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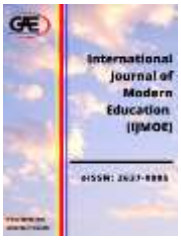

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DUAL LANGUAGE PROGRAMME IMPLEMENTATION IN MALAYSIA: SCIENCE TEACHERS ACROSS EXPERIENCE LEVELS

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Abstract:

The Dual Language Programme (DLP), which involves teaching Science and Mathematics in English, was introduced in Malaysia in 2016. The aim is to strengthen English proficiency while maintaining the status of Bahasa Malaysia as the national language. The program is optional, allowing approved schools autonomy in managing its implementation. Effective DLP implementation depends largely on classroom-level enactment by teachers. Despite increasing research interest, limited studies have examined how teachers' years of DLP teaching experience influence classroom practice. The study investigates how teachers' years of DLP teaching experience influence their perceptions of the reform, classroom practices, and challenges in implementation. Three Science teachers from a secondary school in Selangor participated in the study, with two, five and nine years of DLP teaching experience respectively. A qualitative research design was adopted, with data collected through semi-structured interviews. The findings revealed that experience, gained through repeated DLP instruction, had significant impact on teachers' perceptions, their classroom enactment and the way they viewed the challenges. Teachers expressed strong views regarding the value of DLP for their professional practice and English proficiency development. More experienced teachers perceived long-term language gains more strongly, while novice teachers were more cautious in their optimism. More experienced teachers demonstrated stronger confidence in the long-term benefits of DLP and adopted more systematic instructional scaffolding, while less experienced teachers relied more heavily on reactive strategies such as code-switching. Experience influenced instructional confidence but did not eliminate structural constraints.

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Persistent challenges included student language proficiency gaps and cognitive load. The findings suggest the need for differentiated professional development support based on career stage. These findings highlight the need for differentiated professional development and sustained institutional support to ensure effective long-term implementation of the DLP.

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Keyword:

Bilingual Education, Dual Language Programme, DLP, EMI, English-Medium Instruction, Language-In-Education Policy

Introduction

Malaysia has long positioned education reform as central to national development and global competitiveness. The aspiration to strengthen English proficiency while maintaining Bahasa Malaysia as the national language has been a recurring educational priority. One such reform is the introduction of Dual Language Programme (DLP) in 2016 by the Ministry of Education, following the discontinuation of Pengajaran dan Pembelajaran Sains dan Matematik dalam Bahasa Inggeris (PPSMI) (Suliman et al., 2020; Yunus & Sukri, 2017). The programme aims to enhance students' English proficiency without compromising content mastery in STEM subjects. Rather than the typical top-down mandated implementation, interested schools that meet the readiness criteria are granted with the autonomy and flexibility to coordinate the teaching of Science and Mathematics in English. These readiness criteria include school leadership support, teacher competency, parental consent, and student readiness (Kathirasen, 2022; Nurfaradilla et al., 2018).

Science education inherently involves technical terminology and global knowledge production, much of which is disseminated in English. Implementing Science in English has been argued to increase students' access to international scientific resources, improve preparedness for tertiary education and global careers, and strengthen academic English proficiency within disciplinary contexts (Abdullah & Nordin, 2023; Zulfakhar & Nasri, 2023). Language of instruction reforms, however, are complex. Studies have demonstrated that they are deeply intertwined with teachers' pedagogical beliefs, classroom interaction practices, students' language proficiency levels, and with the potential of affecting sociocultural and political sensitivities surrounding language in Malaysia (Moses & Malani, 2019; Othman et al., 2020; Yunus & Sukri, 2017).

In the DLP implementation, teachers undertake the role as central agents of policy implementation – they are policy interpreters rather than passive implementers (Bullah & Yunus, 2019; Masrom et al., 2021; Suliman et al., 2020). Studies have revealed that teachers'

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conceptions of DLP have direct influence on their instructional strategies, code switching practice, assessment approaches and student achievement (Juhari & Zakaria, 2024; Mat Hasan & Daud, 2022; Md Jaafar et al., 2024; Nurfaradilla et al., 2018). Additionally, differences in length of service and variations in teacher training background also shape teachers' classroom engagements particularly in relation to their comfort level with English-medium instruction, as well as the established pedagogical routines in contrast to their adaptive flexibility (Abdullah & Nordin, 2023; Idris et al., 2023).

Although the DLP has reached a decade of implementation, several gaps are noted in the literature. Existing studies on DLP largely focus on general perceptions of teachers and students, student achievement outcomes and English proficiency gains. Very few studies have measured teachers' classroom actions at micro level. Perception-focused studies inclined to examine teachers' insights on the program, however, studies exploring their perspectives from a comparative lens of seniority and years of service are scarce.

Given the abovementioned gaps, this study aims to fulfil the following objectives:

i. Examine the perceived benefits and drawbacks of the DLP as experienced by science teachers with different lengths of service.
ii. Investigate how science teachers of varying seniority implement DLP in classroom practice.
iii. Identify challenges faced in DLP implementation and explore how these challenges differ according to years of service.

