

Science Teacher Perceptions of the Barriers to Implementing Dialogic Teaching: A Qualitative Case Study

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ABSTRACT

Dialogic teaching (DT) has been shown to improve student performance and increase interest in science. Despite these reported advantages, DT is not widely adopted. This research aims to determine whether science teachers perceive there to be barriers to the implementation of DT and to determine the nature of these barriers. This case study was conducted with a cohort of science teachers in a United Kingdom secondary school. Inductive content analysis was used to interpret data from a questionnaire, interviews, and a focus group. Results show that science teachers do believe there are barriers to implementing DT. The most commonly reported perceived barrier was the confidence and anxiety of students. This has not been described previously and may be one of the many negative outcomes of the COVID-19 pandemic. Whilst science teachers believed that most barriers could be overcome, there were few suggestions on how to overcome the barrier of student confidence and anxiety. This study also found that whilst science teachers were positive about DT, their understanding of the term is not fully developed. This could lead to incorrect implementation. The findings indicate a need to provide high-quality training programs to improve understanding of DT and how to overcome the barriers identified.

KEY WORDS: Dialogic teaching, science education, talk pedagogy, teacher attitudes, teacher perceptions

INTRODUCTION

Dialogic teaching (DT) is one of a number of talk-based pedagogies that are becoming increasingly popular in United Kingdom (UK) schools. DT finds its roots in the work of Bakhtin (1981) and Vygotsky (1962), who both promoted the importance of dialogue over monologue for learning and development. The definitions of DT are varied within the literature, but for this research, it is defined as “a general pedagogical approach that capitalizes on the power of talk to foster students’ thinking, learning, and understanding” (Kim and Wilkinson, 2019).

The use of dialogic activities in the classroom is effective in promoting student progress (Alexander, 2018), and students who talk more perform better in tests (Sedova et al., 2019). Howe (2023) suggests a relationship between reasoned dialogue and learning gains. Furthermore, the benefits of DT have been reported in science education specifically, having a significant positive effect on student attitudes toward physics (Belay et al., 2022) and increasing student interest in science (Juuti et al., 2020). Overall, DT is a pedagogy that has the potential to improve outcomes for students.

Despite the reported advantages of DT, it is not widely adopted by teachers (Cui and Teo, 2021; Sedova et al., 2020) and is rarely observed in lessons (Vasalampi et al., 2021). Resnick et al. (2018) go as far as to say that DT is not happening at all. There is, therefore, a gap between the research and practice. The absence of an applied dialogic pedagogy in the classroom

suggests that there must be some “common barriers” to implementation (Sedova et al., 2020, p. 28), which need to be investigated.

Very little research has been conducted into teacher perceptions of barriers to DT in the context of secondary science education in the UK. Alharbi and Johnston-Wilder’s (2023) work on the perceptions of teachers toward DT involved a primary school in Saudi Arabia, with a significantly different education system and culture from the UK. Similarly, a significant body of research into DT and teacher perspectives has taken place in Czech schools (Sedova, 2017; 2021; Sedova et al., 2016), where age ranges for institutions differ, and much of the research took place in language arts lessons. Research in a UK secondary school fills a research gap, as there are currently 3,452 state-funded secondary schools in the UK (Department for Education, 2024); therefore, insights from the present research may have relevance to a large number of institutions.

Prior research into teacher attitudes toward DT has often only included preservice (trainee) teachers (Arslan and Whitehead, 2022; Groschner et al., 2019), results of which may not be fully transferable to experienced teachers. By conducting research with practicing teachers, the present study provides data for a group of teachers who are directly involved in implementing pedagogies.

Although limited research has been conducted into the perceived barriers toward DT, and much of what has been written has been confined to the discussion section of papers,

some barriers have been suggested in the literature. First, the concept of perceived time constraints of DT (Poole and Norton, 2023; Sedova et al., 2020; Yildirim and Uzun, 2021), where teachers do not feel able to utilize dialogic activities and still cover the full curriculum. Second, the mindset of teachers about students (Sedova et al., 2020; Snell and Lefstein, 2018), where teachers do not believe that some groups can access dialogic tasks. Finally, teacher knowledge and experience of DT can prevent implementation (Arslan and Whitehead, 2022; Groschner et al., 2019). This could be connected to confusion about the large number of terms for talk-based pedagogies, according to Kim and Wilkinson (2019) and Calcagni and Lago (2018).

