

Teachers' Pedagogical Transformation Towards 21st Century Learning in Enhancing Students' Thinking Skills

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ABSTRACT

Learning in the 21st century has its own challenges and demands that teachers transform in their teaching. This study aims to examine how Malaysian teachers implement 21st Century Learning (21CL), focusing on teaching strategies, challenges, and the integration of Higher Order Thinking Skills (HOTS). Using a qualitative design, data were collected through interviews, classroom observations and lesson plan analysis involving purposively selected teachers. Findings show that teachers use various 21CL strategies such as collaborative, project-based and problem-based learning, digital tools and visual thinking techniques to promote HOTS and active student engagement. Implementation, however, is constrained by limited technological resources, unstable internet, insufficient teaching aids, low digital proficiency and environmental challenges such as large class sizes and limited time. Teachers with prior 21CL training applied the 4C elements which is Communication, Collaboration, Creativity, and Critical Thinking more consistently. The study highlights that effective 21CL practice requires teacher readiness supported by adequate infrastructure, ongoing professional development and strong school leadership. Implications for teaching, administration and policy are outlined, with recommendations for broader sampling, longitudinal studies and intervention research.

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Introduction

The changing landscape of education in the 21st century demands a substantial shift in both teaching philosophy and classroom practice. Traditional teacher-led models are increasingly being replaced by approaches that place learners at the centre of the process, fostering a generation capable of navigating an interconnected, highly digital world. In

Malaysia, the Ministry of Education (MOE), through the Malaysia Education Blueprint 2015–2025, has made it clear that national educational advancement is tied closely to teachers' capacity to drive reform and sustain effective, forward-looking pedagogies (Gopal et al., 2024; Kementerian Pendidikan Malaysia, 2015; Tee & Samuel, 2017). This blueprint highlights the importance of embedding 21st Century Learning (21CL) principles in classroom activities, which encompass the four key competencies, such as communication, collaboration, creativity and critical thinking together with strong values and technological fluency (Herlinawati et al., 2024; Tohani & Aulia, 2022; Agaoglu & DemİR, 2020). Within this educational vision, teachers are positioned not simply as transmitters of knowledge, but as facilitators who guide learners towards critical, creative and reflective thought (Mufid, 2025; Jagtap, 2016). However, the success of 21CL depends greatly on educators' willingness and readiness to undertake substantial pedagogical transformation, which includes rethinking lesson design, instructional delivery and assessment approaches (Ratri et al., 2025; Vaganova et al., 2019).

Numerous studies have examined how teacher pedagogy supports the development of students' cognitive abilities in the context of 21st century education. Ahmad et. al (2023) discusses the framework of Education 5.0, advocating for learner-focused environments enhanced by technologies such as Artificial Intelligence (AI), blockchain, Virtual Reality (VR) and Augmented Reality (AR) to boost engagement and personalise learning. Likewise, Sharma & Shah (2024) argue that lifelong learning within Education 5.0 is underpinned by adaptive and individualised pathways, leveraging AI, AR/VR, IoT and blockchain to cultivate higher-order skills such as creativity and critical thinking. A report in Kementerian Pendidikan Tinggi (2025) identifies educational transformation as a central priority across ASEAN, noting Malaysia's curriculum reforms, digital pedagogy training for teachers and reinforcement of Technical and Vocational Education and Training (TVET). It was reported that more than 100,000 teachers nationwide have received updated training in 21st century pedagogy to ensure that their methods align with evolving educational expectations. Ahmad & Rathakrishnan (2025) and Adams & Lok (2022) evaluated teachers' readiness to incorporate digital tools into their practice, acknowledging the advantages but also pointing out persistent barriers such as insufficient training and resistance to new practices. The use of generative AI as a reflective learning aid, showing that large language models like ChatGPT can provide pedagogically tailored feedback to stimulate deeper thinking (Govindarajan, 2025; Saman et al., 2024). Similarly, Fuzi & Yahaya (2024) demonstrated that Makerspace-based activities in computer science classes effectively nurtured collaboration, communication, creative thinking and problem-solving skills among learners.

