Example GCSE Resources – rationale for teachers

Introduction

When setting homework, teachers can often face problems such as:

- The homework was too easy to complete.
- The homework was challenging for students to complete, but took up too much of the teacher's time to mark.
- The students were able to complete the homework and it is straightforward to mark. Whilst the student has practised a skill, they don't successfully apply this in later tests or exams.

Having discovered Isaac Physics, I quickly began to realise the potential that it could have in resolving the issues above. However, when first setting Isaac Physics, I felt that many of the assignments were taking too long to complete.

To address this concern, I set about creating smaller bespoke boards for the students. Almost immediately, the students were completing homework in an acceptable time frame and they began to enjoy the ethos of the Isaac Physics platform.

Using this knowledge, I began to create more unique boards for the entire GCSE Physics course. I soon realised that (over time) I could reduce my workload, improve the students' ability - and ultimately their confidence in Physics - as well as being able to provide specific individual feedback to each student.

Why smaller boards?

At the heart of the design of these smaller bespoke boards were three main factors:

- Student time to complete each board
- Addressing and improving the students' fundamental mathematical skills
- Improving students' ability at comprehending exam style questions

These core design principles were the driving force behind the size and style of each board. I started with the question: if students couldn't comprehend an exam question, was that because they weren't able to access the mathematical skill required? If so, then if I could create a system where they practised the mathematical skill, were rewarded, and then applied that skill to an exam style question, then they may see improvement.

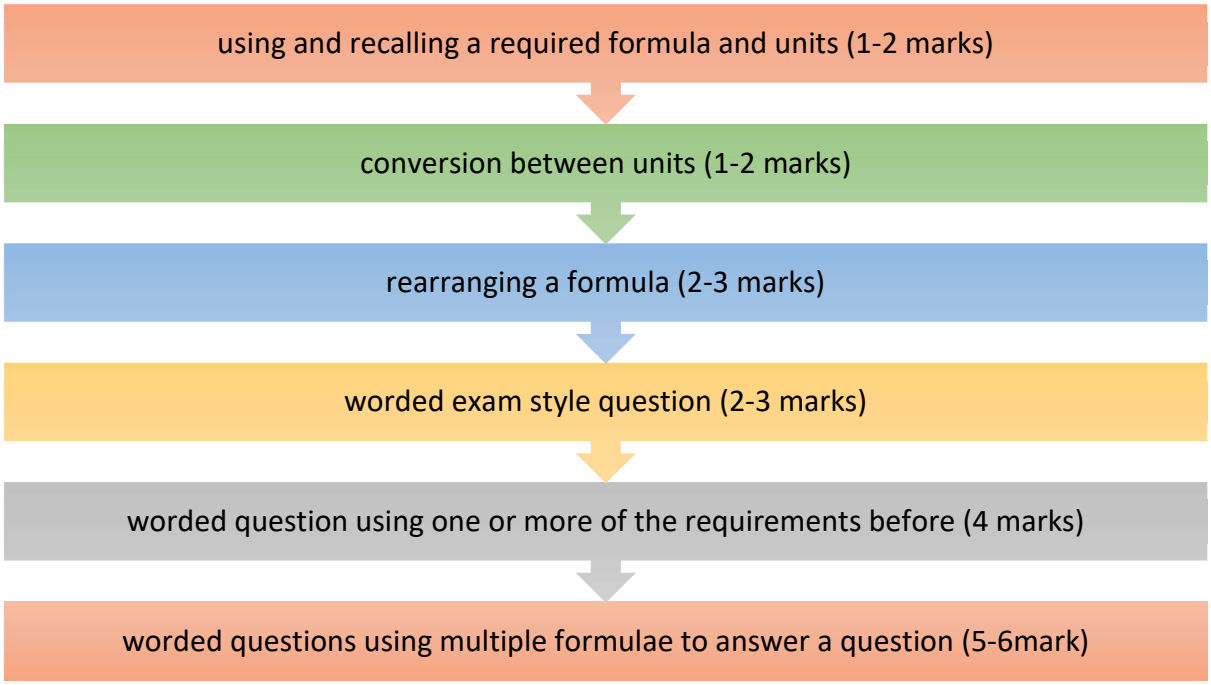
I often noticed that students would fall into one of two categories:

1. Not knowing the mathematical demands of the question. Such as not having the skill to rearrange a formula, convert units or simply not knowing the formula.

2. Unable to comprehend the question and thus extract the correct information to allow them to answer successfully.

So, I attempted to create a range of boards that were 20-45 minutes in length and most importantly, addressed the two categories above.

Where possible, each board incorporates the following progressions in demand:



*With each progression the question may use a skill from the previous levels. **Marks assigned to each level are **very rough approximations** and are to be used as a guide only.

In the spreadsheet of boards, there is a column for 'Number of Questions'.
Generally, where there are more questions they are lower demand (using the first 3 levels of the above flow chart). The fewer the questions, the more demanding the question is with regards to mathematical skill (the last 2 levels of the flow chart).

Suggestions for day to day use

All students are required to present their workings in the lesson – on the due date – as proof of completion of their homework. This generally ensures that the student completed the work themselves, and it gives an important starting point for discussion with the student (essential where the student has made a mistake).

Investing the time to create these boards (that are self-marking) has freed up valuable time that the teacher can spend with students to provide feedback on how they can improve. This face to face time has far more impact on students' learning and progression than traditional approaches, as well as significantly reducing overall teacher workload.

There are three approaches that I have found to be successful when using these boards:

Spaced Retrieval: based on research investigating the impact on spaced repetition, the teacher would set boards 2-3 weeks after covering the topic – sometimes even longer – to improve the student ability at recalling information.