The study is significant in providing an experience-based account of DLP from the perspective of science teachers. This study contributes to research on how language policies in education are implemented in real classroom settings, particularly in the context of the Dual Language Programme (DLP). It provides insight into how teachers interpret and carry out language-in-education reforms differently depending on their years of experience. The findings also contribute to understanding how science is taught in bilingual classrooms, where teachers must balance content accuracy and language demands. In addition, the study offers practical implications for teacher professional development with provision of training and support according to teachers' career stages.

Literature Review

The Dual Language Programme (DLP) was introduced in 2016 by the Malaysian Ministry of Education. Its main aim is to strengthen English language proficiency among Malaysian students, while upholding the status of Bahasa Malaysia. The programme is voluntary, schools are given the autonomy to decide whether or not to adopt the policy. However, specific readiness criteria must be met in order to qualify for its implementation. These include teacher capability, resource availability, students with satisfactory performance in Bahasa Malaysia and parental support (Bullah & Yunus, 2019; Nurfaradilla et al., 2018; Yunus & Sukri, 2017).

The DLP implementation can be better understood against the backdrop of the earlier PPSMI policy (2003-2012). A nationwide initiative, PPSMI involved the teaching and learning process of science and mathematics in English. The aim was similar: equipping Malaysian students with sufficient language mastery in response to global competitiveness demands. PPSMI however was later discontinued due to concerns pertaining to teacher readiness, student comprehension and sociopolitical resistance (Yunus & Sukri, 2017). A shift away from PPSMI,

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DLP adopts a voluntary and decentralised model. Schools are provided with freedom and flexibility in decision-making; hence, implementation vary according to local context, readiness and capacity (Nurfaradilla et al., 2018; Suliman et al., 2021; Yunus & Sukri, 2017).

Within the broader framework of bilingual education, DLP is viewed as additive where the acquisition of English is intended to complement rather than replace the first language (Bahasa Malaysia) (Mat Hasan & Daud, 2022). Within science education specifically, English-medium instruction is perceived critical as global academic discourse predominantly operate in English (Suliman et al., 2021; Zulfakhar & Nasri, 2023). Proficiency in the language is an added value for future tertiary studies and career advancement, particularly in a nation of non-native English speakers (Nurfaradilla et al., 2018). However, teaching in English requires teachers themselves to be proficient in the language. Given the additive nature of English within the DLP context, students must already acquire sufficient mastery in Bahasa Malaysia with adequate level of proficiency to understand and engage in English instruction. These pose unique pedagogical complexities and challenges. Teachers must skilfully mediate the conceptual understanding of scientific content with linguistic development (Othman et al, 2020; Suliman et al., 2020). Teachers' pedagogical competence, language proficiency, instructional strategies and contextual responsiveness to student needs must all be at play for effective DLP lessons (Abdullah & Nodin, 2023; Mat Hasan & Daud, 2022).

Perceived Benefits and Drawbacks

A substantial number of studies have reported teachers' favourable perceptions towards DLP. Teachers believe that it improves students' English proficiency and enhances student confidence in academic communication. DLP has also been found effective in promoting student access to global knowledge resources and preparing students for globalized higher education and employment (Idris et al., 2023; Yunus & Sukri, 2019). Urban teachers, in particular, demonstrate higher confidence in implementing DLP, with greater student readiness for English medium instruction (Bullah & Yunus, 2019). Despite the positive views, some teachers are pessimistic of DLP benefits. Teachers reveal that their students experience confusion with scientific terminologies, struggle to master complex science and mathematical concepts in English, and engagement in English language places students' conceptual understanding at risk (Abdullah & Nordin, 2023; Moses & Malani, 2019; Zulfakhar & Nasri, 2023). Teachers also complaint of longer instructional time with over-reliance on code-switching (Abdullah & Nordin, 2023; Bullah & Yunus, 2019; Moses & Malani, 2019).

Instructional Strategies and Practices in DLP Classrooms

The literature on DLP implementation in science classrooms has identified code-switching as the most common instructional strategy adopted. Teachers switch between English and Bahasa Malaysia to ensure students' understanding regardless of their level of proficiency (Bullah & Yunus, 2022; Othman et al., 2020). In addition to the use of Bahasa Malaysia to support instruction, visual aids and multimodal resources have also been utilised to support understanding (Idris et al., 2023; Moses & Malani, 2019). Other pedagogical strategies include simplifying the language without diluting content and the adoption of collaborative and student-centred approaches (Nurafaradilla et al. 2018; Yunus & Sukri, 2017). There are, however, inconsistency in the findings with teachers of higher language competence demonstrate less reliance on code-switching. Studies have also found that teachers with fewer years of experience demonstrate greater flexibility; while senior teachers rely on established

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pedagogical routines (Abdullah & Nordin, 2023). Many studies share teachers' language proficiency and confidence as central to effective DLP implementation.

Challenges in DLP Implementation

Literature has identified four clusters of challenges in DLP implementation: teacher-related challenges (Bullah & Yunus, 2018; Moses & Malani, 2019), student-related challenges (Masrom et al., 2021; Mat Hasan & Daud, 2022), resource-related challenges (Idris et al., 2024; Ma, 2023), as well as socio-cultural and parental factors (Kathirasen, 2022). Limited English proficiency and lack of training in bilingual pedagogy are major stumbling blocks for teachers. The use of English language has also diminished teachers' instructional confidence causing lessons to be ineffective (Othman et al., 2020). In addition, the reform causes fatigue as teachers are overwhelmed by the instructional changes (Abdullah & Nordin; 2023; Bullah & Yunus, 2018). Students' low English proficiency remains one of the most cited challenges to DLP implementation. In the initial phase of its implementation, students experienced difficulties to transition into English medium instruction (Moses & Malani, 2019; Yunus & Sukri, 2017).

