

7004: Design, conduct, and critically evaluate a close-to-practice research project focusing on the model of the transformative teacher in developing practice that has a positive impact on the learner.

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1. Context of the Research

1.1 Introduction

This research project explores issues regarding pupil engagement and whether incorporating technology into the science classroom can improve pupil perceptions and interests. The impetus behind the study stems from alarmingly high levels of disengagement observed in science, technology, engineering, and mathematics (STEM) subjects across Wales compared to England. Science educators pursue a passion for STEM, so researchers must further investigate this phenomenon to help teachers better understand their pupils' needs and know how to accentuate the underlying curiosities best. This project aims to contribute to a broader bank of knowledge and understanding by completing a case study research on pupil engagement to uncover strategies that foster a more engaging and immersive learning experience.

1.2 The School

The studies took place in an English-speaking secondary school located in South Wales. The school caters to a diverse range of students, aged 11 to 19, from a community facing socioeconomic challenges. Approximately 24% of the students are eligible for free school meals, higher than the national average of 16.4%. Furthermore, about 37% of the students come from the 20% most deprived areas in Wales. The student population is predominantly English-speaking, with few speaking Welsh at home or from minority ethnic groups. The school also caters to a diverse range of educational needs, with close to 28% of students having special educational needs (SEN), exceeding the national average of 22.9%, and just over 5% having a statement of special educational needs, also higher than the national average of 2.2%.

1.3 The Class

This research project's subject class is a year 7 (ages 11 - 12) mixed-ability science class, with minor to significant levels of disengagement recorded on Classcharts (minor being refusal to complete work and significant being total absenteeism from class). The subject class covered foundational topics in biology, such as life processes (MRS GREN - Movement, Respiration, Sensitivity, Growth, Reproduction, Excretion, Nutrition), cellular structures, and specialised cells. By implementing technological interventions while delivering these core concepts, the study aimed to assess whether pupil

engagement could be enhanced, particularly among those who had previously exhibited disengagement from science subjects.

2. Literature Review

2.1 Engagement in Education

Pupils can demonstrate their level of engagement through two means - school attendance and classroom behaviour. Many studies demonstrate that factors reflect classroom engagement by observing pupil action. Pupils readily engaged in the lesson content are observed as actively listening, displaying eye contact, participating in classroom discussions, note-taking, using upright and alert body language, engaging in on-task behaviour, and being enthusiastic towards learning. Meanwhile, readily disengaged people have been observed as inattentive, idle, fidgeting, disruptive behaviour, rushed or incomplete work, closed body language, and a lack of participation (Ainley, 2012). In recent years, growing concern has developed across countries and industries regarding the level of interest displayed in young people, with low numbers opting for a career in STEM (Hampden-Thompson and Bennett, 2013). Among STEM, young people experiencing socioeconomic deprivation are persistently underrepresented (Ro, Fernandez and Alcott, 2018).

Disengagement is a multifaceted issue with no single root cause; barriers such as low literacy/numeracy levels, household poverty, teenage pregnancy, caring responsibilities, disabilities and homelessness can all impede aspirations to attend higher education (Bryan et al., 2022). Evidence suggests that factors like attainment levels, family background, school environment, and access to social capital also play significant roles in a pupil's ability to engage with STEM (Allen and Hollingworth, 2013). Recent evidence has shown that these socioeconomic factors merely influence a pupil's self-perception, making them less likely to expect to attain their ideal job, indicating a mismatch between their ambitions and their perceived ability to overcome barriers to success rather than their innate ability and enthusiasm towards the subject (Archer, DeWitt and Dillon, 2014).

The connection between the issue of pupil disengagement in STEM subjects and poor socioeconomic conditions is of particular concern in Wales. Many areas of Wales, relative to England, are afflicted by high levels of deprivation and economic stagnation, resulting in a marked decrease in STEM engagement.

2.2 Science in Education

When contemplating methodologies to improve pupil engagement in scientific learning, it becomes imperative to investigate the intricacies of how pupil perception forms over time and how science is being delivered in the classroom. A study by Halim et al. (2018) concluded that a growing number of pupils perceive science as too difficult, lack the support of a more knowledgeable person in science to guide them, or view the discipline as uncreative. Meanwhile, the increasing demands placed on standardised testing and knowledge recall throughout science curricula have given some weight to the difficulty placed on the subject, leaving severely narrow opportunities for success, causing higher rates of pupils leaving education (Machin, McNally and Ruiz-Valenzuela, 2020).

