Can increasing students' engagement with DIRT Feedback impact on their progress in science at KS4?

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A Research & Development Project Submitted for the MSc Learning & Teaching 2018

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Research and Development Project submitted to the University of Oxford for MSc in Learning and Teaching

Abstract

Research was carried out with a year 10 Chemistry class (n=26) in a comprehensive Academy in Oxfordshire over the first four months of 2018. This class was chosen due to their lack of engagement with DIRT feedback sessions prior to the study. The purpose of this intervention was to identify DIRT feedback techniques which students engaged with and using end of topic test data, assess the impact this had, if any, on their progression in science at KS4. Students were exposed to a four-step cycle of written, peer, verbal and self-feedback on their work and through lesson observations and collaborative analysis of students' work, students' engagement with each of these feedback tasks was assessed.

The study revealed that judicious written feedback provided by the teacher resulted in the most engagement from the participants of this study. Students involved in this research engaged least well with peer feedback despite collaboration with colleagues on writing success criteria and suggested prompts for students to use in their feedback on peers' work. The most significant findings of this research were that 77% of students scored higher in the following end of topic test and that 92% agreed or were neutral that responding to teachers' written feedback helps them to progress in science.

In terms of the implications of this research, it would be interesting to collaborate with other departments at the Academy to explore in more detail how they carry out DIRT feedback sessions and what strategies they use to get students to engage with feedback. Within the science department, the imbedding of crib sheets, collaboration when writing comments on students' work and teachers using a variety of feedback techniques would have a positive impact on student engagement with DIRT feedback sessions.

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Introduction

At an Academy in Oxfordshire, Directed Improvement Reflection Time (DIRT) feedback sessions are a key part of the marking policy and are where teachers give students the opportunity to respond to written feedback during lesson time. Educational research supports the importance of DIRT feedback sessions as “feedback has no effect in a vacuum; to be powerful in its effect, there must be a learning context to which feedback is addressed” (Hattie and Timperley, 2007, p.82).

From discussions with colleagues and reflection on my own practice, I have found that the older the student, the more resistant they were to responding to feedback during these DIRT feedback sessions. Key Stage 3 students, aged 11-13 years old, would diligently spend the portion of the lesson allocated to DIRT feedback responding to my comments and attempting to improve their understanding of a concept. However, when delivering feedback in a similar format to Key Stage 4 (KS4) students, aged 13-15 years old, I found that students were more reluctant to engage with these sessions, with responses to my feedback ranging from “okay miss” to “thanks” and “will do”. This is in agreement with Hattie (2012) who states that “while feedback is among the most powerful moderators of learning, its effects are among the most variable” (p.129). I felt that the power of feedback was not being utilised by these students and I wanted to explore what alternative methods were out there for delivering feedback with the intention of increasing students’ engagement with DIRT feedback sessions.

In addition to simply increasing student engagement, I wanted to investigate further the power that feedback could have on student attainment. In 2017, I found that 45% of students that I taught had a fixed mindset towards science and believed that their ability could not be changed. If students scored low results in assessments, students with a fixed mindset would decide they were just bad at that subject and that that could never change. Perhaps if students could identify that the teacher's feedback and responding to the feedback were having a positive impact on their progression in a subject this could be an effective method of breaking a fixed mindset.

In terms of the wider relevance of this research, education has more purpose than simply teaching students to pass examinations. "The whole purpose of education is to turn mirrors into windows" (Sydney Harris, 1900s). If education is a mirror, students only see what they already know. To have their knowledge increased and life skills harnessed is the window to success. The teacher plays a crucial part in facilitating the change of a mirror to a window and DIRT feedback could be one way of achieving this.

Another reason for this research is that although the literature can only praise the importance of feedback in the classroom, it does not offer much advice on what to do if your students don't engage with the feedback. Ofsted (2011) expects feedback to play an important part in teaching yet withdrew their examples on how this should be done on 6th November 2015 saying that it depends on the school's marking policy to decide how it should be done. Black and Wiliam's research on feedback, though still relevant today, was carried out in 1998. The GCSE and A-Level Curriculum have recently reformed with many people reporting that exams are getting harder. With science being a compulsory choice for students to study at GCSE, it is necessary for all students to progress with their understanding of science, and utilising our techniques of providing students with feedback could perhaps be fundamental in helping students to do well.

Therefore, my review of the literature will focus on four areas. First, I wish to explore in more detail the importance of feedback in the classroom and use this to drive the techniques I choose to use in my intervention. Also, I wish to use previous educational research to identify what hinders and enables effective feedback to make sure that the way I deliver DIRT feedback sessions has maximum impact on student progression. Additionally, I want to use the findings from previous research to identify different methods of feedback which successfully engaged students to trial in the classroom during my DIRT feedback sessions. Finally, I wish to research in more detail the effect that feedback can potentially have on student attainment.

Literature Review

From my own teaching practice, ensuring engagement of all students with DIRT feedback sessions has been a challenge. The purpose of this literature review is to draw on a variety of types of literature to summarise how feedback should be used in the classroom. Then, via analysis of previous research studies, I wish to identify different techniques of providing feedback which engage students. Lastly, by analysing the available literature, I hope to identify the link between responding to feedback and progression within a subject.

The role of feedback in the classroom

Feedback, in terms of this research, is a method of communication that provides the opportunity of enabling students to progress from where they are currently to where they potentially could be (Black and Wiliam, 1998; Leahy et al, 2005). In terms of teaching, the Education Endowment Foundation (2011) defines feedback as "information given to the learner and/or teacher about the learner's performance related to learning goals" (p.1). Ramaprasad (1983), though not specifically talking about education, describes feedback as being the information about the gap between where one is presently to where they are trying to get to. This idea of closing the gap between current and ideal performance is used by Laws (2013) in his speech on reducing the difference in academic attainment between students in the UK from different backgrounds. Though not specifically stated by Laws (2013) in his speech, perhaps a more prominent role of feedback in the classroom could be one way to help close the gap.

Sadler (1989) discusses that feedback should be used “to monitor the strengths and weaknesses of their performance, so that aspects associated with success and high quality can be recognised and reinforced, and unsatisfactory aspects modified or improved” (p.120-121). Sadler concludes his work by highlighting that this will lead to students developing “self-monitoring” (p.120) and not being dependent on the teacher to provide feedback and guidance on how to improve. This agrees with the findings of Black and Harrison’s (2001) research from interviews with teachers in Medway and Oxfordshire, reporting that they saw a shift in responsibility from the teacher to the student. My literature search revealed no negative results from the view that feedback is important in the classroom.

Marsh (2006) reported that many schools are not using feedback at such a frequent level as perhaps they should. A suggested reason for this was that schools focus too much on examinations and rote learning. Teachers feel pressured to get students certain grades in examinations and hence student-centered activities get pushed aside. This article did not give evidence for how Marsh (2006) came to this conclusion about the lack of feedback featuring in the classroom, however, from discussions with colleagues, they felt that they did push feedback aside quite often.

A two year development project was carried out at 6 secondary schools in Norway by Havnes et al (2012). They investigated feedback through surveys and group interviews with students and teachers. A teacher commented that “clever or average students” (p.25) were proactive with the feedback that they received and incorporated the feedback into future tasks. The feeling amongst teachers involved in this research was that the students who needed the feedback and guidance on how to improve the most were the least engaged with feedback, including not handing in work for teachers to provide feedback on.

Interestingly, the students in Havnes et al’s (2012) project voiced that their own view of feedback is dictated by different teachers’ attitudes to feedback. They felt that in some subjects, they effectively incorporated the feedback into future tasks, whereas others the feedback provided was not useful and not looked at again. Therefore, in this research, the subject and the teacher played a role in students’ attitudes towards the usefulness of feedback. This difference of opinion between these students and their teachers emphasises the need for there to be clear dialogue between students and teachers regarding what feedback techniques are most effective to enable progression.

Feedback by marking is recognised as an important pedagogical tool by the Government and the Education Endowment Foundation, however, Ofsted do not currently have a document summarising what good or outstanding feedback by marking looks like. A document which appeared to do so titled “Making marking matter” (2011) was removed from GOV.UK’s website in November 2015 as it “no longer reflects guidance in the school inspection handbook". Instead, now published in Ofsted's summary of 'Ofsted myths' is that "Ofsted recognise that marking and feedback to pupils, both written and verbal, are important aspects of assessment. However, Ofsted does not expect to see any specific frequency, type or volume of marking and feedback; these are for the school to decide through its assessment policy" (Ofsted, 2018). This contrasts with Sadler (1989); Black and Wiliam (1998); Nicol and Macfarlane-Dick (2006) and Hattie and Timperley (2007), whom all give examples on how to effectively mark students' work and deliver meaningful feedback.

In summary, feedback is an important technique to allow teachers to adapt and change their teaching depending on the learners in the classroom. Feedback should identify strengths and weaknesses as well as guide and enable student progression. It should cause students to think, identify and correct their own misconceptions. Moreover, feedback should not just be provided by the teacher, students play a vital role in feedback whether by responding to written feedback, providing their peers with feedback or by becoming self-regulated learners (Sadler, 1989) and taking responsibility for their own progression. Yet, the frequency of feedback in the classroom is not as high as it should be, despite the research which says it is important, therefore focus needs to be on effective feedback strategies to reinforce the use of feedback in the classroom that aid the closing of the gap (Ramaprasad, 1983; Laws, 2013).

What enables effective feedback?

At the Academy where I am currently working, there is no whole-academy marking policy as it is set by departments. In the science department handbook it states that;

- "Books should be 'deep marked' twice during a taught topic…

- Marking should include reference to targeted questions
- Pupils should respond to targeted questions from the marking …"

(Academy anonymised, Science Department Handbook, 2017-2018, p.7)

There is no provided model on how science teachers should be providing written feedback to students apart from these bullet points. Therefore, there is much room for individual teacher interpretation on how to deliver feedback and the expectation on the type of response from the students. Initially I thought that this might be a contributing factor for why KS4 students struggle with responding to feedback as there is too much variation between teachers. However, Percell (2017) carried out a study for one year with 5 secondary school teachers in the USA who used different methods of delivering feedback on students' work. This included feedback that was conversational, goal-orientated, task-orientated and encouraging. The main conclusion from this study was that it did not matter what form the feedback was provided in as long as teachers "[utilized] feedback as a purposeful tool to connect with students and encourage them towards their goal" (p.114). Hattie and Timperley (2007) agree with this stating that "feedback aimed to move students from task to processing and from processing to regulation is most effective" (p.91).

Feedback is hindered when it is given to students in the form of a grade or a simple comment which does not require any action by the student as for feedback to be effective it "needs to cause thinking" (Leahy et al, 2005, nop). Spendlove (2015) agrees with this, emphasising that it is important to allow students time to reflect and respond to feedback. Feedback provided by a teacher needs to be presented clearly so "that pupils understand what it is for and how it helps their learning" (p.46).

Nicol and Macfarlane-Dick (2006) summarise the key points that they found from their literature search into “principles of good feedback practice” (p.199). They highlight the importance of teachers providing written feedback to students’ individual work as teachers are most aware of the success criteria and common misconceptions that students can have. As teachers are the ‘experts’, for students to gain the most out of the provided feedback, teachers need to make sure that the success criteria are clear to students and use examples of high quality work to model to students what they are aiming for.

In terms of how much feedback should be provided, Nicol and Macfarlane-Dick’s (2006) literature search emphasised that feedback should be corrective, be limited in the amount and prioritise areas for improvement. They go on to suggest that teachers can ask students for what type of feedback they prefer on their work. This agrees with Percell’s (2017) finding that there is not just one way of delivering effective feedback. Despite this, a report by the Education Endowment Foundation (2016) highlighted the lack of evidence from research about which marking strategies are most effective in the classroom. Hattie and Timperley (2007) had identified the need for more research into feedback and how to best incorporate it into students’ learning nine years earlier.

As part of a publication by Ofsted (2013) titled “Maintaining curiosity in science”, 89 secondary schools were visited over three years in the United Kingdom. Ofsted reported that “the quality of feedback to pupils on how they might improve their science understanding was a common area for improvement in the primary and secondary schools visited, regardless of the school’s overall effectiveness in science” (p.6). They stated that feedback was hindered when it consisted of teachers focusing on students’ presentation, underlining of titles and “finish this work off” (p.32) without follow up from the teacher or student which is not an effective marking strategy. Ofsted (2013) agreed with Black and Harrison (2004) that providing information in the form of questions or targets directing students on how to improve is more useful than simply a tick and flick technique.

Butler (1987) investigated the effectiveness of four different types of feedback on students’ motivation, interest and performance. Her research was carried out with 200 students with a mean age of 11.10 years in four city elementary schools in Israel. Her four experimental conditions were providing feedback in the form of comments; grades only; praise and no feedback. She found that feedback in the form of comments had the most positive effect on students whereas grades and praise did not.