In summary, DT is a promising pedagogy that is currently not implemented in schools. Little research has been conducted to establish why this is the case and what barriers prevent implementation, particularly in the context of UK science education. The present research aims to explore the attitudes of UK secondary science teachers toward DT by asking whether they perceive there to be barriers to its implementation, and the nature of these barriers.

The following research questions are addressed:

1. What do teachers believe are the barriers to implementing DT in science classrooms?
2. Do teachers believe that any of the barriers identified can be overcome?
3. What knowledge and understanding do science teachers have of DT?

METHODS

Context and Consent

A case study methodology was chosen as it offers deep insight and because the results are closely associated with the context (Yin, 2018), allowing a detailed observation of a specific situation (Robson, 2024). This case study was conducted between April and June 2024 in the science department of a state-funded UK secondary school (student ages 11–18). The school is non-selective. The department consisted of 16 members of teaching staff, spread across three science specialisms (56% biology, 25% chemistry, and 19% physics).

All participant teachers took part on a voluntary basis. Informed consent was collected from all participants, which included the right to withdraw up to the point of anonymization. No personal or identifiable information about the participants or school has been included in this article.

The case study included a questionnaire, individual interviews, and a focus group, which allowed triangulation of data.

Questionnaire Data Collection

Initial data collection was conducted via an anonymous online questionnaire using Google Forms. The questionnaire was piloted before use by two education professionals to check for clarity and functionality.

The questionnaire comprised six sections. The first section provided participants with information about the study, collected informed consent, and gave technical instructions. The second section contained two multiple-choice questions that collected data on subject specialism and years of teaching experience. In section three, participants were asked, “What do you understand the term ‘dialogic teaching’ means?” which had a free-text answer box. Section three also included four Likert scale questions for participants to rate their understanding of DT on a seven-point scale (from “strongly disagree” to “strongly agree”), for example, “I am confident in my understanding of the term ‘dialogic teaching.’”

In section four of the questionnaire, participants were defined as DT so that all participants were evaluating the same pedagogy. The provided definition of DT was “a general pedagogical approach that capitalizes on the power of talk to foster students’ thinking, learning, and understanding” (Kim and Wilkinson, 2019). This definition was chosen as a broad definition synthesized from a review of multiple authors (Kim and Wilkinson, 2019). Using this definition, participants were asked to use a seven-point Likert scale to rate their level of agreement (from “strongly disagree” to “strongly agree”) with statements about DT, for example, “Dialogic teaching improves student scores in science assessments.”

Sections 5 and 6 of the questionnaire asked participants to describe their attitudes to DT using a mix of multiple-choice and open-response questions. The questionnaire concluded with the open response question, “Do you consider there to be any barriers to DT in science? If so, please describe them here.”

There was an open invitation to respond to the questionnaire. 12 members of staff completed it (75% of the department). Questions were optional, and the response rate on individual questions varied between nine and 12 responses. The Cronbach’s alpha of the whole questionnaire was $\alpha = 0.68$.

Questionnaire Data Analysis

Data from Likert scale questions in the questionnaire were tabulated, and graphs were created to evaluate trends in agreement and the level of agreement. The definition of DT that each participant wrote was analyzed by comparison to Kim and Wilkinson’s (2019) definition of DT as “a general pedagogical approach that capitalizes on the power of talk to foster students’ thinking, learning, and understanding” (p. 72). This definition involves four key features: Talk, thinking, learning, and understanding. Using these features, participant definitions were assigned a score from zero (no response) to four (a response that included all four features of the definition). The results are shown in Table 1.

Interview and Focus Group Data Collection

Responses from the questionnaire informed the planning of a schedule for semi-structured interviews with individual teachers. Four interviews were conducted, each lasting up to 30 min. Because the questionnaire was conducted anonymously, all questions were planned so that they could be answered by

Table 1: A comparison of participant definitions of dialogic teaching to Kim and Wilkinson's (2019) definition

Participant	Reference to talk	Reference to thinking	Reference to learning	Reference to understanding	Score
A1	Y	N	N	N	1
A2	Y	N	N	N	1
A3	Y	N	N	Y	2
A4	Y	N	N	N	1
A5	Y	N	N	N	1
A6	Y	Y	N	N	2
A7	Y	N	N	N	1
A8	Y	N	Y	N	2
A9					No response
A10					No response
A11	Y	N	N	N	1
A12	Y	N	N	N	1
Count	10	1	1	1	

Y indicates that participant response included reference to that word or similar, N indicates no reference to that word, and blank indicates no response

a teacher who had not completed the questionnaire. Audio of all interviews was recorded and transcribed.