Teachers have also reported low level of classroom engagement. Students have fewer questions and limited verbal engagement in comparison to the non DLP classrooms (Abdullah & Nordin, 2023). In relation to resources, teachers develop or adapt resources independently due to the lack of appropriately designed bilingual teaching materials that align with national curriculum standards. Although textbooks, workbooks and multimedia materials are sufficiently provided, additional resources particularly in the form of reference and activity books are not readily available (Ma, 2023; Othman et al., 2020). Socio-cultural and parental factors also affect DLP effectiveness. Parental expectations vary significantly. While some parents are strong advocates for the use of English as a medium of instruction, there are also parents who express concerns over the potential erosion of Bahasa Malaysia proficiency (Kathirasen, 2022).

Method

This study adopted a qualitative research approach, and it sought to explore the conceptions, instructional practices, and evaluative perspectives of science teachers in their DLP implementations. A qualitative approach was viewed appropriate given the research objectives targeting rich, descriptive and contextualised experience (Cresswell and Poth, 2016). Additionally, the study aimed to understand how policy was translated within classroom realities.

Through the employment of qualitative case study design, the study focused on one daily secondary school in Kota Damansara, Selangor. A case study design was selected because it allows for an in-depth investigation of teaching practices within a school (one bounded system), provides holistic understanding of complex educational phenomena, and captures contextual influences on policy implementation (Naess, 2018; Nascimento & Freitas, 2023).

Population and Participants

The population consisted of science teachers who are under the DLP in Kota Damansara secondary schools. The teachers should be active teachers under the DLP, engaged in English medium instruction, and involved in classroom-based evaluation of DLP effectiveness. Purposive sampling technique is utilized. The technique is a non-probability sampling method

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suitable for qualitative research (Palinkas et al., 2015). Participants in the study must be directly involved in DLP with variation in years of teaching experience. The use of purposive sampling strengthens the study's internal validity by ensuring that participants possess the specific expertise and experience required to address the research objectives (Benoot et al., 2016). Even though the sample size was relatively small (n=3), it was viewed appropriate for an in-depth qualitative case study due to the emphasis on depth of insights (Benoot et al., 2016; Alele & Malau-Aduli, 2023).

The sample consisted of three female secondary school science teachers specialising in Science Education (Chemistry). They vary in relation to years of experience in teaching under the DLP. This variation enabled for cross-case comparison and the identification of differences in instructional and evaluation strategies.

Data Collection Method

Data was collected through semi-structured interview, enabling probing questions, clarification of responses and exploration of emerging themes. Questions were open-ended to encourage participants to elaborate freely and provide detailed reflections. Interviews were conducted within the school compound with prior approval from the school administration. Each session was audio-recorded with informed consent and lasted approximately 30 to 40 minutes. The recordings were transcribed verbatim to ensure accuracy and preserve participants' original meanings. The study employed thematic analysis in the analysis of the interview transcripts.

Validity, Reliability and Trustworthiness

Several strategies were adopted in ensuring research quality and methodological rigour. In enhancing credibility, member checking was carried out involving participants reviewing the interview transcripts to verify accuracy. Additionally, the researchers keep clear documentation of the research procedures and interview protocol, coding and theme development were conducted systematically, and the audio-recordings serve as mechanism in ensuring accuracy of transcription.

Ethical Considerations

Ethical approval was obtained from the Faculty of Education's Ethics Committee prior to data collection with formal permission was sought from the school administration. Participants were provided with informed consent prior to participation and could withdraw at any time. Confidentiality was maintained through the use of pseudonyms, removal of identification details, and ensuring secure storage of audio files and transcripts.

Findings

The study aimed to answer three research questions: perceived benefits and drawbacks of DLP implementation; classroom practice; and challenges to effective DLP implementation. The analysis was framed by variation in teachers' years of DLP teaching experience. This sub-section begins with the demographic information of the research participants.

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Demographic Profile of Participants

The study was participated by three female teachers from a secondary school in Kota Damansara, Selangor. All of these teachers specialized in Chemistry and were teaching Science and Chemistry under DLP. Table 1 presents the demographic profile of the participants.

Table 1: Participants' Demographic Profile

Participant	Age	Years of teaching DLP	Gender	Major	Subject Taught (2025)
Teacher A	39	2 years	Female	Science Education (Chemistry)	Science & Chemistry
Teacher B	40	5 years	Female	Science Education (Chemistry)	Science & Chemistry
Teacher C	50	9 years	Female	Science Education (Chemistry)	Science & Chemistry

Perceived Benefits and Drawbacks of DLP Implementation

Three themes of perceived benefits were identified: improvement in students' English proficiency and confidence in using the language; academic and cognitive benefits in learning science; and professional benefits for teachers. On the other hand, two major themes of drawbacks emerged: language related barriers to conceptual understanding; and limitations of teaching and assessment materials.

