Action Research Project 2015:

Links between Science and Design Technology

Can students identify links between Science subjects and Design Technology to improve their understanding and learning in both subject areas?

If so, can these links be enforced to make concepts from both subjects areas more comprehendible?

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Index

Rationale

With a majority of students focussing on earning high grades, it is the question whether they are devoting most of their time to memorising facts for them to recall in exams or whether they genuinely understand their topics and are able to apply their knowledge when faced with real life situations. This is most evident in Science subjects, as there are large amounts of content to cover in little time.

Being associated with Design Technology, we see the benefits of doing projects such as: building electronic badges and remote-controlled vehicles, which is why we believe knowledge learnt in Science subjects have to be applied in order to develop them.

We decided to investigate whether students believe further collaboration between the Science and DT departments will offer an improved learning experience for them, across the school years and why? Through this investigation, we also aim to find whether this would encourage students to continue any DT subjects at higher levels (GCSEs and A-Levels).

- How many links students can identify between DT and Sciences?
- By introducing slight changes in presentation of specific subject areas?
- If particular corresponding topics from Science and DT were taught in the same time period?
- If connected topics from DT and Science were taught in the same time period
- Through collaboration, the DT and Science departments can teach connected topics during the same time period, which will allow students gain knowledge?

Methodology

As a group we decided the most appropriate method of data collection would be a questionnaire, which we could distribute to a range of year 8 - 11 students, giving us a wide sample of those who would most likely benefit from the use of teachers using links between Design Technology and Science subjects such as Physics, Biology and Chemistry to benefit their learning and enhance their understanding. Clearly this would provide us with the most representative sample of data. The data produced would mainly be of quantitative value, due to the ease of analysis, it also gives a more reliable and objective range of results and can also use statistics from the research to generalise a finding. Questionnaires also often reduce a range of complex problems as it limits the answers to a number of variables.

Questionnaires:

The questionnaire was used as a way of revealing what the majority consensus was to our question and how people felt about the idea to use links between Design Technology and Science subjects such as Physics, Biology and Chemistry to benefit the learning and enhance understanding. It was designed in a way to ensure that the questions were unambiguous, needed no further explanation and were clear and concise, so there was also no need of help to understand the questions. For the most part, the questions were closed. We believe this made it easier and quicker for each participant to complete the survey. However, we had to be careful when creating 'option' answers that all possible or likely answers were included, so that no one was unable to answer the questions. The questionnaire gave us general data.

The sample for the survey was a range of Year 8 - 11 (13-16 years of age) students, they completed the questionnaire during form time and lunch time, and this meant we had enough responses to analyse the overall interpretation. We as a group expected that our participants were mainly students that have been at RMGS since year 7 so therefore related the questionnaire to previously completed projects in DT.