The interview schedule started with questioning about the participant's understanding of the definition of DT, and again provided Kim and Wilkinson's definition of DT for reference (2019). Participants were also asked if they could think of times when they had used DT. The middle section of the interview schedule asked participants to comment on results from the questionnaire, specifically that 100% of questionnaire respondents who answered the question said that "Dialogic teaching is an effective teaching strategy in all subjects, including science." The final part of the interview schedule asked participants about possible barriers to DT.

The interview sample was representative of the subject specialisms of staff within the science department; two interviews (50%) were conducted with biology specialists, one with a chemist (25%), and one with a physicist (25%). A range of teaching experience at the school was represented, from 1 to 22 years.

After initial coding of the individual interviews, a focus group was conducted with four participants who had not already taken part in individual interviews. Responses from the questionnaire and interviews informed the focus group schedule. In the opening activity for the focus group, participants were asked to discuss anonymized interview responses about the definition of DT. Later in the schedule, the group was provided with barriers to DT that interview participants had identified and were asked to rank the top three barriers from their perspective. The barriers are outlined in Table 2.

Interview and Questionnaire Data Analysis

Interview and focus group recordings were transcribed. The researcher then used NVivo 12 software to manually code in phases.

Analysis of the nature of barriers and of teacher understanding was conducted using inductive content analysis. The analysis used emergent codes and themes in four stages as described by Kleinheksel et al. (2020): Identifying the units of meaning,

Table 2: Common barriers to DT that were identified by interview participants, used as prompts for the focus group

Barrier to dialogic teaching to discuss

"Students talking off topic"
 "There isn't enough time due to content."
 "Lack of vocabulary"
 "If they both have the same misconception, then they reinforce it."
 "They can be very reluctant to speak"
 "Certain SEND [Special Educational Needs and Disabilities] students may find it difficult"
 "Disruptive behaviour"

labeling with codes, grouping like codes into categories, and describing the categories.

This research was done in stages, with the questionnaire taking place first. A small codebook was developed after the questionnaire phase, which identified simple labels of barriers and statements of teacher understanding. This coding was used to inform the writing of the individual interview schedules. After the individual interviews were conducted, a coding tree was built, adding sub-codes to the original codebook. This then informed the focus group schedule. After all data were collected, codes were reviewed and refined before final naming and defining of categories. Names of categories were descriptive statements rather than direct quotes, in order to reflect the range of participant responses.

Independent of the content analysis, a separate coding phase was conducted, restricted to identifying any statements from participants about whether they perceive there to be barriers to DT. As a binary question, it is reported separately from the content analysis as a count of each barrier.

RESULTS

Perceived Barriers

All survey respondents described at least one barrier to DT, and 72% of respondents identified two or more barriers

(one participant did not answer this question). All interview participants stated that there are barriers to DT and provided examples such as, “I would say your main one is behavior for the distraction” (Participant A). Participant B explicitly stated the challenge of DT as “I do think it’s something that’s really hard to do. I don’t think I’m very good at it, actually.” Similarly, all of the members of the focus group said that there are barriers to DT.

The focus group was given a list of barriers identified in the questionnaire and interviews and was asked to agree on a rank of the top three barriers. They selected the following barriers as the most significant, but did not assign a specific order:

- Students talking off-topic
- Disruptive behavior
- There isn’t enough time due to the content.

The number of references to different barriers described across all research instruments is displayed in Table 3.

Despite identifying barriers, teachers showed a positive attitude toward DT and a willingness to use DT (Table 4).

Content Analysis

The following categories emerged from content analysis of the questionnaire, interviews, and focus group:

- Category one: Student confidence and anxiety
- Category two: Student behaviors
- Category three: Understanding and misconceptions
- Category four: Vocabulary
- Category five: Timing
- Category six: The name and nature of DT.

The interconnections of these categories and their subcategories are shown in Figure 1, with each category from the content analysis and the associated subcategories.

Category One: Student Confidence and Anxiety

As shown in Figure 1, Category 1 includes the subcategories of anxiety and the reluctance to talk, and it does not include comments about teacher anxieties. Here, participants described a perception that some students did not like speaking in front of their peers. This first emerged in the questionnaire, where one response said, “Some students lack confidence to talk in front of class, so they can become disengaged with this approach.” Sometimes this was linked to mental health concerns, such as anxiety, as described by one participant:

“You can physically see them shrink into themselves. You can see their shoulders go up and their heads bob a bit down” (Participant D)

Teachers believed that students worried that talking would expose a lack of understanding. This was especially noted amongst A-Level students (ages 16–18 in the UK education system).

