2016 cohort

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Can changing the nature of practical work in the classroom, and making it more applicable to real life, affect attainment in A-level physics?

Nationally, students sitting A-level physics gain the lowest average percentage in paper 3. This paper includes short and long answer questions on practical experiments and data analysis and is worth 18% of the overall A-level grade. The average percentage nationally in this exam was 40% (AQA Exams Analysis GCE A-Level Physics, 2018)

The main aims of the project are to improve students' confidence and attainment in practical and applications skills questions.

Students performed more small practical tasks during all lessons on electricity to allow them to better understand the topics and how they relate to the real world. This helped them to see the topics as less abstract and more applicable to real life.

Practical experiments have been long established as a means through which to teach physics (Sneddon et al 2009, Gee & Clarkson 1992). Hodson (1996) discussed the benefits of practical work in a classroom, concluding that teachers want to teach science in an environment that mimics how science is performed in research and industry – in a laboratory. He assessed that practical activities can be used to *learn* science, *learn about* science and to learn to *do* science. They can be used to stimulate interest, gain laboratory skills, improve concept acquisition and development, understand specific scientific inquiry and develop the skills necessary to carry out and enquiry.

These are the same skills that AQA wish to assess in students and so including practical experiments beyond those that are assessed and prescribed by the practical skills endorsement included in the AQA A-level physics course should improve the results obtained in paper 3.

Students carried out practical activities for each topic that they covered while studying the electricity topic to allow them to see the purpose of each physical concept and see how they could apply these ideas to past paper questions.

Students carried out more short practicals throughout their electricity course – as far as is possible they built the circuits that they were studying and drew and interpreted the graphs that represent their findings in each experiment, while interpreting uncertainties in all of the experiments. These are the skill that they are lacking and that have produced poor results both in a baseline test and their Christmas mock. This intervention should help the students in their ability to interpret graphs and compare them to the corresponding equations. It also familiarised them with the practicalities of error and uncertainty calculations and has given them practice in working on such calculations and allowed them to see how these uncertainties apply to the actual experiment.

Students sat a base line test, and a Christmas mock, both of which included questions on practical skills. The natural progression as the students became more settled into their A-level studies can be measured between these tests. Students are currently sitting their end of year 12 exams, having completed the set of lessons which include more practical activities and analysis. The results of these tests can be compared with the earlier exams to see if there is any significant difference. Students also completed questionnaires to establish how confident they felt about practical activities and exam questions. This was completed before the set of lessons, and students will be asked to complete it again after they have done their exams to see if there is any significant change in attitude towards this aspect of physics.

Conclusions and recommendations

- Students should have a better understanding of the topics (electricity) that will be supplemented with extra practical and application activities.
- Students should have a better understanding of analysis of experimental results and calculations of uncertainties, specifically in the A- level electricity topic.
- Students should gain confidence in their ability to answer application/practical style questions
- Students may change their attitudes towards physics, and no longer see it as an abstract subject, but one that applies to the world around them
- Students will broaden their knowledge and understanding of complex physical concepts
- Physics teachers will also gain a better understanding of the applications of each topic

References

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