Although the literature underscores the value of Education 5.0 and its associated digital innovations including AI, VR, blockchain and learner-centred pedagogies for fostering essential 21st century competencies, several gaps remain unresolved. Firstly, many works, such as those by Ahmad et. al. (2023), Sharma & Shah (2024) and Abdullah et al (2026), address technology integration from an international perspective, leaving relatively few in-depth investigations into its application within Malaysia's national curriculum and cultural context. Secondly, despite recognition of the benefits of educational technology, there is a lack of large-scale empirical studies addressing teachers' readiness particularly gaps in professional training, ongoing support and openness to change (Ahmad & Rathakrishnan (2025). Thirdly, the sustained impact of AI-driven pedagogy, immersive AR/VR tools and Makerspace activities on student achievement and skill acquisition remains inconsistent across research findings. Fourthly, while generative AI's potential as a reflective learning tool has been highlighted globally (Abdullah et al., 2026)), its suitability, effectiveness, and learner reception in Malaysian primary and secondary schools have yet to be adequately

explored. Finally, although initiatives to strengthen TVET have been undertaken by the MOE, there is limited research on how integrating TVET with Education 5.0 approaches can significantly influence 21st century skill development among school students (Kementerian Pendidikan Tinggi, 2025).

Given these research gaps, the present study seeks to investigate the transformation of teachers' pedagogical practices in implementing 21CL, with a focus on enhancing students' thinking skills. Such transformation is crucial to ensuring that instructional strategies remain relevant to the demands of contemporary education, which prioritises innovation, analytical thinking, teamwork and effective communication. The study pursues three key objectives: (1) to explore the teaching approaches adopted by educators in cultivating and strengthening students' thinking skills; (2) to identify the challenges and constraints teachers encounter in applying 21CL; (3) to examine the execution of 21CL-oriented teaching and its influence on students' thinking abilities.

This research is novel in its holistic examination of 21st-century teaching practices in Malaysia, bridging gaps between pedagogy, curriculum implementation, and student cognitive development. By pursuing these aims, it seeks to present a comprehensive view of current teaching practices within Malaysia's educational landscape, contributing evidence-based insights to refine strategies that enhance student cognitive skills in alignment with curriculum goals and global competencies.

This investigation is valuable and contribute in providing actionable insights for teachers, enabling them to design and deliver learning experiences aligned with 21CL principles and aimed at nurturing students' higher-order thinking. Findings will also help school leaders identify both effective practices and persistent obstacles in 21CL implementation, supporting the development of targeted professional learning initiatives. For policymakers, the study's outcomes may serve as a foundation for curriculum enhancement and policy reform that better reflect present and future educational needs, as outlined in the Malaysia Education Blueprint. Furthermore, this work can act as a reference point for future scholarship in pedagogy and cognitive skill development. Ultimately, learners stand to benefit from richer, more engaging and learner-driven experiences, thereby reinforcing higher-order thinking skills as essential preparation for the challenges ahead.

Method

This section presents the methodological framework that guided the conduct of this study. It describes the research design, the selection of participants, the instruments used, the procedures undertaken during data collection, and the analytical strategies applied to interpret the data. A rigorous and systematic methodological approach was employed to ensure the credibility, validity, and reliability of the research findings.

Research Design

This study adopts a collective case study design to allow an in-depth investigation into teachers' pedagogical transformation towards 21st Century Learning. The scope of the inquiry encompasses teaching strategies, the barriers and challenges encountered, as well as classroom practices aimed at fostering students' thinking skills. A collective case study was deemed appropriate as it enables the researcher to examine multiple teacher cases from different backgrounds and subsequently draw comparisons to identify both commonalities and distinctions between them (Othman, 2022). By employing this approach, the researcher can gain a holistic understanding of the educational phenomenon going beyond identifying what happens to uncover how and why such pedagogical transformation occurs (Creswell & Poth, 2017). Furthermore, the use of this design strengthens the robustness and diversity of

findings, as it draws on data from multiple sources and contexts (Yin, 2017). Consequently, the collective case study design is well-suited for exploring the complex interplay between teachers' instructional practices, the surrounding environment, and the overarching aims of 21st century education.