Category one: “Confidence and anxiety” was the category of barrier that teachers were least likely to offer suggestions about how to overcome it. One participant suggested engaging

Table 3: A count of the references to each barrier that was identified in the questionnaire, individual interviews, and focus group

Barrier	Number of times this barrier was described
Student confidence to speak	16
Behaviour	15
Engagement	14
Misconceptions	14
Vocabulary	13
Curriculum time	11
Time for planning	8
Special educational needs and disabilities	5
English as an additional language	3
Hard to assess	3
Needs experience	3
Topic dependent	1
Writing	1

Table 4: Example positive statements made by interview participants about dialogic teaching

Participant	Example positive statement about dialogic teaching
A	“This is probably my approach, the pedagogical approach that I use the most” “I would say it’s imperative to use talk in your lessons”
B	“I would say it’s a positive approach. I think it’s true that if a kid can verbalize their thinking, they’re more likely to be able to write it clearly”
C	“It’s definitely part of my practice. That’s something that I do all the time. So yeah, I think it’s valuable”
D	“I think it’s a brilliant tool”

these students in a more structured dialogue with the teacher themselves; another participant suggested providing example answers to less confident students. Other participants who identified confidence as a barrier did not suggest solutions. This category relates to Category Two, as teachers often described linked comments about student confidence and student behaviors, which is represented by the connecting line in the mind map in Figure 1.

Category Two: Student Behaviors

Category Two describes perceived reasons for a lack of engagement (other than confidence from Category One) and includes the two subcategories of behavior and engagement. Category Two does not include statements about teacher behaviors.

Some participants identified disruptive behavior as a barrier to DT, particularly with regard to individuals who might disrupt an activity for a whole group or class. Participant E said, “all it takes is one student to ruin a dialogue amongst the group.” A questionnaire respondent suggested that the lack of structure in a dialogic lesson might lead to disruption or even arguments. Teachers who identified this barrier felt that it could be overcome with careful planning of student seating or groupings.

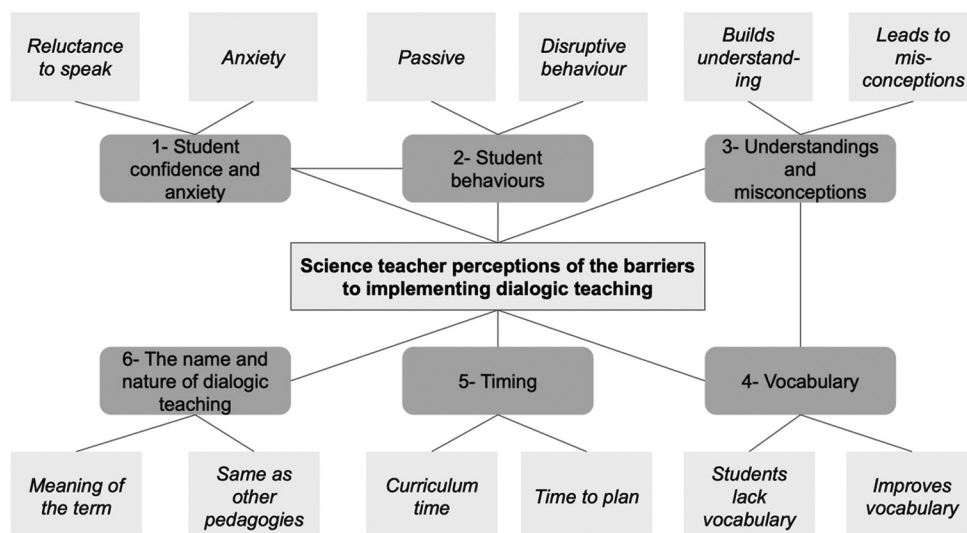


Figure 1: A mind map of categories that emerged from content analysis of the questionnaire, interviews, and focus group, showing interconnections between the categories

Most participants did not describe serious disruptions, but apathy or a lack of focus. The phrases “off-topic” or “off-task” were frequently repeated. Others described passive students, who did not engage in dialogue at all. One participant felt that passive students were more challenging to engage, as “forcing someone to actually have a discussion is very difficult” (Participant C).

Reasons suggested for the perceived lack of engagement in DT were the lack of structure in dialogic activities and an apathy toward school and science as a subject. Teachers suggested some methods for overcoming this barrier, including using the school behavior policy, careful grouping, and clear expectations.

Category Three: Understanding and Misconceptions

This category includes statements about the effect of DT on student understanding and misconceptions. It does not include any discussions from participants of their own understanding about DT.

