

Immediate (live) marking in science

The Westwood Academy, Coventry

Problem: What challenges does your school have that needs to be addressed?

Currently, evidence on written marking practice and its effectiveness is lacking. Several guidance documents have indicated that there are workload issues over current marking practices regularly used in schools. Feedback is a strategy which can be used to develop pupils' metacognition and can be used to reduce misconceptions developing nearer to the point of learning subject content or skills. Live marking enables pupils to build upon the acquisition of knowledge and to deepen their thinking.

Innovation: How will the innovation help improve the problem you have identified and benefit teachers and learners?

Live marking is a strategy which can be used to target a range of pupils in a particular lesson. During whole class teaching, teachers can assess work and give questions to pupils; which closes the gap in learning. Teaching assistants in science will have a set of structured tasks which can be used over a 30 minute period to identify general misconceptions in pupils' work. Teaching assistants are given a list of key misconceptions and guidance is provided on best ways of teaching these. The practice will change in classrooms because teaching staff will need to give feedback nearer to the point of errors and misconceptions developing.

This will be based on reviewing pupils' work, and providing specific action points through written feedback, which require thinking time and responses. Teachers can use a visualiser to identify misconceptions and errors. The visualiser can be used by a teacher to model what an excellent piece of work looks like.

Existing evidence: What evidence is there that this innovation will improve outcomes?

Hattie et al. (2008) have undertaken a range of meta-analyses which have identified feedback as a strategy which enables pupils to make progress. Evidence from *A Marked Improvement* (Education Endowment Foundation, 2016) suggested that the quality of evidence for feedback in the form of written marking is low. A review of feedback by Shute (2007), suggests that immediate feedback is defined as “right after a student has responded to an item or problem”. Research on immediate feedback (Clariana, 1990) suggests that when learning a new task, immediate feedback is better than delayed feedback. Kulik and Kulik (1988) have found similar evidence, that the closer to task acquisition the error is corrected the faster rate of skill or concept acquisition. Immediate feedback has been shown to work effectively for low achieving pupil, especially when they are learning new concepts or skills (Mason and Bruning, 2001).

It is hoped that the immediate feedback given through live marking will enable misconceptions to be acknowledged and rectified nearer to the acquisition of the knowledge which will allow pupils to develop a greater breadth of knowledge and understanding in science.

Research question or hypothesis: What effect will the intervention, implemented for how long, with which pupils, have on what outcomes?

What effect will Live Marking in science lessons over one academic year have on Progress Test in Science scores for Year 7 and 8 pupils?

We would expect pupils in the intervention group to make greater levels of scientific progress during the intervention period, as measured by the Progress Test in Science. We would also expect pupils in the intervention group to be more engaged in science lessons.

Method: Include sample, design, measures, intervention, process evaluation, and analysis

Sample

200 pupils from The Westwood Academy, Coventry, who will be in Years 7 and 8 in September 2017. All pupils in Years 7 and 8 will participate in the evaluation.

The Westwood Academy is a small comprehensive in the south west of Coventry, with fewer than 600 pupils in Years 7 to 11 from a largely white British cohort (85%). Around 60% of pupils in the school receive Pupil Premium funding and around 10% of pupils are on the Child

Protection register or are classified as Children in Need (3% are looked after children). Around 35% of pupils at the school have Special Educational Needs or a Disability and 32 pupils have an Education Health and Care Plan. Pupils entering the school at the beginning of Year 7 have relatively low prior attainment compared to the national average (-2.5 Year 7 pupils in September 2016).

Allocation to groups

Year 7 pupils are streamed into four ability-based sets based on their English and maths levels, as reported by feeder primary schools. Year 8 pupils will be grouped into ability-based sets based on their end of Year 7 science assessments. Sets 1 and 3 in Year 7, and sets 2 and 4 in Year 8 will be in the same condition, and sets 2 and 4 in Year 7, and sets 1 and 3 will be in the same condition. The condition was randomly allocated by flipping a coin:

	Year 7	Year 8
Sets 1 and 3	Control	Intervention
Sets 2 and 4	Intervention	Control

Within the school, timetabling of science lessons for Year 7 and Year 8 pupils are blocked so all pupils in the year have science lessons at the same time. Two science teachers will be randomly chosen to teach only intervention groups in these year groups, and two science teachers will teach all control groups. One of the two teaching assistants who work in the science department will support only control group classes, while the other will support only intervention group classes.

Pupils occasionally move between science sets during academic years, for a range of reasons. If a pupil moves to a set in a different condition during the course of the evaluation, their data will be removed from the analysis. If this occurs, the characteristics of pupils who drop-out from analysis will be reviewed to identify any patterns in drop-outs which may impact on outcomes.

Measures

Participating pupils will all take the GL Assessment Progress Test in Science at pre- and post-testing. This provides standard age scores and stanine scores in biology, physics, chemistry and working scientifically. This assessment will be administered by the school exams officer at the same time as the Cognitive Abilities Test (CAT) and will be marked externally. The CAT is routinely used within school, so the systems and process used in this assessment is familiar to staff and pupils.

Published tests are routinely used at the end of each science scheme of work within the school. These tests require pupils to provide a written answer or calculation for questions relating to the topic they have just completed. A mark scheme allows teachers to calculate a grade for each

pupil. This data will be used to compare the scientific understanding of pupils in the innovation and control groups for each topic. Tests will be administered in class as usual at the end of each scheme of work. Pupils will not write their name on the paper but will each be given a randomly allocated number to identify their test paper. End of unit tests will not be marked by the pupils' science teacher (eg. the Year 7 set 1 teacher will mark Year 7 tests for sets 2, 3 and 4).

