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**A critical analysis of how dialogic discourse impacts students'  
engagement: A case study teaching Homeostasis  
in a year 10 class**

**Kate Shearer**

(PGCE Secondary Science with Biology, 2023-2024)

email: [kate.shearer@hotmail.com](mailto:kate.shearer@hotmail.com)

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## **A critical analysis of how dialogic discourse impacts students' engagement: A case study teaching Homeostasis**

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### **Abstract**

*Student engagement has been a rising topic of discussion in recent years, where high levels have been associated with academic achievement, and increased satisfaction with school life. Lack of engagement, however, can cause higher dropout rates and is a growing concern in secondary education. Research suggests dialogic discourse in the classroom can enhance student engagement by fostering critical thinking, active participation, and a supportive classroom environment. However, it also highlights potential challenges, such as increased disaffections and discomfort among less participative students. This study aims to assess the impact of dialogic discourse on behavioural, emotional, and cognitive engagement when teaching homeostasis in a science classroom. By utilising questionnaires, observations, and examples of student work to measure engagement, findings suggest that dialogic teaching enhances behavioural and cognitive engagement. The impact on emotional engagement, however, is more variable, with some students reporting increased anxiety due to the interactive nature of dialogic activities. Overall, whilst dialogic discourse shows promise in enhancing student engagement, its implementation must be carefully managed to address the diverse needs of all students.*

# **A critical analysis of how dialogic discourse impacts students' engagement: A case study teaching Homeostasis in a Year 10 class**

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## **Introduction**

The concept of homeostasis, the process in which the body maintains a stable internal environment, whilst vital to understanding human biology, presents unique challenges to learners due to its abstract nature and the complex mechanisms involved. Engaging students effectively in this topic requires thoughtful pedagogical strategies, among which dialogic discourse emerges as a strong method. The dynamics of dialogic discourse and its impact on student engagement have been studied for decades (Mercer & Dawes, 2014), consistently highlighting its role in promoting higher levels of engagement among students (Mercer & Littleton, 2007). To examine the impact of dialogic teaching on student engagement, this study will first define and examine the nature of dialogic discourse and its theoretical underpinnings. I will then define and provide a framework for measuring engagement, whilst outlining the importance of studying engagement in educational settings. The correlation between the use of dialogic activities on students' engagement will then be assessed through a case study approach. This will be implemented by identifying dialogic strategies that can be effectively utilised in teaching homeostasis, and measuring student engagement using questionnaires, observations, and examples of student work. By providing empirical insights into the benefits and challenges of implementing dialogic discourse in science education, this study offers valuable suggestions for educators seeking to enhance student engagement and understanding in complex subjects such as homeostasis.

## **Literature Review**

### **What is dialogic discourse?**

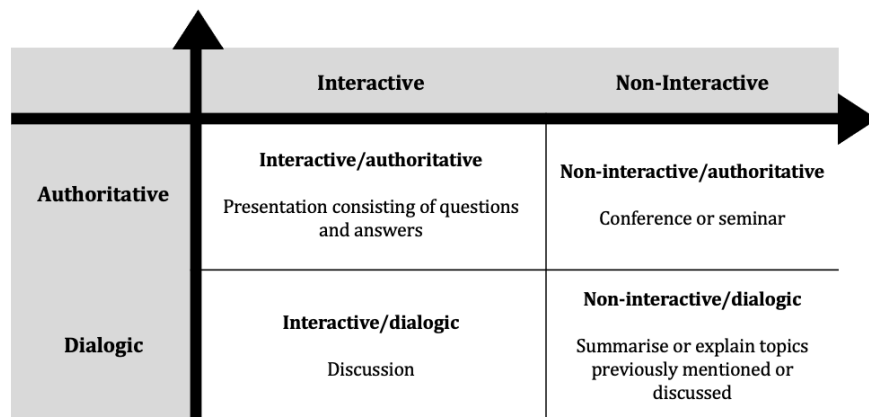
Dialogic discourse, a term that stems from the work of Russian philosopher Mikhail Bakhtin (1981), refers to a mode of communication based on conversation and interaction. Bakhtin proposed that all

language and thought is inherently dialogic, as they involve an exchange between different perspectives. Although Bakhtin focused on ideas around literature, and how all words and language exist in response to previous interactions, dialogism can be adapted from his ideas, and applied in educational settings. In an educational setting, dialogic discourse refers to activities that encourage students to engage in discussions, where multiple viewpoints can be acknowledged and explored. This method of learning contrasts with the monologic approaches of traditional teaching, where a single perspective such as the teacher's, dominates the lesson. This "banking model" of education where teachers impart knowledge onto passive students, has been criticised by various educational theorists, such as Freire (1970). In "Pedagogy of the Oppressed", Freire (1970) advocated for the method of dialogic education, and years later, the same argument continues to be made. For example, Osborne (2007) argued that "dialogic enquiry is central to learning as it demands the use of epistemic processes – describing, explaining, predicting, arguing, critiquing, explicating and defining" (Osborne, 2007, p.180). Dialogic activities, in this context, are those that empower students to question, critique, and apply knowledge critically, rather than just memorizing it. Unlike a monologic discourse where communication flows in one direction from speaker to listener, without genuine engagement with the listener's responses or perspectives.

Dialogic discourse is not only explored within an educational context, but in psychology, and communication studies. In Psychology, dialogic discourse is used to understand ones' self and others in a deeper way. It is seen as a way to navigate and build personal identities and relationships. Through dialogic interaction, individuals can explore different aspects of their personalities and work towards self-understanding (Hermans & Gieser, 2012). Hermans and Gieser (2012) essentially stated that a person is comprised of multiple, sometimes conflicting, voices or stances, rather than being unitary. In the field of communication studies, dialogic interaction is explored as a means of resolving conflicts and building better relationships. It shows how if individuals engage in constructive dialogue, where conflicting parties can express their views, listen to each other, and work collaboratively, a solution can be found (Poyasok & Zuman, 2017). Although dialogic dialogue is studied in many fields, its core meaning remains the same: it encourages interactive talk and exploring different perspectives.

Throughout the decades, dialogic discourse has been studied as a key pedagogy in encouraging student participation, allowing ideas to be exchanged, and prompting discussion. Mortimer and Scott (2003) provide a framework for characterising different kinds of classroom dialogue, which are

summarised below (Figure 1). Here, they define dialogic talk as encouraging the exploration of multiple perspectives and ideas, allowing students to discuss and question, promoting deeper understanding of scientific concepts. Interestingly, they also state that dialogic dialogue can be non-interactive (Mortimer & Scott, 2003). This type of dialogue includes summarising and explaining topics that have already been mentioned or discussed. They also define the opposition to dialogic talk as authoritative. This is centred around delivering established scientific facts and concepts. This entails giving clear explanations and direct instructions, essential methods for conveying scientific knowledge. Scott et al. (2006), propose that a science lesson must include both dialogic and authoritative dialogue to provide optimal learning conditions for students. Here, they emphasise that a lesson cannot solely be authoritative, and that dialogic talk is essential.



**Figure 1: A framework and listed examples of different types of talk.**

**Adapted from Scott & Mortimer (2003)**

### Examples of dialogic discourse

Dialogic discourse can manifest itself in many ways within the classroom. Researchers have increasingly become interested in “argumentation” where students are encouraged to discuss their way to solving problems in science. Duschl and Osborne (2002) claim this debate-like manner of learning must be dialogic as it “requires the opportunity to consider plural theoretical accounts and the opportunity to construct and evaluate arguments relating ideas to their evidence” (p.52). Due to the importance of debate-like discussion throughout the literature, this study uses debates and “argumentation” discussions in the classroom as dialogic activities throughout the taught lesson sequence. Mini whiteboards have also been popularly used in interactive classrooms (Roman & Uttamchandani, 2018) and were therefore employed in this study. Another key form of dialogism in the classroom is group discussion. Gillies (2020) highlights the importance of group discussion in

inquiry-based science learning, a form of exploratory and problem-solving learning central to the idea of dialogic teaching. Reznitskaya and Glina (2013) also argue that teaching and learning in a dialogic classroom is characterised by open questions, promotion of meaningful enquiries, and the students' responsibility for the flow of discussion. Based on the above research, my study will employ dialogic strategies such as student and teacher led discussions, group work, mini whiteboards, and debates.