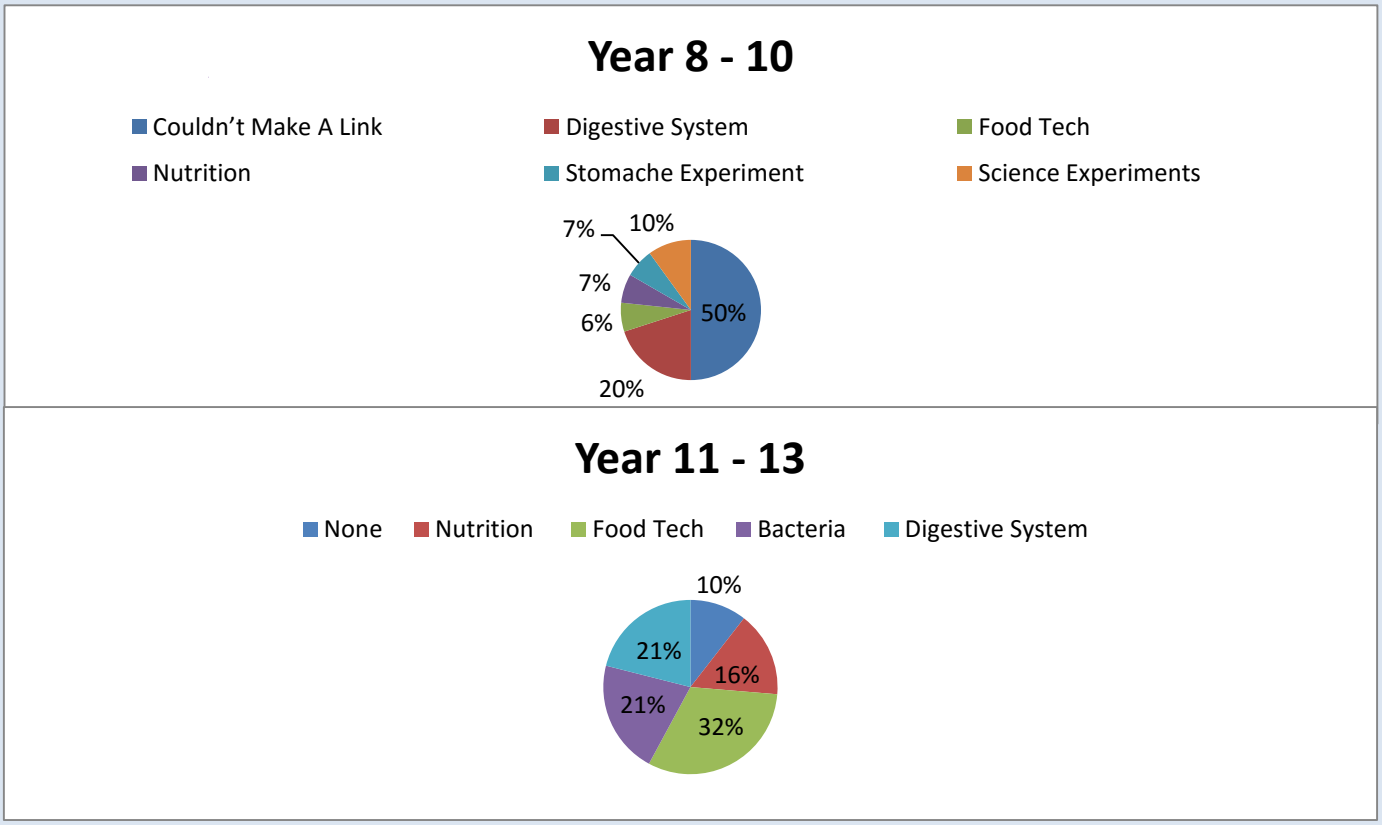
All questionnaires were anonymous to accommodate data protection regarding identification of pupils.

Focus Groups:

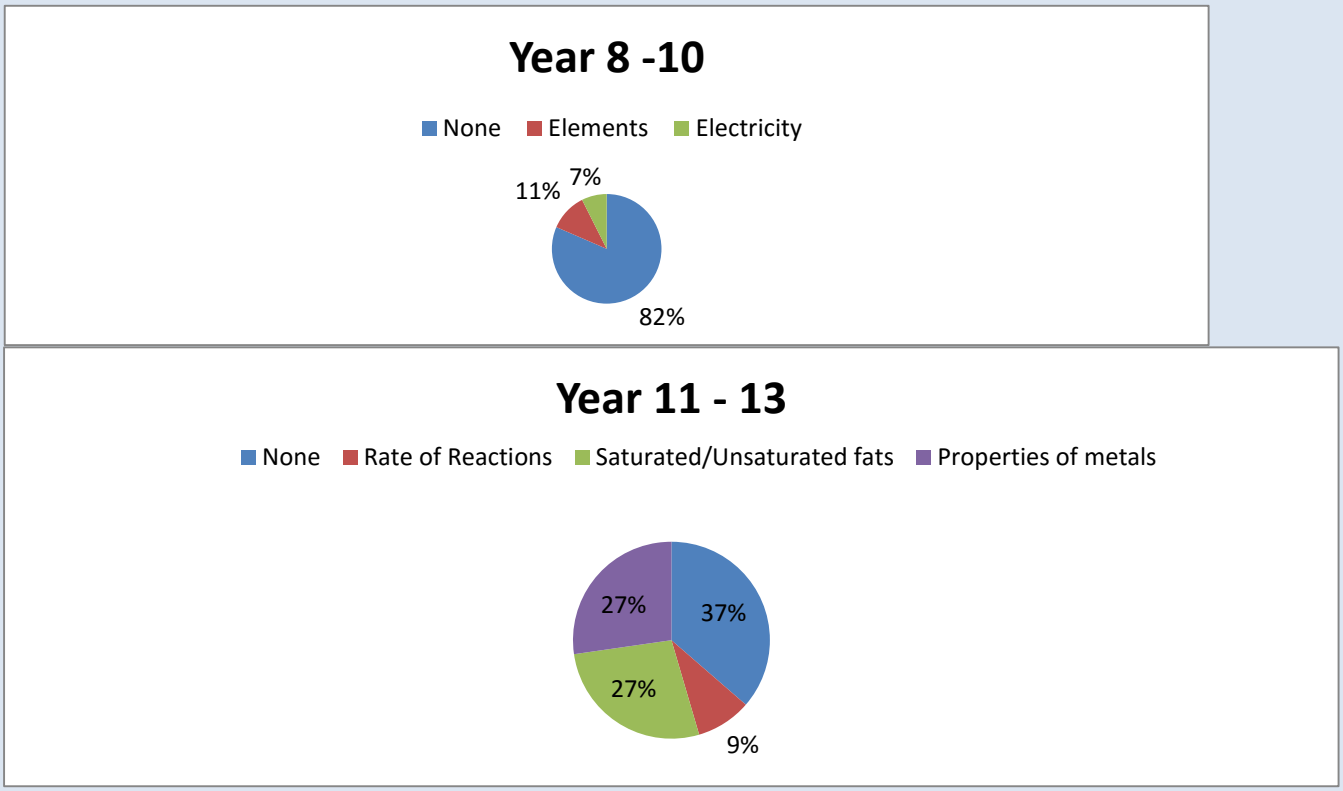
As a means of gaining a deeper understanding of students' views, we will call some of the students who completed a questionnaire back to join a focus group, where we could discuss some of their answers to the questionnaire in detail. This would enable us to fill any blanks we discover during the analysis step.