Population

In qualitative research, the term population refers to a group of individuals or cases that share characteristics relevant to the phenomenon being studied (Creswell & Poth, 2017). For this study, the target population consisted of primary school teachers in Melaka who teach Level 1 students and possess specific attributes pertinent to the investigation of 21st Century Learning (21CL) pedagogical practices. Specifically, participants were selected based on the following criteria: (1) they employ teaching strategies aligned with 21CL principles, such as fostering critical thinking, creativity, collaboration, and effective communication in the classroom; (2) they are undergoing or have undergone pedagogical transformation, reflecting a shift in instructional approaches toward learner-centered and inquiry-based methods; and (3) they teach subjects with high potential for cultivating students' thinking skills, including Malay Language, English Language, and Mathematics, which are key areas for developing cognitive and problem-solving abilities in early learners.

By defining the population with these criteria, the study ensures that participants are directly relevant to the phenomenon under investigation, thereby enhancing the credibility, depth, and applicability of the findings. Furthermore, this careful delineation of the population supports the purposive nature of qualitative sampling, allowing the researcher to engage with information-rich cases that can provide meaningful insights into the implementation of 21CL practices. Consequently, the selected population enables an in-depth exploration of pedagogical transformation within authentic classroom contexts, strengthening the overall trustworthiness and contextual relevance of the study.

Sampling Technique

A non-probability purposive sampling technique was employed in this study, as collective case studies prioritize in-depth understanding of the phenomenon rather than statistical generalization (Ahmad & Wilkins, 2025; Patton, 2015). This sampling approach allows the researcher to deliberately select participants who possess substantial knowledge, experience, and engagement with 21st Century Learning (21CL) practices, ensuring that each case is directly relevant to the research objectives (Yahaya et al., 2022). By focusing on teachers who have undergone pedagogical transformation and actively implement 21CL strategies in their classrooms, purposive sampling facilitates the collection of rich, detailed, and meaningful data that can provide insights into both shared patterns and unique variations in instructional practices across different contexts.

Selection Criteria

The selection of participants was guided by specific criteria to ensure their relevance and suitability for the study. These criteria included: (1) a minimum of three to five years of teaching experience, providing sufficient exposure to pedagogical practices and classroom dynamics; (2) participation in 21CL-related training programmes or professional development courses, ensuring familiarity with contemporary teaching strategies aligned with 21st Century Learning principles; and (3) representation from both urban and rural schools, allowing the study to capture a diverse range of teaching contexts and environmental factors that may influence pedagogical transformation.

Sample Size

In line with Stake's (2013) recommendation that collective case studies typically include between four and ten cases to allow for detailed and comprehensive analysis, three teachers from the districts of Melaka Tengah, Alor Gajah, and Jasin were purposefully selected for this study. Each participant met the predetermined selection criteria and provided voluntary consent to take part in the research. The inclusion of teachers from different districts ensured geographical and contextual diversity, which enhanced the richness of the data and allowed for meaningful comparisons across cases.

Instruments

Three primary instruments were employed to collect data, each serving a complementary purpose to enhance triangulation and ensure the validity of the findings (Creswell & Poth, 2017). First, a semi-structured interview protocol was used to capture teachers' perceptions, experiences, and interpretations of 21CL pedagogical transformation, with interviews conducted in person, recorded with consent, and transcribed verbatim. Second, a classroom observation checklist based on the 21CL framework documented real-time instructional practices and student engagement, with each observation session lasting approximately 60 minutes. Third, document analysis, focusing on teachers' Daily Lesson Plans (DLP), teaching materials, and relevant school documents, was conducted to validate and contextualize the data from interviews and observations, providing insights into instructional planning and the integration of 21CL elements.

Data Collection Procedures

Prior to data collection, all ethical procedures were strictly observed, including obtaining informed consent from participants and ensuring the confidentiality of all information. Data collection was conducted in a systematic and rigorous manner to maintain the trustworthiness and credibility of the study. The process involved identifying and recruiting participants who met the selection criteria, scheduling and conducting semi-structured interviews, performing classroom observations using the 21CL checklist, and collecting and reviewing participants' Daily Lesson Plans and teaching materials. All data were then organized and prepared for subsequent analysis. A process flowchart (**Figure 1**) was developed to visually illustrate the sequential steps followed during the data collection phase.