### **What is engagement?**

To assess the impact of dialogic teaching on student engagement, it is important to define and provide a framework for measuring engagement in the classroom. Over the past decades interest in engagement has grown, although there is a substantial variation in the way it is defined. Initially, student engagement was defined and assessed through observable behaviours such as participation in class, time spent on tasks, and the frequency of interaction with teachers and peers. Classic studies, such as Brophy (1983) emphasised these behavioural aspects, linking them directly to student success and classroom dynamics. One of the earliest frameworks of engagement includes the participation-identification model (Finn, 1989). This defines engagement as “having both a behavioural component, termed participation, and an emotional component, termed identification” (Finn & Voelkl, 1993, p.249). Another earlier model developed by Connell and Wellborn (1991), proposes that engagement belongs to a spectrum. At one end of the continuum is engaged students that show a positive attitude towards learning, persevere in the face of challenge, and display a positive emotional tone. Contrastingly, at the other end are disengaged or disaffected students who are passive, don't try hard, give up easily and display negative emotions such as denial and anger.

As research has progressed, the scope of engagement has expanded to include emotional components. Connell and Wellborn (1991) and Finn (1989) were pivotal in advocating for this broader perspective, arguing that feelings of belonging, enjoyment, and emotional attachment to school plays a crucial role in motivating students. Further development in this field led to the recognition of cognitive engagement, of which researchers have argued that self-regulation is a vital aspect (Miller et al., 1996). Self-regulation is the degree to which students can autonomously motivate themselves, plan their learning activities, monitor their progress, and regulate their behaviour towards achieving their learning goals (Miller et al., 1996).

Today, student engagement is understood as a complex construct, encompassing various dimensions. When reviewing the existing literature, Fredricks et al. (2004) proposed that student engagement

could be divided into three dimensions: behavioural, emotional, and cognitive. This comprehensive review provided a framework summarising all areas of engagement discussed within the literature (see Table 1).

Type of Engagement	Definition	Supporting literature
<b>Behavioural</b>	Draws on the idea of participation in academic, social, or extra-curricular activities	Connell & Wellborn 1991 Fredricks et al. 2004
<b>Emotional</b>	The extent of a student’s positive and negative reactions to teachers, peers, and the school	Finn 1989 Connell & Wellborn 1987
<b>Cognitive</b>	A student’s level of investment in learning. This includes the willingness to understand complex ideas and master difficult skills.	Fredricks et al. 2004 Miller et al. 1996

**Table 1: Definitions, adapted from literature, of behavioural, emotional, and cognitive engagement**

Another important dispute within the literature is that of the difference between student engagement and motivation. Motivation in educational settings has traditionally dominated research, primarily focusing on why students undertake certain activities and what sustains their effort over time (Skinner & Pitzer, 2012). Theories of motivation have explored the processes that direct and sustain behaviour, emphasising the internal drives and goals that inspire students to be motivated (Siefert, 2004). Interestingly, the theory proposed by Siefert (2004), named goal theory, is described by Fredricks et al. (2004) as a framework to measure cognitive engagement. This theory is based around the goals an individual sets and how these influence their behaviour, emotions, and attitudes (Siefert, 2004). Here, there is a clear crossover between engagement and motivation, raising the question: are they distinct from one another? Martin et al. (2017) aimed to define this distinction, highlighting that they are, in fact distinct from one another. Further, they propose that motivation may be more important in predicting subsequent engagement than engagement is in predicting subsequent motivation. This is also stated by Ainley (2012), who claims that engagement is often the visible outcome of motivation, manifesting in a student’s active participation and involvement in learning activities. For the purpose of this study, I will define engagement as an “outward manifestation of motivation” (Skinner & Pitzer, 2012, p.22).

### **Why is engagement important?**

Research consistently shows that high levels of engagement are associated with academic achievement, a reduction in dropout rates, and increased satisfaction with the educational experience (Appleton et al., 2008). This potential impact on educational outcomes highlights the need to study

student engagement and research how it can be improved. Engagement has also been linked to positive social outcomes, such as better interpersonal relationships and improved social skills. Kuh (2009) argues that engagement is a key indicator of an institution's effectiveness, influencing not only student learning and retention but the overall quality of an institution. He proposes that when students are more likely to persist through challenges and remain committed to their educational goals, this in turn promotes a positive reputation and operational success for educational institutions. Furthermore, studying student engagement helps educators develop targeted interventions that can support at-risk students and create inclusive learning environments. Skinner and Pitzer (2012) highlight that understanding the factors that enhance or inhibit engagement can guide improvements in teaching practice, curriculum design, and policy development. Beyond academic achievements, student engagement has significant implications for psychological and developmental well-being. According to self-determination theory proposed by Connell and Wellborn (1991), engagement is linked to the satisfaction of three basic psychological needs; competence, autonomy, and relatedness, which are essential for positive self-esteem and wellbeing. Students who feel engaged in these areas are more likely to experience psychological well-being, exhibit resilience, and have lower levels of anxiety and depression.

Not only does student engagement show to correlate positively with achievement, it also correlates negatively with the likelihood of dropping out of school (Fredricks et al., 2004). It has been estimated that by high school as many as 40-60% of students are disengaged (Marks, 2000). This highlights engagement as a critical area for intervention. This widespread disengagement prompts a closer examination of the factors that contribute to its rise, as well as strategies to engage students again. Considering this, the study of student engagement is not only critical for improving educational outcomes but also essential for informing strategies for schools to improve engagement and reduce drop-out.

### **How is a dialogic discourse related to student engagement?**

Dialogic discourse is closely related to student engagement as it actively involves students in the learning process, which creates a more interactive environment in the classroom. Research throughout the decades has consistently shown that dialogic discourse enhances cognitive, emotional, and behavioural student engagement. This mode of interaction encourages students to express, elaborate, and reflect upon their ideas, fostering a deeper understanding of the content (Mercer & Dawes, 2014).

Further, the importance of dialogic teaching has emerged throughout the COVID-19 pandemic, where remote teaching was prominent across the country. This emergency remote teaching struggled to maintain student satisfaction and engagement as students lacked a sense of belonging, and social relatedness. Schou-Juul et al. (2024) found that dialogic online teaching created high student satisfaction and was even comparable to their satisfaction with physical teaching. This result highlights the importance for dialogic teaching, not only in the classroom, but particularly if emergency and regular remote teaching were to be required in the future.

This study will focus more specifically on dialogic teaching in the science classroom, and therefore it is important to note that many educational research studies use the phrase “scientific inquiry” (Gillies, 2020; Herrenkohl et al., 2011). This refers to the process by which scientists generate, investigate and test hypotheses, a core aspect of science education. Dialogic teaching is relevant to scientific inquiry as it encourages the use of critical thinking skills and the exploration of ideas through discussion. Students can engage in discussion where they describe, explain, predict, argue, and define concepts, as noted by Osborne (2007). This form of teaching enhances students’ abilities to engage in the process of scientific inquiry.