The new Curriculum for Wales (CfW), introduced in 2022, has shifted the educational perspective regarding teaching science. The CfW places a greater emphasis on teaching progressive skills, using research-based pedagogy to create well-rounded, resilient learners. This approach allows for much more flexibility in learning science and moves away from the traditional regime still seen in England. A meta-analysis of science classroom pedagogy shows that the following methods have proven effective in enhancing pupil success: setting learning experiences in familiar and/or personally meaningful contexts, frequently engaging in meaningful discussions as a group, routinely using basic literacy strategies to make the text more accessible, and by introducing less content at a time to allow pupils to explore new concepts fully (Jones and Baker, 2005).

2.3 Intervention Strategies

The Welsh government has undertaken significant efforts to enhance engagement with STEM subjects in recent years. Initiatives such as the Seren Network have been implemented with the aim of encouraging more able and talented (MAT) pupils to pursue STEM subjects in higher education, providing enhanced levels of support and guidance (Bryer, Davies, & Suhaer Ynus, 2018). Alongside the Seren Network, the Welsh government has allocated funding for a series of online workshops called "technocamps," delivering STEM enrichment and playground computing programmes to increase young people's involvement across STEM disciplines (Crick & Moller, 2015). The technocamps have garnered considerable success, with over 100,000 young people participating in at least four full days of activities and more than 400 teachers benefiting from professional development (Moller, 2023).

The new curriculum for Wales recognises that more still needs to be done to improve pupil engagement across STEM subjects. In an effort to increase pupil engagement and make STEM education more relevant, the Curriculum for Wales has implemented a skills-based, cross-curricular approach that moves away from traditional, content-heavy pedagogies (Donaldson, 2016). The new curriculum emphasises inquiry-based and hands-on learning experiences that allow students to actively explore STEM concepts through experimentation and problem-solving (Welsh Government, 2022). It promotes integrating STEM with other subjects to highlight real-world applications and contextualise learning to students' interests and backgrounds. Developing digital competencies like coding and computational thinking is also prioritised to align STEM with modern technological demands (Donaldson, 2015). The Curriculum for Wales aims to foster greater enthusiasm and participation in STEM from an early age by cultivating transferable skills, engaging in practical activities, interdisciplinary connections, and digital literacies. This learner-centred philosophy focuses on building well-rounded capabilities over rote memorisation to enhance STEM engagement and better prepare students for future STEM pathways.

2.4 Engagement in the Science Classroom

Within the classroom itself, there are several research-backed strategies that teachers can employ to further improve student engagement in science. Contextualised, hands-on activities that connect concepts to real-world applications and students' lives have been shown to increase interest and motivation (Potvin & Hasni, 2014). Frequent class discussions, interactive demonstrations, and inquiry-based investigations allow students to participate actively rather than passively receive information (Shumow, Schmidt and Glynn, 2014). Using multimedia resources, educational games and simulations can also capture students' attention and make abstract science ideas more concrete and engaging (Barak, Ashkar and Dori, 2011, Honey et al., 2011).

Fostering engagement from an early age is critical, as studies show students' attitudes toward science are largely formed by 4th grade and remain stable over time (Archer et al., 2010). Engaged students demonstrate improved academic performance, higher retention of concepts, and more positive attitudes about science that can impact future course selections and career decisions (Lee, 2013). Prioritising engaging, student-centred science

instruction lays a strong foundation for STEM literacy and continued engagement throughout the educational journey.

2.5 Measuring Engagement in the Classroom

Measuring pupil engagement in the science classroom is crucial for evaluating teaching strategies' effectiveness and identifying areas for improvement. Researchers have employed various methods to gauge engagement levels, each with its own strengths and limitations. Observational techniques, where trained observers systematically record pupil behaviours such as attentiveness, questioning, note-taking and time-on-task, provide in-the-moment data but can be time-consuming (Fredricks, Blumenfeld and Paris, 2004). Self-report surveys that ask pupils to rate their interest, motivation and cognitive investment can offer insights into their subjective experiences, although response biases may occur (Appleton et al., 2006). Tracking academic outcomes like test scores, coursework grades, and progression rates can serve as proxies for engagement but may not fully capture the underlying psychological processes (Sinatra, Heddy and Lombardi, 2015). Triangulating multiple data sources, such as observations, surveys and academic data, is recommended for a comprehensive assessment. Newer technological tools like galvanic skin response wristbands, eye-tracking software and electroencephalograms (EEGs) also show promise for objectively measuring physiological indicators of engagement (D'Mello, Turkeltaub and Stoodley, 2017). Whichever methods are employed, it is important that engagement data collection aligns with the specific dimensions and contexts being examined to inform educational practices accurately.