Butler’s (1987) finding agrees with those of Black and Harrison (2001) who carried out a study on feedback with teachers in Medway and Oxfordshire with students of ages 11 to 16 years old (sample size not stated). They found that teachers whom were initially hesitant to take on comment-only marking, despite the research evidence, found that it was successful when implemented into the classroom. As my research is also being carried out in Oxfordshire, I believe that the findings of Black and Harrison (2001) are more relevant to my research than Butler’s (1987) as despite no sample size being stated, the research was carried out in a more similar educational setting to mine with a similar age group.

Another study was carried out by Butler (1988), which investigated the interest and performance of students after receiving different types of feedback on work. She carried out her investigation with 132 mixed ability students separating them into three groups.

One group received feedback in the form of written comments, another received only grades and the final group received both comments and grades on work. The outcome was that students who only received comments as their form of feedback had the highest interest and performance levels at the end of the research.

Butler's (1998) findings are reinforced by discussions that Black et al (2003) summarised in their book "Assessment for learning – putting it into practice". Conversations with teachers identified that teachers were annotating students' work with comments, however, because a grade was also provided, students did not read, respond or act upon the comment as most students were only interested in the grade. Black and Harrison (2004) mention that grades do not communicate ways for students to improve their work, they "demotivate low attainers and give no challenge to high attainers" (p.11) as well as "discourage collaborative learning" (p.11). In addition, "a numerical grade does not tell pupils how to improve their work, so an opportunity to enhance their learning has been lost" (Black et al, 2002, p.8).

A suggestion by Gibbs and Simpson (2004-05) to tackle this problem was to initially provide students with the marked piece of work containing comments and no grade. Self-assessment by the student should then be made by attempting to make suggested improvements on their work. Only after this has been done will students receive the grade for their work. Even though feedback by comments is more time consuming than grades, it enables all learners to "believe that they can improve" (Black et al, 2003, p.46) through effort, unlike grades, which focuses on ability and can negatively impact on the confidence of students of lower ability.

Black et al (2004) highlighted the issue of changing from giving feedback to students in the form of just comments rather than also giving grades due to conflicts with current marking policies. However, many students preferred comment-only marking as it gave them more direction on how to improve. None of the students wanted a grade to feature on their feedback instead expressing that they wanted tips from the teacher on how to fix highlighted errors. However, Peterson and Irving (2008) found from their work with 41 students that although students wanted honest and informative comments on their work, they saw grades as more useful for how they were progressing in a particular subject. The students spoke that praise featured too often in comments with a comment of “try harder” (p.246) at the end of the positive comment. Students reported that this gave them no direction on how to improve whereas a grade that is comparable to the rest of a cohort was more useful. This disparity between student and teacher opinion of feedback use was again found by Price, Handley and Millar (2011).

The importance of creating opportunity for written dialogue between teacher and student is highlighted as fundamental for allowing students to make progress (Black and Harrison, 2001; Hattie and Timperley, 2007). Interestingly, in higher education, verbal feedback is seen to be more effective. In particular, Oxbridge’s feedback techniques involve students writing an essay, reading it aloud to their tutor in a one to one tutorial and receiving immediate feedback on their work. This technique of providing feedback at higher education is reinforced by Mulliner and Tucker’s (2017) work with 220 participants which found that individual verbal feedback was the most effective form of feedback. Previously, Boulet, Simard and De Melo (1990), though with a smaller sample size of 80 secondary students, found similar findings when researching the effects of providing verbal, written and no feedback found that written feedback was less effective than verbal feedback. This increases my confidence in the relevance of the findings of Mulliner and Tucker’s (2017) work with higher education students to my research with secondary school students.

As part of a review of the evidence about effective marking, a survey was carried out with 1,382 teachers with teachers ranging in expertise from maintained primary and secondary schools. In answer to the question “how much, if at all, do you… [give] pupils time in class to write a response to previous marking comments”(Elliot et al, 2005, p.15), 691 teachers (50%) said that they always provide students with an opportunity to respond back. This figure is surprisingly low compared to all the research by Black and Harrison (2001) about the importance of written dialogue in the classroom.

Gibbs and Simpson (2004-05) emphasise that feedback needs to be timely, annotated with corrections and most importantly, “encourage students to continue studying” (p.20). However, as a result of increasing class sizes, the amount and timeliness of feedback to students is being negatively impacted due to teachers’ workload increasing. In March 2016, the Independent Teacher Workload Review Group met to come up with strategies that would reduce teachers’ workload. They focused on marking, acknowledging that it is a very useful tool to provide feedback for student progression, however it is pointless if the teacher is spending longer than the student on the work. The main theme running throughout this report is that it is quality not quantity that makes feedback from teachers via marking effective.

Ding (reported in Higgins, Hartley and Skelton, 2001) highlights one of the issues with feedback being when students are not proactively acting on the feedback provided. This is something which I have come across myself within my teaching practice where students make the same mistakes in future tasks despite having received feedback on how to avoid doing this again. Chanock (2000) suggests that the reason behind this might be due to the fact that students do not understand what the feedback means. It is important to remember that the effectiveness does not just rely on the teacher providing the feedback, but whether the feedback is appropriately written to allow students to understand and interpret it in the way it was intended. Chanock (2000) asked 101 humanities students to explain as part of a written survey what is meant by the feedback "too much description; not enough analysis" (p.95). 49 students, i.e. nearly half, did not understand this comment the way which the tutor had intended. Perhaps this is what is happening with my students who are responding to feedback with comments like "okay miss" because they cannot access the task due to a lack of understanding of subject-specific vocabulary.

Sadler highlights that for students "to improve their performance, students need to know how they are progressing" (1989, p.142). He goes on to discuss the difficulties of this when teachers provide students with feedback which they do not understand. It is not simply enough for the teacher to mark students' work but to make sure that the feedback is in an accessible format for each student. Higgins, Hartley and Skelton (2001) suggest that feedback needs to focus on "feeding forward rather than feeding back." Feedback needs to empower the receiver to act upon comments given and to believe they are capable of achieving the targets set, not that they cannot improve.

In addition, Black and Wiliam summarise that the "dialogue between pupils and a teacher should be thoughtful [and] reflective" (1998, p.12). This notion of suddenly being able to write feedback in a way that is accessible to all students and enables them to progress is a skill which takes time to perfect even if teachers are in agreement that comment-only marking is the way forward. Harrison et al (2002) who carried out a project with 24 (half science, half mathematics) teachers from secondary schools in Medway and Oxfordshire, identified that perhaps writing comments on students' work involves collaboration between teachers on how best to approach this until writing comments becomes a more natural process.

As shown above by the literature, it is evident that comment-only marking is the best form of written feedback. Hattie and Timperley (2007) reported that to make this written feedback more effective, the comments written by teachers should be helping students to answer these three questions;

1. "Where am I going? (What are the goals?)
2. How am I going? (What progress is being made towards the goal?)
3. Where to next? (What activities need to be undertaken to make better progress?)" (p.86)

Nine schools in England (See et al, 2016) over a yearlong period took these three statements from Hattie and Timperley's (2007) research and embedded them into their pedagogical practice. All teachers at these schools were involved in the research with participants being 1677 students between years 2-6 (aged 6 to 11 years old). The research was not entirely successful however the study itself identified several factors for if further research was carried out. The study identified that teachers involved needed more direction for how to use feedback effectively, more collaboration on identifying the success criteria of the lesson and not seeing classroom instruction being the same as feedback.

Peer feedback can be effective when used in a strategic way as shown by Tasker and Herrenkohl (2016). Gan and Hattie (2014) found similar findings with their investigation into effective peer feedback. The research took place with 121 students, aged 16-17 years old, studying Chemistry at secondary schools in New Zealand. Each student was given the task of providing feedback on a peer's work by comparing it to the success criteria. Some of the students were provided with three questions prompts to help them with providing feedback. These prompts got students to annotate their peer's work about what they did well or did not do well and what improvements could be made. These question prompts were not complex and could be applied to many different pieces of work. By students using the question prompts and success criteria to analyse their peers' work, it actually resulted in producing feedback which identified ways of closing the gap (Ramaprasad, 1983) between the peer's work and the success criteria. The outcome was that those students without question prompts provided less meaningful feedback containing a lot more praise than those students with the question prompts.

Shute (2008) identified guidelines for effective feedback;

1. "Focus feedback on the task not the learner…
2. Provide elaborated feedback to enhance learning… [and] in manageable units…
3. Be specific and clear with feedback message…
4. Keep feedback as simple as possible…
5. Reduce uncertainty between performance and goals…
6. Give unbiased, objective feedback…
7. Promote a learning goal orientation via feedback…
8. Provide feedback after learners have attempted a solution…" (p.177-178)

In summary, what appears to hinder effective feedback are the provision of grades, praise, lack of dialogue and written comments which are not understood in the intended way by students. The use of feedback as a dialogue between teacher and student, the opportunity to act upon the feedback and quality marking appear to result in increased effectiveness of feedback.

Opinions on a variety of feedback methods

Doan (2013) carried out a study with 206 students at Aston University, Birmingham, who completed questionnaires about the feedback received from tutors on their work. The key finding was that 80% of students felt that feedback was important to their learning with 89% stating that the feedback provided allowed them to progress and improve in future assignments. This contrasts with the opinion of 132 students in a secondary school in Africa whom upon completion of questionnaires about the feedback they received from their teachers (Agbayahoun, 2016), the key finding was that 65% of students were dissatisfied with the feedback received. Despite the method of obtaining the opinions of students on feedback being similar, the outcome was very different. Both studies are relevant to my research as Agbayahoun's (2016) is a more recent study carried out with a similar age group to my research. On the other hand, Doan's (2013) had a larger sample size and is in a more similar educational setting to my research than Agbayahoun's (2016).

Price, Handley and Millar (2011) carried out research at three universities into what methods of feedback engage students in higher education. The sample size consisted of 776 students, 20 staff and a mixture of surveys and interviews were used for analysis. A selection of different methods of feedback were trialled including comments via email; comments on a form or on a script; tick boxes; one to one appointment; peer session and debates. The tick box method was the least well received from students as they felt that staff had not spent enough effort providing feedback on their work. One member of staff had scheduled one to one meetings with students but no-one turned up. The overall conclusion from this research is that feedback can be too subjective and if one particular method of engaging students with feedback is chosen then, over time, students might lose their engagement with it “unless the feedback is seen to be well integrated within broader learning processes” (p.894).

Van der Schaff et al (2013) investigated the impact of including verbal feedback between teacher and student on work in addition to teachers providing written feedback. 72 Dutch students between the ages of 16-18 participated in this study with half of the participants receiving verbal feedback with their teacher about their work. The outcome was that students who were given verbal feedback in addition to written feedback felt that they were more reflective about their work and that the combined feedback techniques were more useful to them. This highlights the need for a combined range of feedback techniques to be employed as students differ in which one they perceive as the most useful.

Mulliner and Tucker (2017) through their work with 194 students and 26 members of staff in higher education in England, found that students perceived individual verbal feedback (face to face) to be the most effective and preferred method of receiving feedback on pieces of work. On the other hand, whilst 95% of staff saw individual verbal feedback as the most effective form of feedback, their preferred method of delivering the feedback was typed. Perhaps this can be explained simply through being realistic that the time taken up by individual verbal feedback is not feasible with the number of students and assignments given.

Feedback from peers is another way that students can be guided on how to progress with their learning. However, peer assessment is not a skill which comes easy to all students as they do not know balance of criticism to apply. Tasker and Herrenkohl

(2016) reported on research done with 30 students (aged 12-13 years old) in a science class in the USA investigating the power of peer feedback. Students initially used too much praise in their feedback, so students had to be trained on how to provide useful, constructive feedback to one another.

Perhaps Gamlen and Smith's (2013) research explains in more detail why providing feedback to peers does not come naturally. Students interviewed about peer assessment said that although they enjoyed and benefited from working with peers, they struggled with providing one another with feedback as they had been taught to be 'positive' with their comments which they felt led to the feedback they wrote to not be as effective at helping one another to progress. Ruegg (2018), when comparing teacher feedback versus peer feedback, found that praise was again a factor which negatively impacted on students resulting in teacher feedback appearing to be more effective. The purpose of Ruegg's study was to investigate 67 Japanese students' self-efficacy over a one year period. Self-efficacy in this context is defined as one's own confidence and is highlighted by Ruegg to be a major factor in the effectiveness of feedback despite not having played a key role in previous research.

A prior study looking into the effect of praise featuring as part of feedback was Cowie's (2005) who carried out interviews with over 70 students, aged 11-15 years old, in New Zealand. Some of the students did not like it when praise or a lack of praise featured in a piece of work as they wanted an explanation as to why that particular part was good or why another part was wrong. The students wanted suggestions from the teacher in the form of feedback on how to complete tasks. An interesting point mentioned in these interviews was that students felt if the teacher did not come and speak to them during the lesson, the teacher had not 'assessed' them to see how they were getting on.