### **How does a dialogic discourse impact students’ cognitive engagement?**

Dialogic teaching significantly boosts cognitive engagement by encouraging students to think critically and engage actively with scientific concepts. By promoting discussions that require students to reason through scientific process and analyse data, dialogic teaching helps students form more coherent understandings of scientific concepts. Many studies illustrate that through dialogic interactions, students achieve better understanding and performance in scientific inquiry (Herrenkohl, et al. 2011). Dialogic discourse can make learning more relevant and interesting to students by linking the content to their experiences and encouraging them to explore topics more deeply. This relevance and depth can increase students' intrinsic motivation to learn. Mercer and Littleton (2007) found that classrooms that employed dialogic discourse strategies saw increased student motivation and interest in the subject matter. This has further been evidenced by Herrenkohl et al. (2011), as not only did students’ understanding improve during the dialogic learning process, but their answers also significantly improved after follow-up inquiry tests and group project scores (Herrenkohl et al., 2011). This indicates that the benefits of dialogic teaching may extend beyond immediate learning and contribute to long-term application of knowledge. It is important to note that although there is a

correlation between dialogic teaching and improved student cognitive engagement, this does not necessarily suggest a causal relationship. They implemented this research with two teachers and their respective classes, indicating a small sample size, which raises questions regarding the applicability of the results to broader populations. Nevertheless, many other studies notice the same correlation between dialogic teaching and students' cognitive engagement. For example, Gillies (2020) found that students engage constructively during scientific inquiry group tasks. Furthermore, he found that participants became more accomplished at expressing opinions and providing explanations and justifications for the 'scientific' positions they acquired during 6 inquiry-based science lessons. These are core cognitive engagement practices that support learning. Again, this study was carried out on a singular year 6 class, and therefore cannot be applied in a broader context where diverse students and learning environments exist. Alexander (2018) combats the issue of small sample sizes by reporting a randomised control trial with 5000 students and 208 teachers across four major UK cities, lasting 20 weeks. He introduced the dialogic teaching method of enriching students' and teachers' range of classroom interactions to foster dialogue and argumentation. This led to students in intervention groups outperforming their peers in tests across English, Maths and Science, highlighting the effectiveness of dialogic teaching in enhancing student cognitive engagement.

### **How does a dialogic discourse impact students' emotional engagement?**

Classrooms with a focus on dialogic discourse create a more positive and supportive learning environment, which, in turn, promotes greater student engagement (Mercer, 2019). Research has consistently shown that a positive classroom climate is essential for effective dialogic teaching. Mutual trust and respect, as well as the feeling of being valued and comfortable to speak openly are crucial (Mercer, 2019). These elements help students to engage not just cognitively, but emotionally, fostering a sense of belonging and safety. To achieve this sense of safety, the interaction between teachers and students is pivotal. Chen et al. (2020) suggest that when teachers actively listen, respect, and consider students' opinions, it contributes to a more emotionally supportive dialogue that engages students more. This has been empirically proven by Howe et al. (2019), who found that in a large study of 72 demographically diverse classes studying science, dialogic teaching correlates with positive attitudes towards learning.

Although studies have proven a positive correlation between dialogic teaching and emotional engagement, there is also extensive research on how this form of dialogue increases student

disaffection. Disaffection, defined as ‘the negative face of engagement’ by Henry and Thorsen (2020), is where students pay little attention, and participation becomes ritualistic. This can lead students to be overwhelmed by many negative emotions such as sadness, frustration, anger, anxiety and tiredness (Henry & Thorsen, 2020). In a study of 140 pupils and seven different teachers, Vasalampi et al. (2021) found that although overall behavioural engagement was observed to increase with dialogic teaching, students’ perceived competence decreased after dialogic teaching. They also found that there was no significant difference in emotional engagement or disaffection between both lessons (dialogic, and non-dialogic). This may be due to the dialogic teaching practices introducing a new concept of learning, which could be challenging for some pupils. Reznitskaya and Glina (2013), in line with this suggestion, found that irrespective of the preparation of teachers in constructing a dialogic classroom, not all students were comfortable with participation. Reznitskaya and Glina (2013) argued that not all students will understand the responsibilities of learners and therefore need to be taught to work with each other’s opposing viewpoints. Some students might naturally be more introverted or may prefer working alone, making them less inclined, or even stressed when participating. When assessing the impact of dialogic teaching on emotional engagement, it is important to consider pupils that may not be as comfortable with participation as others.

### **How does a dialogic discourse impact students’ behavioural engagement?**

Research by Jay et al. (2017) provides empirical support for the connection between dialogic teaching and increased behavioural engagement. In their study, classrooms that implemented dialogic teaching strategies showed a significant increase in students’ on-task behaviours and participation in learning activities compared to traditional lecture-based classrooms. This suggests that dialogic interactions may directly influence students’ willingness and enthusiasm to engage with the learning process. It is important to note this was implemented in primary schools, therefore caution should be taken when applying these findings to older age groups. Another study, however, that highlights the increase in behavioural engagement when implementing dialogic strategies is Vasalampi et al. (2021). Interestingly, although this study concluded that behavioural engagement increased with dialogic teaching, as mentioned before, the results showed that students’ self-reported behavioural and emotional engagement significantly decreased with dialogic teaching. The conclusion of this study states “These findings provide preliminary support to the idea that promoting teachers’ awareness of dialogic teaching supports their use of these practices in classrooms, which, in turn, can contribute positively to pupils’ classroom engagement.” (Vasalampi et al., 2021, p.7). They fail to conclude that

although observed engagement increased, there was a statistical decrease in self-reported engagement. This is perhaps due to research bias, where researchers and observers will interpret data subjectively to achieve the conclusion they seek to find (Denscombe 2017). Despite this potential bias, it cannot be ignored that the literature highlights a significant increase in behavioural engagement of students when taught in a dialogic manner.

## **Research Questions**

As covered in the literature review, many researchers suggest that employing dialogic teaching strategies can increase behavioural, cognitive, and emotional engagement in students. It is important to note that some literature also highlights the role dialogic teaching can play in negatively affecting engagement, especially emotional aspects. In light of the literature, this study will focus on three main Research Questions (RQs):

RQ1: How does dialogic teaching impact behavioural engagement of students in a year 10 science class?

RQ2: How does dialogic teaching impact cognitive engagement of students in a year 10 science class?

RQ3: How does dialogic teaching impact emotional engagement of students in a year 10 science class?

## **Research Design**

### **Methodological Approach**

Fredricks and McColskey (2012) suggest the optimal way to measure engagement is combining various methods of data collection. Considering this review, a convergent mixed methods research design was used where quantitative data (student self-report survey), and qualitative data (lesson observations, and work completed in their books) were collected from 26 high-attaining year 10 students. The students had experienced dialogic discourse in lessons I had previously observed, meaning I did not need to create a setting for the purpose of my research. While some of my own teaching would form a key part of the research (creating dialogic activities for the students to take part in), this was not a change that needed to be created to evaluate and reflect on the result. The nature of my research meant I needed to understand the existing engagement in dialogic discourse in

the classroom - building on existing research and context with my own teaching. For these reasons, this research employs a case study approach. Denscombe (2017) states the key feature of a case study is about achieving an understanding of relationships and processes underlying the case and finding a holistic viewpoint of the existing literature combined with your research. My research therefore encapsulates a case study as defined by Denscombe (2017).

## **Lesson Design**

As Alexander (2018) outlines, dialogic activities may include debates, peer reviews, group projects, and any other format that requires active participation and exchange of ideas among participants. These ideas were practiced in the classroom through a four-lesson sequence, outlined below. The sequence of lessons taught were based on the topic “Homeostasis”, specifically the nervous system, reflexes, the brain, and the eye. All activities carried out in the lessons pertained to various definitions of dialogic teaching detailed in the literature review above. Table 2 (next page) below breaks down each lesson into its title, the type of dialogic activities used, the specific contents of said activities, and the supporting literature that justifies each activity as dialogic.