3. Discussion of Research Design: Case Study

3.1 Purpose of a Case Study Approach

Case study research involves an intensive study of a single unit or bounded system to provide a rich, holistic understanding of a specific case through the analysis of multiple data sources (Merriam and Tisdell, 2016). This approach works best when investigating contemporary events, where the boundaries between the event and context are not delineated. As such, a case study approach fits the purpose of this research - where it is crucial to ensure that the study is carried out within an authentic real-world context, thus allowing for an in-depth exploration of specific phenomena (Hollweck, 2016).

3.2 Strengths of a Case Study Approach

A key strength of the case study method lies in its ability to facilitate a multi-faceted exploration of phenomena and events as they manifest in an authentic real-world context. By utilising multiple data sources like interviews, observations, and questionnaires, a research can gain a nuanced understanding of not just the phenomena itself, but how it interacts with and is influenced by the contextual environment (Baxter and Jack, 2008). This contextualised comprehension is critical for unpacking the root causes of the dynamics at play.

The intensive nature of case studies also allows a researcher to be attuned to unanticipated issues and tensions that may surface, providing an opportunity for fluid responses and elevating the research. This flexibility allows new insights to emerge from the data organically. While the findings may not be easily generalised, case studies are well-suited for exploratory research that can identify key variables (Eisenhardt, 1989).

3.3 The Drawbacks of a Case Study Approach

Whilst a case-study approach offers several valuable strengths, it also has some inherent limitations that warrant discussion. One such major drawback is a lack of generalisation of the findings beyond the case - meaning that the results of the study cannot be readily translated across environments beyond that of the particular case investigated. This is because the case study approach focuses on such a specific example, making it hard to extend the results to broader populations or circumstances (Yin, 2018). There are also concerns regarding subjectivity and researcher bias unintentionally influencing the analysis and findings of the study. With the researcher being the primary instrument of data collection and analysis, it can be difficult to ensure full objectivity throughout the study (Shepard, 1991).

In addition, case studies are often criticised as being too narrow and subjective compared to other empirical methods (Gerring and McDermott, 2007). The sheer volume of data generated through multiple sources can make data management and robust analysis time-consuming and laborious for the principal researcher. The study also runs the risk of becoming too narratively descriptive rather than explanatory (Zainal, 2017).

3.4 Context of a Case Study Approach

Given the exploratory nature of this study and the aim to gain deep insights into pupil engagement within a specific real-world classroom context, a case study approach was deemed the most appropriate methodology. As Yin

(2014) highlighted, case studies are particularly valuable when the research addresses a descriptive or explanatory question about a contemporary set of events over which the investigator has little or no control. In this instance, a case study enables an in-depth examination of the complex social phenomena of pupil engagement as it naturally unfolds within the authentic setting of the science classroom.

4. Research Methods

4.1 Qualitative Methods

To comprehensively investigate pupil engagement and understanding in science lessons, a series of qualitative methods were employed to gather data through observational techniques and focus groups. Qualitative approaches allow researchers to explore phenomena deeply without drastic efforts to facilitate context (Creswell and Poth, 2018).

The decision to utilise observational data throughout this study was heavily influenced by the unreliability of children's innate self-perception. In addition, observational data can provide valuable insights into children's actual experiences and behaviours that they may not be able to articulate themselves fully. Whereas the open-ended focus group discussions complemented this by eliciting the pupils' own voices and perspectives regarding their experience. Focus groups are an effective method of exploring children's subjective meaning-making around their experiences, allowing them to express themselves freely compared to more constraining quantitative scales (Heary and Hennessy, 2006). Employing multiple qualitative techniques in this manner allows for data triangulation, enhancing the credibility of the results through cross-verifying findings from different data sources (Patton, 1999).