Gamlen and Smith (2013) found some interesting results from interviews with 11 students (aged 13-15 years old) in Norway from 4 secondary schools. Students' perceived feedback as positive or negative relative to the amount of time spent doing something with the feedback. If students were given the time to work on improving their work and following up on the feedback, they saw the feedback provided as useful and positive feedback. However, if teachers did not give students this time to work on the feedback or if it was not followed up, students labelled this as negative feedback. It is interesting to see that in this case, students were not focusing on the quality of the feedback provided as to whether it was categorised as positive or negative, instead students focused on the purpose of the feedback, i.e. did it help them progress with their learning. Askew (2000) reinforces this through interviews carried out with 14 secondary school students about teacher-student interaction. The key points from the interviews were that students find the most effective feedback from teachers were ones which "clarifies goals…gives a sense of direction and purpose…identifies mistakes…and provides advice" (p.54-55).

An interesting technique trialled by Bloxham and Campbell (2010) with 9 undergraduate students was students submitting questions about their work along with their assignment for staff to answer upon marking. The feedback from this was mixed with staff saying that responding to questions gave them a focus when marking and saved them time. Students however said that they found thinking of the questions hard and often asked questions which were too broad and did not necessarily give useful feedback for that particular assignment. This reinforces that students struggle with self and peer assessment and is a skill which they need to be trained in.

Teacher and student opinions of feedback varies greatly depending on the perceived effectiveness of the provided feedback. It does however highlight that greater communication needs to occur between teachers and students about feedback. Just because the teacher finds a particular method of feedback the best does not mean that the student agrees. Students dislike praise featuring in their feedback and instead want feedback to consist of useful comments that provide targets and guidance on how to improve. Students are also happy with receiving verbal feedback and peer feedback, but struggle with delivering peer feedback unless strict guidance is in place.

<u>Does feedback allow progression?</u>

Hattie (2012) states that assessment is most powerful when teachers use it to make changes in their teaching strategies and use it as a feedback opportunity. Through assessment, when students make mistakes, these should be used as “opportunities to learn and they are to be embraced” (p.139-140).

Yin et al (2008) wanted to investigate further the effect of embedding formative assessment on motivation and achievement of students. The specific formative assessment techniques used were not stated. Their research took place in the form of an experimental group (of 6 students) who had embedded formative assessment into the curriculum and a control group (again, of 6 students) where teachers just carried out their normal practice. The results showed that there was no drastic difference in motivation and achievement of students between either students which contrasts with many other research findings. Yin et al (2008) hypothesised that this could have been due to the fact that the teachers in the control group also carried out formative assessment, some more effectively than the teachers in the experimental group. However, it was found that the gap between high and lower ability students in the experimental group was narrower than the control group. The conclusion from this research was that formative assessment cannot just be put in the curriculum to have its desired effect, teachers need to be trained on how to use it effectively.

There are mixed views about whether feedback that is just focused on corrections is effective. Lipko-Speed, Dunlosky and Rawson (2014) found in their research, with a sample size of 65 students, that those who received corrective feedback did better than those who received no feedback. Conversely, Fyfe and Rittle-Johnson (2016), found from their research with over 100 students that corrective feedback was only beneficial to those with no prior knowledge of the task whereas those with prior knowledge did not progress despite receiving feedback.

A more recent study was carried out in the Netherlands with a larger sample size of 62 students in grade 9 (12-13 years old) investigating formative assessment in the classroom (Vogelzang and Admiraal, 2017). Two classes were involved with one class being exposed to formative assessment techniques (written feedback from teachers and peers) and the other did not experience formative assessment. It was found that the class that experienced formative assessment did better in tests. Interestingly, the groups were then switched so that the class who did not receive formative assessment did and vice versa. It was again found that the class which was exposed to formative assessment did better. The fact that both groups of students did better in tests when they received feedback from the teacher and peers increases my confidence in the validity of these results. In addition, prior to this, Decristan et al (2015) found similar results with 551 elementary students and 28 teachers that those students who were given feedback by the teacher during the course of the study improved their scientific understanding more than the control group.

From the literature cited above, it is clear that feedback has the potential to be beneficial in allowing progression if used appropriately. The key points that have emerged are that feedback does make a difference to attainment as shown by Butler (1987); Decristan et al (2015) and that feedback in the form of comments results in the most engagement from students and increased attainment compared to feedback in the form of praise or grades (Butler 1989). The power of comment-only marking rather than grades is supported by the findings of Black et al (2004) to be one of the most effective forms of written feedback provided by the teacher.

However, written feedback is not the only method of providing effective feedback. Verbal feedback has been shown to be an effective method of feedback (Mulliner and Tasker, 2017) however from a practical point of view, it can also be time consuming. Gan and Hattie (2014) and Tasker and Herrenkohl (2016) found peer assessment to be very effective, when students were given more structure on how to provide feedback i.e. relating feedback to success criteria. Studies that investigated a variety of feedback methods came to the conclusion that students benefit from a variety of feedback methods as each learner is unique will prefer a different method of feedback (Van der Schaff et al, 2013).

Based on this literature, there are three questions which I wish to focus on trying to answer through my research;

1. How do students perceive DIRT feedback sessions?
2. What is the association between the type of DIRT feedback task and student engagement?
3. What is the impact of engaging students with DIRT feedback sessions?

I have chosen these research questions because I initially want to investigate further what is making students disengaged with DIRT feedback sessions in the first place so I can respond to this. Then I will trial a variety of feedback methods that are mentioned in the literature to see which ones engage these students the most. Finally I want to analyse if there is any impact on students' progress in science as a result of getting them more engaged with DIRT feedback sessions.

Methodology

This research was carried out from January to April 2018 at a mixed comprehensive Academy in Oxfordshire with a year 10 (14-15 years old) Chemistry class. The class was chosen because I have found them to be the group of students who are most reluctant to respond to and act upon feedback. I therefore believed that intervention with this class would have the biggest impact. The class itself (n=26) is a triple science class, with varying ability due to no setting within the science department at the Academy.

Ethics

As this research was carried out with participants aged 14-15 years old, the initial preparation for this research required obtaining ethical approval for it. I sent an application to the Central University Research Ethics Committee (CUREC) and on the 8th November 2017, I received confirmation that my research project had been approved (Appendix 1). Upon receiving this, I sent a letter to the Principal at the Academy, requesting permission to carry out the research (Appendix 2).

I used the first ten minutes of a Chemistry lesson to introduce my research to students and to explain why I was carrying out this research (Appendix 3). The emphasis of this introduction to my research was that students had no obligation to participate in this research if they did not want to and could withdraw from the research at any time (BERA 2011). To ensure anonymity of students for the questionnaires and interviews, I did not use their real names in the findings and discussion sections (BERA, 2011). All test data collected was also anonymised (BERA, 2011). I then told students that any data collected would only be used by myself and my University supervisor, Sibel Erduran, and would be destroyed on the 13th September 2018. I gave students 48 hours to think and reflect on my research proposal and the impact it would have on them.

Phases of Research

1. *Collection of baseline data*

I used data from the last Chemistry end of topic test to be the baseline for assessing progression in attainment at KS4 (Appendix 4). I had been keeping a teacher reflection diary on this class since September so I could accurately assess any changes in engagement with DIRT feedback sessions.

2. *Pre-intervention Questionnaires and Interviews*

I obtained written consent from participants (Appendix 5a) and as part of the starter to a lesson, they completed the pre-intervention questionnaire (Appendix 6). By administrating the questionnaires myself I got a high response rate. Interviews (Appendix 7) however were carried out outside of lesson time, therefore a lower response rate was obtained. Again, written consent was obtained from students (Appendix 5b) and the data collected was stored in a safe location.

3. *Intervention Lesson*

Starter: Students prepared a mind-map listing as many reasons as possible for why teachers mark books. I then chose random students to explain what statements on the board meant. The purpose of these two tasks was to highlight and address any misconceptions surrounding feedback.

Main: students were given photocopies of anonymised student work that contained my written feedback and responses from students. Working in groups, students had to annotate the different pieces of work showing what was and was not 'good' about the students' responses. This task was designed so students themselves could see the variety of feedback responses in the class and examples of the level of detail required in responses. These annotations then formed the basis of a class discussion where we summarised the key things you should be applying when responding to written feedback. We then compared this to a crib sheet I had made (Appendix 8) and added any extra points to it.

Plenary: students had to respond to written feedback from myself about their homework applying the strategies learnt in the lesson and were to write a 'Specific, Measurable, Achievable, Realistic, Time-Based (SMART) target (Spendlove, 2015) to implement on the following piece of work (Appendix 9).

Four Step Action Cycle:

In order to expose students to a variety of DIRT Feedback tasks, a four-step cycle was incorporated into a series of lessons (Figure 1). Each type of feedback task is explained in more detail in sections 4 to 6 below. Classroom observation and analysis of student work would be used to assess which type of feedback students engaged with the most.

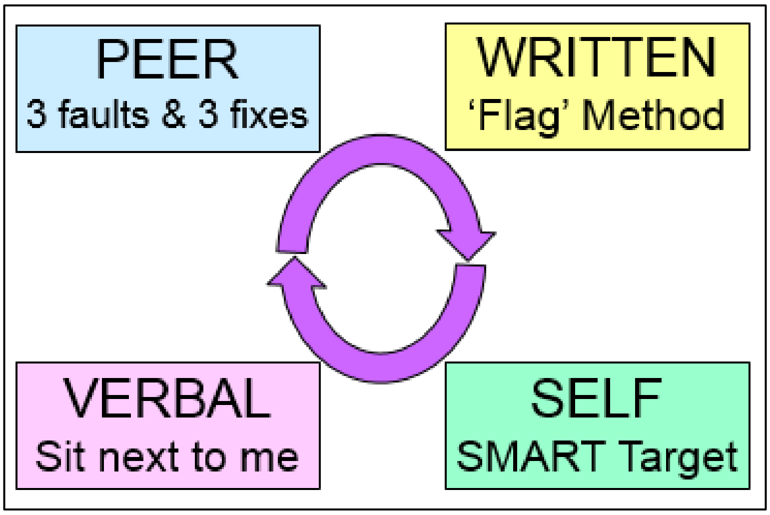

Figure 1: Variety of feedback tasks used in this research

4. *3 faults and 3 fixes*

In order to assess students' engagement with peer assessment, the following lesson as a plenary, students peer assessed one another's work against success criteria (Gan and Hattie, 2014) using a 3 faults and 3 fixes table (Spendlove, 2015). Students were randomly assigned someone's work to mark. Student have to write about 3 faults of that student's work. They then got their own book back and responded back to the faults identified by fixing them.

5. *Responding to written feedback ('flag' method) and writing SMART targets*

At the start of the following lesson, students responded to my written feedback on their work and wrote a new SMART target. They also commented on whether they had achieved their previous SMART target and why. To increase students' timely response to feedback I decided to stick flags beside my written feedback to give a visual cue to students where my comments on their work were. The first time upon using these flags I identified to students that the flags were to identify that a response was required from the student in the allocated DIRT part of the lesson (typically a starter). The flags could only be removed when a response was completed. After a typical marking session students would have two flags in their work.

To prevent responses to my feedback being “okay miss”, I made sure that my written comments contained at least one question. I had previously felt that my marking had contained this in accordance with the science department’s marking policy of including a strength and a target with each deep-mark of a student’s book. I incorporated page numbers for students to use as an aid for responding to my questions and had a ‘model answer’ available for students to use as a guide when tackling similar exam questions.

6. *Sit next to me*

To assess students’ engagement with verbal feedback, I decided to use homeworks, specific pieces of classwork and end of topic tests as an opportunity to speak one to one with students about how they did and what they could do in the future to progress (Spendlove, 2015).

7. *Post-intervention Questionnaires and Interviews*

Using the same volunteers, I asked the students to complete the same questionnaire and interviews (Appendices 6 and 7) to see how their opinion had changed. During the research project, all participants remained the same with no-one withdrawing from the project.

Methods of Data Analysis

Table 1 shows the research questions which arose from my literature review, along with the research instruments and methods of data analysis.

Table 1: Summary of research questions, research instruments and methods of analysis

Research Questions	Research Instruments	Method of Data Analysis
1. How do students perceive DIRT Feedback sessions?	Pre and Post Questionnaires Pre and Post Interviews	Quantitative Qualitative and Quantitative
2. What is the association between the type of DIRT Feedback task and student engagement?	Teacher Observations Pre and Post Questionnaires Pre and Post Interviews Studying students' work	Qualitative Quantitative Quantitative Quantitative
3. What is the impact of engaging students with DIRT Feedback sessions?	Students' attainment Students' written work in class books Teacher Reflection Diary	Quantitative Quantitative Qualitative

I chose to use mixed methods data analysis with the intention of reducing the bias from either type of data analysis (Creswell, 2003). Questions 1 to 7 were closed questions in the questionnaires so were analysed by descriptive quantitative analysis due to generating answers on a three-point Likert scale. I calculated the percentages for each category chosen and plotted the data in a bar chart to allow easier comparison between pre-intervention and post-intervention questionnaires. Students' attainment was assessed through end of topic tests which I converted to percentages and plotted as a bar chart.