## **Ethics**

To preface the research methods outlined below, I will first outline the measures put in place to ensure the study was undertaken within the guidelines on educational research ethics issued by the British Educational Research Association (BERA) (2018). Firstly, I completed the Faculty Ethics Form and checklist for this research, which considered any issues that may arise during the study. In line with BERA guidelines, the measures outlined below were designed to ensure participants’ understanding and consent, uphold their right to withdraw, and prevent any disadvantages from participation from the study. Before data collection, I explained that participation was a choice, therefore allowing anyone to decline the option to participate. To ensure no one was at a disadvantage, after delivering the full content of lessons, questionnaires were given in lesson time therefore reducing requirement for the participants’ free time. When carrying out interviews, refreshments were given, and participants could decline to answer at any point. Before the research commenced, a detailed briefing about the project was provided to students, including an optional session for queries regarding the study. Additionally, all data presented in this study has been anonymised to protect the identity of participants.

Lesson	Lesson Topic	Activity type	Content	Supporting Literature
1	Nervous System	Mini Whiteboard task	Teacher will ask students questions about parts of the nervous response pathway	Warwick, Hennessey, and Mercer 2011 Roman and Uttamchandani 2018
		Group practical Activity	Reaction Times required practical. They will drop and catch a ruler, and compare reaction times when talking, to when silent.	Alibali and Nathan 2018 Gillies 2020 Vasalampi et al. 2021
2	Reflexes	Group activity	“What is meant by the term voluntary?”. Students will discuss and then sort actions into a table in small groups.	Gillies 2020 Vasalampi et al. 2021
		Student-led discussion task	“Why do you think it’s important that reflexes go to the relay neurone?” Students will discuss amongst themselves after being shown a video	Scott and Mortimer 2003 Reznitskaya and Glina 2013 Vasalampi et al. 2021
		Teacher-led discussion	The teacher will ask different students to input their answers of reflex pathway examples. The class will go through examples together	
3	The Brain	Mini Whiteboard task	Students will answer questions on areas of the brain after watching a video	Warwick, Hennessey, and Mercer 2011 Roman and Uttamchandani 2018
		Discussion and debate	“Is it easy to investigate and treat disorders of the brain?” Discuss and debate this question	Gillies 2020 Duschl and Osborne 2002
4	The Eye and correcting eye defects	Student-led discussion	“What is the function of the eye? What parts of the eye can you remember, and can you name their function” Students will discuss amongst themselves then give answers to the teacher.	Scott and Mortimer 2003 Reznitskaya and Glina 2013
		Group work	Students will investigate shining lights through convex and concave lenses	Gillies 2020 Vasalampi et al. 2021

**Table 2: Outline of lesson design  
(lesson sequence and topic, with associated dialogic activities and supporting literature)**

## Measuring engagement

Outlined below in Table 3 is a summary of the data collection methods used to measure each type of engagement: Cognitive, Behavioural, and Emotional. Ticks show whether the method was used for each type of engagement. In this section, I will further build on the methods listed below, describing each method of data collection and the types of engagement involved.

Type of engagement measured	Observation template	Student Questionnaire	Work done in books
Behavioural	✓	✓	
Emotional	✓	✓	
Cognitive	✓	✓	✓

**Table 3: A summary of research and data collection methods for each type of engagement**

## Teacher Observation

Teacher observations allow for the collection of real-time data on student engagement, capturing variations in behaviour, participation, and interaction that other methods such as self-report surveys may miss (Fredricks & McColskey, 2012). Due to the strengths of this method teacher observations were employed as a form of data collection. For each lesson taught, the designated teacher was asked to observe the dialogic content and comment on the behaviours seen. To focus on each type of engagement, the teacher was given an observation template for each lesson, as shown in Figure 2 (next page). This template outlined the specific activities to observe, and certain behavioural indicators of each type of engagement: behavioural, cognitive, and emotional. They were given definitions of each type of engagement, as summarised in the literature review above. They were also shown which specific behaviours to look out for in each type of engagement. Some behaviours shown in the template have been mentioned in the review above, and some stem from interpretations I have made from analysing the literature. Using these behaviours as a guideline, the teacher could then tick these behaviours where observed, and add extra notes if needed. For example, observers may look out for positive indicators of behavioural engagement such as listening, asking and answering questions, and actively participating in the learning activity, and negative indicators such as off-task behaviour and behavioural disruptions. These behaviours have been outlined in numerous studies to embody behavioural engagement (Fredricks et al., 2004).

Dialogic Activity	Emotional Engagement (✓)	Behavioural Engagement (✓)	Cognitive Engagement (✓)	Notes
Mini whiteboard task – questions about parts of the nervous response				
Practical – calculating response times whilst silent and talking				

**1. Emotional Engagement: This encompasses students' affective reactions to school, including their feelings of belonging, interest, and enjoyment in learning**

- Positive emotions: Expressing enjoyment, interest or enthusiasm towards learning activities
- Students express feelings of enjoyment or satisfaction in learning.
- Positive interaction with peers (e.g., encouraging comments, respectful listening).
- Willingness to take risks or make mistakes in the learning process.
- Demonstrates a sense of belonging or value in the class community.

**2. Behavioural Engagement: This refers to students' participation in academic activities, including their conduct and effort in learning processes.**

- Students are actively participating (e.g., raising hands, contributing to discussions).
- Students follow directions and stay on task without frequent reminders.
- Students show persistence in challenging tasks or questions.
- Body language indicates attention (e.g., facing the speaker, making eye contact).
- Interaction with learning materials (e.g., taking notes, using tools effectively).

**3. Cognitive Engagement: This involves the investment of mental effort in learning, including the use of self-regulated learning strategies and the pursuit of mastery.**

- Students ask questions that reflect deep thinking or curiosity.
- Contributions to discussions that demonstrate understanding or connection-making.
- Students offer creative ideas or solutions.
- Engagement in problem-solving or analytical thinking tasks.
- Shows metacognition (e.g., self-reflects on learning, plans approaches to tasks). Also – WORK DONE in books

**Figure 2: An example teacher observation template for lesson 2: “The Nervous System”**

As may be seen in the first column, the dialogic activities are outlined as a mini whiteboard task, and the GCSE required reaction times practical.

**Student Questionnaire:**

Self-report surveys offer direct insights into students’ perceptions and feelings about their engagement. This provides a first-person perspective that can reveal internal attitudes that may not be observable by a teacher as per the template above (Figure 2). These surveys can also be distributed to all participants simultaneously, making them an efficient way to gather data (Denscombe, 2017). When carrying out activities in the science classroom, such as the required “reaction times” practical (see Table 2 earlier), students may not be seated at their desks, but engaged in practices involving group work around the classroom. When measuring engagement in this setting, it is a challenge to obtain data without disrupting the flow of the activity. This is why self-reports and observations are often used as they are less likely to break the flow of learning compared with other methods (Sinatra et al., 2015).

### Rochester School Assessment Package

The questionnaire used in this study contains a mixture of self-made questions based on research I have carried out, with others extracted from the Rochester School Assessment Package (RAPS). This package, developed by Wellborn and Connell (1987), has been used by various researchers to measure engagement (e.g., Caraway et al., 2003). In their manual, they describe two types of assessment package: student self-reports and teacher report measures both for middle and elementary school. For my research, I selected questions from the student self-report survey, particularly towards middle school students. This survey was categorised into 3 sub-sections: engagement (ongoing engagement and reaction to challenge), beliefs about self (perceived competence, perceived autonomy, and perceived relatedness), and categories were spread across 88 questions in total. My study, however, due to the focus on engagement only, and limited time available, contained 9 questions.