Flipped Learning: students will be set a board ahead of the lesson and guided to the notes section on the website/book to get the basic information of a topic (units, formula, and basic theoretical concept).

The teacher would view the mark sheet ahead of the class to get an understanding of how the class got on with the homework and this will then inform one or more future lessons. A couple of scenarios/concerns often arise:

1. **Several students were stuck on similar questions** (a few red squares on the mark sheet): there are three ways to address this problem. The below solutions often take 10-15min of a lesson to address, which is normally the time required to do a starter/plenary of a lesson. This acts as the starter for the lesson.

    a. *Small groups*: using the mark sheet designate 'experts' of those questions and in small groups, students teach each other.
    b. *Student/Teacher presentation*: ideally, the teacher would use a student to come up to the whiteboard with their workings and verbally walk the other students through the answer. This is a great way to develop presentation and verbal skills, as well as confidence which often students lack, especially in Physics. If this is inappropriate for your group, the teacher can guide the students through the correct process and address common errors.

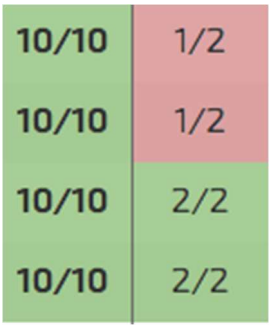
2. **The whole class struggled** (lots of red squares on the mark sheet): This will then result in taking the time to go through the concerns. It is my view that each component of the course requires a solid foundational understanding of mathematical skill and conceptual understanding. If this is lacking in one area, the teacher could spend time addressing this with the result that time will be saved later on.

Traditional approach: cover a topic in the lesson and set the relevant board accordingly. Address any areas of concerns as you would do normally.

One would not exclusively use these as the only method of homework, and I am not advocating you do so. The resource is a comprehensive one to address the vast mathematical demands of the course. It could in theory, be used each week alongside other traditional homework methods such as exam questions or flash cards.

Using the mark sheet (assignment progress, on the menu), you can identify quite quickly where each student struggles. Often the recall questions are first on the board and thus looking at the mark sheet students will be 'Green'.

The image on the right is a sample of data relating to a Year 9 class that had completed the board 'P6: Wave Equation and Time period Formula Practice'.



The first 10 questions give drill practice on the wave formula and the next 2 questions are worded questions applying this formula. Immediately, we know most students understand the formula and can use it at a basic level and two students (red squares) struggle with worded types of questions. We can now decide how we need to approach addressing these errors.

Using the data

A teacher's day is often flooded with data, but the data provided by Isaac Physics is an asset as it can be used directly.

Fundamentally, one could use the data to give a quick snapshot of areas where one could delve deeper. It will not provide you with the answer to your problems but crucially it provides direction and a path for a teacher to investigate.

Talking with the students will then help you work out the best approach to the solution.

Below are just some examples in which the data, from the mark sheet, have been used outside of the day to day identification of misconceptions from their homework.

1. To provide students with targeted revision topics, individual to their needs. Downloading a group spreadsheet, you can immediately guide individual students, or groups of students, to areas that they need to improve. This approach will have a greater impact on their learning

and confidence than some traditional approaches to revision. You can then spend time with these students to understand where they are going wrong and then set further questions to assess learning. These be further questions from the book or ideally the level 1 problem questions from the question tab on the website.

2. Revision style lessons can be uniquely tailored to the student/group. Rather than having the students self-select areas for improvement, you can now quickly and accurately assign groups to areas for improvement within a lesson. Students can first revisit the relevant theory of the topic, cover some basic questions and then attempt the worded questions and/or problem boards.

3. During parents' evening, it can be a powerful tool when addressing homework concerns; students and parents can quickly understand your concerns.

Target Audience and Time Required

There is an infinite number of variables to consider when designing these boards and you will know your students and classes best and thus the recommendations below are intended as just that. Please adjust your expectations based on the students you have in front of you.

One might be reluctant to suggest the ability/levels that these boards should be used for, as the intention is not to deter students from the outset by saying something is above their ability. Yet we must appreciate the need for guidance when implementing this resource.

Currently in my practice, these boards are used with:

- Year 9 – Year 11 students (we start GCSE in Year 9)
- Triple Science groups
- Set 1 and 2 "Double Award"; this equates to students who are expecting around a final GCSE grade of 5-9.

This does not limit its use, this is simply where I have implemented it. The goal is to eventually utilise Isaac Physics for all abilities and all sets, but the method and approach may need to differ to achieve this ambitious goal.

As previously mentioned, each board was created with a time limit in mind. This limit was between 20-45 minutes. This time restriction ensures student engagement whilst also completing the task in a timely manner.

The time to complete a board will vary according to the student, as well as their confidence at each topic, but the following approach was used when preparing the boards:

1. **Simple formula drill practice:** 1-2 minutes per question e.g. fill in the missing cells of a table, multiple choice questions etc.

2. **Worded questions**: 2-3 minutes per question. This was on the basis that they will be similar to exam-style questions which are on average 3 marks (1 minute per mark) per question.

This allows for differentiation within a class, as one student may take 20 minutes to complete an exercise whereas another may take 45 minutes. This knowledge provides you with an opportunity to confirm to students that this difference is acceptable and expected. Whilst I would not suggest rewarding a student who completes a task more quickly, I would tell students that they will get quicker as their mathematical fluency improves.

The above is an approximation in terms of time, and one should allow for natural timings based on the relevant student's ability. All students were expected to provide full working out in their books and this was accounted for in the timings.