Questions 8 to 10 in the questionnaires and all of the interview questions were open-ended questions so needed to be interpreted by qualitative analysis as the data collected was more obtuse. In addition, the students' work being analysed was not numerical but instead was a dialogue between students and myself, so this needed to be qualitatively analysed as well as the notes made from teacher observations and the teacher reflection diary.

Piloting and Collaboration

I piloted the questionnaire and interview questions with another year 10 science class at the Academy in December 2017 after receiving CUREC approval and permission to carry out research from the Principal. I chose this class because they were the same age range as the actual participants of this study and are of a similar academic ability. Piloting my questions was valuable because I wanted to confirm that my questions were pitched at an appropriate level and that students would interpret the questions in the intended way. To assess this I asked this pilot group of participants for feedback on whether "any of the questions [were] unclear or ambiguous" (Bell, 2005, p.147). No questions needed to be altered.

My collaborators for this research were one Biology and one Physics teacher at the Academy who taught the same class of students who were the participants in this study. Therefore, the collaboration in the project consisted of these two science teachers giving me feedback on my written comments on students' work, and students' responses to my feedback. They fed back on whether students' attitudes to DIRT feedback sessions changed over the course of the intervention in their own lessons even though their lessons did not have any intervention strategies specifically taught in them.

Justification of Research Instruments

I decided to use both questionnaires and interviews in this research project because of the advantages and disadvantages of both. Questionnaires have advantages as they are straight forward to analyse, do not take up much time to complete, they allow anonymity and therefore encourage greater honesty (Munn and Drever, 1990; Daniel, 2016). A disadvantage of questionnaires can be the low rate of return therefore I orchestrated the handing out and collection of questionnaires within my Chemistry lesson with this class and counting of questionnaires before the class was dismissed to check how many were returned. Munn and Drever (1990) highlight disadvantages to include that "the information collected tends to describe rather than explain why things are the way they are… [and] can be superficial" (p.5). Daniel (2016) also highlights this an issue saying that questionnaires can leave participants with "no room to contribute to the study". To prevent superficiality having a negative impact on my research, I also carried out interviews with participants from this class to gain a wider insight into their views on this topic.

Carrying out interviews allowed me to collect unique data about students' insight and understanding of DIRT feedback which could not be provided by questionnaire. I purposely chose for the interview to be made up of open-ended questions to allow all participants the opportunity to go in as much depth as possible with their responses. I chose to record the interviews as although the time taken to transcribe and analyse the data would be lengthy, it would prevent inaccuracies in the data collected by relying on memory alone and allows parts of the dialogue which perhaps was not initially considered to be of importance to still be present upon later analysis.

From my initial literature search, I had not come across a questionnaire that had been used with students which was similar to the course of intervention which I wanted to pursue, therefore I made my own questionnaire. The questionnaire was made up of ten questions, eight of which were closed questions and three which were open-ended. For the closed questions I decided to use a three-point Likert scale which required students to make a choice of whether they agreed, disagreed or were neutral about the question posed. Using a Likert scale supported previous research carried out by Laerhoven, Zaag-

Loonen and Derkhx (2004) on trialling three different types of questionnaires with 120 children between ages 6-18 years old who found Likert to be the preferred questionnaire format.

There is some lack of clarity in the available literature surrounding which type of Likert scale is most favoured. Likert (1932) states that five-point scales can be more satisfactory than three-point scales, however more recent studies have reported that three-point scales are good enough (Jacoby and Matell, 1971; Lehman and Hulbert, 1972; Mellor and Moore, 2013). Mellor and Moore (2013) highlight the important point that Likert response formats are something which children are unfamiliar with and therefore thought needs to be put into whether the participants understood the difference between the different options. A dichotomous scale is preferable as everyone is clear on what is meant by 'agree' or 'disagree' however, there is no neutrality option for those without a strong opinion. The problem with five-point scales is although there is a range of options for participants to express their opinion, each participant may interpret strongly agree and mostly agree differently.

A solution is therefore to use the three-point scale, where there is clarity about each category, and a neutral option present for people to pick from (Krossner and Presser, 2009). I chose to use the three-point scale rather than a five-point scale when writing the questions for the questionnaire as I felt that students might struggle distinguishing between strongly agree, mostly agree and agree. Using a three-point Likert scale also made these closed questions easier to analyse.

I decided to make the interviews consist of open-ended questions to allow students to articulate their thoughts with more detail than a one word response (Cohen et al, 2011).

All students who participated in the interview had also completed the questionnaire, so this allowed for more probing into detail about the closed questions on the questionnaire. As the interview had been designed in the form of structured questions, I decided against using focus groups as I wanted responses from all participants to be comparable rather than groups going off topic and thus reducing the usefulness of the data collected (Cohen et al, 2011). In addition, Hayes (2000) highlights that focus groups can have the disadvantage of dominant participants taking over the discussion with others being left out of the conversation.

The questionnaire itself was designed to be an initial starting point to assess students' opinions about feedback and its usefulness. A benefit of this particular questionnaire was that it took five minutes to complete, so easily fitted into the lesson as a starter. The purpose of the interview in this research is to get a deeper insight into students' perceptions of feedback. Interviews, though being time-consuming, have uses in that they allow participants to give more description in response to a question rather than being limited by scales. In terms of conducting the interviews, there was a choice between one to one or group interviews. The advantages of having interviews in groups is that you can get through your sample much quicker, and students feel more comfortable talking in groups than by themselves (Taber, 2007). However, in groups, there can be one or two participants who dominate the dialogue which prevents an accurate representation of what all individuals think about the matter (Bell, 2005). Also, students may have a different opinion to their peers which would be valuable to the research, but might not want to voice it in front of others, (Hayes, 2000; Taber, 2007), perhaps being afraid that their peers would make a negative judgement of them.

I felt that using the same questions before and after the intervention allows for greater comparison of results between participants and to see the difference in engagement and attainment of students before and after the intervention.

Limitations of the research

Some might say that the sample size of this research being only 26 students is a limitation. Cohen et al (2011) report that "if researchers plan to use some form of statistical analysis on their data" (p.144) then 30 students is the smallest sample size. However, I am not analysing my data by statistics, therefore I am following Cohen et al's (2011) statement that "the correct sample size depends on the purpose of the study" (p.144). I felt that these 26 students, whom were of mixed ability and displayed reluctant engagement with DIRT feedback tasks prior to the intervention, would be a large enough sample size to properly analyse any changes in significant engagement and the impact the intervention had, if any, on their attainment at KS4. The students involved in this research are of an age where they are able to clearly articulate their opinions in interviews and at the same time are malleable to changes in engagement with tasks.

I decided to carry out this research with just one class and no control group. My focus is on studying the relationship between engagement with feedback tasks and student attainment. To have a control group for this project would be to either give a class DIRT feedback which they are not engaged with or to give the control group no DIRT feedback tasks and then compare the control group to the class which were exposed to engaging feedback tasks. This is difficult to achieve as teachers may feel that they are not providing students with DIRT feedback opportunities but they might be subconsciously doing so without realising it is embedded in their practice. This is shown by the research of Yin et al (2008) who found that having a control group when investigating formative assessment did not find credible results which Yin et al believed to be due to the fact that it is not possible to prevent teachers from using formative assessment techniques.

In terms of ethical considerations, to have a group of students who are not given DIRT feedback goes against the Academy's marking policy where this research is carried out and goes against the do no harm policy of educational research (Taber, 2007). If it was found during the study that increasing students' engagement with feedback did increase their attainment, then the control group would have had their learning limited, which with this sample being a year away from completing GCSEs, is not desirable.

Findings

Pre-intervention Questionnaires

The research was carried out with 26 students of whom all gave written consent to be part of the study. Therefore n=26 for the pre-intervention questionnaires. Questions 1 to 7 were closed questions and had a three-point Likert scale. I had 100% completion from students for questions 1 to 6 and a 96% response rate for question 7. However, for questions 8 to 10 which were open-ended, I had an 87% response rate.

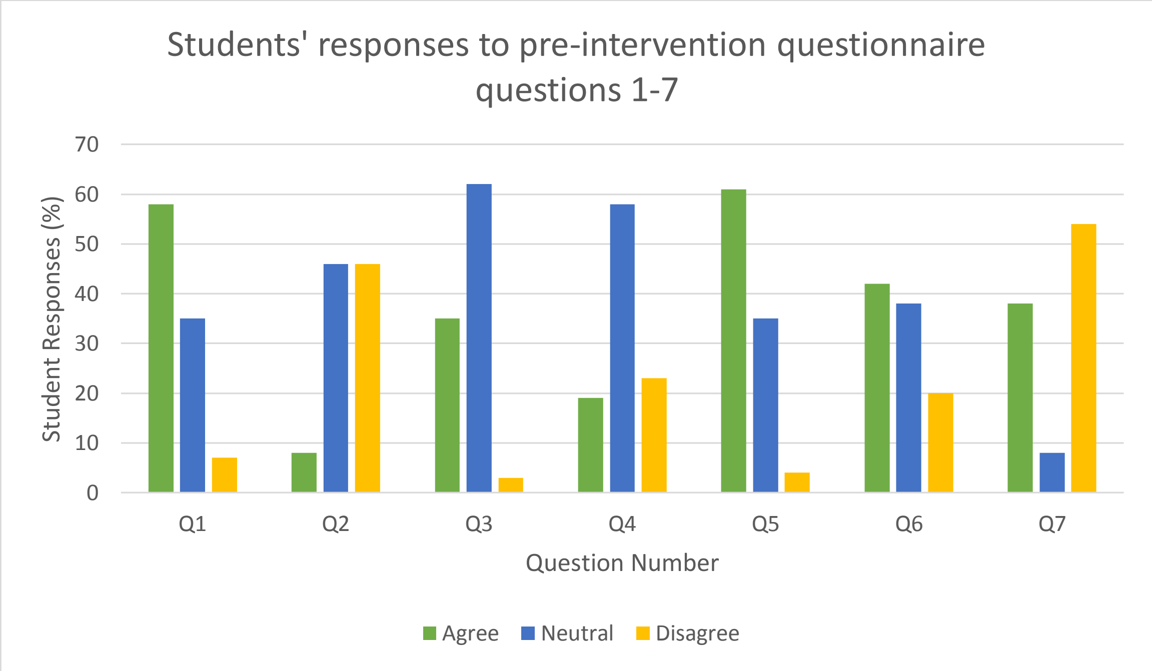

Figure 2: A graph showing the responses from students to pre-intervention questionnaire questions 1-7

Question 1 was focusing on seeing whether students actually read the comments provided by teachers about their work. The data showed that the majority of participants do read these comments. Perhaps this can be interpreted as evidence that students have found previous comments from teachers to be useful and therefore see the benefit of reading these comments.

The purpose of question 2 was to identify if students engage with feedback provided. As shown above, only 8% of students responded back to the feedback without the teacher reminding them. From the literature available, there are extensive sources which talk about the importance of feedback in terms of student progression (Sadler 1989; Black and Wiliam, 1998; Hattie and Timperley, 2007) yet it seems that this research has not embedded itself well enough into the classroom for these students. This was therefore vital to address in the following intervention lesson.

Interestingly, the results of question 3 showed that only 3% of students felt that teachers' marking and writing comments about work was not useful for progression within science. From my reflections and observations of this class before this research began, I would have predicted that the majority of students did not link teachers' feedback and progression due to their apparent lack of engagement with it. This illustrates the value of including this question in the questionnaire to show that the way feedback is being delivered in the classroom is the problem rather than not understanding the value of feedback.

As shown in question 4, 58% of students felt neutral about using teachers' feedback in future tasks with 23% disagreeing with this statement. This figure of 81% of students not feeling like they actively use teachers' feedback in future tasks is proof that current methods of feedback with these students are not engaging them which could perhaps be limiting their progression at KS4.

The data collected for question 5 showed that the majority of participants felt that they understood why teachers provided opportunities for DIRT feedback sessions to feature in the classroom. Unfortunately, a majority was not the case for question 6 where only 42% of students felt that responding to feedback helps them to progress in science. This finding is similar to Hattie's (2007) statement about feedback being one of the most important tools for learning yet it does not automatically result in progression unless used properly.

As expected, 54% of students did not know what DIRT feedback means. Though many pieces of literature discuss the importance of opportunities to respond to feedback in the classroom, they do not specifically refer to it as DIRT feedback. In fact, the only time that I found the term 'DIRT feedback' specifically stated was in Spendlove's (2015) work on summarising key techniques for assessment for learning in the classroom. Therefore, perhaps it is not much of a surprise that students are not familiar with this term.

8. What does "respond to my feedback" mean?

When defining the term "respond to my feedback", nine students used the word 'respond' in their answer. Nine students mentioned answering questions written by the teacher in their definition. Making improvements to work was only mentioned by six students. The most significant feedback received by this questionnaire was the comment stated by one student that they "write 'ok' beneath it because I have no idea how to respond". Having taught this class from September, I have had responses of 'okay' to feedback from more than ten students yet only one mentioned it in the questionnaire.