Qualitative approaches are not without disadvantages. They are labour-intensive, requiring extensive time for data collection and analysis (Creswell & Poth, 2018). Additionally, qualitative findings are contextually grounded, limiting generalisability, a problem already perpetuated through using a case study approach (Shenton, 2004). Nonetheless, this qualitative design was well-suited to provide an in-depth, contextualised exploration of pupil engagement within the authentic classroom setting.

4.2 Quantitative Methods

To further bolster the qualitative data, quantitative methods were employed to systematically measure self-perceived levels of engagement and

understanding across the science lessons. More specifically, a pre-and post-intervention questionnaire was administered that included an array of statements using the Likert scale - ranging from strongly disagree to agree strongly. Each value was assigned a corresponding value to obtain a class average response. The statements used an alternating innate bias to encourage in-depth thinking before responding (Jebb, Ng and Tay, 2021).

4.3 Observation Forms

Conducting systematic classroom observations at regular intervals was a critical component of data collection, capturing real-time behavioural engagement as lessons unfolded. This process of using slices of time rather than constant recording is known as momentary time sampling - it is a less intensive technique used to record approximate changes in behaviour over time (Harrop and Daniels, 1986). This study utilised this technique in order to cut down on the already extensive demands of data collection.

The observations-based approach is in line with the literature methods discussed. Firstly, observations eliminate the response bias that may be inherent to any line of question the pupils would be subjected to, and it provides an opportunity to verify the somewhat unreliable self-perceived responses provided. Secondly, it provides an excellent timeline to observe how engagement may wax and wane throughout the lesson, providing a quantifiable timeframe for observed phenomena. Examining engagement in this granular, time-sensitive manner can also shed light on which aspect of the lesson components resonated with the children to foster a higher level of engagement and how long these bursts of engagement last.

Additionally, a whole-class observation provided a more comprehensive view than random sampling with just a few local students, which could be overly idiosyncratic. However, this approach did require strategic techniques like classroom scanning and a high level of attentiveness compared to other methods. Furthermore, this method is limited by observer biases, where the observers' definition of on-task behaviour may be more or less lax than that of other individuals (Hrobjartsson et al., 2012). This is especially true for this study, where the observer is also the class teacher. To mitigate these concerns, the researcher relied on clear behavioural definitions, as outlined in the literature review, closely related to signs of engagement.

4.4 Focus Groups

The study utilised a subset of randomly selected pupils to obtain an extensive qualitative data set detailing the pupils' nuanced experiences

regarding the study. The focus groups allowed for a more in-depth view into the pupil's perspective on engagement within science, using probing questions to explore factors impacting engagement. This method was most concerning as a child's level of accuracy has already been questioned. However, the language used throughout the line of question was specifically designed to be accessible for young children and elicit depth without becoming taxing.

4.5 Pre-and Post-intervention Questionnaires

A key aspect of the quantitative data collection was administering the same questionnaires using the Likert scale before and after the intervention. Pre/post interventions are critical in examining changes resulting directly from an intervention (Scholin and Burns, 2012). The repeated measures design enabled the analysis of how pupils' self-reported engagement and understanding shifted over the course of the intervention implementation. The Likert scale in particular was selected for this study as it was shown to be accessible to children when addressing simple, tangible concepts such as their opinions and feelings towards a subject (Mellor and Moore, 2013). Careful scale construction with clear, age-appropriate wording and avoiding double-barreled items enhanced comprehension.

To reduce the potential for acquiescence and extremity biases, the scales implemented used an alternating blend of positively and negatively worded statements (Zeng, Wen, and Zhang, 2020). Negatively worded statements such as "the science lessons are boring/dull" helped counterbalance any tendencies to agree with all statements, forcing the pupil to think carefully about their answer. Using a 5-point scale also avoided the dichotomous yes/no response formats that can lend very little in terms of details. Steps were also taken to remove any social pressures leading to inaccurate answers by having the pupils submit their responses anonymously and separately from their peers. Furthermore, pupils were encouraged to answer honestly through reassurance that the study would not impact their academic standing. These implementations are in line with standard research practices for reducing social desirability biases (Nederhof, 1985).