Perceived Benefits

Enhancement of Students' English Proficiency and Confidence

All teachers agreed that DLP improves students' scientific vocabulary and English communication skills. The teachers noted students' improvement in their communication skills particularly in presentations and collaborative activities over a period of DLP implementation. Teachers also observed that sustained exposure to English during science lessons gradually increased students' confidence in speaking and responding in English. For example, Teacher A describes, "… *the students feel like they are smarter than the other classes because they speak and learn in English, so I think indirectly they feel more confident, more assured and the engagement in class is also more positive*…"

Though reluctant at first, students gradually became more comfortable to respond to verbal questions in English. According to Teacher C, "*Classroom engagement was not as responsive at first. Even for students with good English, they were shy to use the language. When asking questions in English, I knew that some students knew the answers, but they hesitated because they were afraid their language might come out wrong. But over time, I sensed that students are more confident. They understood that their responses do not have to be perfect – if they are able to communicate correct scientific concepts*."

More experienced teachers perceived long-term language gains more strongly, while novice teachers were more cautious in their optimism.

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Academic and Cognitive Benefits in Learning Science

Teachers perceived that learning science in English impacted positively on students' academic and cognitive capacity. The teachers viewed DLP enabled students to access a wider range of reference materials, including online resources and international content. Teacher C noted, "*I've noticed that as we progressed through the syllabus, students are able to produce wider range of resources to support their assignments and pre-prepared in class activities. Some of the materials are compelling, for examples scientific or STEM practice from institutions in other parts of the world…*". Teacher B produced similar statement, agreeing that English medium instruction improves students' proficiency in the language resulting in students' ability to have wider access to materials at international level.

Exposure to scientific terminology in English, too, was seen advantageous for future tertiary education and global competitiveness. Additionally, Teachers A and B believed that bilingual engagement with content encouraged deeper processing and conceptual flexibility.

Senior teachers were more likely to express the cognitive and academic advantages in broader developmental terms.

Professional Benefits for Teachers

All three teachers admitted that DLP inspired them to be more instructionally creative and resourceful. Teacher B expressed, "… *I've become more creative in finding the right way to stimulate their* (students') *higher-order thinking skills. There are plenty of resources in English that cultivate creative STEM teaching. I would not have looked for English materials have I not taught in the language myself*."

Resonating with Teacher B's view, Teacher C indicated, "…*throughout my teaching, I have to use creative and innovative methods so that students understand, grasp the concepts. I am more creative now… I feel the need to be more creative because I teach mostly forms 1 and 2. Teaching using English does help me approach my teaching a bit differently – there are lots of English activities that are fun. I emulate that but try to make chemistry or science as the major focus*."

Perceived Drawbacks

Language-related Barriers to Conceptual Understanding

The most dominant concern cited by the teachers was students' low English proficiency. Students experienced difficulty in engaging effectively in science instruction, understanding scientific concepts, and taking longer time to demonstrate learning that served as evidence in the attainment of learning outcomes. Teacher C explained that the transition to an English-medium instruction was the most challenging to students, especially those who attended full Bahasa Malaysia program in primary school.

The low level of English proficiency led to difficulty to grasp scientific terminologies particularly ones that are abstractive in nature. Teacher A described how her students would often misunderstand and misspell scientific terms. According to her, "…*for example,*

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transpiration and photosynthesis. Although they are two different things, students always misunderstand and spell the words incorrectly."

Students also lacked confidence in using the language and this, to a certain extent, limited their learning effectiveness. Question and answer session was not as lively as some students refused to speak; group discussions were dominated by the use of mother tongue when teachers were occupied with other groups; and students' demonstration of learning in activities such as presentations was limited as students did not communicate well the learning that they have acquired.

Limitations of Teaching and Assessment Materials

While DLP encouraged the teachers to be more creative in their pedagogical approaches, they felt that textbooks and multimedia materials would assist in higher quality instruction if they are more comprehensive and in-depth in relation to coverage and explanation. The teachers indicated that for some chapters the content was too brief, they also expressed disagreement with the suitability of some of the materials provided. These resorted to teachers having to often modify or supplement resources independently.

To Teacher C, her primary concern was looking for teaching materials that aligned with the Malaysian curriculum standards. This was supported by Teacher C who also faced similar issue. According to her, "*Whenever I search (online) for suitable teaching aids in English targeted for Chemistry or Science, I always ended up on UK or Australia sites. I need to make sure that the materials are aligned with the Malaysian standards. So, it does take time to edit and ensure that they are suitable for my students. It's really hard to find materials that I can use right away. So, in a way, my lesson planning time is slightly longer*."

The findings indicate that all three teachers perceived DLP as beneficial. The programme enhanced students' English proficiency, confidence in academic communication, and access to wider scientific resources. Teachers with longer DLP experience articulated the benefits in broader developmental terms: long-term academic growth, cognitive flexibility, and preparation for tertiary education and global competitiveness. Drawbacks were consistently associated with students' low English proficiency, confusion in scientific terminology, and the need for additional instructional time. More experienced teachers appeared to contextualise these challenges within transitional or systemic perspectives rather than viewing them as instructional instability. Overall, variation in years of DLP teaching experience influenced the depth and framing of teachers' perceptions. It also noted that increased experience influenced broader evaluative perspectives and with greater emphasis on long-term educational advantages.