9. Why do you think you need to reply to what teachers write about your work?

Fifteen students replied to this question by identifying the purpose of responding to teachers' comments being that it helps their own learning and allows them to make improvements. Whereas nine students focused on answering this question by talking about the major purpose of responding to teachers' comments being that teachers can identify whether or not students have understood their written comment. One student talked about the effect of responding to comments meant that they would be prevented from making the same mistake. However, three students mentioned that the only reason they respond to teachers' written comments is because they have to. Interestingly, two students phrased their responses with "it may help" or "it might help your understanding" as if they had not experienced the benefits of responding back to teachers' comments. These findings contrast with Gamlem and Smith's (2013) whom found that students had a much more positive outlook on responding to teachers' comments and found feedback most useful when they had a chance to respond to it.

10. What would motivate you to reply to what teachers write about your work?

The answers provided by students ranged slightly more with this question. Motivation in the form of chocolate or sweets (or in one case, pretzels!) was asked for by nine students. Three students said that if they felt responding was worthwhile and useful, they would do it. In terms of progression with learning, six students felt that responding to feedback helped them learn. Interestingly, only one student mentioned that more praise used in feedback would motivate them to respond. Two students said that nothing would motivate them to respond to teachers' feedback. One student said "being given feedback that can be responded to by more than ok". This statement agrees with the work of Leahy et al (2005) who stress the importance of feedback to "cause thinking" (nop). Another student highlighted in this question that they would be motivated to respond more if they had more direction from the teacher on how to respond to the feedback.

<u>Post-intervention Questionnaires</u>

Again for these questionnaires, n=26. For questions 1 to 7 I had a 100% response rate. However, for questions 8 to 10, I had a 96% response rate. In the post-intervention questionnaires, for all questions bar questions 2 and 4, the 'agree' category has the highest percentage of responses. Questions 2 and 4 had an equal percentage of students choosing the 'agree' or 'neutral' categories.

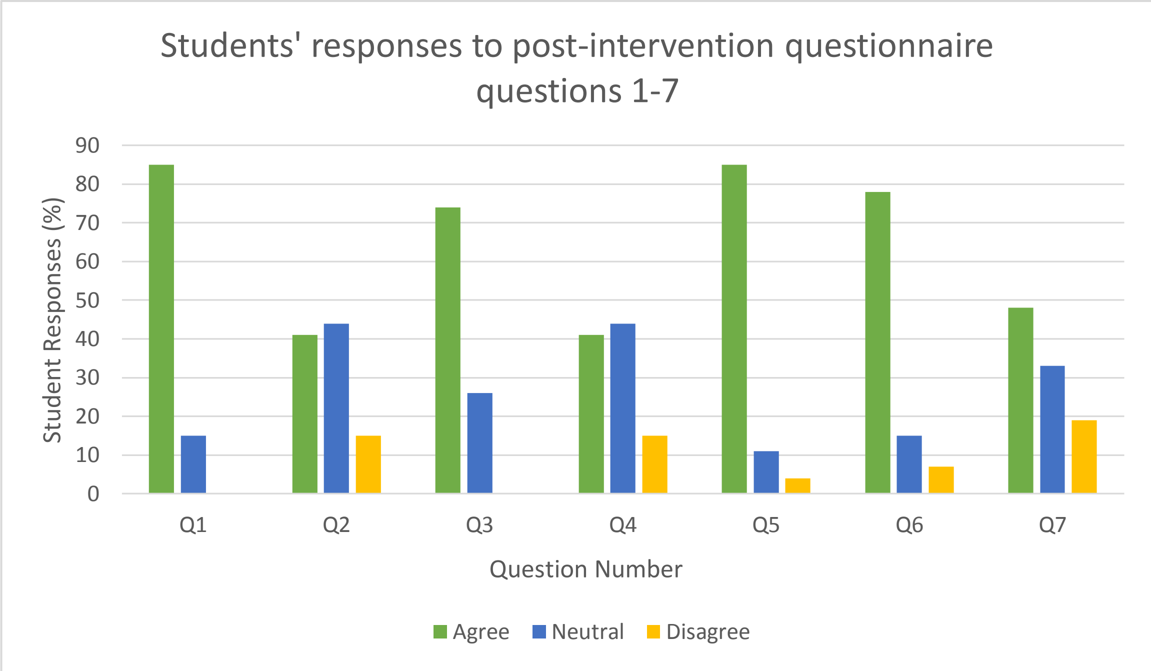

Figure 3: A graph showing the responses from students to post-intervention questionnaire questions 1-7

In response to question 6, 77% of students felt that they developed their understanding of science as a result of responding to written feedback. Doan's (2013) study found similar findings to mine and as his study was carried out with a larger sample size, this increases my confidence in this finding.

Of particular significance to my research is that no students disagreed with question 1 "I always read what the teacher writes about my work" and question 3 "I think that teachers checking and writing comments about my work helps me improve in science". This perhaps shows that a larger number of these students now understand the relationship between provision of feedback and progression in science.

In question 5, 85% of students agreed that they understood why teachers provide opportunities for responding to their comments in lessons. This is a finding which perhaps explains why 42% of students stated that they are engaging more with what teachers write about their work (questions 2 and 4).

A final success for this intervention is that only 19% felt strongly that they did not understand what DIRT feedback means.

8. **What does "respond to my feedback" mean?**

The answers to this question following the intervention were far more extensive and only three students this time used the word 'respond' in their answer. Students in the pre-intervention questionnaires focused on just the immediate task of what responding to feedback means i.e. write in green pen next to teachers' comment or read and reply to question written by the teacher. Now, in these post-intervention questionnaires, eight students defined the term by stating their opinion of the actual purpose of responding to feedback by making statements such as "apply what the teacher has written to future work" and to "develop understanding in the long term".

9. **Why do you think you need to reply to what teachers write about your work?**

Again, fifteen students mentioned 'improve' in their response to this question however the focus this time was on utilising the response time to deepen their own understanding and progression within science. One student specifically responded with "to improve in science". Fifteen students stated that replying to teachers' comments resulted in progression in that subject. Only five students stated that the sole reason was to show the teacher if you understood their comments or not. No students said "because they have to".

10. **What would motivate you to reply to what teachers write about your work?**

The number of students who wanted prizes (food or other) decreased from nine students to five. One student mentioned that the 'flag' method that was used was helpful in being a constant reminder that there was something there to respond to. Three students highlighted that comments with questions made them more likely to act upon it and retain the feedback rather than just a comment about what to do next time. The eighteen remaining students discussed that comments needed to include positive and negative feedback that was purposeful and going to help them progress in that subject.

Analysis of questionnaires

Figure 4 below shows the results from both sets of questionnaires to illustrate more clearly the difference in data collected. Pre-intervention data is shown by the categories 'agree', 'neutral' and 'disagree' and post-intervention data is shown by 'agree2', 'neutral2' and 'disagree2'. In terms of a general trend, there is an increase in the number of responses for the 'agree' category with the post-intervention questionnaires and a decrease in the number of responses for the 'neutral' and 'disagree' categories. I chose to plot these graphs as percentages to show more significance when discussing trends in the data.

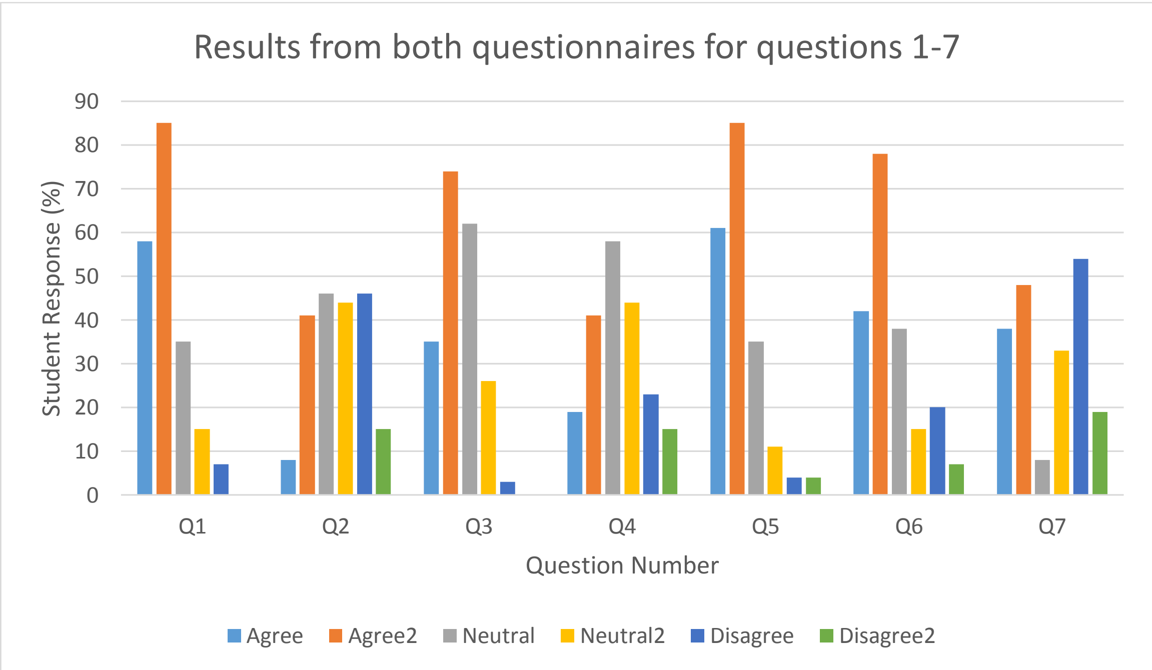

Figure 4: A graph showing the responses from students to pre-intervention and post-intervention questionnaire questions 1-7

The immediate difference shown by this graph is that with the post-intervention data, the percentage of students who picked 'agree' has increased, the percentage who picked 'neutral' has decreased and percentages for 'disagree' have all decreased bar one which remained the same. This is evidence that this intervention was successful at getting students to perceive DIRT feedback sessions in a more positive way. In addition, because of the increased percentage of students agreeing with the statements in the questionnaire, there is an association between the type of feedback task and student engagement due to the independent variable of this research being type of feedback task.

Question 2 was initially put into the questionnaire to identify the number of students out of these participants who were disengaged with feedback. The intervention has therefore had some success with the figure of student engagement raising by 34%. I also believe that the 'flag' method was a useful tool to have incorporated within this intervention as it was a non-verbal reminder that students had feedback to respond to.

To identify whether students were fully engaging with feedback, I wanted to see if students not only read and responded to feedback but actually applied it in future tasks. Question 4 showed a 23% increase in the number of students who agreed that they acted upon feedback in future tasks. Although this still does not bring this overall percentage to over 50%, perhaps if this intervention was carried out for longer, we would see further improvement in results. However, no students said that they did not act upon feedback in future work which may suggest that the intervention had significant impact with changing students' lack of engagement with feedback sessions.

Prior to this intervention, one of my theories was that the lack of student engagement with feedback sessions was due to them not understanding why teachers write comments about their work and why opportunities are given for responses to be written to teachers' comments (questions 3 and 6). Post-intervention, it is apparent that 100% of students understand why teachers mark their work and 92% of students 'agree' or are 'neutral' that responding to feedback makes a difference to their understanding of science.

Pre-intervention Interviews and Post-intervention Interviews

The interviews were carried out individually at a time outside of the lesson which suited the interview participant. Despite all students wanting to be involved with the study and complete the questionnaires, only four students (Students F, K, N and P) volunteered to be take part in the interviews. The same students were used before and after the intervention and written consent was received from all (Appendix 5b). To allow best comparison between pre and post-interviews, I have written the pre-intervention in normal font and post-intervention in italics.

1. **What does the word 'feedback' mean to you?**

Student F summarised this well stating that feedback is "guidance provided by a peer or someone with more expertise in a particular field with the aim of helping you to improve." This idea of progression is similar to Black and Wiliam's (1998) and Leahy et al's (2005) definitions of feedback. Students K, N, P applied the definition of feedback to thinking of when a test is done in school and comments are provided on how to improve. No student mentioned feedback specifically in terms of their books when it is marked with comments by a peer or teacher.

Post-intervention, all students this time defined feedback in terms of when the teacher either says or writes comments on your work which highlight where improvements need to be made.

2. **What does the term "DIRT Feedback" mean to you?**

None of the students interviewed identified that DIRT was an acronym. This is unsurprising as I only found one piece of literature which specifically defined what DIRT stood for. All identified it to mean time when green pen annotations should be made to previously completed work to improve it. Students K and P also mentioned that DIRT feedback was the title of the lesson after an end of topic test had been completed.

Students again did not define the acronym however all mentioned that some sort of response was required by the student on their work. Student F said that it meant you needed to thoroughly make improvements on your work.