The potential of DT for reinforcing misconceptions was described as a barrier 14 times. One questionnaire response said, “Some concepts would require too much dialogue between students and most likely reinforce misconceptions” (Anonymous). This barrier was further described in the interviews, where participants felt that two situations could occur in dialogic group work. First, that none of the members of the group knew the correct answer, and second, that one incorrect student might dominate the conversation.

Interview participants suggested that the barrier of misconceptions could be overcome by scaffolding discussions and by giving students feedback. Furthermore, the focus group discussed how misconceptions from unstructured dialogue could be mitigated by the teacher checking answers during discussions.

Despite concerns about misconceptions, participants frequently stated a belief that DT strengthens student understanding. 100% of questionnaire respondents agreed that “Dialogic teaching helps students to learn in science.” This was reinforced in the interviews, where Participant A stated, “I would say it’s imperative to use talk in your lessons umm, yeah to aid memory and understanding.” Teachers also believed that dialogue is beneficial for exposing and correcting misconceptions. As shown in Figure 1, Categories Three and Four are connected, as many teachers referred to the link between understanding of topics and understanding of vocabulary, or of the challenges of students’ understanding of dialogue, where they lacked sufficient vocabulary.

Category Four: Vocabulary

This category includes statements about how DT supports the learning of new vocabulary and discussions about whether students have the necessary vocabulary to access DT (shown as subcategories in Figure 1). This category does not include any statements about teacher vocabulary or terminology.

Some teachers perceived that DT has a positive impact on student vocabulary and spoke about how dialogue gives students the chance to apply and practice new vocabulary. Other participants identified vocabulary as a barrier (Table 3), where students may lack the necessary vocabulary to participate in dialogue. A questionnaire response identified a lack of confidence in the terms needed for the explanation of scientific phenomena. In the interviews, Participant B stated, “if they haven’t got the vocabulary or the ability to actually talk about it at the level you want them to, then it doesn’t work so well.”

Most teachers were confident that through the use of scaffolding, students would be able to use key vocabulary in dialogue correctly; “it comes down to scaffolding what kind of resources I’d provide them” (Participant A). Participants also

repeated the concept of student rehearsal of vocabulary and dialogic techniques as a way to overcome this barrier, linking the use of vocabulary to student understanding (Figure 1).

Category Five: Timing

This category includes discussions from participants relating to DT and time, and includes statements relating to time for planning, curriculum time, and time for training students. It does not include any statements about the time required for teachers to be trained in DT.

In the questionnaire, three Likert scale questions probed teacher attitudes toward time (Figure 2, all panels). All respondents agreed that dialogue is a valuable use of lesson time. More teachers disagreed than agreed with the statement that “Dialogic teaching requires lots of time.” Findings for the statement “If lesson time is limited, I use a lecture style of teaching” were mixed, with slightly more teachers agreeing than disagreeing.

In the individual interviews, participants identified curriculum time as a barrier to DT, describing a perception that there was insufficient time to teach the whole curriculum if they used DT strategies. Participant D stated that “there are times that it works really well and other times where there isn’t enough time due to content.” In the focus group, one participant explained that the large amount of content in the science curriculum didn’t allow time for DT if it was an “add-on” (Participant F); however, it was possible to cover the curriculum if DT was fully embedded into teaching.

Across all the research instruments, there were eight references to the perceived barrier of the planning time required for DT, for example, “you have to work hard to find the time to put it in place where it will be most effective” (Participant B). This planning time was frequently linked to other barriers, where teachers discussed the time needed to plan activities that would overcome a given barrier, such as behavior.

A few interview participants suggested ways to overcome the time constraints for planning; however, the focus group

suggested that every lesson would have small opportunities for dialogue that required no preparation. One focus group participant felt strongly that DT was not an effective use of time, stating, “there is a better use of our time to get them to actually know the stuff” (Participant E). Whilst other members of the focus group generally disagreed, they discussed the idea that DT wasn’t suitable for all teaching activities, for example practical work.

Category Six: The Name and Nature of DT

This category includes participant definitions of DT and descriptions of its features. The category was expanded during the interview phase to include comments from participants about how they would use different terminology for DT. This category does not include advantages or disadvantages of DT, which are not descriptive features.

In the interview, participants were asked, “What do you understand the term “dialogic teaching” means?” and responses were scored against Kim and Wilkinson’s (2019) definition. The results are shown in Table 1.

Table 1 shows that 100% of the respondents included talk in their definition (this included similar terms such as dialogue or chat). However, only 30% of respondents included more than one word from the definition, and no respondents included more than two of the features in their definition. Teachers were not familiar with Kim and Wilkinson’s (2019) definition of DT.