DLP Implementation by Teachers of Different Lengths of Service

The findings revealed implementation practices that were organized into four major themes: use of instructional resources and visual aids in reducing language barriers; collaborative and student-centered learning approaches; classroom communication strategies; and language scaffolding practices.

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Use of Instructional Resources and Visual Scaffolding

All the three teachers used instructional resources and visual teaching aids in their DLP classrooms. PowerPoint slides, drawings, diagrams, videos and posters were some of the commonly adopted resources and aids, however their objectives of use differed between the teachers.

The findings revealed that teachers with more experience were more systematic in aligning the use of these tools with language objectives. The lessons of Teachers B and C, with five and nine years of DLP teaching experience respectively, were characterized by the use of simple sentences complemented with visual aids. Teacher B demonstrated stronger reliance on visual format of information presentation. She engaged in mind maps, i-think maps, flowcharts and comparison tables as means of transforming information. Students were required to convert textbook passages into visual formats rather than copying directly. Teacher A also indicated the common use of diagrams and tables however her descriptions of the practice were less structured in comparison to Teacher B. Teacher C admitted to utilizing more aids for lower secondary classes. These included diagrams, images and physical models. She would also show video demonstrations before commencing with laboratory experiments to familiarise students with procedures. In contrast, Teacher A's reliance on resources and teaching aids was with short term focus that directly linked to the enhancement of scientific concepts.

The findings revealed that teachers' reliance on visual scaffolding aligned with lesson objectives involving sequential steps and scientific processes as well as abstractive concepts requiring visual representation. Given the length of their experience, the teachers had anticipated topics entailing long and complex explanations in which the use of visual aids would be significant in guiding student understanding.

Across teachers, online resources were used when textbook explanations were insufficient; visual demonstration would ensure more accurate understanding; and additional practice questions were required (e.g. Quizziz and Kahoot).

In linking practice with years of DLP teaching experience, the study found that increasing experience influenced teachers' use of resources and visual aids. Teacher A was more reactive in her approach, with Teacher B adopting slightly more structure in her instructional design. Teacher C was found to be the most consistent in her use of instructional aids and resources in her practice.

Language Mediation Practices

All the three teachers conducted their DLP lessons primarily in English at varying degrees of bilingual mediation. English was predominantly used for scientific terminology, written instructions and assessment tasks. Teachers also paid deliberate attention, not only on the accuracy of conceptual understanding, but also to correct pronunciation and spelling of scientific terminology (e.g. respiration, photosynthesis, transpiration). The teachers described simplifying the language of instruction through the use of shorter sentences; break down textbook explanations; rephrase complex statements into more accessible English; and repeat instructions multiple times.

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Teachers A and B indicated that they often explained any concepts first in English and would switch to Bahasa Malaysia when students misunderstood or appeared confused. Cues such as facial expressions, incorrect responses and student silence served as indicators for teachers when determining students' misunderstanding or misconception. According to both teachers, switching occurred at the level of conceptual explanation rather than terminology, admitting the importance for the use of scientific terms to be retained in English.

Teacher C, on the other hand, maintained the use of English throughout her lessons. She believed that frequent switching could lead to student confusion. In her practice, code switching was limited to moments where students' misunderstanding or misconception were eminent. She preferred consistent use of English language unless clarification was necessary.

The findings showed that longer DLP experience corresponded with reduced reliance on code-switching. Years of experience appeared to influence the improvement in teachers' linguistic stability.

Laboratory and Demonstration-based Instruction

There were similarities and differences in the strategies employed for lessons involving laboratory and demonstration. General implementation across all three teachers included the use of questioning during experiments primarily in connecting practical outcomes with terminology; asking students to verbalised observations using scientific vocabulary; and in clarifying procedural vocabulary, for examples words such as measure, observe, record, stir, heat. The teachers also corrected students' use of terminology during practical explanation, and reinforced scientific spelling when students recorded their observations.

The teachers' strategies varied significantly in other aspects within these practical lessons. The findings revealed Teacher A's inclination towards the use of digital tools in her teaching. She showed YouTube demonstrations to visualise microscopic or internal processes and used video clips when physical experiments may not fully illustrate the intended process. Additionally, she utilized diagrams on board while explaining experiment outcomes, asked students to describe their observations in English; with discussion on experiment being used to strengthen vocabulary recall. The teacher also integrated demonstration discussion into follow-up questioning session.

Teacher B demonstrated stronger English language control. She maintained the use of the language throughout the activities; ensured that procedural explanation was clearly delivered; required students to answer experimental questions orally in English; and used short questioning sequences to probe student understanding during activity. Teacher B also monitored group activity while asking guiding questions and reinforced correct vocabulary and use of terminology during experiment discussion.

Teacher C, in contrast, employed experiential learning strategies particularly when teaching the lower secondary students (Form 1 and Form 2). She opted for frequent practical sessions instead of relying solely on theoretical explanation, preferred the use of physical models such as organ and structural models during lab sessions, and allowed student to independently manipulate apparatus. Students were also encouraged to observed directly rather than relying their understanding only on slides. She emphasised differentiation between similar terms

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during observation discussion and encouraged students to explain what they saw in English before summarizing the experiment.

