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THE JUBILEE CENTRE FOR CHARACTER & VIRTUES

UNIVERSITY OF BIRMINGHAM

ITY TEACHING HONESTY RESPECT RESILIENCE CURIO
E CHARACTER
RIT THROUGH SUBJECTS MOTIVATION FOCUS OPTIM

MATHEMATICS

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Teaching Character Through Subjects – Mathematics Suite 1 Key Information

Teacher	Ruth Jennings	**School**	Kings Langley School

Overview

Curriculum Area	Maths
Subject Focus	Indices Circle theorems KS4 GCSE as part of the higher course specification
Identified Key Character Qualities	Focusing on performance virtues: Perseverance Resilience Motivation Confidence
Character Focus	They are thread through the whole lesson as students are asked to consider these traits whilst they are attempting to complete these areas of mathematics. Students are asked to consider their actions and see what that says about these traits and then through questioning/ discussions try to set targets and improve their awareness of their abilities with these character traits to then allow them to develop in these areas. Although I am trying to use the caterpillar model, it was very new and it is something that I think I will develop more with myself and the students in future. Evidence of improvement is seen in how the students tackle the new tasks at each stage, after evaluating their previous efforts. It was seen that students being more aware demonstrated more perseverance and resilience and therefore motivation (evidence based on student voice and quantity of work completed/ support required by students). The impact on confidence was more varied. I had hoped that by having more confidence, they were able to improve the other traits however I felt they improved the other traits to "do the right thing" and "impress me" rather than the fact they had improved their confidence. I hope their confidence has improved but less evidence of this.
Differentiation	As this is a top set, mathematically I did not really differentiate apart from at the very top level, by including some real stretching exam questions. However I found that it was within the character virtues that needed differentiating e.g. confidence, motivation was so personal and therefore each student's goals were different. This meant asking different questions or having slightly different conversations as well as setting different targets for students.
Adaptability	I think these lessons can be adapted as you can use the same principle with all areas of mathematics and therefore at all different abilities/ levels and all ages.

	To a certain extent, all mathematics lessons should include these principles.
Affect on School Priorities	I think the students have some to appreciate the reasons for me "being mean" as they originally thought of it. They have come to appreciate the fact they can work more independently and have asked for more of these styled lessons. (Probably to hear less of my voice ☺
Things That Worked Well	The mathematics material worked well and did what I wanted them to do which was to allow the students to work more independently.
Things That Might Be Improved	Although I believe the students understood the virtues we were trying to work on and improve – and did so. The questions, discussions around them were quite new to the students (and me in some cases) and I felt that these were sometimes quite basic. "Would you say you have shown any resilience this lesson?" "How?" "How could you improve this?" "What will you try next time?" I think that my using the caterpillar model might help with this and is something that I would recommend people adapting for use within these lessons.
Lessons	
Subject Focus	Lesson One: Know, understand and use the simple indices rules Know, understand and use the more complex indices rules, including negatives and fractions Lesson Two: Know, understand and use the more complex indices rules, including negatives and fractions Be able to apply all the indices rules to examination questions Lesson Three: Know and understand the circle theorems Lesson Four: Know, understand and be able to apply circle theorems to questions Lesson Five: (Topic of choice – we did area and volume questions)
Character Focus	Lesson One: Know and understand what resilience and perseverance is and what it looks like in the classroom Lesson Two: Understanding how resilience and perseverance can impact your motivation and confidence Lesson Three:

	Understanding how motivation and confidence can impact on risk taking – and how risk taking can improve performance, but also requires resilience/ perseverance to continue when the risks do not pay off Lesson Four: Applying and developing motivation and confidence to allow risk taking Lesson Five: Applying and developing all four performance virtues and appreciating how these might translate into other areas
Lesson Activities	**Lesson One:** Initial conversation about working independently showing resilience and perseverance rather than just guessing answers or links, ensuring that you are basing your ideas and answers on evidence. Indices worksheet – The students follow the guidance and instructions on the sheet which leads them into finding the simpler indices rules such as $a^n \times a^m = a^{n+m}$ This sheet is written so it is completed independently or in small groups, allowing the students to feel they are in charge of their own learning. This hopefully also leads to greater understanding of where these rules come from and how to apply them. The character virtues of resilience and perseverance here are crucial as it requires pattern spotting and then drawing conclusions, without the teacher support or guidance. It is at this point that the conversations with the students are important, not mathematically but on the virtues, especially when faced with the "I can't see it/ can't do it" comments. Whilst the students are working, it gives the teacher a chance to speak to all students individually about their own virtues being careful not to be drawn in by the mathematics. A plenary of discussing how quickly did you give up; did you do one example make a guess then try to confirm with someone else or keep going yourself – what does that say? Who tried to check their answers with the teacher/ another student? Why did you do that – what support does that give you- what does that say? How did it feel when you were left on your own? Nervous etc. As part of the plenary you could confirm the first few rules with everyone as part of a mathematical discussion but I feel that at this point it would take away from the main aim of the lesson and therefore choose not to do so.
	Lesson Two: Remembering what we learn yesterday about the virtues, what are the areas you are going to focus on? What are your targets? Continuation of the indices sheet but this gets harder as some of the rules are tough and expect them to translate and apply linked knowledge.