Question Number	Question	RAPS Sub-section	Type of Engagement
1	I work very hard on my schoolwork	Ongoing Engagement	Behavioural
2	I pay attention in class	Ongoing Engagement	Behavioural
3	How important is it to you to do the best you can in school?	Ongoing Engagement	Cognitive
4	I work hard on my schoolwork because it's fun	Perceived Autonomy (Intrinsic Self-Regulation)	Behavioural
5	The interactive activities in this lesson made me feel more engaged in the topic	N/A	Behavioural
6	The interactive activities in this lesson made me feel happier	N/A	Emotional
7	I'm pretty smart in school	Perceived Competence (Ability Capacity)	Cognitive
8	When I'm with my classmates, I feel good	Perceived Relatedness (Peer Emotional Security)	Emotional
9	When I think about myself, I feel happy	Perceived Relatedness (Emotional Security with Self)	Emotional

**Table 4: A summary of the questions used in the student self-report questionnaire, and which section of RAPS they have been extracted from**

Questions included can be seen from Table 4 (above). Each question had a selection of answers ranging from “Very True”, “Sort of True”, “Not very True”, and “Not true at all”. These answers were chosen according to their use in the RAPS (1987), avoiding the use of a “Neutral” option to give students an opportunity to choose a direction and therefore reveal clearer opinions. N/A indicates the questions I created based on my own research. The type of engagement measured in each question is also listed.

### **Self-made questions**

As Sinatra et al. (2015) state, a challenge in measuring engagement is identifying its source. This research aims to directly link the impact of a dialogic discourse to student engagement, yet the reason for a student’s engagement may largely be unknown if the research questions are generalised, as seen in the RAPS (1987). If a researcher reports engaged behaviour in a lesson, is it the concept itself, or the interaction with other students that is the cause of engagement? To address this issue, questions 5 and 6 (see Table 4) directly ask students if their engagement is a result of the activities introduced in the lesson.

### **Different types of engagement measured by the questionnaire**

It is important to note that the questions extracted from RAPS were from various sections that do not explicitly state the measurement of behavioural, emotional, or cognitive engagement. For example, three questions used in my questionnaire (see Table 4) were from the section “Ongoing Engagement”. Wellborn and Connell (1987) define this as the extent to which a student exerts effort on schoolwork, pays attention in class, prepares for class, and believes that doing well in school is personally important. For this “Ongoing engagement” section, I have categorised the questions into cognitive and behavioural engagement, in line with the definitions used in the literature review above. For example, their definition of ongoing engagement encompasses cognitive engagement in that students are committed to understanding work, and this assesses how they set goals or organise study effort. It also encompasses behavioural engagement, focusing on effort and attention. Due to the misalignment of their framework with mine, I have categorised the questions/subsections in the RAPS into the three types of engagement according to my definitions in the literature review above, as shown in Table 4. It is important to note that this is my own perception and categorisation of engagement types, from comparison of literature with the RAPS, therefore other researchers may

differ in opinion of where these questions place into each type of engagement. In the following sections, I will give reasoning for each categorisation of the questions within the self-report survey.

### **Emotional engagement-based questions**

Questions 8 and 9 (from the “perceived relatedness” sections of RAPS) have been categorised into emotional engagement as this type of engagement involves a student’s sense of belonging or connection to their school, teachers and peers. This definition can be adapted to fit the “Perceived Relatedness” section of RAPS, which measures a students’ emotional security with themselves and their peers. Question 6 also falls into the category of emotional engagement, due to its reference of a positive emotion such as happiness.

### **Behavioural engagement-based questions**

Questions 1 and 2, belonging to the section “Ongoing Engagement” in RAPS, as mentioned above, have been categorised as assessing behavioural engagement. The core reason is they refer to behaviours such as “working hard” and “paying attention”: 2 key indicators of behavioural engagement (Brophy, 1983). Question 4, labelled under “Intrinsic self-regulation”, due to its association with “fun” was interpreted as behavioural engagement.

### **Cognitive engagement-based questions**

Question 3 encapsulates cognitive engagement as the importance of doing well in school can be associated with mastery goals centred around this form of engagement. Again, the “Ongoing Engagement” section is defined as a measure of students’ commitment to understanding work (Connell & Wellborn, 1987, p.2), which is directly related to the various definitions of cognitive engagement discussed in the literature review.

### **Questionnaire Delivery**

The questionnaire was given to the students for 2 lessons, as with hindsight, many were general questions regarding engagement and did not contribute to the focus of dialogic activities and their impact on engagement. Rather, they focused on students’ overall engagement with lessons. It was interesting to receive this information and compare their general engagement with their perception of

the activities within the lesson, however these questions were not required for each of the 4 lessons. After the first 2 lessons, the questionnaire (see Figure 3) was reduced to questions 5 (slightly adapted) and 6 (in Table 4 earlier) (assessing emotional and behavioural engagement), now nos. 2 and 3 respectively in Figure 3. Two more questions were added, one (no. 1) reading “The activities in this lesson made me think about the topic more”. The other question added (no. 4) was open-ended, allowing me to assess students’ thoughts, showing more detail into their answers and providing a more holistic view on the topic. To remove researcher bias, the question asks what they enjoyed/not enjoyed receiving both positive and negative opinions.

1. The activities in this lesson made me think about the topic more	A Very True	B Sort of True	C Not Very True	D Not at all True
2. The activities in this lesson made me participate more in the topic	A Very True	B Sort of True	C Not Very True	D Not at all True
3. The activities in this lesson made me feel happier than when I entered the classroom	A Very True	B Sort of True	C Not Very True	D Not at all True

4. What did you enjoy/not enjoy about this lesson and the activities in it?

**Figure 3: The second questionnaire given to students for lessons 3 & 4**

## Work done

As highlighted in the literature review above, cognitive engagement can be defined as depth of understanding, thinking, and interaction with the educational material (see Table 1 earlier). Work done in students’ books, and problem-solving approaches are direct manifestations of their thought processes. This output was used as a data collection method as it allows educators to infer the depth and complexity of students’ thinking, and their engagement with the learning material on a cognitive level. The level of interest and intrinsic motivation students have in their learning can often be gauged by the creativity and personal investment in the work they produce. For example, highly engaged students are more likely to explore topics in greater depth (Fredricks et al., 2004). This means the presence of notes, summaries and conceptual maps in their books may indicate active engagement and effort to understand and internalise the content.

## Limitations

When collecting data, it is important to consider the limitations, reliability, and validity of the methods involved. Reliability, as defined by Evans (2017), refers to the “rigour, consistency, and above all, trustworthiness of the research”. Evans (2017) divided this into internal reliability, referring to the reliability of data collected, and external reliability, which is whether the same conclusions of this study would be reached in a different context. Although internal reliability of this research is provided by the clear presentation of data, and the previously validated questionnaire (Wellborn & Connell, 1987), the external reliability is difficult to assess. Achieving external reliability is challenging within the parameters of this study due to the dynamic nature of classroom environments. In light of this, any conclusions drawn from this study can only be applied to the population within the research. Validity can also be measured by external and internal validity, according to Evans (2017). External validity is defined by the study’s applicability and generalisability beyond its immediate context, whilst internal validity focuses on the accuracy of the study in measuring its intended objectives. The external validity of this research is relatively constrained given the diverse nature of classroom cultures. This study also focuses on students of a certain age, and attainment level and therefore cannot be applied in broader context without caution. Nevertheless, by placing the questions of this study in broader context of the existing literature, this study can enhance the reader’s ability to judge how the findings can be applied in wider settings.

