2016 cohort

Hannah Somers – Biology Teacher

Walking Talking Learning: Improving Maths Skills in BTEC Applied Science students

This project aimed to understand and create a route for BTEC Applied Science students to be more successful on their course, specifically by targeting two areas of difficulty: maths in science and exam confidence.

BTEC courses were originally introduced as coursework-based qualifications, in which students would produce portfolios of work for internal assessment (Studential, 2018). However, due to the introduction of new courses, aiming to address student inability to prepare for higher education examination, 335 of BTEC content is now assessed through external examination, a common source of anxiety and potentially an area for reduced attainment in students (MacKay, 2016). The disconnect between maths and science has long been identified in research literature (Bialek and Botstein, 2004; Dweck, 2008; Speth, 2010) and is a key area of interest personally, and I wanted to design a project that would enable students to develop their maths skills and understand the importance of maths in science, while enabling them to improve their attainment and confidence in exam scenarios.

The pupils were selected as part of the Y12 Applied Science cohort, and all students were included in order to understand the application and efficacy of the project across a range of student backgrounds, GCSE attainment levels and needs. Students were chosen for interview randomly in order to reduce any teacher-bias. I chose to work with this group as I wanted to target these issues early in the Applied Science course, and I felt it would be more appropriate moving forward for these students to have consistent teaching across both years of their course, as opposed to Y13 students who have now followed alternative teaching methods from their initial year on the course.

The intervention involved the teaching of all mathematical content using live modelling, guided practice and independent practice within lesson time. Students then had to attend interventions once a week to consolidate the method, and complete practice work at home on a regular basis to solidify this foundation. Independent practice was designed to be akin to exam conditions with students unable to ask peers or teachers for support, in order to assimilate with the ways in which their exams will be run, and to reduce anxiety about working independently in silent rooms with others.

Reading literature on student learning, I came across Rosenshine's Principles of Instruction (Rosenshine, 2012) and identified that a number of these techniques had been implemented successfully in my school already e.g. recapping prior learning at the beginning of each lesson to revisit and solidify foundational knowledge. I had previously carried out analysis of the exam papers sat by Y12 students last summer and identified that across both externally assessed units, students achieved marks either lower than national average or very close to the national average in mathematical and data handling content questions. Having read the Principles of Instruction I

decided to use a subset of these principles to create a standard teaching thread for teaching data handling and mathematical content: Modelling of a method or Statistical Test; Guided Practice using short questions and reinforcing "why did we do that?" to build a theoretical knowledge base; and finally Independent practice of the new technique, with teacher circulation to ensure all students were focussed and on-task. The desired impact of independent practice would be that students familiarised themselves with

Myself and two other teachers in my department responsible for teaching these externally assessed units, developed resources to ensure these principles were followed, and to standardise vocabulary to create a pattern in the students' brains so they would be aware of, and engaged with, this teaching method.

I decided to use student interviews at the start and end of the project, focussing on student attitudes and confidence in exams and towards answering mathematical questions. I analysed the results of these interviews using coding, to identify common themes among student answers. The reasoning for this was two-fold: firstly to access qualitative data to understand student approach and affinity for these methods; secondly to triangulate attainment data and to ascertain whether improved confidence and improved attainment were seen consistently, or whether one aspect could improve without the other.

Preliminary attainment data has shown that the live modelling process with subsequent guided practice and independent working has increased student marks in associated question types compared to last year's cohort of Y12 students. The predominant increase has been found within the Physics section of the exam, an area that students have typically found difficult (as found in initial interviews). The live modelling process appears to have had more of an impact on some students than others: some of the steps can be clearly seen in student exam papers, suggesting the modelling has embedded at different levels with students. This will be explored further and will inform teaching practice and resource design for the incoming Y12 cohort of students. Full data analysis cannot yet take place as the full comparative exam will take place shortly before the real exams themselves.

Pre-project interviews indicated that students had some apprehension when approaching exams, and that the new design of the BTEC course has had further reaching impacts than previously recognised; one major theme from the analysis of these responses indicated students predominantly chose the course due to a belief there were no exams involved. While this is communicated to Y11 students, this will be stipulated more strongly in all communications in order to ensure students enter the course fully understanding the requirements.

The significant learning from this project is that students follow models well and can learn topics they have identified as difficult when following a structured teaching method which is consistent across the taught units. The post-project interviews are yet to be analysed fully, however the preliminary analysis shows that students are more confident in their exams and in their own ability as they have had the opportunity to practice their skills and embed the methods in lesson and at home. I believe however, that it is also worth recognising that the level to which students have engaged with this has varied in preliminary data and that this is an area for focus in exam preparation, to ensure all students can fully access these concepts independently and apply these where necessary to new questions and content.

References

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