Data Analysis

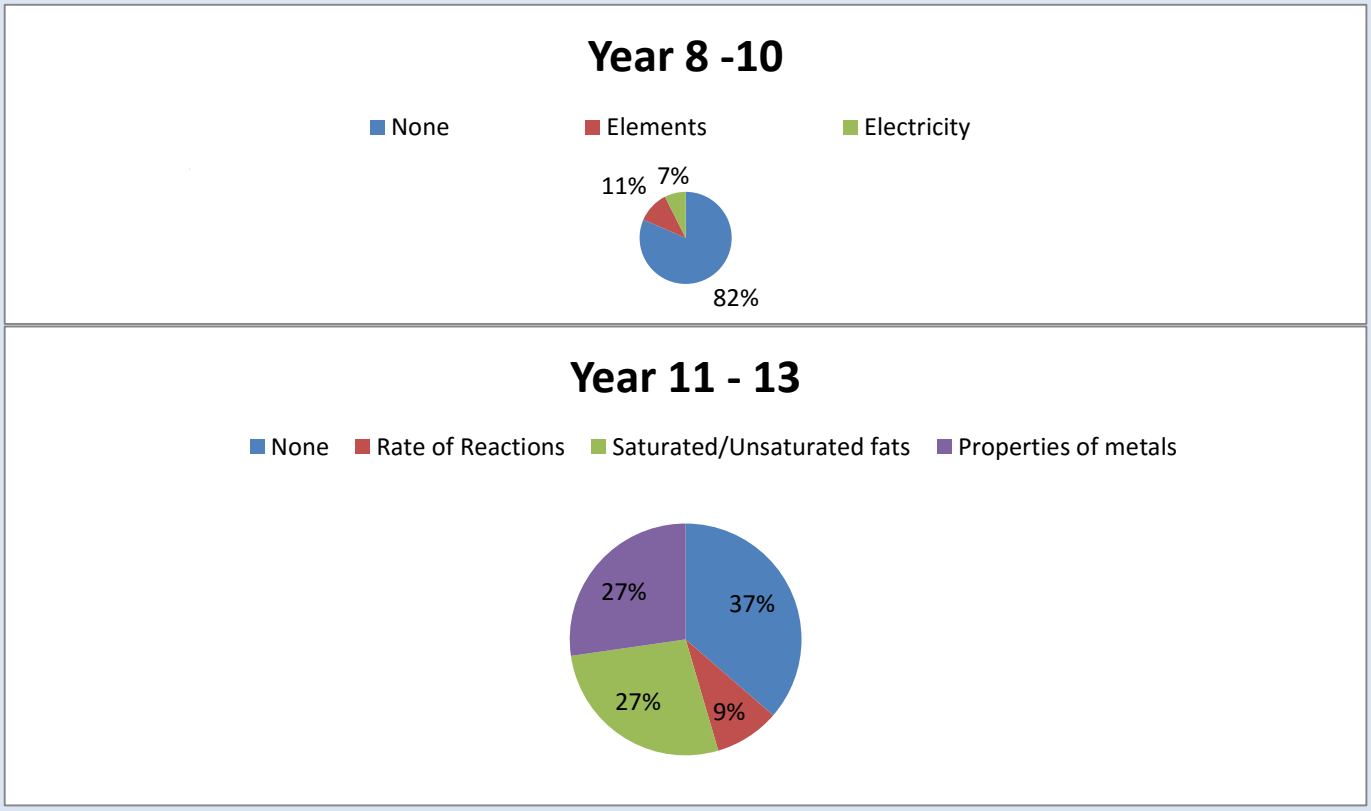
1. Links between DT and Biology



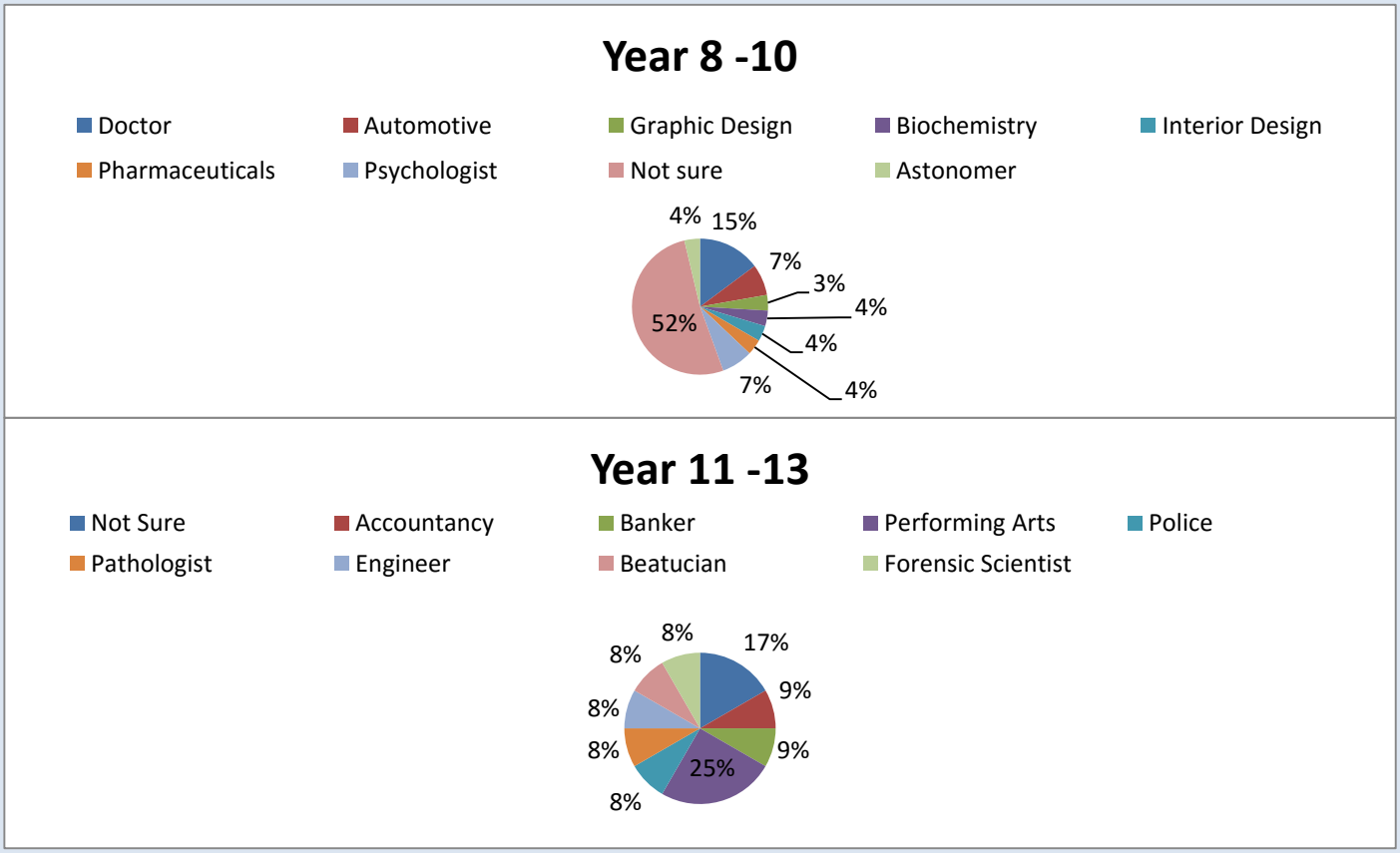
2. Links between DT and Physics



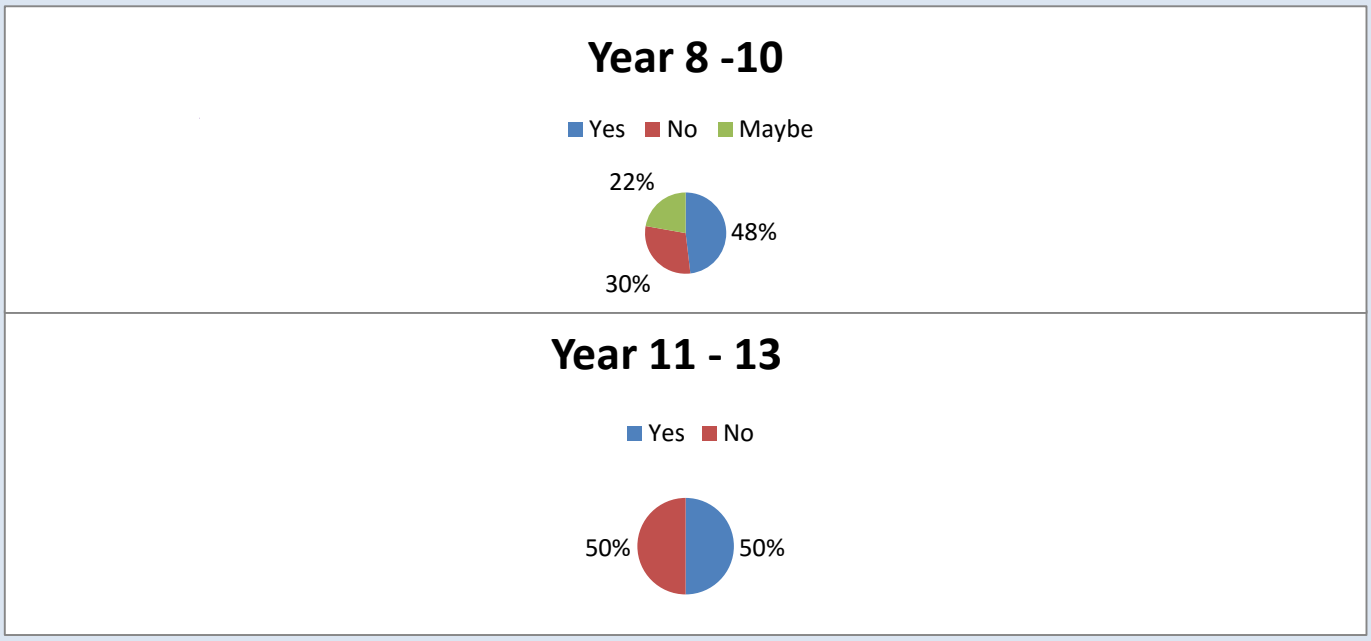
3. Links between DT and Chemistry



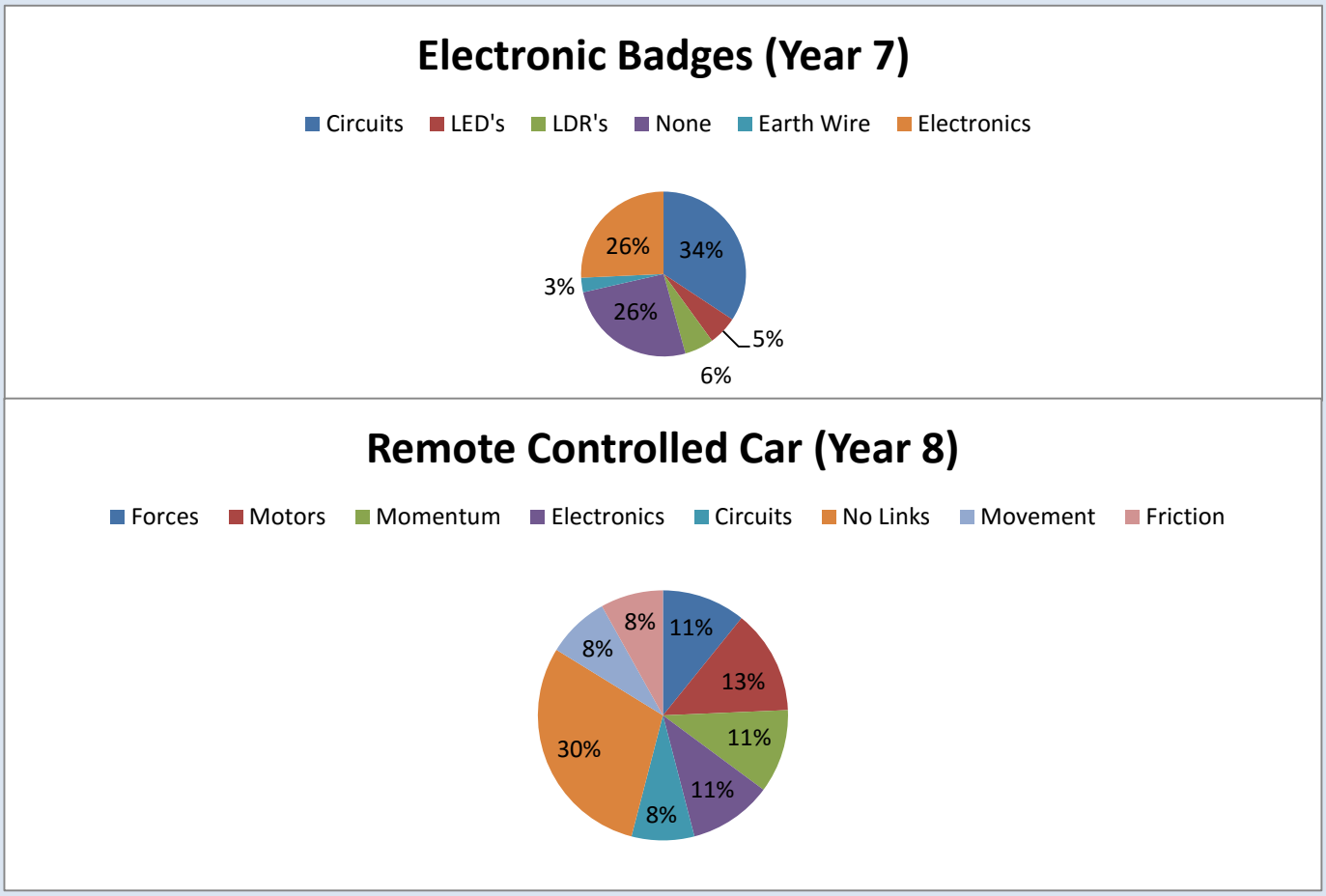
4. Future Ambitions

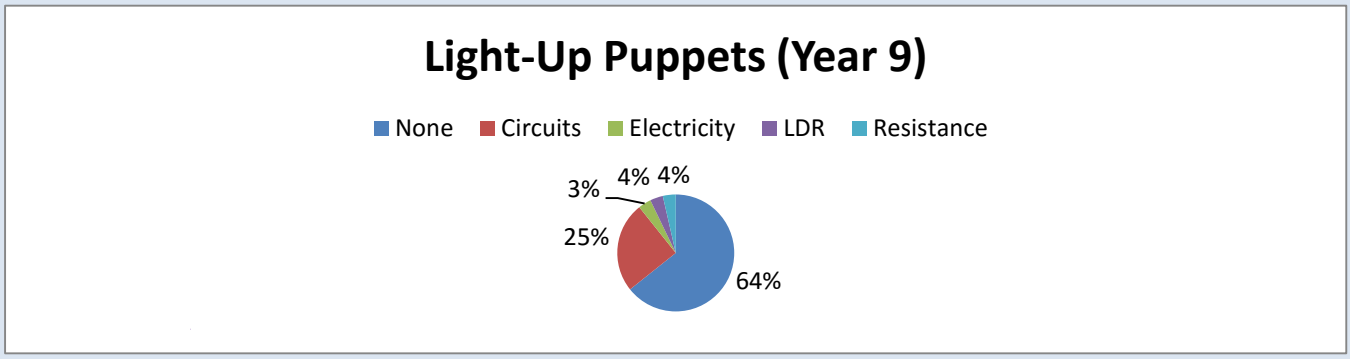


5. **Should cross-curricular links be used when teaching Science subjects and DT?**



6. **Can students identify scientific links with past DT projects?**





Questionnaires

First of all, we asked the students to make as many links between DT and the three Science subjects to identify any topics which have the potential to be taught alongside each other (during the same term). The results for this are shown in graphs 1, 2 and 3. Furthermore, those interested in a particular Science subject and those who read into these subjects outside of school, identified more links (showing they understand more about real life applications).

In chart 4, we have collected data for all the students' future aspirations and have grouped them for ease of reference. In most cases, the students' ambitions are Science related, leading onto the question: why can't Design Technology aid students to achieve their ambitions?

Chart 5 shows us that there are quite a lot of students interested in the prospect of cross-curricular links. However, due to the number of "yes" and "no" votes matching each other, we had to resort to the focus group for more details.