There are many issues that arise when measuring engagement in the science classroom, as discussed by Sinatra et al. (2015). Self-report surveys often require participants to reflect on their experiences, which can introduce biases and inaccuracies due to memory distortion or the desire to respond in a socially desirable manner (Fredricks & McColskey, 2012). Additionally, teacher observations may be subject to bias, as they see what they’re looking for and miss what they’re not (Minner et al. 2010). In other words, they may leave out examples of negative engagement and focus on positive ones. The task of continuously observing and documenting the engagement levels of all pupils can also be challenging, especially in more active classrooms and group work. Finally, analysing work completed in students’ books raises questions regarding its validity. The knowledge that their work will be scrutinised may alter how students engage with their work, potentially adding pressure. To address the limitations of each data collection strategy, this study uses a mixed methods approach which has been suggested as the most suitable (Fredricks & McColskey, 2012). This triangulation enhances the reliability of engagement data collected by offsetting the limitations each method with strengths of

others. By integrating these diverse sources of information, researchers can gain a more comprehensive understanding of student engagement.

## Results

### First Questionnaire

Question 3 (in Table 4), asking “How important is it to you to do the best you can in school?”, had the highest number of participants answering with “Very True/Important” across both lessons (Figure 4). All pie charts have been colour coded so that shades of red are negative responses (“Not Very True, Not at all True”), and shades of green are positive (“Very True”, “Sort of True”).

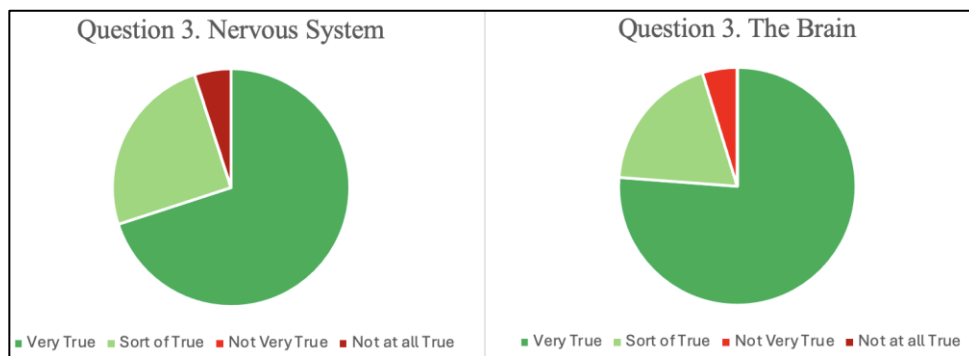


Figure 4: Pie chart showing student answers for question 3 in lessons 1 and 2

When asked “I work hard on my schoolwork because it’s fun” (question 4 in Table 4), most students disagreed across both lessons (Figure 5). No students answered with “Very True”. This implies that students across this survey, although finding it important to do well in school, do not agree that schoolwork is fun.

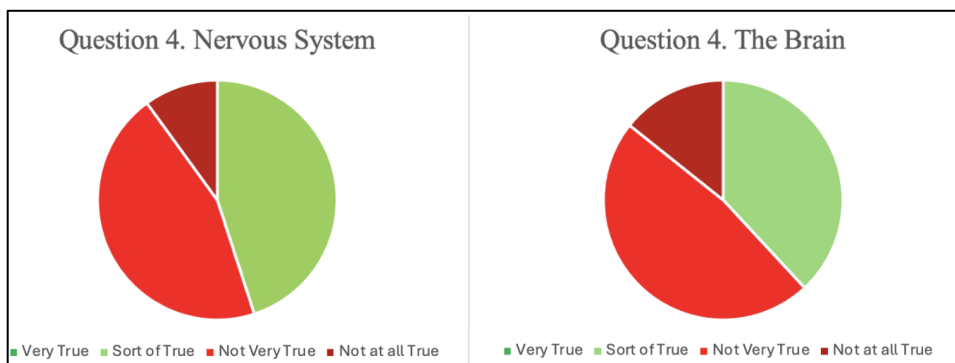


Figure 5: Pie chart showing student answers for question 4 in lessons 1 and 2

When asked how they felt when with classmates (question 8 in Table 4), most students responded positively for both lessons (see Tables 5 & 6). For questions relating engagement directly to activities within the lesson, most responses were positive for behavioural engagement (question 5 in Table 4). Regarding emotional engagement (question 6 in Table 4), responses were mixed. Overall, they were negative by one person in the nervous system lesson, and 50% of students reacted negatively in “The Brain” lesson.

**Nervous System**

Question Number	Very True	Sort of True	Not Very True	Not at all True
1	8	13	0	0
2	9	12	0	0
3	16	4	1	0
4	0	8	10	3
5	8	12	1	0
6	2	8	9	2
7	3	16	2	0
8	11	9	1	0
9	2	14	5	0

**Table 5: Questionnaire data for the lesson “Homeostasis Intro”**

**The Brain**

Question Number	Very True	Sort of True	Not Very True	Not at all True
1	5	14	0	1
2	6	12	2	0
3	14	5	0	1
4	0	9	9	2
5	8	10	2	0
6	3	7	10	0
7	7	11	1	1
8	5	15	0	0
9	9	5	5	1

**Table 6: Questionnaire data for the lesson “Nervous System”**

## Second Questionnaire

### Cognitive Engagement

This questionnaire assessed the types of engagement and their direct association to the dialogic activities in the lesson. When assessing cognitive engagement, using the question “The activities in this lesson made me think about the topic more”, both lessons 1 and 2 had an overall positive response, as seen below (Figure 6). The dialogic activities in the “Reflexes” lesson had a slightly more positive impact on cognitive engagement.

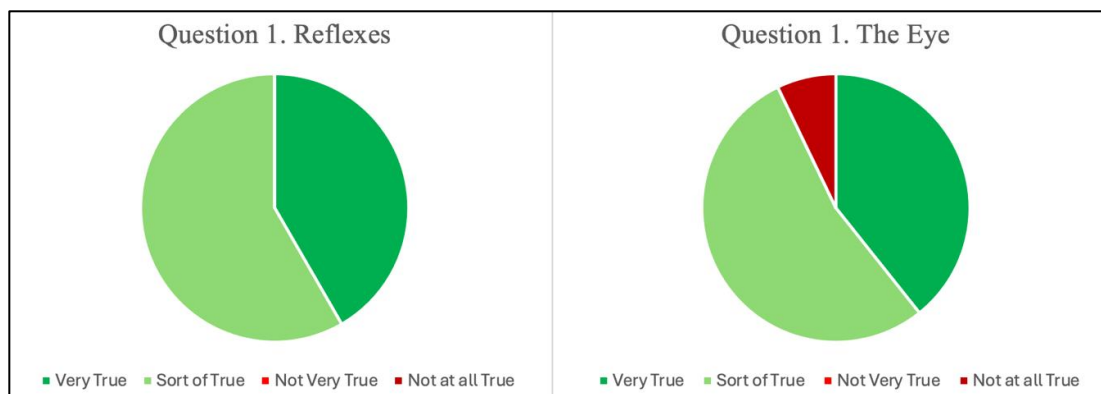


Figure 6: Pie charts showing student responses to question 1 in lessons 3 and 4

### Behavioural Engagement

When asked to respond to the statement “The activities in this lesson made me participate more in the topic”, students’ overall response was positive (Figure 7). A few more students had negative responses compared with their cognitive engagement (Figure 6), yet this difference is minimal.