The teachers believed that the reliance on these strategies during practical lessons had increased student engagement, reduced dependence on textbook explanation, reinforced scientific vocabulary, and strengthened retention of conceptual understanding.

Student-Centred Participation Practices

The teachers' lessons were also dominated by collaborative and student-centered learning activities. Group discussions and collaborative activities were mobilized mainly to encourage peer interaction in English, in addition to promoting verbal engagement and reduce language anxiety. According to the teachers, group setting helped in diminishing the sense of shyness in communicating in the target language. It was found, however, that the degree of implementation varied: Teacher A relied more on structured questioning while Teacher C facilitated more open-ended discussions in English. Teacher A, however, cautioned that group activities needed to be monitored closely as to ensure minimal use of Bahasa Malaysia.

Student participation and engagement were encouraged through structured oral activities. Common practices included group discussions and presentations in English; peer questioning following presentations; random questioning to ensure wide participation; and immediate correction of inaccurate terminology.

Further analysis revealed different approaches in scaffolding student use of English. Teacher A emphasised spontaneous speaking. Students were requested to carry out presentations without relying on full scripts, with spontaneous explanation encouraged. Teacher B, however, was more orientated towards short, structured discussions. Following a five-minute group task, for example, she would select individual students to respond. The short collaborative activity provided students with the opportunity to structure the group task. Teacher C admitted to using rewards such as compliment and encouraging words as reinforcement for desirable behaviours. According to her, the strategy was effective particularly with students at lower secondary level. She also made sure that selection of presenters was rotated to avoid selection of confident students. Even though Teacher C committed towards the use of full English, she allowed students to briefly discuss in Bahasa Malaysia to facilitate better understanding.

Overall, teachers' facilitation of activities evolved from one that placed directive control (Teacher A) to structured facilitation (Teacher B), and to more confidence facilitation of classroom activities (Teacher C).

Assessment and Monitoring Practices

Teachers' assessment practice in the DLP classrooms was framed by the classroom-based Assessment (or Pentaksiran Bilik Darjah-PBD) with a combination of formative and summative assessment tasks and strategies. In addition to summative assessments such as the continuous assessments, tests and examination; their lessons were more informed by formative assessment strategies. The teachers conducted oral questioning, group activities, presentations, workbook exercises and short quizzes in gathering evidence of learning. Classroom observations focused on student engagement, collaboration and classroom interaction.

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The findings revealed stronger emphasis on formative assessment strategies for Teachers A and B, with Teacher C asserted firmer emphasis on traditional assessment. Specifically, assessment focus shifted from activity-based formative assessment strategies (Teacher A) to monitoring (Teacher B), and to one with longitudinal performance tracking (Teacher C). Teachers A and B often alternated their classroom activities with online quizzes such as Quizziz and Kahoot for their formative assessment. Teacher C had stronger view on the importance of examination in measuring student performance and adopted a shared digital tracking system in maintaining systematic exam performance records.

All teachers were found to observe student performance trends and conducted comparative analysis between mid-year and final examination results in evaluating student growth and performance. The three teachers used students' examination performance as the main means of determining their DLP effectiveness.

The findings demonstrate that years of DLP teaching experience influenced the degree of structure, consistency, and stability in instructional implementation. These were particularly evident in language mediation, visual scaffolding, and classroom participation practices. The least experienced teacher adopted more reactive and adaptive strategies. Teacher A showed stronger reliance on code-switching and situational use of instructional aids to address immediate comprehension needs. The mid-range teacher, Teacher B, exhibited more structured instructional design. The most experienced teacher demonstrated greater linguistic stability, systematic integration of experiential learning. Teacher C also showcased more sustained emphasis on longitudinal assessment tracking.

Challenges to Effective DLP Implementation

Linguistic and Instructional Delivery Challenges

The teachers in the study admitted to experience difficulty to converse fully in English particularly in sustaining extended explanation of abstract scientific concepts. To them, English explanation was more taxing and required additional cognitive effort in comparison to Bahasa Malaysia. These served as a challenge as the teachers felt the pressure to monitor vocabulary precision and pronunciation while maintaining conceptual clarity.

Linguistic instability was most evident among the least experienced teacher. With experience, however, language delivery became more stable and deliberate. This was demonstrated in the teachers' code-switching practice, adopted as a compensatory strategy when students appeared confused. Repetition was frequent in Teacher A's instruction before reverting to Bahasa Malaysia to confirm understanding. She expressed concern about miscommunication if she used English fully. Teacher B appeared to strategically switch between English and Bahasa Malaysia especially involving aspects within lessons requiring her to relate examples to daily life, or when students showed confusion. She, however, maintained full use of English for terminology. Teacher C indicated that she experienced lack of confidence to converse fully in English during the early years of her DLP instruction. Her current practice, however, was dominated by full use of the language and only code-switch when necessary.

The findings revealed implementation practices that were organized into four major themes: use of instructional resources and visual aids in reducing language barriers; collaborative and

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student-centered learning approaches; classroom communication strategies; and language scaffolding practices.

Student Language Proficiency and Comprehension Gap

Students demonstrated varied levels of English proficiency within DLP classes. Most students, particularly those in the lower secondary, were hesitant to respond orally in English. This reluctance limited full class engagement which in turn affected lesson effectiveness. Additionally, lower-proficiency students experienced difficulty following multi-step explanations delivered in English. Students, generally, also took longer time to form understanding as they needed to ascertain what the English words meant before they could comprehend the science concept itself.