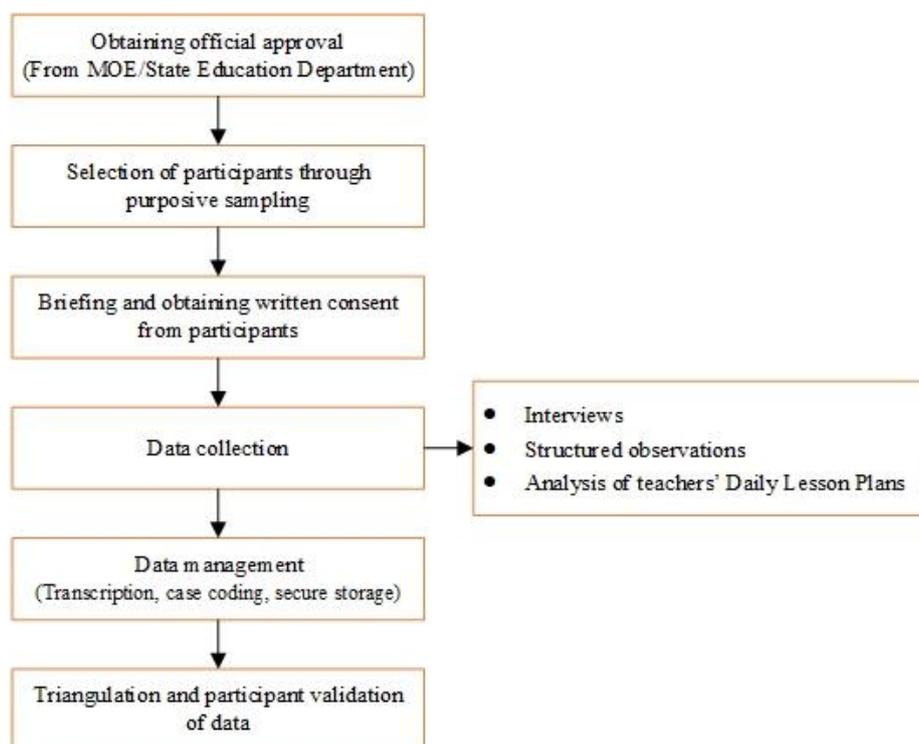


Figure 1. Data Collection Procedures

Data Analysis

The data gathered in this research were examined systematically, with the analytical approach tailored to each instrument to ensure accurate and comprehensive interpretation of findings. For the semi-structured interview data, the researcher employed thematic analysis following the framework proposed by Braun & Clarke (2006). This process encompassed six key stages such as (1) repeated reading of interview transcripts to gain a full understanding of the context, (2) generating initial codes to identify relevant units of meaning, (3) searching for themes by grouping codes that share common patterns, (4) reviewing themes to confirm their alignment with the original dataset, (5) assigning clear and precise labels to each theme, and (6) compiling the findings into a report supported by direct quotations from participants.

Observation checklist data were examined using descriptive analysis to determine the frequency and patterns of 21st Century Learning (21CL) elements implemented in classroom settings. The observation results were organised into frequency tables and percentage distributions, which were then complemented with qualitative descriptions to illustrate the classroom context and provide deeper insight.

In the case of the teachers' Daily Lesson Plans, a qualitative content analysis approach was applied. This allowed the researcher to evaluate the extent to which lesson planning incorporated key 21CL elements such as communication, collaboration, critical thinking, creativity and moral values. The analysis process involved a thorough reading of the documents, systematic coding according to predetermined categories and assessment of the frequency with which these elements appeared across lesson plans.

By adopting multiple analytical techniques, the study not only captured a richer and more holistic understanding of the phenomenon but also enhanced the trustworthiness and validity of the results through data triangulation from different sources, consistent with the recommendations of Creswell & Poth (2017). A summary table was subsequently developed to present the analytical methods alongside the corresponding research instruments utilised in this study (Table 1).