3. **When teachers say "respond to my feedback on your work", what do you do?**

Students F, K and N acknowledged that this statement meant that teachers' written comments needed to be read and acted upon by writing a response in green pen. Student N said that even though they knew a response was required, they did not always do so if they did not understand what to do. This finding perhaps explains why Havnes et al (2008) found that students who required the feedback the most to progress were the least engaged with the process. It is not a lack of engagement but perhaps a lack of understanding of how to respond. Student P said that they thought they just had to acknowledge they had read it by writing 'okay' or "will do" and would act upon that comment in future tasks.

Students K, N and P said that it meant improvements were required on their work. Student F said that they would often do extra research outside of class on the area identified by the teacher that they needed to improve on.

4. **Why do you think teachers write comments about your work?**

Responses included “because it is their job to get you to improve in that subject”, “to help you to do better next time” and “so you know which parts you went wrong”. I was pleased to hear that students understood the comments were written to act as guidance for improvement. Interestingly this went against my prior thoughts to this intervention that most students did not understand why teachers marked books. This finding also contrasts with Marsh (2006) as feedback by marking must be having a prominent enough role in the classroom if students understand its purpose.

Students F, K and N said that the purpose is help you to improve. Student P took this further by saying that it makes sure that the student “is clear on the information, to prevent them getting stuck and so you don’t fall behind”.

5. **Why do teachers want you to read and reply back to what they have written about your work?**

This question took most students interviewed a few seconds to think about their response. Perhaps this was because students thought that they understood why teachers marked their books but had not really considered their role in marking besides completing the work set for the teacher to mark. Responses from Students F, K and P focused on the point being that teachers knew you had read their comments if you replied to them. Student N said that your response allows teachers to see whether you understood their comments on your work. No students linked this back to thinking about the effect that replying to comments would have on their own progression.

Student F said that by responding, it shows the teacher that you have acknowledged and taken on board the teacher's feedback. Students N and K spoke about it allowing the teacher to see if you understand their feedback. Student P interestingly developed this further by discussing the importance of responding back to feedback sooner rather than later so the feedback is more purposeful and helpful whilst the concepts you are studying are still fresh in your mind.

6. **Do you think you should reply back to what teachers write about your work? Why is that?**

There were mixed responses to this question. Students F and P replied saying that yes you should because the teacher asked you to. Student K responded saying yes because it allows the teacher to see if you now understand what you got wrong before. Interestingly, student N said it depends on the way that the teachers' comment is written. You should respond back if the teacher's written comment was meaningful enough to require a response, no if the only thing you can write back is 'okay' or 'thanks'. This finding agrees with Leahy et al's (2005) statement that feedback "needs to cause thinking" (nop).

This time no student mentioned that you should because the teacher asked you to. All students mentioned that it is useful to respond as it helps you to progress.

7. **Have you ever acted upon what teachers write about your work? Why is that?**

As expected, the responses from students to this question varied considerably. Students F and P said that they always acted upon it as the point of the comments was to help improve your understanding in that subject. Students K and N replied sometimes if they understood what the teacher had written about their work.

All students felt that had already answered this question earlier so they did not need to answer it again.

8. **What do you think the value is in replying back to what teachers write about your work?**

All students highlighted that there was some value in replying to the teachers' comments if it was clearly going to help them to improve in that subject.

Student N felt it was useful to allow progression and allowed the teacher to see if you did or did not understand. Student F said that the response helped them to remember. In terms of exam questions, Student P felt that by replying back to teachers' comments, you were able to "draft the perfect answer to get full marks for exam questions which are useful in preparation for tests".

9. **Do you think that responding to what teachers write about your work helps you to progress in science? Why do you think that?**

Student F mentioned that it was helpful as it allowed them to see what areas they were struggling with and needed to improve. Student N said that it depended on what the teacher wrote about the work. If the comment consisted of constructive feedback with a task for the student to complete, there was more value in responding to this than just reading a comment and writing okay beside it. Students K and P felt that it was kind of useful but that other things were more useful such as revision.

Students K, N and P said yes because it helps to improve little things which make a difference to your overall understanding of a subject. Student F liked the 'flag' method as they were useful reminders and being able to remove them upon completing a response make them "feel great" and that they understood more about a particular concept.

10. What would encourage you to reply back to what teachers write about your work?

Student N highlighted that if they could see the benefit of responding straight away to a teacher's comment that this would help them to do so. The importance of timely feedback is emphasised by Gibbs and Simpson (2004-05). Students F, K and P mentioned that the comments written by the teacher needed to be phrased in a way that demanded an extended response from the student and guidance on how to complete it.

Student F felt that the flags were a useful reminder to respond back to feedback. Student N emphasised the need for clear and concise comments where it was clear on what to respond with. Students K and P said that they just do and they do not need to be encouraged although Student K said that "other people in their year would probably say food!"

11. What do you think helps you to improve your understanding and progression in science?

Answers ranged from independent study outside of the lesson to consolidate understanding, completing homework set, asking for help either from the teacher or peers. No student mentioned feedback from the teacher being a way to improve understanding despite students earlier articulating the value of it in terms of their progression in science.

Student F spoke of repetition of things studied a while ago whilst student N mentioned the importance of coming to the teacher for help if stuck. Student K mentioned the importance of completing practice past papers and exam questions. Student P was the only student to mention that written feedback from the teacher was important for progression within a subject.

12. **On a scale of 1-10, how important would you rate replying to what teachers write about your work in terms of how it affects your academic progression? Explain why you think that.**

Student P ranked it as a 4 as it can be useful in making sure you understand something, which in turn, is going to aid you with your progression in a subject. Student F gave it a ranking of 3 as they felt that revision and going over key concepts outside of class was more responsible for their academic progression. Students K and N were more positive about the importance of feedback giving it a rating of 6. Their explanations were similar focusing on the fact that the teacher is the expert in the subject and by you responding to their comments you are only going to progress more than if you did not take on board their feedback.

Student N gave it a ranking of 7 as it was dependent on the format that the feedback was provided in the first place. Student P gave it a ranking of 8 for a similar reason. Student F gave it a ranking of 5 as they felt that it was not the biggest factor in terms of impact on their progression in science. However student F felt it was still a worthwhile task to do. Student K gave it a score of 9 as they felt that it was useful to assess your understanding of a concept.

<u>Analysis of Interviews</u>

The main outcome of these interviews was that these students are more positive about the role of feedback in the classroom after the intervention. Students now value feedback due to seeing that it is making a difference towards their attainment. One student felt that by responding to feedback, they could draft the perfect answer to exam questions. In KS4, there definitely is a big focus on GCSEs and exam technique, so if students can see that DIRT feedback can help their attainment in exams, they should hopefully engage with it more.

An interesting finding from the interviews was that post-intervention, no student mentioned being unable to answer the comments written by teachers in the DIRT feedback sessions. Perhaps this is as a result of the successful implementation of the crib sheet to aid responses to feedback.

Sadly, at the end of this intervention, students did not know what the acronym DIRT stood for. However, all students agreed that feedback should result in them thinking and they ranked it higher on a scale of 1 to 10 for how important DIRT feedback is in terms of their progression in science.

Intervention Lesson

Most students were very thoughtful and engaged right away with creating a mind-map about why teachers mark their work. Answers varied from “because it’s their job” to “it helps us” to “it identifies ways to improve our work”. Upon going around the room and randomly picking on students to feedback their ideas, no student could not come up with an idea as to why teachers mark work.

The statement which students were the least confident and articulate with explaining was “we are doing a DIRT feedback lesson”. Responses were limited to stating that corrections were going to be made to work and that means we have just done a test and are going to go through it. No student went deeper with their explanation to actually explain what the purpose of a DIRT feedback lesson is. All of the other statements for this part of the intervention lesson were answered well.

To start with students were hesitant to annotate their peers’ photocopied work. I then adapted the task to project each ‘example’ of feedback on the board and we annotated each piece as a class. The students then came up with a list of things to include when responding to written feedback.

- Use scientific keywords
- Reply to feedback straight away as you are more likely to remember the content
- Answer in detail. Your response should take up more than two lines in your book
- Ask for help if unsure what the teacher's written comment means

On comparison of the students' list of ideas to mine (Appendix 8), the two looked similar. Some students took advantage of the tip I gave about students using textbooks to help review the concept before responding to my feedback.

The writing of a SMART target was incorporated into the intervention because I wanted students to not only respond to my feedback but to start being self-reflective and proactive about how they were also going to independently progress with their learning in Chemistry. Even with the guidance of the crib sheet on how to write a SMART target, at this point in the action cycle, students struggled with this. However, this is a skill which takes time to achieve and does not come naturally to everyone. It did however make students think harder about what their target would be and no-one wrote statements like "to get better at Chemistry" which some had been inclined to write in previous end of topic test DIRT feedback lessons.

The 'flag' method

Using the 'flag' method of alerting students when a response to feedback was required turned out to be very effective with all students. At the start of the intervention there were many areas in students' books where my written comments had been overlooked or responded to in not enough detail. After the intervention lesson I stuck sticky flags in students' books highlighting all the areas where they needed to respond to.

Figure 5: Using the 'flag' method to highlight areas in students' books which require responses

Towards the end of the research students, upon entering the classroom, actively after picking up their books began responding to the feedback in their books without me needing to incorporate "respond to feedback" as part of the starter or giving verbal reminders. Upon checking students' responses to my feedback the next time I marked these books, the couple of students whom had removed flags without responding to feedback just had the flags reappear next time with some more guidance, for example, textbook pages to help them to respond to my feedback. With each set of marking of books, on average, two flags appeared in a student's book. If students had more, this highlighted that feedback had not been responded to previously or not enough detail was given. The students in this class are quite proud of how they appear to one another, so students were intrinsically motivated to complete feedback in the required detail the first time around to prevent extra flags being stuck in their book.

An additional bonus from this intervention has been an increased hand in rate of students' books for marking. At the Academy where the intervention was being held, the departmental policy is to not run detentions for homework which has not been handed in, with the expectation being that it is handed in the next day. I would try and explain to students that if they did not hand in their books then I could not provide them with guidance on how to progress. The 'flag' method has also had the additional benefit of visually highlighting to the class which students are not handing in their books for marking. Whilst their peers were proactively responding to feedback at the start of the lesson, students who have not handed in their book, had an alternative starter activity to complete. However, they must have felt a bit left out as since February, I have had 100% hand in from students sometimes with some written comments from students asking for guidance on particular areas they had struggled with.

3 faults and 3 fixes

Peer assessment was not successful with these students. In the first use of peer feedback in the classroom, students were either confused on how to identify faults in their peers' work or did not use the time constructively, with at least five members of the class not having had any comments written in their books. During the task, I was on behaviour management control trying to stop the off-task behaviour by students as they were not engaged. This was perhaps due to the fact that students did not know how much praise or criticism to use in their marking which was found to be the case in previous research (Gamlen and Smith, 2013; Tasker and Herrenkohl, 2016; Ruegg, 2018).

On collaboration with the teachers who also teach this class, they drew my attention to the fact that the success criteria for the exam questions might not have been structured in a way to facilitate the writing of feedback and instead restricted students to just identify correct and incorrect answers in students' work with ticks and crosses. The next time that 3 faults and 3 fixes was used, I collaborated with these colleagues and together we designed and had displayed during the task a model answer, success criteria and typical mistakes that could have been made during this task to see whether this enabled students to provide more effective feedback to their peers. However, similar results were seen again with lack of engagement and task completion.

<u>Test Data</u>

From the test data collected for this class (Appendix 4), the baseline pre-intervention test data highlighted seven students who underperformed. Students G and X achieved lower than I expected in the end of topic test with students L, P, U, Y and Z being well below target. In the following post-intervention test, all students apart from student P scored a higher percentage (Figure 6).