The findings suggest that teachers with more experience seemed to be more aware of the long-term impacts of proficiency gap. Teacher C, for example, correlated weaker English student with weaker science performance, particularly in the cases where proficiency gap was more severe.

Time and Instructional Pacing Constraints

Time was one of the prominent challenges that the teachers had to face with lessons involving low proficient students. The use of English required longer planning as well as longer explanation time during instruction. The teachers also indicated that more supplementary materials such as visual aids had to be produced compared to teaching in the native language. The teachers added that English explanations required repetition, clarification with occasional translation. Additionally, more time was needed for lessons involving introduction to new terminology. The teachers stated that they needed to strategically balance the depth of explanation with syllabus completion.

Even though all the three teachers cited time as a persistent challenge, perceived time pressure was found to be stronger for the less experienced teacher According to Teacher A, her English instruction was usually time consuming due to repetitions, clarifications and code-switching. Teacher B reported minimal pacing disruption, while Teacher C mentioned shortened lesson periods as additional constraint.

DLP Assessments

The teachers cited English-medium assessments as a challenge in two ways. First, in relation to traditional assessment such as test and examination, item construction remained as a major stumbling block. The process of item construction for their DLP assessment took longer time as various considerations needed to be at play. In addition to common concerns involving assessment validity and reliability, other considerations included aligning content difficulty with appropriate level of language complexity; and ensuring items were linguistically effective.

Second, teachers were concern that language proficiency might act as a barrier to students' ability to sufficiently demonstrate their scientific understanding. Additionally, teachers were worried that students might not have adequate time to answer all questions within the specified time frame given the need to reread the questions several times and longer cognitive processes.

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Overall, the study noted that experience reduced teachers' uncertainty. The teacher with the most DLP experience, Teacher C, maintained more sustainable practice in ensuring high quality assessment. She relied on a question bank system and established performance tracking enabling her to monitor student performance in examination. Teacher B demonstrated stronger reliance on table of specifications, while Teacher A sought consultation and clarification from more senior teachers in her test design.

Teacher Confidence and Professional Readiness

Teachers' confidence and readiness to implement effective English-medium Science lessons were found to be highly associated with their trainings and professional development (PD) experience. The teachers in the study had varied PD exposure. Teacher A had attended a short DLP-focused workshop, while Teacher B had no formal DLP training. Teacher A confessed that she was still developing her confidence, with Teacher B shared that she gained confidence gradually through self-practice. Teacher C had attended multiple DLP-focused trainings in the past and reported gradual professional growth. The study also found that confidence appeared to increase with repeated implementation and had direct influence on teachers' ability to mediate other challenges such as language, pacing and assessment.

Linguistic delivery, student proficiency gap, time constraints, and assessment construction were the primary challenges affecting DLP implementation across all three teachers. Teacher A demonstrated stronger linguistic instability and greater reliance on repetition and code-switching. Teacher B experienced fewer language-related disruptions but continued to encounter challenges in managing student proficiency differences and instructional pacing. Teacher C exhibited greater instructional stability; however, student language proficiency and time limitations remained persistent structural constraints. Overall, experience was found significant in reducing uncertainty and improving classroom management of DLP demands. However, systemic challenges related to language readiness and cognitive load continued to influence instructional effectiveness.

Discussion

The study aimed to understand science teachers' perceptions of DLP benefits and drawbacks, the classroom practices, and challenges to effective DLP implementation. The findings were examined based on variation in teachers' years of DLP teaching. DLP teaching experience was found to influence classroom practices, perceived benefits, teachers' management of challenges, and their confidence in sustaining English-medium science instruction. Across all cases, the interaction between teacher experience, student language readiness, and instructional demands of science content had impacted DLP implementation.

The first research objective explored perceived benefits and drawback. Teachers believed that DLP improved students' vocabulary acquisition, enhanced exposure to English scientific terminology, and elevated students' confidence in using the language. Drawbacks centred on uneven student proficiency and slower conceptual processing due to language demands. The least experienced teacher focused more on immediate language difficulties of the students; whilst the more experienced teacher placed greater emphasis on long-term academic gain and global advantages. Teachers B and C associated DLP benefits within a broader educational scope rather than as a linguistic burden. This suggests that prolonged engagement with DLP may shift perception from operational concern to developmental opportunity. These findings

align with Malaysian DLP studies revealing the vital role of conditional teacher support for English-medium instruction (Moses & Malani, 2019; Suliman et al., 2020). Despite the perceived benefits, classroom-level constraints continued to affect DLP lesson effectiveness (Abdullah & Nordin, 2023; Bullah & Yunus, 2019; Mat Hasan & Daud, 2022). The teachers in this study demonstrated a more pragmatic view in contrast to Yunus and Sukri's (2017) study that reported strong teachers' resistance towards similar reform in the past.