Table 1. Summary Table of Data Analysis Methods

Instrument	Analysis Method	Type of Data	Aim of analysis
Interview	Thematic	Qualitative	Extracting overarching themes and sub-themes from teacher narratives
Observation checklist	Descriptive and content analysis	Quantitative + Qualitative	Assessing the frequency and analysing behaviour patterns
Document	Content Analysis of Documents	Qualitative	Assessing the extent to which 21st-century learning elements are integrated into planning

Results and Discussion

Objective 1: To explore teachers' instructional strategies in fostering and developing students' thinking skills

To gain a deeper understanding of how teachers facilitate higher-order thinking skills in line with 21st Century Learning (21CL) principles, the study analysed interview and classroom observation data. The analysis focused on the instructional strategies teachers employed, how they integrated technology and collaborative practices, and the variations in approach based on teaching experience. The findings reveal that teachers adopted a range of student-centred strategies, including problem-based learning, guided inquiry, and structured questioning techniques aimed at stimulating critical and reflective thinking. Classroom observations further indicate that collaborative group work and the use of digital tools were intentionally designed to encourage active participation and peer interaction. Differences were also observed between novice and experienced teachers, particularly in the depth of questioning techniques and the flexibility of instructional adaptation, highlighting the influence of pedagogical experience on the effective cultivation of students' thinking skills.

The analysis of interview and observation data revealed that teachers employed a variety of instructional strategies grounded in the 21CL framework to develop students' higher-order thinking skills (HOTs). All participants (P1, P2, P3) emphasized collaborative learning, reflection, and self-assessment, creating opportunities for students to work together, communicate effectively, and critically evaluate both their own work and that of their peers. For example, P1 implemented a "Gallery Walk" activity, in which students rotated between stations to assess group work, thereby fostering communication, collaboration, and reflective thinking. The integration of technology was highlighted by P1 and P3, who used digital applications, interactive quizzes, and animated videos to engage students and support active learning. Analytical skills were developed through tasks involving prediction, data analysis, and hypothesis formulation, as described by P1 and P2, while all participants utilized idea visualization tools, such as mind maps and graphic organizers, to help students organize and connect concepts. Teachers generally adhered to structured lesson plans to ensure curriculum objectives were met; however, less experienced teachers tended to follow these plans rigidly, which limited opportunities for flexible, student-centred approaches. Overall, the findings suggest that while teachers employ diverse strategies to foster HOTs, the degree of adaptability and integration of multiple approaches varies, with teaching experience playing a significant role in shaping instructional practices. **Table 2** summarizes the interview codes for this objective.

Table 2. Interview codes for Objective 1

Main theme	Interview code	Participant	Description
Collaborative strategies	STR_KOLAB	P1, P2, P3	Group activities aimed at developing communication and teamwork skills
Reflection & Self-Assessment	STR_Reflek	P1, P2, P3	Students evaluate their own work or that of peers with teacher guidance

Main theme	Interview code	Participant	Description
Use of Technology	STR_Tekno	P1, P3	Integration of digital applications, interactive quizzes, and instructional videos
Analytical Skills	STR_Analitik	P1, P2	Activities involving prediction, data analysis, or hypothesis development
Idea Visualisation	STR_Peta_Mind	P1, P2, P3	Use of mind maps or graphic organisers to link concepts
Structured Lesson Plan	STR_RPH_Fix	P1, P2, P3	Following the lesson plan (RPH) rigidly without flexible adaptation

The findings indicate that teachers applied diverse 21CL-based strategies such as collaborative learning, project-based learning, problem-based learning, mind mapping and digital technology integration. These strategies aim to promote students' HOTS while encouraging active interaction and self-directed learning. For example, the "Gallery Walk" activity provided opportunities for students to assess peers' work, thereby strengthening their communication, critical evaluation and reflective thinking abilities. Recent studies reinforce these observations. [Nafisah et. al. \(2025\)](#) reported that 21CL implementation is often hindered by classroom management challenges and workload pressures, highlighting the importance of teachers' organisational competencies. Similarly, [Azman et. al. \(2023\)](#) and [Williamson \(2023\)](#) found that project-based learning significantly enhances HOTS through collaborative and problem-solving approaches. The national education framework, such as the Malaysia Education Blueprint (PPPM), also supports these strategies through initiatives aimed at embedding HOTS. More recently, research on AI literacy curricula revealed that while teachers display creativity in integrating AI into lessons, they require additional support and preparation time to fully harness technology as an effective teaching tool. Overall, employing a wide range of flexible instructional methods enables teachers to tailor their approaches to students' proficiency levels and learning needs. Nevertheless, the success of these strategies relies heavily on teachers' ability to manage time, maintain classroom control and optimise available resources.