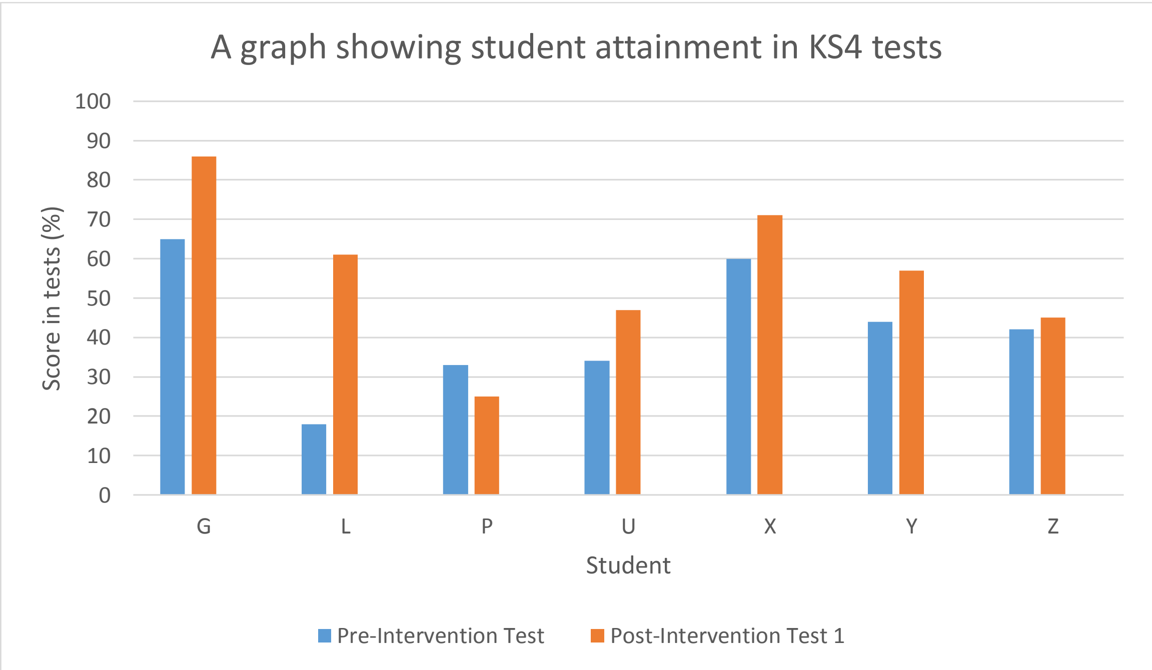

Figure 6: A graph showing scores achieved by 'focus' students in end of topic tests pre and post-intervention

In terms of the rest of the class, there was an increase in the results obtained compared to the baseline set of test data (Appendix 4). In the lesson after the test where we focused on DIRT for the whole lesson, from my observations, students appeared to be a lot more reflective in their manner and focused on making improvements to their work. Previously with this class, I would not have felt confident enough to have one to one conversations to provide students with individual verbal feedback without needing to also oversee the class behaviourally and circulating to keep them on track during these DIRT feedback lessons. However, in these lessons, I did not observe any student who was off-task and upon checking their books, they had all corrected their test and completed DIRT feedback tasks well.

I found that the one to one conversations with students, even though they lasted for no longer than two minutes, were extremely useful. I was able to get an insight into how they viewed their results instead of just having my own opinion of whether they performed well and students were able to ask for more clarification on questions they had struggled with.

In the DIRT feedback session after their end of topic test I asked students whether they had done anything differently to prepare for this test. Responses included changing their revision technique, their last test score had been enough motivation and they had understood this topic better. When asked to expand on what they meant by "understood this topic better" some were able to articulate that the DIRT feedback sessions in class had allowed them time to understand key concepts better and have misconceptions identified and corrected. Others just said that it had clicked more than previous topics. Perhaps this 'click' was due to increased use of DIRT time in lessons.

Discussion

How do students perceive DIRT Feedback sessions?

The increase in responses of students picking the 'agree' columns shows that students perceive DIRT feedback sessions in a more positive light. Through this intervention students perceived DIRT feedback sessions as useful and meaningful to have in the classroom.

An interesting statement from one of the students who were interviewed prior to the intervention was that they thought DIRT feedback sessions only happened after a test as that was the title of the lesson. Students interviewed perceived feedback sessions as when you acknowledge the teacher's marking and that writing the response is mainly for the teachers' benefit. This perception shifts more positively post-intervention, with students seeing DIRT feedback sessions as an opportunity to progress and make improvements to your work to progress within a subject. Despite a small percentage of the sample being interviewed, I feel that the shift in views towards feedback is as a result of this intervention.

What is the association between the type of DIRT Feedback task and student engagement?

From this research, written feedback from the teacher was most favoured by this particular group of students. Perhaps this finding could be explained by students identifying the teachers' role to be the expert and therefore providing the most important and useful feedback (Nicol and Macfarlane-Dick; 2006). Using the 'flag' method to highlight to students that feedback had been provided meant that students knew exactly where in their work an action was required from them. Simply by putting a coloured flag in their book, students engaged more with completing their responses and by the end of the intervention, students no longer needed to be reminded to complete responses. Student F in the interviews also mentioned that this ‘flag’ method engaged them with responding to feedback as they knew without the teacher needing to speak that there was feedback on their work.

I found that by incorporating SMART targets into lessons, students often looked back at the written feedback that I had provided on previous work to be the focus for what their SMART target should be. By default, at the writing of the next SMART target, students had to decide whether they had achieved their previous SMART target, in other words, they were reflecting on whether they had done anything about the feedback provided by the teacher. This active process from the students of engaging with feedback further than just reading it links in with Hattie and Timperley’s (2007) three question approach when providing feedback where previously completed work needs to be reflected on and used to progress further in future work.

An unusual outcome from this research was the students’ apparent disengagement when it came to peer assessment despite trying different methods of scaffolding and provision of success criteria for students to use. This finding agrees with Ruegg (2018) but contrasts with Tasker and Herrenkohl (2016) who found positive results upon providing success criteria. A key finding from the pre and post-intervention questionnaires and interviews was the necessity of particular phrasing of feedback to engage students. Perhaps the reason why peer assessment did not work with these students is similar to Cowie’s (2005) findings that students did not find the praise featuring in peer’s comments on their work to be useful to them.

What is the impact of engaging students with DIRT Feedback sessions?

In terms of the intervention that took place between January and April, the main difference between how I taught the Chemistry topic prior to the intervention and the topic during the intervention was the type of DIRT feedback session and the portion of the lesson dedicated to DIRT feedback. As students became more engaged with DIRT feedback tasks, I noticed that the portion of the lesson required increased from five minutes to fifteen minutes. From taking on board students' comments about more hints or help sheets to guide their responses, students were observed to be a lot more independent and reflective in their study. When marking books, I noticed that responses to feedback were much more detailed with scientific terminology and questions written back to me asking me to verify whether the answer they had written was correct. I commented in my reflection diary that "I no longer have to look back through students' books just to confirm whether or not they have responded to my feedback, instead I now look back to read their response!"

The test data in Figure 6 also shows the increase in attainment at KS4 in science for 77% of students with 8% of students achieving the same percentage. This data shows that the majority of students in the class showed increased progression in science. Obviously, there are other factors that could have contributed to this, for example, different revision strategies by students or students might have just found this topic easier. However this data I believe can be used as evidence to support that increasing students' engagement with feedback can positively impact on their progression at KS4.

On collaboration with my science colleagues who also teach this class, in the same time period of teaching, Physics had 54% of students increase in their attainment and Biology only 12% (Appendix 10). There are of course other factors to take into account for this difference in increased attainment across the three sciences such as amount of revision completed by students and relative easiness of the topic to each student. However, perhaps this focus upon feedback during these months is evidence that it does make a positive impact on students' progression in science at KS4 and is something which needs to have a higher focus on in the department.

Conclusion

The purpose of this research was to investigate whether increasing students' engagement with DIRT feedback had an impact on their progress in science at KS4. The first part of this research focused on finding a particular DIRT feedback task which students engaged with. From analysing the quality of students' responses to feedback as well as classroom observation, it was apparent that students engaged most with written feedback from the teacher. Perhaps this finding can be explained by Nicol and Macfarlane-Dick's (2006) "principles of good feedback practice" (p.199) which highlight the important role that teachers' written feedback has at addressing the common misconceptions which students may have as well as being the experts at marking to the success criteria. This contrasts with Mulliner and Tucker's findings (2017) which found verbal feedback to be the preferred method of feedback however this study was carried out with participants at higher education rather than secondary school, so could account for the difference in finding. I was surprised that written feedback was the most engaging to these students as the reason I had chosen this class to carry out this research with was because they were not engaging with my written feedback. Perhaps though, with the embedding of crib sheets in my DIRT feedback sessions (Appendix 8) and thinking more carefully about the language of my feedback to make sure that students understood it (Chanock, 2000), this overcame some of the barriers which resulted in students' previous disengagement with written feedback.

Interestingly, the type of DIRT feedback task which had the least student engagement was peer feedback. Following advice from the literature (Gan and Hattie, 2014), I provided alongside the task, model answers and success criteria for students to follow. However, the feedback provided by peers focused too much on praise and students did not find it useful. This is consistent with the findings of Gamlen and Smith (2013) and Ruegg (2018). If the research had had more focus on training students on how to provide constructive feedback to one another, then maybe the outcome would have been more similar to the findings of Tasker and Herrenkohl (2016).

A mixture of feedback techniques was highlighted in the literature to be of importance to engaging students in the long term with DIRT feedback sessions (Price, Handley and Millar, 2011; Van der Schaff et al, 2013). From classroom observations and analysis of students' work, it appeared that written feedback was by far the most engaging method of feedback in addition to having the most impact on their progression. Perhaps this is less surprising a finding when consulting Shute's (2008) guidelines for effective feedback. Students in this research struggled with providing peers with feedback which focused on the "task not the learner" (p.177) and focusing feedback on achieving a learning goal. Though self-assessment did enable learners to focus feedback on achieving a learning goal through writing SMART targets, feedback was less "elaborated … to enhance learning" (p.177). Verbal feedback was perhaps not taken on board as much as a written comment as students did not have something to specifically refer back to when completing future tasks.

From the questionnaires carried out at the end of the intervention, 85% of students understood the purpose of DIRT feedback sessions, which was a 24% increase from questionnaires completed prior to the intervention. 100% of students now feel that teachers' comments on their work helps them improve in science which is consistent with the findings of Butler (1989) and Black et al (2004). Leahy et al's (2005) point that "feedback needs to cause thinking" (nop) is echoed in my findings with 92% agreeing or were neutral that responding to teachers' written feedback helps them to progress in science. In addition, 84% agreed or were neutral that they always act upon teachers' comments in future tasks. This data shows that these students perceive DIRT feedback sessions in a positive light with the majority of participants seeing the impact which it is having on their progression in science.

These findings could be interpreted that these students are starting to understand the role of feedback in the classroom. By students identifying that they value the feedback provided by teachers, they are showing that they understand the impact feedback has on their progression within a subject (Black and Wiliam, 1998; Leahy et al, 2005). With the increase of students agreeing that they act upon teachers' comments in future work increasing from 19% to 42%, this showed that more students after the intervention took on the responsibility of increasing their performance in a subject which is evidence of "self-monitoring"(Sadler, 1989, p.120).

The attainment of students in tests and students' classwork was used to assess the impact of these DIRT feedback sessions. In the following test, it was found that 77% of students scored higher which shows that there is a positive impact on students' progress in science at KS4. This is consistent with the findings of Decristan et al, 2015 and

Vogelzang and Admiraal, 2017. There are, of course, other factors which could have contributed towards this, for example, more revision time allocated by students towards this test or finding it to be an easier topic. However, from studying students' classwork, their increased focus and effort during these DIRT feedback sessions seemed to be due to these students seeing the benefit of responding to my feedback. The interviews with students confirmed this.

Implications

In terms of my professional practice, this research has assured me of the positive impact which feedback has on students' progression in science. I believe that my delivery of written feedback has improved through using the 'flag' method, crib sheets and addition of examples and page numbers to support students when they are responding to feedback has resulted in greater engagement in DIRT feedback sessions. Due to the success of this intervention with this class, in September 2018, I am going to incorporate the above strategies with all of my classes.

At the Academy where this research was carried out, the current DIRT feedback sessions in the science department are not engaging the majority of KS4 students. However, my research is evidence that these students can be engaged with DIRT feedback sessions if we make the feedback more relevant to the individual learner. I believe that the implementation of crib sheets across the department would have a positive impact and more collaboration between teachers to discuss the best ways of delivering feedback and allocation of success criteria when marking students' work. In addition, in the first term, the way that DIRT feedback sessions are delivered should be on a cycle of peer, self, verbal and written until students identify to the classroom teacher which method of feedback works best for them. Then the teacher can use that information to deliver feedback in the most engaging way for that particular class.

The next step would be to assess the impact on students' progress in science over the next academic year across the whole school. This larger sample size and longer research period with more teachers involved would bring a larger amount of data to analyse. As part of the control variables for this future research, teachers in the department would have to be trained on the delivery of the various feedback techniques to ensure consistency.

Within the Academy staff, it would be useful to work across the departments to find out what different methods of feedback are used and collaborate as to the most efficient way of delivering feedback. From my research, peer feedback did not turn out to be successful and I would therefore be interested in exploring further with teachers who find peer feedback to be successful what they were doing differently.

Looking at the findings of this research beyond my own school, I think that this research highlights the need for all teachers and researchers to be aware that methods of feedback do not always work. The current literature would perhaps benefit from not just promoting the benefits of feedback, but highlighting to teachers that different feedback techniques are more trial and error than guaranteed success, and particular strategies not working for particular students is to be expected.

In addition to using this research to add to the current literature, teachers in schools are a powerful tool to spread the findings of this research. A TeachMeet would be a simple way to get a group of teachers together from schools across a county to collaborate on ways to modifying DIRT feedback techniques which teachers are experiencing difficulties with implementing successfully in the classroom. It would also be an opportunity to see whether these teachers have any other ideas of feedback techniques that could be implemented in the classroom as part of future research.

