflect gains found nationally, rather than simply reflecting programme effects. In sum, both programmes showed gains, but it is likely that at least some of the gains are attributable to factors not directly related to programme characteristics.

Pupil Attitudes to Mathematics

Pupils' attitudes to mathematics were assessed using start and end of year attitudinal questionnaires, and in two sets of interviews carried out during the year with a subset of pupils in each participating class. Questionnaire responses indicated that pupil attitudes to mathematics were generally positive. There were increases in the percentages indicating that they liked maths (by 6% in both groups), felt they learned interesting things in maths lessons (by 8% in JUMP and 3% in IMPACT), and believed everyone could be good at maths (by 5% increase in JUMP and 7% in IMPACT). However, at both the start and end of the year, almost half of pupils in each group worried they would not be able to answer questions in class. Positivity towards mathematics and confidence in mathematical ability increased slightly more for boys than girls in JUMP, and more for girls than boys in IMPACT. Again, caution should be

exercised in interpreting relatively small gender differences found in four small groups of pupils.

Among pupils who were interviewed, some programme differences emerged. JUMP pupils were more likely than IMPACT pupils to raise the fact that they enjoyed being challenged when learning maths. Also, JUMP pupils were very positive at *both* interview times (December and May) about how much they liked their Third class maths lessons, whereas the IMPACT pupils interviewed in May were less positive than those interviewed in December.

Teachers' mathematical knowledge for teaching

Teachers' knowledge for teaching mathematics was assessed at the start and end of the year, using a shortened version of the Mathematical Knowledge for Teaching Questionnaire (based on work by Delaney, Ball, Hill, Schilling & Zopf, 2008). Baseline scores were closely matched for teachers in the two programmes, and slightly higher than the mean score of an Irish norm sample of teachers. At the end of the year, the average number of correct responses increased for both JUMP and IMPACT teachers, meaning that both answered noticeably more questions correctly on the MKTQ-S, relative to the Irish norm group. There was, however, considerable individual variation in both groups, and JUMP teachers did not demonstrate a change over and above that demonstrated by IMPACT teachers.