Delivery of intervention

Training and Materials

The project coordinator, who developed the intervention, will create Understanding Maps for each scheme of work involved in the evaluation. This will contain questions about the topic relating to the different levels of Bloom's taxonomy (Bloom, 1956).

Teachers who are randomly allocated to teaching the intervention group will receive training on Live Marking from the project coordinator. This will consist of sharing and explaining the Understanding Map and demonstrating what Live Marking looks like in a lesson context (this may be through teachers observing the approach live in lessons or videos of lessons).

The teaching assistant who is randomly allocated to work with intervention classes will be given training on how to use the Understanding Map to identify specific misconceptions in science and how to use questions in the Understanding Map to address identified misconceptions.

Intervention

All Year 7 and 8 pupils have 7 x 1 hour science lessons per fortnight. The science curriculum is split into schemes of work, each of which is between 10 and 12 lessons long. Live Marking will be used with the intervention group in half of the science schemes of work during the year (these will be the schemes of work in which pupils often develop scientific misconceptions). In the remaining schemes of work Live Marking will not be used. Control group pupils will receive their teachers' usual teaching approach throughout the evaluation. The evaluation will continue for one academic year.

In Live Marking lessons the teacher will use a visualiser to demonstrate the work pupils will be undertaking and address potential misconceptions that are likely to arise. As pupils carry out independent work the teacher and teaching assistant will use the Understanding Map to ask pupils questions to identify misconceptions of the topic. The teaching assistant will give feedback to the teacher on which pupils demonstrated which misconceptions. When the teacher or teaching assistant detects a misconception they will clarify the gap in knowledge through verbal questioning. The feedback provider will use question stems to articulate an appropriate question which affords an opportunity for a pupil response. This is reviewed by the teacher or teaching assistant, enabling a feedback dialogue until the misconception is overcome. Pupils will be given

written feedback with specific action points or questions that they must think about and respond to. This written feedback will be targeted at the task or process level in the feedback cycle.

Follow-up support and treatment integrity

The project coordinator will carry out observations in intervention classes. These will have the dual purpose of monitoring whether the intervention is being delivered as intended and feeding into a coaching conversation with intervention teachers about the use of Live Marking.

Ethics

Consent

Consent for involvement in the evaluation will be gained from the head teacher, and school staff will be informed of the purpose of the research. Both pupils and parents will be provided with information about the research and will be able to contact the researchers to ask questions.

Parents can choose for their children not to participate in data analysis for the evaluation, and pupils will be asked for verbal consent before participating in interviews.

Confidentiality

Any data gained from test results and used in the study will be placed into an encrypted spreadsheet so that access can only be gained by the researcher. If pupils reveal something that raises concern, then confidentiality will need to be breached and safeguarding procedures will be followed, as per school protocol. All pupil identities will be anonymised in written reports.

Process evaluation

Process evaluation methods used will be face to face interviews with pupils and an online staff survey.

- At the pre-testing phase, an online staff survey will be used to review previous and current approaches to science teaching and views about methods currently used.
- At the post-testing phase, an online staff survey will be used to review staff confidence levels in using the innovation and staff perceptions of benefits and disadvantages of the approach.
- At the post-testing phase, pupil views of their engagement and confidence levels will be gathered using one-to-one interviews.

Data analysis

Excel will be used to calculate effect sizes for the Progress Test in Science.

Excel will be used to calculate effect sizes for the assessments completed at the end of the topic

**Conclusion: What will happen if your innovation improves outcomes, or not?
What are the limitations of your evaluation?**

Implications from positive or negative results

If Live Marking is found to have a positive effect findings would be shared locally and other schools in the area would be supported to use the approach. The principles of Live Marking would be transferred to other curriculum areas, and the impact of their use in these subjects would be evaluated.

If Live Marking is found to have no effect, or a negative effect, school staff would question the validity of using Live Marking in school. A negative finding would also make the school leadership team reflect on the use of Teaching Assistants more widely within the school as it would feed into the evidence on ineffective deployment of teaching assistants.

Potential limitations or biases, and steps taken to address these

It is possible that control group teachers and teaching assistants could use elements of Live Marking with control group pupils (*diffusion of treatment*). The following steps have been taken to minimise this threat:

- All teachers and teaching assistants within the science department will teach only pupils in the control or the intervention group. Those working with the control groups will not be trained in the intervention.
- The developer of the intervention is one of the science teachers who will be randomly allocated to teach either the control or intervention groups. He is aware of the possible threat of diffusion of treatment if he is allocated to teach control groups, and would make a conscious effort not to use elements of Live Marking in his teaching, and would reflect on whether this had happened.

It is possible that the intervention and control groups will not be equivalent.

- Attempts have been made to maximise equivalence through the allocation to groups. Pre-test data will also be analysed to identify whether the groups are equivalent.
- The characteristics of pupils who drop out of the intervention (e.g. prior attainment, pre-test score, set, receipt of pupil premium etc.) will be analysed to determine whether group characteristics change during the intervention.

As the project coordinator developed the programme and is head of the department in which the evaluation is being carried out, it is possible that teachers may not wish to give their honest opinion of Live Marking during the process evaluation (especially if their opinion is negative). In

order to minimise this threat:

- An anonymous online survey will be used to gather staff views.
- The importance of gaining teachers' honest views in order to inform the improvement of the intervention will be highlighted.

This is a pilot test of an intervention being delivered in one small secondary school. Care should be taken not to over-generalise any results to other settings or contexts without further evaluation.

Communication of results

The findings of the project will be shared through the Research Schools Network, Shireland Research School and at a range of meetings in the West Midlands regardless of outcome. Results would also be published through organisations such as the Chartered College of Teaching or the Association of Science Education (ASE) or journals such as *Science Education* and *School Science Review*.

References

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