5. Data Presentation and Analysis Methods

5.1 Qualitative Data Presentation

For the qualitative data obtained via focus group responses, a thematic analysis approach based on the principles outlined by Braun and Clarke (2006) was employed. This was done by using an iterative coding process to

identify semantic and latent themes within the data. The resultant themes and supporting quotes were compiled to vividly illustrate participants' perspectives and experiences in their own language. The same process of analysis was used to assess the recordings throughout the observations - coding and categorising events into specific themes. Both data sets were then cross-referenced to improve the validity of both.

5.2 Quantitative Data Presentation

For quantitative data from the Likert-style questionnaires, mean scores and response frequencies were calculated and displayed visually via bar graphs and tables, aligned with best practices for quantitative data presentation (Albers, 2017). Changes in engagement and understanding levels pre-to-post intervention were assessed using appropriate statistical tests based on data distributions. These quantitative results complemented and triangulated with the qualitative findings to provide a comprehensive picture grounded in multiple data sources, as Fetters et al. (2013) advocated in their mixed methods framework. Converging statistics and narrative themes mutually reinforced interpretations.

6. Being Ethical

6.1 School Setting and Power Dynamics

This study unavoidably involved working with young children in a school setting, which raised several ethical implications that had to be considered. As Etherington (2007) discussed, researchers must be aware and reactive to power dynamics and positionality when researching vulnerable populations, such as young children. In this case, the principal researcher being in the position of classroom teacher inherently created a power differential that could not be ignored. In order to mitigate the inherent effect this may have on the study, the subjects involved were made aware of the study taking place and informed that inclusion was entirely voluntary and that their involvement would have no bearing on their academic standing or treatment.

6.2 Data Protection

Protecting the participants' privacy and confidentiality throughout the study is paramount. As stated within the ethics form (see appendix), the procedures for preserving anonymity were outlined as follows: Each participant will be assigned a placeholder name, and all written recordings will be kept anonymous. All other identifying details were also removed to prevent any identities from being uncovered through investigation. These

safeguards aligned with guidelines from the British Educational Research Association (2018) on anonymising participants.

6.3 Young People

Finally, given the participant's status as a minor, securing parental/guardian consent and pupil assent was necessary. As stated in the ethics form, consent was secured by sending home information packets that clearly explained the study's aims, activities, risks, benefits, and data handling procedures. This information packet was carefully constructed to ensure it was written in accessible readily accessible language. This multilayered consent process followed research-backed standard practices on remaining ethical throughout practices involving children (Dockett, Einarsdottir and Perry, 2009).

7. Results

7.1 Pre-and post-intervention questionnaire

Statement number:	Statement:	Pre-intervention Response frequency:					
		1	2	3	4	5	Mean score:
1	I am excited to go to science class...	3	9	7	5	2	2.77
2	Science lessons are boring and dull...	1	4	6	10	5	3.54
3	I pay close attention during science lessons...	3	4	11	6	2	3.00
4	I find the science topics we learn about interesting...	5	2	8	6	5	3.15
5	I don't like having to participate in science activities...	3	4	7	6	6	3.31
6	I understand the key concepts taught in the science classroom...	5	9	7	4	1	2.50
7	The science content is too difficult for me to follow...	3	8	7	7	1	2.81
8	The examples used in class help me understand the concepts better...	3	4	9	7	3	3.12

Figure 1: A table of responses to the post-intervention Likert-scale survey.

Statement number:	Statement:	Pre-intervention Response frequency:					
		1	2	3	4	5	Mean score:
1	I am excited to go to science class...	4	7	10	2	3	2.73
2	Science lessons are boring and dull...	2	3	7	11	3	3.38
3	I pay close attention during science lessons...	2	5	10	6	3	3.12
4	I find the science topics we learn about interesting...	3	3	7	8	5	3.35
5	I don't like having to participate in science activities...	2	6	8	4	6	3.23
6	I understand the key concepts taught in the science classroom...	3	10	9	3	1	2.58
7	The science content is too difficult for me to follow...	3	6	9	7	1	2.88
8	The examples used in class help me understand the concepts better...	3	2	8	10	3	3.31

Figure 2: A table of responses to the pre-intervention Likert-scale survey.