Objective 2: Identifying the obstacles and challenges faced by teachers in implementing 21st Century Learning (21CL)

To address Objective 2, the study examined the obstacles and challenges that teachers encounter in implementing 21st Century Learning (21CL), focusing on factors that hinder the adoption of innovative pedagogical practices and the development of students' higher-order thinking skills. The findings indicate that teachers frequently struggle with limited instructional time, heavy administrative workloads, and the pressure to complete a content-driven syllabus, which restrict opportunities for inquiry-based and collaborative learning activities. In addition, inadequate access to digital infrastructure and varying levels of technological proficiency were identified as significant barriers to the effective integration of technology in classroom instruction. Classroom management issues, particularly in large or mixed-ability classes, further complicated efforts to facilitate meaningful discussion and higher-order questioning. Collectively, these challenges demonstrate that successful 21CL implementation requires not only teacher commitment but also systemic support, adequate resources, and sustained professional development to address contextual constraints.

The analysis revealed that teachers encounter multiple challenges in implementing 21st Century Learning (21CL). Resource constraints were reported by P2 and P3, who described shortages of technological equipment, such as laptops and projectors, as well as insufficient supplementary materials to support interactive learning. Skills limitations were highlighted by P1, P2, and P3, with teachers explaining that limited proficiency in digital applications and a lack of training often hindered the effective integration of 21CL; for instance, some participants struggled to use online learning platforms or interactive tools

confidently. Environmental barriers also affected instructional practice, as P2 and P3 noted that limited instructional time made it difficult to implement 21CL activities fully, while all participants indicated that large class sizes restricted opportunities for hands-on and student-centred learning. These findings suggest that although teachers are committed to adopting innovative pedagogical strategies, challenges such as resource shortages, skill gaps, and environmental constraints significantly limit the effective implementation of 21CL practices. **Table 3** summarizes the interview codes for this objective.

Table 3. Interview codes for Objective 2

Main theme	Interview code	Participant	Description
Resource Constraints	CAB_Tekno	P2, P3	Shortage of technological equipment such as laptops and projectors
	CAB_Sumber	P1, P2	Insufficient supplementary learning materials
Skills Limitations	CAB_Kem_Digi	P3	Limited proficiency in using digital applications or platforms
	CAB_Latih	P1, P3	Lack of training related to 21CL implementation
Environmental Barriers	CAB_Masa	P2, P3	Limited instructional time to conduct 21CL activities
	CAB_Bil Murid	P1, P2, P3	Large class sizes hinder interactive activities

Interview findings reveal that teachers face a range of challenges in executing 21CL, which can generally be grouped into three categories which is resource limitations including inadequate technological devices, unstable internet access and a shortage of instructional materials, skills-related barriers such as insufficient digital proficiency and limited expertise in HOTS-oriented pedagogy, and environmental constraints including overcrowded classrooms, limited teaching time and diverse levels of student competency. These issues align with recent research by [Rahim & Al Amin Mydin \(2024\)](#), which identified insufficient technological infrastructure and gaps in teacher competence as major impediments to the effective integration of 21CL in Malaysian schools. Likewise, the [Kementerian Pendidikan Malaysia \(2015\)](#) emphasised that restricted instructional time and high teacher workload are among the key factors limiting the adoption of innovative, student-centred teaching methods. Collectively, these findings strengthen the view that the success of 21CL implementation depends not only on teacher readiness but also on systemic support comprising proactive school leadership, sufficient resource allocation and ongoing professional development to enhance 21st-century pedagogical capabilities.

Objective 3: Exploring the implementation of teachers' instructional practices within the 21CL framework in relation to students' thinking skills

This section explores how teachers implement instructional practices within the 21st Century Learning (21CL) framework and examines the ways in which these strategies contribute to the development of students' thinking skills based on classroom observations and daily lesson plans. The analysis reveals that teachers who systematically aligned lesson objectives, learning activities, and assessment tasks with the 4Cs framework were more consistent in promoting higher-order thinking processes. Observational data further indicate that the use of structured questioning techniques, collaborative problem-solving tasks, and reflective classroom dialogue created opportunities for students to articulate reasoning and justify their answers. In several cases, lesson plans explicitly incorporated inquiry-based and technology-supported activities, demonstrating intentional planning to stimulate critical and creative thinking. Overall, the findings suggest that the effectiveness of 21CL implementation is closely linked to deliberate instructional design and the teacher's ability to translate conceptual understanding of 21CL into coherent classroom practice.