Participants were not confident in their understanding of the term DT (Figure 3), with more teachers choosing disagree rankings (42%) than agree rankings (25%).

In the interviews and focus group, teachers expressed an attitude that DT was not a unique term, but an alternative name for an existing pedagogy. This was summarized by one participant who said, “I think (DT) is probably a very common thing, but not labeled as such” (Participant G).

In all the research instruments, participants were asked if they believed that oracy and DT mean the same thing. In

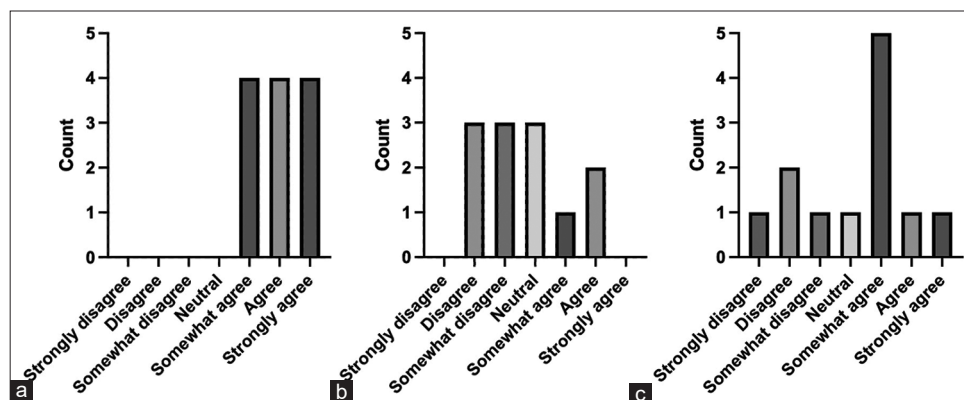


Figure 2: Questionnaire responses to Likert statements relating to time and dialogic teaching. Questionnaire responses to Likert statements relating to time and dialogic teaching and time. (a) Count of responses versus the level of agreement to the statement “Dialogue is a valuable use of lesson time in science lessons.” (b) Count of responses versus the level of agreement to the statement “Dialogic teaching requires lots of time.” (c) Count of responses versus the level of agreement to the statement “If lesson time is limited, I use a lecture style of teaching”

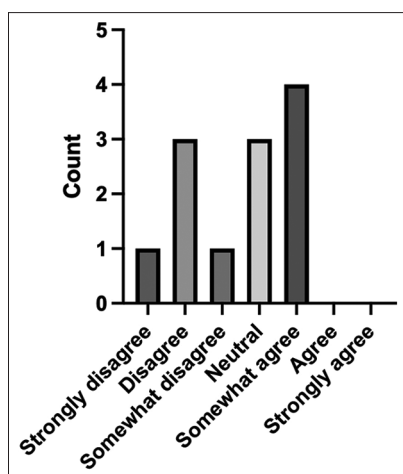


Figure 3: Count of questionnaire responses versus the level of agreement to the statement “I am confident in my understanding of the term ‘dialogic teaching’”

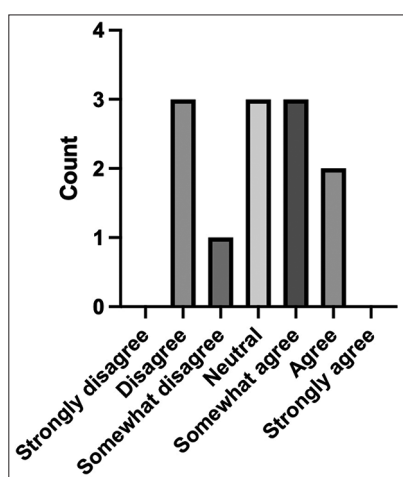


Figure 4: Count of responses versus the level of agreement to the statement ““Dialogic teaching” and “oracy” mean the same thing”

the questionnaire, five out of 12 respondents agreed that the terms had the same meaning (Figure 4). In the focus group, Participant E said, “At my previous school, we were focusing on oracy, which I think is the same as dialogic teaching.”

DISCUSSION

Research Question One: What do Teachers Believe are the Barriers to Implementing DT in Science Classrooms?

The primary finding of this research is that secondary school science teachers perceive there to be barriers to DT. The most commonly cited barriers were student confidence to speak, behavior, misconceptions, and engagement. Student confidence and behaviors emerged as barriers, as did concerns that students lack necessary vocabulary and that DT leads to misconceptions. This is consistent with the findings of Sedova et al. (2020), who posited that there must be some barriers preventing the use of DT. A perception amongst teachers that barriers exist could mean that they are less likely to use DT and may revert to a

lecture style of teaching (Figure 2, panel C), which supports the findings of Barak (2024).