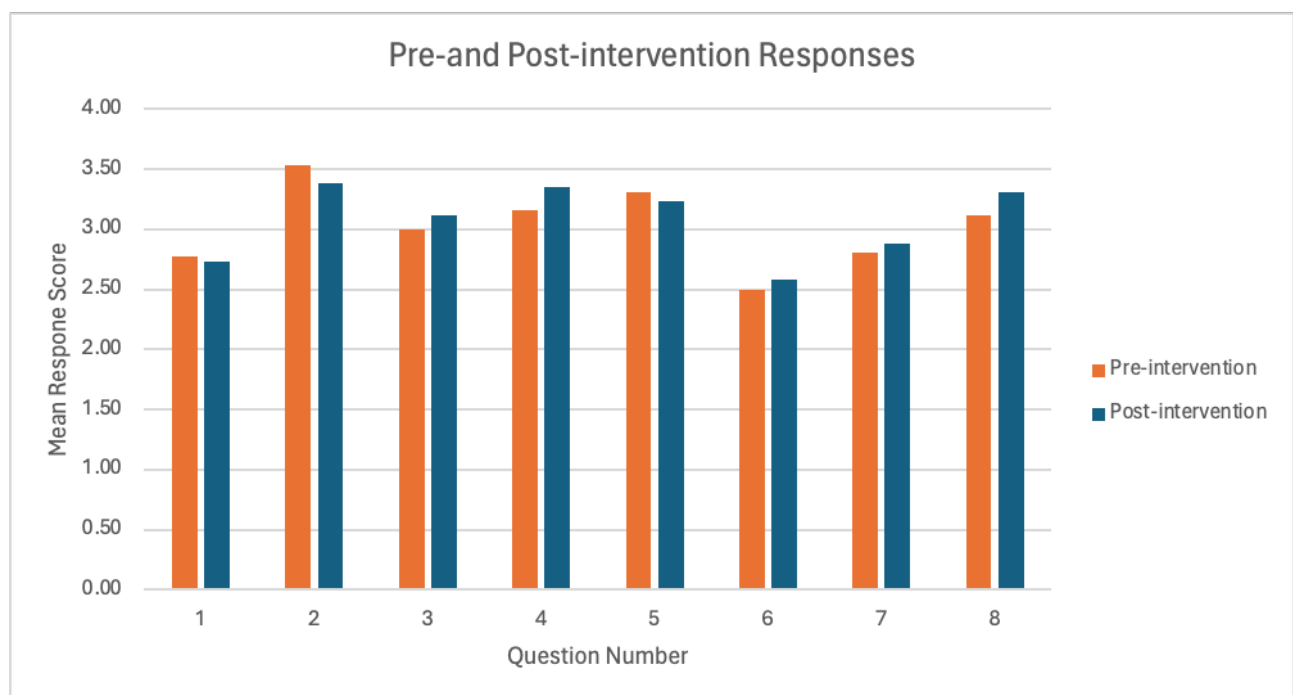


Figure 3: A bar graph to show the difference in results from the pre-and post-intervention questionnaires.

As seen in Figures 1 and 2, there was only a slight change in results post-intervention, with only statements 4 and 8 eliciting a change greater than 5%. Following common statistical practices, all results with a change less than 5% were ignored, as the change was not considered significant enough to be accredited to the intervention (Di Leo and Sardanelli, 2020). Statements 4 and 8, were both deemed significant enough to warrant further discussion. Statement 4, “I find the science topics we learn about interesting”, went from a mean score of 3.15 to 3.25 (a 6.10% increase). This positive increase highlights that pupils’ self-perceived interest levels had risen by the end of the intervention. This statement alone, however, is insufficient to signify that the intervention was a success as life processes were a new topic for them, making it impossible to distinguish whether or not this topic resonated with them or whether or not the intervention was a success. Statement 8 on the other hand, “The examples used in the class help me understand the concepts better”, went from a mean score of 3.12 to 3.31 (a 6.17% increase). This statement is far more reflective of the pupils’ self-perceived level of engagement and understanding in that they clearly felt more confident in their own abilities. Again, this statement alone does not reflect whether the intervention was a success, as pupils did not undergo any form of summative assessment, making it difficult to quantify whether they truly understood the concepts presented to them.