To summarise, DIRT feedback sessions are vital in the classroom and are important to allow students to progress within a subject. However, there is no one particular method of feedback which works optimally for everyone. Each learner is unique and each will learn best from a different form of feedback whether it is written, verbal, peer or self. It is our job as teachers to be flexible to the learning needs of our students and to be open to providing feedback in different ways. Written feedback will often be ideal for students but care must be taken with the quality of written feedback. Simple trainings at INSETs could be an easy way to reinvigorate teachers with the benefits of providing feedback in different ways. Students welcome DIRT feedback sessions as they can see the benefit of feedback to their progression in a subject. Teachers now need to be flexible with the feedback methods that feature in the classroom to allow all students to fulfil their potential.

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Appendix 1: CUREC Approval

Dear XXXXXX,

Can increasing students' engagement with DIRT Feedback impact on their progress in science at KS4?

The above application has been considered on behalf of the Departmental Research Ethics Committee (DREC) in accordance with the procedures laid down by the University for ethical approval of all research involving human participants.

I am pleased to inform you that, on the basis of the information provided to DREC, the proposed research has been judged as meeting appropriate ethical standards, and accordingly, approval has been granted.

If your research involves participants whose ability to give free and informed consent is in question (this includes those under 18 and vulnerable adults), then it is advisable to read the following NSPCC professional reporting requirements for cases of suspected abuse

http://www.nspcc.org.uk/globalassets/documents/information-service/factsheet-child-abuse-reporting-requirements-professionals.pdf

Should there be any subsequent changes to the project which raise ethical issues not covered in the original application you should submit details to research.office@education.ox.ac.uk for consideration.

Good luck with your research study.

Sincerely

Dr LF Gearon
Chair DREC
Department of Education
University of Oxford

Appendix 2: Letter to Principal

UNIVERSITY OF OXFORD
DEPARTMENT OF EDUCATION

15 Norham Gardens, Oxford OX2 6PY
Tel: +44(0)1865 274024 Fax: +44(0)1865 274027
general.enquiries@education.ox.ac.uk www.education.ox.ac.uk

Director Professor Jo-Anne Baird

UNIVERSITY OF OXFORD

Academy: omitted for anonymity

Principal: omitted for anonymity

November 2017

Dear XXXXXXXX,

I am writing to enquire about conducting research in school this academic year. I am studying for the Master's in Learning and Teaching at Oxford University, supervised by Sibel Erduran. The focus for my research will be investigating "Can increasing students' engagement with DIRT feedback impact on their progress in science at KS4?"

The research will take place with one Year 10 Chemistry class working towards their GCSE. I am focusing on exploring how students perceive DIRT feedback sessions, trialling different DIRT feedback tasks to observe the effect on student engagement and what the impact of DIRT feedback tasks is on student progress.

By participating in the research, the school would be contributing to a project that will insightful into the mindset of students at the Academy, it will increase students understanding about DIRT feedback and allow us to understand what types of DIRT feedback tasks have the biggest impact on our students progression.

I hope to conduct this research between January 2018 and June 2018. I would carry out pre and post interviews and questionnaires with students. The questionnaires would be for all students in the year 10 class and interviews with volunteers from this class. I would like to audiotape these interviews and would obtain written consent from students before doing so. In addition, I would analyse students' written work and may photocopy parts of their work. Any work or quotes from students used will be anonymised.

Oxford University has strict ethical procedures on conducting ethical research, consistent with current British Educational Research Association guidelines. The University also recognises, however, that my study is a piece of practitioner research, and that schools already operate with the highest ethical standards. Therefore only <u>your</u> formal consent as Principal is necessary, and not that of individual parents or staff.

However, throughout the research, students and other teachers will be able to refuse to participate in any research activities at any time.

All participants, including students, teacher and the school, would be made anonymous in all research reports. The data collected would be kept strictly confidential, available only to my supervisor Sibel Erduran sibel.erduran@education.ox.ac.uk and me, and only used for academic purposes. It will be kept for as long as it has academic value.

If you are happy for me to proceed with this study, please confirm that using the attached reply form. If you have any concerns or need more information about what is involved, please contact me or my supervisor. Further, if you have any questions about this ethics process at any time, please contact the chair of the department's research ethics committee, through: research.office@education.ox.ac.uk

I look forward to hearing from you.

Yours sincerely,

XXXXXXXXXXX

Can increasing students' engagement with DIRT Feedback impact on their progress in science at KS4?

XXXXXXXXXXXXXXXX, University of Oxford, Department of Education

Academy: Omitted for anonymity

Principal: Omitted for anonymity

☐ We do not wish to participate in this project.

☐ We would like to find out more about this project.

☐ We would like to take part in this project.

____

Principal's signature

Please return this form to XXXXXXXXXXXXX.
Thank you for your help.

Appendix 3: Information for read aloud to participants

The purpose of this research is to investigate whether increasing students' engagement with DIRT Feedback has an impact on their progress in science at KS4.

The intervention will take place in the form of a variety of DIRT feedback tasks and seeing what the effect of these tasks is on student attainment. Students' books will be analysed along with test data. To assess the impact of this intervention, questionnaires will be carried out with all participants before and after the intervention. Volunteers from this class will also participate in pre and post intervention interviews.

The interviews will be audiotaped only with your consent. If you do not wish to participate in the interviews, you do not have to.

The data collected from this research will be only accessible to myself and my university supervisor, Sibel Erduran. After the 13th September 2018, this data will be destroyed. The data will be used for analysing whether the DIRT feedback sessions have any impact on students' progress in science at KS4.

You are allowed to withdraw yourself from this research at any time and your work and verbal comments in class or in interviews will be anonymised.

Appendix 4: Test Data

Student	Pre-Intervention Test (%)	Post-Intervention Test 1 (%)
A	58	67
B	81	76
C	74	88
D	77	73
E	51	59
F	65	86
G	51	51
H	56	73
I	67	55
J	58	71
K	18	61
L	47	49
M	53	69
N	33	25
O	60	61
P	51	47
Q	56	59
R	51	76
S	34	47
T	47	75
U	58	75
V	60	71
W	44	57
X	42	42
Y	58	63
Z	70	71

Appendix 5a: Written Consent for Questionnaires

PARTICIPANT CONSENT FORM

CUREC Approval Reference:

"Can increasing students' engagement with DIRT Feedback impact on their progress in science at KS4?"

Purpose of Study: To investigate whether increasing students' engagement with DIRT Feedback impacts on their progress in science at KS4

		Please initial each box
1	I confirm that I have heard and understand the information sheet for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.	
2	I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason, and without any adverse consequences or academic penalty.	
3	I understand that research data collected during the study may be looked at by designated individuals from the University of Oxford where it is relevant to my taking part in this study. I give permission for these individuals to access my data.	
4	I understand that this project has been reviewed by, and received ethics clearance through, the University of Oxford Central University Research Ethics Committee.	
5	I understand who will have access to personal data provided, how the data will be stored and what will happen to the data at the end of the project.	
6	I understand how this research will be written up and published.	
7	I understand how to raise a concern or make a complaint.	
8	I agree to take part in the study	

______________________	__________	________________
Name of Participant	Date	Signature
______________________	__________	________________
Name of person taking consent	Date	Signature

Appendix 5b: Written Consent for Interviews

PARTICIPANT CONSENT FORM

CUREC Approval Reference:

“Can increasing students’ engagement with DIRT Feedback impact on their progress in science at KS4?”

Purpose of Study: To investigate whether increasing students’ engagement with DIRT Feedback impacts on their progress in science at KS4

		Please initial each box
1	I confirm that I have heard and understand the information sheet for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.	☐
2	I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason, and without any adverse consequences or academic penalty.	☐
3	I understand that research data collected during the study may be looked at by designated individuals from the University of Oxford where it is relevant to my taking part in this study. I give permission for these individuals to access my data.	☐
4	I understand that this project has been reviewed by, and received ethics clearance through, the University of Oxford Central University Research Ethics Committee.	☐
5	I understand who will have access to personal data provided, how the data will be stored and what will happen to the data at the end of the project.	☐
6	I understand how this research will be written up and published.	☐
7	I understand how to raise a concern or make a complaint.	☐
8	I consent to being audio recorded	☐
9	I understand how audio recordings will be used in research outputs	☐
10	I agree to take part in the study	☐

______________________	______________	______________________
Name of Participant	Date	Signature
______________________	______________	______________________
Name of person taking consent	Date	Signature

Appendix 6: Questionnaire

1. *I always read what the teacher writes about my work*

   Agree **Neutral** **Disagree**

2. *I always reply back to what the teacher writes about my work without having to be reminded*

   Agree **Neutral** **Disagree**

3. *I think that teachers checking and writing comments about my work helps me improve in science*

   Agree **Neutral** **Disagree**

4. *I always act upon what my teacher writes about my work in future tasks*

   Agree **Neutral** **Disagree**

5. *I know why teachers include opportunities for me to reply to what they have written about my work in lessons*

   Agree **Neutral** **Disagree**

6. *I think replying to what teachers write about my work in class helps me to develop my understanding of science*

   Agree **Neutral** **Disagree**

7. *I am clear about what "DIRT feedback" means*

   Agree **Neutral** **Disagree**

8. What does "respond to my feedback" mean?

……
……
……

9. Why do you think you need to reply to what teachers write about your work?

……
……
……

10. What would motivate you to reply to what teachers write about your work?

……
……
……

Appendix 7: Interview Questions

1. What does the word ‘feedback’ mean to you?
2. What does the term “DIRT Feedback” mean to you?
3. When teachers say “respond to my feedback on your work”, what do you do?
4. Why do you think teachers write comments about your work?
5. Why do teachers want you to read and reply back to what they have written about your work?
6. Do you think you should reply back to what teachers write about your work? Why is that?
7. Have you ever acted upon what teachers write about your work? Why is that?
8. What do you think the value is in replying back to what teachers write about your work?
9. Do you think that responding to what teachers write about your work helps you to progress in science? Why do you think that?
10. What would encourage you to reply back to what teachers write about your work?
11. What do you think helps you to improve your understanding and progression in science?
12. On a scale of 1-10, how important would you rate replying to what teachers write about your work in terms of how it affects your academic progression? Explain why you think that.

Appendix 8: Responding to teacher's feedback

- USE GREEN PEN!
- If you do not understand their comment, put up your hand and ask the teacher to come and explain it to you
- Search up the topic in the textbook for what the teacher has asked you to improve on to further your knowledge and understanding
- Brainstorm a plan of the key terms you will need to include in your answer in the margin before committing to responding back
- Your written feedback ALWAYS needs to be at least a paragraph – a minimum of 5 full sentences
- Your response is not supposed to be easy to complete! Take time and effort with making sure your response is the best version it can possibly be!

Appendix 9: SMART Goals Writing Structure

	Thought Process
Initial Goal (Write the goal you have in mind): Perhaps base this goal on your teacher'	*I want to understand electrolysis better*
1. Specific (What do you want to accomplish?)	*I want to understand how the process of electrolysis works*
2. Measurable (How can you measure progress and know if you've successfully met your goal?):	*I want to understand how the process of electrolysis works so I can get 6/6 marks on exam questions*
3. Achievable (Do you have the skills required to achieve the goal? If not, can you obtain them?):	*I will reattempt exam questions on electrolysis studied in class and go to chemistry clinic to get them marked and have feedback on my re-drafted answers.*
4. Relevant (Why am I setting this goal now?):	*Electrolysis is a common exam question*
5. Time-bound (What's the deadline and is it realistic?):	*Two weeks time*
S.M.A.R.T. Goal (Review what you have written, and craft a new goal statement based on what the answers to the questions above have revealed):	**In two weeks time, I want to understand the process of how electrolysis works to do better on exam questions**

Appendix 10: Analysis of science tests

	Chemistry		Biology		Physics	
Student	Pre-Intervention Test (%)	Post-Intervention Test 1 (%)	Pre-Intervention Test (%)	Post-Intervention Test 1 (%)	Pre-Intervention Test (%)	Post-Intervention Test 1 (%)
A	58	67	82	64	62	49
B	81	76	86	80	66	84
C	74	88	90	85	87	90
D	77	73	76	67	89	67
E	51	59	72	38	45	56
F	65	86	76	60	70	61
G	51	51	76	50	62	71
H	56	73	74	70	68	59
I	67	55	80	62	77	57
J	58	71	70	40	66	78
K	18	61	52	33	49	53
L	47	49	70	39	47	47
M	53	69	64	78	45	67
N	33	25	72	3	36	32
O	60	61	62	65	60	65
P	51	47	76	36	57	55
Q	56	59	72	29	60	51
R	51	76	72	64	64	73
S	34	47	76	73	68	22
T	47	75	68	52	38	53
U	58	75	78	50	68	53
V	60	71	68	24	66	69
W	44	57	98	80	40	49
X	42	42	42	45	44	48
Y	58	63	82	74	55	63
Z	70	71	80	85	83	55