Finally, as a group we wanted see whether students could identify scientific links within projects they have completed in DT. It was interesting to see that 64% of students couldn't make any links when it came to the Light-Up Puppets, even though they spent a term learning about the electronic circuits used in them. This can suggest that scientific links weren't identified clearly enough when the students did this project.

Focus group

In terms of chart 5, further discussions showed that some of the students who put "maybe", believed that the idea might help their peers, but it won't have an impact on their own performance. During one of the sessions, we discovered a high number of students struggling with any/all of the Science subjects wanted there to be cross-curricular links as they believed they learnt more from "doing" rather than "conventional learning".

Evaluation

On the whole, this research has enabled us to identify strong reasons to form cross-curricular links between Science and DT. At the same time, it has also increased awareness of any issues we may face while creating these links.

From the focus groups we have discovered many struggling Science students want more cross-curricular links between DT and Science as they believe they learnt more through practical application. Keeping in mind the school does provide support for these students through Year 12 Senior Students, it might be beneficial to teach particular topics during the same term. For example: year 8 students can be taught about electrical components and circuits during the same terms as their Light-Up Puppet project in DT.

As part of our research, we also managed to find a document released by the Institute for Education, which supports our ideas. The following points are from the documents for GCSEs:

	Scientific knowledge and skills requirements	*Examples of Design and Technology application*
Use scientific vocabulary, terminology and definitions:	Metals and non-metals and the differences between them, on the basis of their characteristic physical and chemical properties.	Classification of the types and properties of a range of materials.
Life cycle assessment and recycling:	The basic principles in carrying out a life-cycle assessment of a material or product	Selection of materials and components based on ethical factors taking into consideration the ecological and social footprint of materials.
Using materials:	The conditions which cause corrosion and the process of corrosion and oxidisation	Understanding of properties of materials and how they need to be protected from corrosion through surface treatments and finishes. Appreciate how oxidisation can be used when dyeing materials.

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/473188/GCSE_design_technology_subject_content_nov_2015.pd

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Conclusion and Implications

We concluded that cross-curricular links between DT and Sciences would be especially beneficial to those struggling in Science and that it should first be trialled on younger years as they want it more (according to the questionnaires). Also with the younger years, all of them will be doing Design Technology until the end of year 9, meaning it might have a positive influence on their GCSE choices and they aren't capped by any course syllabus.

As part of this program, it would help if the teachings of the following topics coincide:

- Electrical circuits & Light-Up Puppet/Electronic badge projects
- Nutrition, digestion & Food Tech
- Forces & Remote-controlled car project

Hi-lighting these links to those teaching Design Technology and the Sciences, could encourage collaboration between staff to promote increased understanding by students. The impending changes to the GCSE and 'A' level curriculum, stating what these links should be, as illustrated on page 9, show that the question investigated by this document is in line with current thinking by the Department for Education. It can only benefit all students, from Year 7 upwards, to pursue a more cohesive approach to the STEM subjects across the school.

Appendices

Questions aimed at year 11 to focus on the (existing or otherwise) links between Science and DT

1) How many links can you make between things you've done in biology which are similar to things you've done in design technology? Any activities or experiments you have done etc.

2) How many links can you make between things you've done in physics which are similar to things you've done in design technology? Any activities or experiments you have done etc.

3) How many links can you make between things you've done in chemistry which are similar to things you've done in design technology? Any activities or experiments you have done etc.

4) Are you considering taking either any of the Science's or design technology at A-Level? If you're thinking about taking a Science which one?

5) What are your future ambitions? Do you have a specific job in mind?

6) Which A-Levels are you considering taking?

7) How do you think physics links in with the moving vehicles you made in year 8 in resistant materials?

8) How do you think physics links in with the badge you made in year 7 graphics/electronics?

9) How do you think physics links in with the /soft-circuit electronics puppet you made in year 8 in graphics/electronics?

10) Would you find science easier if teachers used other subjects to explain theory that linked to other subjects e.g. you studied this in science when doing this experiment?