7.2 Classroom Observations

The results of the classroom observations can be split into six independent themes:

1. Novelty and curiosity (0 - 10 minutes) - at the start of the lessons, pupils appeared engaged, eager and ready to learn despite being high energy as the new topic of MRS GREN was introduced.
2. Distractability and fatigue (10 - 20 minutes) - as the teacher explained each component in more depth using multimedia and visual simulations, class focus began to deviate, with some pupils beginning to fidget.
3. Practical application (20 - 30 minutes) - as the teacher directed the pupils onto their main task of identifying living organisms and definitions of key terms using online interactive learning tools, engagement levels began to pick up, with several on-task classroom discussions heard. Some pupils began to disengage from the task

assigned due to not understanding what to do and the long loading times on their laptops.

4. Interest wanes (30 - 40 minutes) - Nearing the end of the lesson dedicated to this topic, pupils once again show signs of restlessness and fatigue. More side conversations and off-task behaviours like playing with stationery are observed as pupils' interest starts to dip. The teacher has to redirect pupils' attention repeatedly.
5. Resurgence through discussion (40 - 50 minutes) - After an independent practice segment with, the teacher transitions to a full class discussion reviewing the MRS GREN examples. This sparks a resurgence in pupil participation and attentiveness. Many pupils raise their hands, comment, and actively listen to peers' contributions.
6. Anticipation of transition (50 - 60 minutes) - In the final 10 minutes, pupils begin exhibiting restless behaviours again as they anticipate the transition to their next class. There is more fidgeting and off-task conversations

The implementation of multimedia resources, interactive online activities and simulations encompasses the themes of: distractability and fatigue, practical application and interest wanes. These observations demonstrate how engagement waxes and wanes throughout a lesson. The results somewhat suggest that the use of multimedia resources and simulations causes a dip in engagement, whilst the use of interactive online tools causes a peak. This is in concordance with the literature findings for interactivity - in that these approaches can raise engagement and make abstract concepts more accessible. However, a concrete conclusion between engagement cannot be drawn during the theme "distractability and fatigue", as no comparison can be made between a base level, meaning that it is impossible to tell whether or not these observations were a significant improvement or deterioration in their engagement levels. By cross referencing these observations with the pupils self-perceived engagement and understanding seen above, it can be inferred that these levels of engagement were higher than normal. However, further investigation into their base levels would be required to say with certainty.

7.3 Focus Group Statements

The focus group discussion focused on answering four simple questions, designed to extract pupil perception towards science. The first question

explored pupils' general interest in science, with most pupils admitting that they struggle with science because they find it "hard". The second question explored aspects of science they enjoyed throughout the week, with most agreeing that the hands-on computer activity and classroom discussions were the most enjoyable. The third question explored barriers to participation and challenged pupils to think about why they sometimes don't want to participate in science - the results from this question were mixed. Some pupils admitted that they were "scared" to get a question wrong or say something "stupid", whilst others confessed that they often felt like they "didn't get it", meaning that they were unsure of what they should be doing or what was expected of them. Lastly, question four investigated how pupils felt during hands-on practical activities. Many pupils agreed that this was often the most fun part of science. Upon further probing, a lot of pupils found this part to be most engaging as they weren't "just writing things down". Overall, the focus group results are supported by the literature in that pupils react well to hands-on learning and feel they can engage well with tasks of this manner. The results also support the observations seen by the researcher and the increase in statement 8 of the post-intervention questionnaire.

8. Conclusions

Overall, the focus group results are supported by the literature in that pupils react well to hands-on learning and feel they can engage well with tasks in this manner. The results also support the observations seen by the researcher and the increase in statement 8 of the post-intervention questionnaire. However, it is difficult to draw a confident conclusion from all the data sets as there is insufficient prior understanding and a lack of results from a wider pool of subjects. This makes it very difficult to generalise the results to examples outside of the case study.

9. Recommendations

For future studies, it is recommended that the study examine a wider array of classrooms under the same circumstances to determine better whether the results observed are consistent instead of circumstantial. It is also recommended that the study be continued over a longer time frame so that the conclusions drawn from the data sets can be confidently accredited to the intervention strategies used and not the changing circumstances like pupils, content covered and out-of-school influences. Regarding methodology, the pre-and post-intervention questionnaires were an excellent

tool for readily viewing pupil perception, whereas the observations provided little more than context to the lesson. In future research, it is recommended that the observations be handled by multiple someones other than the primary teacher to provide a more nuanced understanding and further reduce biases.

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11. Appendices

See separate attached document.