	Working with the students on building their confidence and allowing them to get things wrong is crucial here. If they feel when they make a mistake it is wrong, then they will not be so ready to try things. It is this that is the pivotal thought for this lesson for the teacher. Once the students have completed finding the rules, they then complete the GCSE questions. For some students this is their proud break through moment – "I've had no teaching but I can answer a GCSE question on this topic and I've done it all myself!" For those who got caught up on the harder rules and required some support from the teacher, it is here that you can regain any motivation that may have been lost when they had to ask for help in the end. The plenary for this lesson is longer than usual and is talking to students about their feelings and how they felt they had been challenged and had to show resilience and perseverance as well as motivation and confidence. Pick over the last two lessons, looking at examples of what went well and what happened that could have been improved with a different attitude/ approach.
	Lesson Three: This lesson started with a reminder that we needed perseverance and resilience as well as motivation. Also from a mathematical view, how many examples might you need to make an assumption. Students were given the Finding the circle theorems sheet – I taught this in two ways – first time I gave everyone a sheet and let them get on with it (top set year 10), the other time I cut up the sheet and created stations for students to work at in groups (year 11 set 3 targeted C). This was for "virtue" reasons as I felt the year 11 were not as resilient and motivated as the year 10 and wanted to chunk up the task more for them so an additional stepping stone. The lesson is then student led and the teacher is walking and talking to students about their attitudes and behaviors towards the tasks. Have they completed enough examples to draw a conclusion? Why do they think they have/ have not? Are they on track to complete the whole task? Are they managing time and resources? What to do about terminology they do not know? What other resources could they use to help them if required? When should they consider using the resources i.e. do not want hem using google to look rules up straight away but to confirm their ideas after an appropriate number of examples and plausible conclusion.. Talking to students remind them of the targets they set themselves after lesson 1 and 2, are they further improving these or because of the topic change has this caused any backwards steps – if so how are they dealing with them? Plenary is about virtues only and how they have adapted their methods and ideas. Are they progressing with the concept of self motivation and working independently – how might these skills/ traits support them in school, during exams, in future?

Lesson Four:

This lesson starts mathematically pulling together all the rules that the students found last lesson, ensuring that they now know the right names for each rule, understand each rule fully and any linked terminology. Remember this is not about re-teaching as otherwise the students will see their part as pointless – it is about filling any gaps only.

There are then two mathematical challenges; proofs and exam questions- top set did both, year 11 only did the exam questions. Which of the circle theorems can you prove algebraically? Which of these examination questions can you complete?

Same process for teacher – walk around talking to students about their attitudes and behaviors, encouraging discussion about how their resilience, perseverance and motivation have changed over this series of lessons. Also given that they are teaching themselves and completing GCSE questions, what impact has that had on their confidence? Challenge throw away answers and dig deeper for examples and longer explanations rather than quick short answers.

Plenary for this lesson focusses more on the differences between this task and the indices task – are they find it easier to demonstrate "better" virtues? If so, why? If not, why not? What will they take away from this and how will they try to embed it into other areas?

Lesson Five:

Take a variety of exam questions – mixed topics

Find questions that have no staging but quite a few mathematical processes in them- maybe not easily recognizable topics such as triangle based questions, so is it trig, Pythag, similarity etc

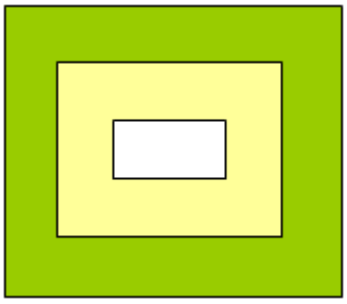
Do the following with them and ask students to follow the staged instructions

Each question copy and paste in the centre of an A4 coloured sheet, then paste that onto an A3 coloured sheet

Stage 1 – write what you know about the topic identified in the question on the A4 sheet

Stage 2 – Highlight the key information on the question

Stage 3 – Answer the question on the A3 sheet



Students work through sheets and questions. How is their resilience, perseverance, motivation and confidence now they have changed topics completely? Where there are weaknesses are they demonstrating strategies that shown they have leanrt something about their own virtues over the last four lessons? Discuss with students as appropriate and use the opportunity to collect examples for later discussion as part of the plenary.

Plenary – went briefly through the answers but more about discussing what they felt they had learnt with respect to the virtues. What would they do now? What strategies might they

	use or nick from someone else?
Notes on Differentiation and Adaptability	Lesson One and Two: Could omit the fractional and negative indices for weaker students but be aware the exam questions would then need editing Lesson Three: As I mentioned above, you could either give the whole sheet to each students, or set up in work stations. You could omit some of the theorems, concentrating on only the easier ones or harder ones Lesson Four: As well as asking the students to complete the exam questions (can edit to add extra easy/ hard questions) you can also ask students to try to prove the circle theorems. Lesson Five: Choose exam questions appropriate the ability or age of your students, but make them suitably complex – not necessarily difficult topics but combined topics.
Other Points Worth Noting	Sit on your hands – the temptation to get into Maths teacher mode is very strong! Remember the more independent they become now and happy to make mistakes and try again, the easier it will be later on to teach them.