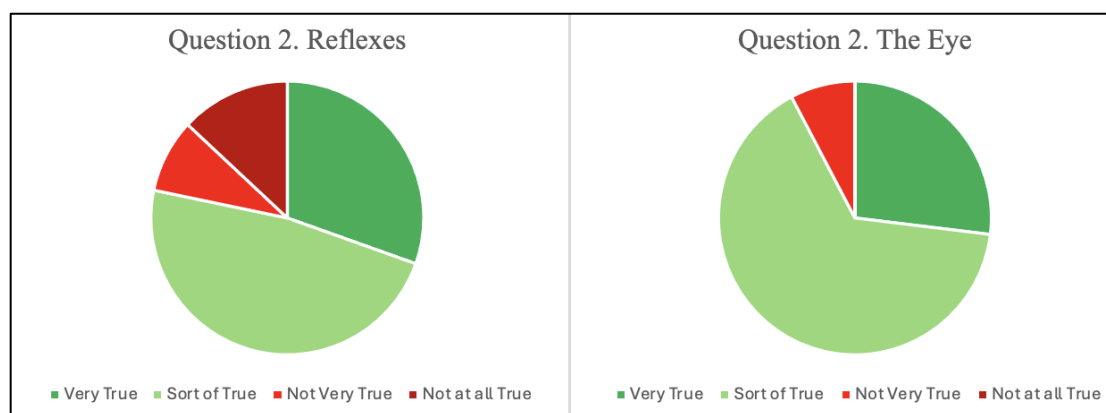
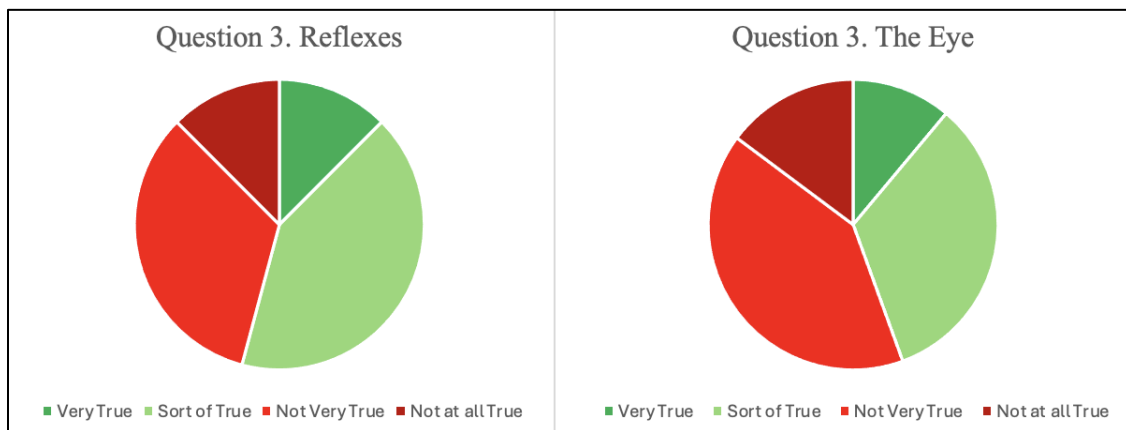


Figure 7: Pie charts showing student responses to question 2 in lessons 3 and 4

### Emotional Engagement

When asked the question “The activities in this lesson made me feel happier than when I entered the classroom”, more students had a negative response than positive in lesson 4 (The Eye) (Figure 8). Although there were more positive responses in lesson 3, compared with other types of engagement, emotional engagement self-reports show a much higher negative response to others.



**Figure 8: Pie charts showing student responses to question 3 in lessons 3 and 4**

### Open-ended question

Many students left this section blank, however over 50% of participating students answered. Most responses were positive, with many referring to the fact they “enjoyed less writing and more discussion”. Lots of students stated how they enjoyed the provision of diagrams such as the reflex arc, which they then labelled. This reduced writing time and left more time for discussion of how the reflex arc works. One student even remarked that the activities were “very engaging and brain-fuelling”, suggesting they felt interested and wanted to explore the topic more. From the reflex lesson, around 9 students commented they liked the activity where you hit your knee to elicit a knee-jerk reflex. There was only one negative response, stating that although they enjoyed discussion tasks and activities, they found some “boring”.

## **Teacher Observations**

### *Lesson 1 “Nervous System”*

Templates were completed by teachers (See Table 7 for example), where they stated whether behavioural, emotional, or cognitive engagement was observed, and add extra notes for each activity. During lesson 1, the whiteboard activity elicited emotional and behavioural engagement, but not cognitive. The teacher commented that “A small minority of students did not answer (due to taking the risk of making mistakes) for a question or two”. There was also behavioural and emotional engagement during the practical activity.

### *Lesson 2 “The Brain”*

Emotional engagement was seen in the whiteboard task, where the teacher stated the students “seemed to enjoy” it. Cognitive engagement was not seen during this task, which may be due to the difficulty in externally observing cognitive engagement in real-time. The discussion activity around treating disorders of the brain produced many engaging conversations and questions asked by students. Some students stayed behind to discuss brain research further, especially new developments in technology, showing cognitive engagement and intrinsic motivation to learn more. Most students were behaviourally engaged during the discussion of Phineas Gage, a man who obtained a head injury from a metal rod through his skull. This promoted interesting discussions around the structure of the brain and which areas were affected, but the teacher noticed some students beginning to discuss “off-task”.

### *Lesson 3 “Reflexes”*

Table 7 (next page) shows an example of a completed teacher observation table. In this lesson, overall students were engaged cognitively throughout all dialogic activities, mostly behaviourally engaged, and sometimes/mostly emotionally engaged. They tended to go off-topic more when in student-led discussions compared with teacher-led discussions. In contrast, they were more emotionally engaged in student-led discussions. They enjoyed discussions that gave context to situations, for example, discussing a reflex to a “loud bang” in the sky – they suggested this could be from the Concorde: a plane they had seen on a school trip the week before.

Dialogic Activity	Emotional Engagement (✓)	Behavioural Engagement (✓)	Cognitive Engagement (✓)	Notes
What is meant by the term voluntary? Then, sort actions into table. This will be teacher-led discussion	50/50	Yes	Yes	Students made notes, listened to the explanation, and answered the questions asked. All students were listening and focused on their teacher.
Why do you think it's important that reflexes go to relay neurone?	Yes	50/50	Yes	Students discussed answer in groups. Most were on task and actively discussing the reasons why the brain is missed out in a reflex action. Some background off-topic chatting happened when left to discuss on their own
Teacher-led discussion of flowcharts	Sometimes	Mostly	Yes	When reading the scenario just double check they are all listening. Loved your discussion about Concorde (making a loud bang in the sky, followed by a reflex) – this engaged students by bringing context. You could ask them to use their planners to indicate understanding which means when circulating you can focus on those with red or orange showing.

**Table 7: A completed teacher observation table of dialogic activities and the engagement observed within them, from lesson 3**

*Lesson 4 “The Eye”*

When asked to discuss and recall the structure and function of the eye from previous years, students appeared to be behaviourally, emotionally, and cognitively engaged. They were “All focused and trying to recall what they could remember.”. The teacher even noted that “C and M were discussing an eye dissection from Primary school!”. After this, students were asked to draw a dot and cross on paper to find their blind spot. This activity gave context to the eye, showing the blind spot is where no rod or cone cells exist on the retina. Students were visibly excited and interested, showing emotional engagement. The teacher noted “They really liked and were engaged by the blind spot activity”. Cognitive engagement was not seen during this activity, but behavioural engagement was seen in most of the class. The teacher, again, noted that some students started to become off task when it lasted longer than a few minutes.