The analysis revealed that teachers employ multiple strategies to support 21st Century Learning (21CL). All participants (P1, P2, P3) utilized collaborative activities (PEL_Kolab) to engage students in teamwork through group projects and joint tasks. Critical thinking (PEL_Kritis) was emphasized by P1 and P2, encouraging students to evaluate information and make evidence-based decisions, while problem-based learning (PEL_PBL), implemented by P2 and P3, required students to solve authentic, real-world problems. Learning reflection (PEL_Reflek) was integrated by all teachers, enabling students to review their learning processes and suggest improvements. Furthermore, the 4C elements—Communication, Collaboration, Creativity, and Critical Thinking (PEL_4K)—were incorporated into lesson plans by P1 and P2 to foster holistic 21CL skills. Participation in 21CL training (PEL_Latih), highlighted by P2 and P3, further supported professional development and enhanced the effectiveness of teaching implementation. Overall, these practices reflect teachers' efforts to combine collaborative, reflective, and problem-solving approaches, demonstrating a commitment to cultivating 21CL competencies effectively in their classrooms. **Table 4** presents the interview codes for Objective 3.

Table 4. Classroom observation and Lesson Plan Code for Objective 3

Main theme	Code	Participant	Description
Collaborative Activities	PEL_Kolab	P1, P2, P3	Students engage in teamwork through group projects or joint tasks
Critical thinking	PEL_Kritis	P1, P2	Students evaluate information, construct arguments, and make decisions supported by evidence
Problem-Based learning	PEL_PBL	P2, P3	Tasks that require students to address and solve authentic, real-world problems
Learning reflection	PEL_Reflek	P1, P2, P3	Students review their learning process and suggest possible improvements
Integration of 4C Elements	PEL_4K	P1, P2	Lesson plans and delivery incorporate Communication, Collaboration, Creativity, and Critical Thinking
21CL training	PEL_Latih	P2, P3	Professional development that influences the effectiveness of teaching implementation

Classroom observations and daily lesson plan analysis indicated that teachers who had participated in recent 21CL professional development were more consistent in embedding the 4C elements like Communication, Collaboration, Creativity and Critical Thinking into their lesson design and delivery. Examples included open-ended experiments, structured group discussions, and real-world problem-solving tasks, which collectively provided students with opportunities to refine their reasoning skills, build evidence-based arguments, and develop innovative solutions. These findings are consistent with [Azman et. al. \(2023\)](#) and [Othman et al. \(2018\)](#), who reported that student-centred, problem-oriented learning strategies significantly improve higher-order thinking skills when supported by effective teacher facilitation. Similarly, [Saad & Zainudin \(2022\)](#) found that project-based and collaborative approaches, coupled with reflective practices, not only deepen conceptual understanding but also enhance decision-making abilities. However, this study also revealed that the degree to which 21CL elements appeared in lesson plans varied depending on teachers' prior experience and their exposure to targeted training. This observation echoes the conclusions of the Ministry of Education Malaysia ([Kementerian Pendidikan Malaysia \(2015\)](#)) in its National Digital Education Policy review, which stressed that continuous professional development and equitable access to training are essential for the successful implementation of 21st-century learning.

Triangulation Data

To gain a comprehensive perspective on the research findings, this study employed data triangulation by integrating three primary sources: teacher interviews, classroom observations, and document analysis of lesson plans. This approach allowed for the validation of data consistency and the identification of points of convergence and divergence across different instruments. The triangulation results for each research objective are summarized in **Table 5** below, demonstrating how multiple data sources corroborated the findings while providing a richer, more nuanced understanding of teachers' instructional practices and challenges in implementing 21st Century Learning (21CL).