A teacher belief that barriers to DT do exist could explain why it has not been widely adopted, as reported by Cui and Teo (2021), and is rarely seen in the classroom (Vasalampi et al., 2021). As Participant B expressed, “it’s something that’s really hard to do,” and where a teacher finds a pedagogy challenging, they are less likely to use it. Significantly, where DT is not being implemented, students will not experience the benefits of improved test performance (Sedova et al., 2019) and improved attitudes (Howe et al., 2019).

High-quality, intensive training on how to use DT may be the solution to the challenge of these barriers, as found by Arslan and Whitehead (2022). Developing teachers’ experience of DT and their knowledge of effective strategies could change their perceptions of these barriers and lead to greater adoption of the pedagogy.

The primary barrier identified in the present research was described in the category of confidence and anxiety, which was closely related to engagement. This has not been reported as a barrier to DT in the literature. This could be explained by the relationship between social anxiety and student challenges in communicating with teachers (Archbell and Coplan, 2022), as if students find communication difficult, dialogic activities will be highly challenging. A further explanation for this could be the increased levels of anxiety caused by disruptions to education during the COVID-19 pandemic (Ding et al., 2022). However, the full effect of these disruptions has yet to be fully explored in the literature.

It should be noted that the present study explored teachers’ perceptions of barriers, which might not be reflective of student experiences, so further research is needed with students themselves. Nonetheless, the perception of a barrier is still likely to prevent a teacher from attempting pedagogy.

Leaders of science departments will need to consider the context-specific issues around building the confidence of students, reducing their anxieties and increasing engagement. A holistic approach could be used, where leaders work across the curriculum to find common approaches to DT so students are well-rehearsed and therefore more confident when speaking in lessons. There should also be collaboration with pastoral care workers within the school to find specific approaches that support individual students.

Finally, when the barriers identified by teachers are considered together, a picture emerges that there is only a very small group of students for whom teachers believe DT will be unimpeded by barriers. Students who are confident, well-behaved, engaged, and who have a large vocabulary are likely to be more exposed to DT, as teachers do not perceive barriers with these groups. These academically strong students will then benefit from DT where others might not, increasing the divide between these students and those who are less advantaged. This highlights the need for increased training for staff on overcoming these barriers, so that all students can equally share in DT’s benefits.

Research Question Two: Do Teachers Believe that any of the Barriers Identified Can be Overcome?

Teachers believed many of the barriers identified toward DT could be overcome. Teachers also had an overall positive attitude toward DT and, as a result, there was a general willingness to implement it. This supports Poole and Norton's (2023) finding that teachers made more positive statements about DT than negative ones. These attitudes could be a result of teachers' recollections of their own positive experiences of DT at school, as described by Groschner et al. (2019), or their own experience of successfully implementing talk pedagogies in the past. A positive attitude also emerged in the interrelated categories of understanding and vocabulary, where teachers described how DT can improve both vocabulary and understanding.

This positivity and willingness to use DT indicates that teachers are interested in finding strategies to overcome the barriers to DT. As a consequence, teachers would be receptive to a DT training program that furthers their understanding and provides solutions to barriers. A training program, both for practicing teachers and those in initial teacher training, is likely to have a large impact as teachers are motivated to use DT.

A further reason for the need for a training program is the variability amongst the suggestions for how to overcome barriers. This indicates that teachers either do not agree on strategies for overcoming barriers or do not know the strategies that will be most effective. There is therefore an urgent need for such training to provide the tools that teachers need for implementing DT.

Research Question Three: What Knowledge and Understanding do Science Teachers have of DT?

This study found that teachers do not have a clear understanding of the definition or nature of DT, and how it differs from other talk-based pedagogies. This category was present in both the definitions that teachers gave and their descriptions of what DT involved. This is consistent with the work of Kim and Wilkinson (2019), who described how the multitude of definitions within the literature has confused educators.

Some of the well-established definitions may be unclear or too broad. Alexander's (2018) definition of DT as "a pedagogy of the spoken word" (p. 2) may be insufficient for teachers to understand that not all classroom talking is DT. This could lead to a misapplication in the classroom, where teachers believe monologic or didactic talk to be an implementation of DT, which would mean students do not gain the benefits of DT. If a lack of coherence in the definition of DT persists, it is likely that teachers will still struggle to use it.