**Work Done in Books**

Most students completed all required work in their books across the lessons, showing cognitive engagement with the material. Noticeably, some students did not complete work and were nudged multiple times throughout the lessons. As the lesson sequence progressed, to tailor for these students, note templates were printed out to structure note taking. After providing a structured note taking system, 2 of these students increased work completed during the lesson. Some students that did not complete work in books were actively involved in discussions and activities, but others were not

engaged in the lessons at all. One student, for example, had their head on the desk for the majority of the lesson. It is important to note this may be due to external factors, rather than the lesson itself.

## **Discussion**

### **Cognitive Engagement**

The data suggests overall cognitive engagement with dialogic activities. This is evidenced by work completed in students' books, along with willingness to stay behind in lessons and learn more about the topic. This was particularly prominent in the lesson of "The Brain" where different methods of researching the brain were discussed, including assessing brain damage, MRI scans, and using electrodes to stimulate the brain. This allowed students to connect classroom learning with real-world applications, making the lesson more relevant and engaging. Particularly, the case of Phineas Gage, a man who survived an iron rod through his skull, yet experienced personality change. Chirillo et al. (2021), whilst studying how to motivate and engage students when teaching the topic of homeostasis, found that teaching through research and investigative discussion increased student understanding and critical thinking. This interactive approach to scientific inquiry, particularly in topics such as homeostasis, can increase students' cognitive engagement. This is further evidenced by student questionnaires, where the majority of students responded positively when asked if the dialogic activities made them "think more" about the topic (Figure 6).

Interestingly, some students did not complete their written work, showing there may be a risk that dialogic discourse could lead to surface-level engagement, where students might participate in discussions without deeply engaging with the material or reflecting critically on the issues at hand. As Kuhn (2015) argues, without proper guidance and structure, discussions could progress into mere exchanges of opinion, but lack analysis and critical engagement. Nevertheless, most students completed work satisfactorily, showing that with the right teaching strategies in place to prevent surface-level discussion, dialogic activities can promote cognitive engagement.

### **Behavioural Engagement**

Both questionnaires and teacher observation data found overall that dialogic teaching increased behavioural engagement, in line with research (Jay et al., 2017). 78% students either agreed or

strongly agreed that they participated more in the topic, as a direct result of the dialogic activities in their “reflexes” lesson. This further reinforces how dialogic discourse can positively influence student behavioural engagement. Interestingly, many students stated that they enjoyed discussions as there was “less writing” to do. Analysis of written and verbal feedback from students showed they enjoyed activities such as the “knee jerk” reflex activity, where you hit your knee to elicit a reflex. This demonstrates how students are engaged in physical activities in the classroom, this is where they use their body to enact certain actions which facilitate conceptual understanding. This is otherwise known as “embodied learning”. As Alibali and Nathan (2018) highlight, embodied learning and using actions to conceptualise learning can promote student learning and engagement. When observing students, it was clear they were actively involved in these physical dialogic activities, further reinforced by their comments. This data, supported by literature, shows how dialogic activities, when active and using the body, can promote behavioural engagement.

Although teacher observations provided a positive view of the impact of dialogic teaching on behavioural engagement, it is important to notice that many students were observed to become off-task in some activities. Noticeably these activities were more student-led discussions, showing how perhaps when in control of their learning, they may become distracted without guidance. Kang and Keinonen (2018) also found, after assessing four approaches to teaching, that guided inquiry-based learning was positively associated with student interest. In contrast, open inquiry-based learning and discussion-based learning were strong negative predictors of student interest in science. This shows how although dialogic activities can be beneficial, it is crucial that they are implemented correctly, and consider the potential to become distracted.

## **Emotional Engagement**

The impact of dialogic discourse on emotional engagement presents a more complicated picture. Interestingly, preliminary questionnaire data suggested that students were not emotionally engaged with the lessons (Table 6). Subsequently, the second questionnaire confirmed this emotional disengagement was attributed to the dialogic activities within the lesson (Figure 8). Although teacher observations noted emotional engagement in lessons, these could be subject to bias, as suggested by Minner et al. (2010). It is also difficult to conceptualise emotional engagement from observations, and therefore in this instance self-report surveys may be more reliable to represent emotional engagement. Students may not emotionally resonate with the activities for several reasons. It can be

challenging for shy or introverted students who may feel uncomfortable speaking up in a group setting. This discomfort can lead to disengagement and a reluctance to participate, promoting negative feelings (Henry & Thorsen, 2020). These findings are in line with Vasalampi et al. (2021) who found that student perceived competence decreased in dialogic activities, where behavioural engagement increased.

Nevertheless, some comments from the open-ended question of the questionnaire suggested a form of emotional engagement with the lesson. This was particularly prominent in the reflexes lesson, where physical activities were involved. Studies have shown that this type of embodied learning in science, as mentioned above, not only helps with cognitive engagement, but emotional engagement (Danish et al., 2020). Not only does using body movement and activities promote emotional engagement, but social. Danish et al. (2020) found that overall, the social interactions between students helped aid emotional engagement during physical activities. This is interesting as questionnaire data shows that 95% of students agreed they felt “good” when around their classmates (Table 5). This may imply that when enabled to discuss and interact with classmates, students are more emotionally engaged, as in general, they feel better when around others.

The discrepancies in self-reported emotional engagement and teacher observations also highlight the complexity of interpreting emotional engagement through observable actions. Even though students appeared engaged in activities, some did not complete their work or responded negatively to emotional engagement questions, showing the importance of providing a holistic view of engagement rather than one area. This observation also underscores the importance of considering a broader range of indicators when assessing emotional engagement beyond physical or observable activities, as suggested by Fredricks et al. (2004). Therefore, future studies should conceptualise and measure emotional engagement more heavily from self-report questionnaires.

## **Conclusion and Recommendations for Future Practice**

The findings illustrate that dialogic discourse can significantly enhance student engagement, especially both behavioural and cognitively. Students were more active and involved in lessons that utilised dialogic methods, such as debates and group discussions, demonstrating an increased willingness to participate and think critically about scientific concepts in Homeostasis. Cognitive engagement was particularly notable, with evidence suggesting that dialogic activities prompted

students to delve deeper and inquire more into the subject. The results regarding emotional engagement, however, were mixed. While some teacher observations suggestive positive emotional engagement, student self-reports indicated a range of responses, with some expressing discomfort or a lack of emotional connection to the activities. This disparity highlights the complicated nature of emotional engagement and the challenges of measuring it effectively. Future research should develop more sophisticated tools for measuring engagement. For example, self-report questionnaires should be complemented with qualitative data, such as student interviews or reflecting journals, to gain a deeper understanding of students' emotional responses to dialogic teaching.

When attempting to engage students, teachers should strive to balance dialogic activities with direct instruction. While a dialogic discourse fosters engagement and deeper learning, as Scott and Mortimer (2003) highlight, direct instruction is essential for delivering clear and structured content to prevent students being distracted. This balanced approach can cater to diverse learning needs and preferences within the classroom. Currently, teachers' inclination of using monologic approaches in the classroom is prevalent, especially due to the pressure of keeping up with curriculum requirements (Hennessy & Davies, 2019). This study, however, shows the positive impact of dialogic teaching on engagement, therefore it can be suggested that professional development programmes should incorporate training on effective dialogic techniques. As researched by Vasalampi et al. (2021), teachers possessing the ability to facilitate discussions, manage classroom dynamics, and integrate dialogic activities into their lesson can promote student engagement. To better understand the long-term effects of dialogic teaching on engagement, longitudinal studies should be carried out. These studies could explore how sustained exposure to dialogic methods influences student engagement over time. A larger sample size could also explore how these methods could be applied to a more diverse classroom setting, and broader context across the country. By implementing these recommendations, teachers can better harness the benefits of dialogic teaching, providing a more engaged classroom environment. Future research in these areas will be crucial for refining dialogic teaching strategies and ensuring they meet the ever-changing needs of students.

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