Table 5. Data Triangulation

Research Objective	Interview	Observation	Document Analysis (Lesson Plan)	Triangulation Conclusion
Objective 1: To explore teachers' instructional strategies in developing pupils' thinking skills	Teachers employed multiple 21st-century teaching strategies such as collaborative learning, project-based learning, problem-based learning, and technology integration	Experienced teachers demonstrated flexibility in combining strategies such as group discussions and mind maps. Less experienced teachers tended to follow lesson plans rigidly.	Lesson plans indicated collaborative activities, technology use, and mind mapping; however, the level of adaptation varied depending on teacher experience.	Findings from all three instruments aligned, showing that teachers consistently applied collaborative, reflective, analytic, and technology-based strategies. Effectiveness, however, depended on teachers' experience and adaptability.
Objective 2: To identify challenges teachers face in implementing 21st-century teaching	Key challenges included limited technological tools, unstable internet access, insufficient teaching aids, lack of digital competency, and restricted teaching time.	Major obstacles observed were large class sizes and limited time, making collaborative activities and monitoring difficult.	Objective 2: To identify challenges teachers face in implementing 21st-century teaching	Key challenges included limited technological tools, unstable internet access, insufficient teaching aids, lack of digital competency, and restricted teaching time.
Objective 3: To examine teachers' instructional practices within the 21st-century framework in relation to pupils' thinking skills	Teachers who had attended 21CL training were more consistent in implementing the 4Cs (Communication, Collaboration, Creativity, Critical Thinking). (Codes: PRAC_4C, PRAC_Training)	Observations showed that open-ended experiments, problem-solving cycles, and reflective discussions encouraged pupils' critical and collaborative thinking. (Codes: PRAC_Collab, PRAC_Critical, PRAC_PBL, PRAC_Reflect)	Lesson plans of trained teachers displayed clearer incorporation of 4Cs compared to those of less trained teachers.	Triangulation indicated that professional training had a direct impact on the effectiveness of classroom practices. Trained teachers successfully created active learning environments that promoted higher-order thinking skills.

The integration of interviews, observations, and document analysis in the triangulation process provided a comprehensive understanding of how 21st Century Learning (21CL) is implemented in schools. Overall, the data indicated that teachers demonstrated a foundational awareness of 21CL pedagogical principles and made efforts to apply approaches such as collaborative activities, reflective dialogue, problem-solving tasks, and the integration of technology. However, the degree of success varied depending on teachers' experience and adaptability. Common challenges were identified across the research objectives, including insufficient resources, limited digital competencies, time constraints, and classroom management difficulties. Nonetheless, evidence from lesson plans and classroom observations showed that teachers who had undergone professional training were more effective in embedding the 4Cs (Communication, Collaboration, Creativity, and

Critical Thinking) into their lessons, thereby supporting the development of students' higher-order thinking skills. In summary, the overall triangulation highlights that while 21CL implementation has begun, its success is heavily influenced by teacher preparedness, availability of resources, institutional support, and ongoing professional development opportunities.

In the context of Malaysia, these findings carry important and specific implications for national educational reform efforts, particularly in strengthening the implementation of 21st Century Learning (21CL) across education. The study indicates that although foundational awareness of 21CL exists among teachers, disparities in digital competence, access to resources, and pedagogical adaptability may widen the implementation gap between urban and semi-urban or rural schools. This suggests a need for more structured and continuous professional development programs aligned with national policy directions, with a stronger emphasis on practical classroom application of the 4Cs rather than conceptual understanding alone. Furthermore, the evidence that trained teachers were more effective in embedding higher-order thinking skills underscores the urgency for the Ministry of Education to invest in sustained mentoring systems, school-based coaching, and equitable digital infrastructure to ensure that 21CL is not merely policy rhetoric, but consistently practiced across diverse Malaysian school contexts.

Conclusion

This study highlights that teachers implement 21st Century Learning (21CL) through various strategies including collaborative learning, project-based learning, digital integration and mind-mapping to stimulate students' higher-order thinking skills, although challenges such as limited resources, insufficient technological proficiency and time constraints continue to hinder full adoption. The findings emphasise that effective 21CL practice requires comprehensive support in the form of continuous professional development, adequate infrastructure, conducive learning environments and strong administrative leadership, with implications for teachers to refine their instructional approaches, for school leaders to enhance logistical and technological provisions and for policymakers to strengthen national 21CL initiatives through improved training modules and equitable resource allocation. Future research should expand sampling across diverse school contexts, employ longitudinal and mixed-methods designs to examine long-term impacts on teacher competence and student outcomes, and explore intervention studies that evaluate the effectiveness of targeted 21CL training programmes.

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