Teachers in the present study conflated DT with other talk-based pedagogies, especially oracy. This reflects the findings of Mercer et al. (2019), who describe how these pedagogies, although related, are distinct. This finding may be due to a lack of clarity in initial teacher training, or the promotion of oracy as a pedagogy in the school where the research took place.

Both strategies are important, but they should be used for different purposes. Explicit training on the different definitions, applications, and challenges of each pedagogy is needed so that teachers can embed a range of talk-based strategies and students can benefit.

The finding that there is confusion about the name and nature of DT is highly significant for two reasons. First, it exposes the lack of training and experience that teachers have, further highlighting the need for a high-quality training program. Second, because teachers may not have a deep understanding of DT, their descriptions of DT and its barriers may not be fully developed. Teachers may have perceived barriers based on a limited experience of DT or based on the definition they were given as part of the research. Therefore, I suggest further research could be conducted where a cohort of teachers is trained in DT, and then asked how their perceptions have changed after the training.

Limitations

Whilst the case study methodology allowed the collection of in-depth attitudes and opinions (Yin, 2018), the findings are specific to the UK state school where the research was conducted and may not have direct applications to other cases (Thomas, 2011). However, this study gives education leaders in different countries and contexts an insight into how teachers perceive dialogue and how this might impact their lessons. It is also likely that the findings can be generalized to similar subject areas to science, for example mathematics and engineering, as they involve similar skills.

A further limitation was the short timescale of this research, which meant that it was not possible to record changes in attitude toward DT over an extended time. This could be explored in further research through a longitudinal study. In addition, because the online questionnaire tool was anonymous, it was not possible to ask specific follow-up questions to individuals in interviews. The benefit of the anonymity was significant, however, in promoting more honest responses.

CONCLUSION

This study found that science teachers do believe that there are barriers to implementing DT. The consequence of this is likely to be a continued lack of DT in UK science classrooms. The most commonly perceived barrier was the confidence and anxiety of students, which is significant as it has not been described previously and may be one of the many negative outcomes for students of the COVID-19 pandemic.

Science teachers were positive about DT and displayed high levels of willingness to implement it. School leaders should be made aware of this positivity and capitalize on it to deliver training on practical ways to overcome barriers. Whilst teachers did suggest ways to overcome barriers, there was a high degree of variability among the suggestions, which further highlights the need for training to provide the tools that teachers need for implementing DT. There were few suggestions on how

to overcome the barrier of student confidence and anxiety. If teachers do not feel equipped to overcome this lack of confidence, it will likely lead to fewer opportunities for students to practice, and their anxieties will continue.

The results of this study show that whilst science teachers are positive about DT, the knowledge and understanding they have is not fully developed. This is likely to further impede implementation as teachers are likely to confuse DT with other talk-based pedagogies or implement it incorrectly so that students do not gain its full benefits for performance and mastery of the curriculum.

Findings from this study suggest the need for changes at three levels. First, at the departmental level, science department leaders need to consider how their teachers can overcome the barrier of student confidence and anxieties. This will differ in different contexts, but leaders should consider working in partnership with other departments and pastoral care staff to develop a holistic approach to building confidence. At a whole school level, school leaders must provide training for staff on the meaning and techniques of DT, which addresses the perceived barriers identified here. Because of the positive attitudes of teachers, this training is likely to have a large impact. Finally, at an academic level, it is vitally important that a consensus is reached on the definition and nature of DT, which puts an end to any confusion for educators who are working to improve the outcomes of students through dialogue.

Further Research

The present study has captured the perceptions of teachers. A study of student attitudes toward DT would complement this research to provide a more complete understanding of why DT is not seen in classrooms. Issues with anxiety in the wake of the COVID-19 pandemic make it particularly important to investigate the links between anxiety and DT. Further research could also be conducted into teacher-perceived barriers to DT across a whole school cohort, including multiple departments, so that attitudes from different specialisms could be compared.

In conclusion, science teachers believe that there are barriers toward implementing DT, chiefly the confidence and anxiety of students. Department and school leaders should work to develop training for teachers on how to overcome these barriers. Teachers do not have a developed understanding of DT; therefore, researchers need to work to create a widely accepted definition which will allow educators to implement DT for the benefit of all students.

DECLARATIONS

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This research received no funding.

Availability of Data and Materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Ethics

Ethical approval was granted by the Faculty of Education, University of Buckingham. Participants gave informed consent, with the right to withdraw up to the point of anonymization. Participants were anonymized; no identifiable information has been included regarding both the school and individuals.

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