The second research objective examined DLP implementation based on teachers' variation in years of DLP service. The findings suggest that teachers did not differ in commitment to DLP but varied in the degree of systematic planning and stability. Teachers were found to maintain English as the primary instructional medium, with the reliance on code-switching becoming less frequent with longer year of DLP service. Teacher C, the most experienced teacher, exhibited greater stability in English use with stronger integration of experiential laboratory learning. With experience and longer exposure to DLP, assessment practice was found to evolve from activity-based formative checks to more systematic performance monitoring. This echoed by the findings studies such as by Abdullah and Nordin (2023), Juhari and Zakaria (2024), Md Jaafar et al. (2024, Othman et al. (2020), and Yunus and Sukri (2017) with teacher cognition and experience served as critical elements in shaping classroom enactment of language policy.

The third research objective investigated the challenges to effective DLP implementation. English proficiency gaps, time constraints, language complexity and assessment construction were highlighted as major challenges. Student language readiness remained a persistent challenge across the three teachers. The least experienced teacher showed greater linguistic instability; however more experienced teachers demonstrated improved instructional control. The teachers also believed the increase of students' cognitive load – students had to decode the language before understanding the questions and scientific meaning – was a major concern (Masrom et al., 2021; Mat Hasan & Daud, 2022; Moses & Malani, 2019).

Years of DLP teaching experience through repeated DLP instruction were found significant in shaping perception and instructional practices. Teachers' perceptions shifted from immediate classroom management for the least experienced DLP teacher to more structured and systematic instruction for the most experienced teacher. Implementation evolved from reaction adaptation to more structured pedagogy. The findings extend existing DLP literature by highlighting experience as crucial in influencing policy enactment at classroom level.

Limitations

The study was bounded by a number of limitations. The small number of participants confined to one school enabled for insights into DLP practice to be gathered, however, this limits the generalisability of the study. The study also employed a single method of data collection. Although the semi structured interview format allowed for teachers' perspectives towards DLP and their implementation to be documented – it may promote response bias where participants may have the tendency to provide socially desirable answers. They may also disproportionately limit negative views. Additionally, more robust and comprehensive findings would be able to be generated if the interview data is triangulated with teaching observation and artefacts analysis (e.g. classroom documents such as lesson plans, worksheet, and assessment instruments). Furthermore, the study's sole focus on teachers' DLP practice did not factor in the transference of pedagogical competence accumulated from years of experience teaching

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other subjects. These limitations warrant a need for future studies that would involve larger and more diverse sample of teachers, with more complex research design.

Implications, Recommendations and Future Research

The findings of this study highlight several practical and policy-related implications: implications for teacher PD; school leadership and institutional support; as well as for policy and reform design. DLP-focused PD programmes should differentiate support based on years of DLP experience. Less experienced DLP teachers require structured training in sustaining English explanations for complex science concepts, designing assessment items in English, and managing classroom participation. Mid-range teachers may benefit from training focused on strengthening instructional scaffolding strategies, integrating content and language objectives more deliberately, and refining formative assessment techniques. More experienced teachers, however, can undertake the role as mentors for novice DLP teachers, resource persons in school-level DLP training sessions, and contributors to best-practice sharing platforms.

The state and district education department as well as the respective schools implementing DLP should accommodate structured mentoring system for new DLP teachers. Schools should ensure the availability of science teaching materials aligned with English terminology and contexts, and assessment item banks to support language-accurate question construction. Classroom observation systems should focus not only on English use but also on conceptual clarity.

Policymakers should recognise that DLP implementation evolves with teacher experience. Reform evaluation should therefore account for teacher career stage rather than assuming uniform implementation. Additionally, DLP guidelines may need clearer frameworks for code-switching boundaries and assessment design in English-medium science instruction. Policy refinement should also include structured long-term teacher support rather than short-term workshops.

Several recommendations are proposed for teachers, schools and policymakers. DLP teachers are recommended to develop structured routines for introducing and reinforcing scientific terminology; incorporate planned language scaffolding instead of relying solely on spontaneous translation; and use consistent questioning strategies to encourage English scientific expression. Schools should establish peer mentoring between experienced and novice DLP teachers; organise regular sharing sessions on effective bilingual science strategies; and provide time allocation for collaborative material development. It is recommended for policy developers to establish PD programmes that align with years of DLP experience; ensuring availability and teacher access to English-medium science materials and assessment resources; and strengthen alignment between DLP expectations and national examination requirements.

Future research should involve triangulation of several data collection methods as well as consideration for mixed-methods approach. Exploratory sequential mixed methods design focusing on survey followed by selected teachers for interview and teaching observation, for example, would provide more robust and comprehensive insights into teachers' DLP practices. The adoption of longitudinal research could also offer deeper perspectives. Additionally, future studies should also recruit larger number of participants.

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Conclusion

The study is grounded by three research objectives exploring the influence of different length of DLP teaching experience on teachers' perceptions towards the reform, their enacted classroom practice, and challenges to effective DLP implementation. Three research participants were recruited from a secondary school operated under the programme, with two, five and nine years of DLP experience respectively. The study found that experience and repeated DLP instruction had significant influence on instructional stability, insightful perspectives and confidence in language use. Variation emerged in the degree of systematic planning, consistency in English delivery, and assessment practices. More experienced teachers displayed greater instructional routine, whereas less experienced teachers relied more on adaptive and reactive strategies to sustain comprehension. Student language readiness and cognitive load remained a persistent challenge across all teachers. Overall, the study highlights that effective DLP implementation is a developmental spectrum where teachers progress through professional adaptation.

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