

Reflective Practices as the Driver to Cultivate Teachers' Digital Learning Agility

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Abstract

Teaching and learning have transformed exponentially during and post pandemic, with several digital tools emerged during this period. Digital Learning Agility (DLA), which stems from the broader concepts of learning agility (LA), emphasises the ability of teachers to adapt, learn, and apply digital tools effectively in teaching. In this context, reflective practices empower educators to assess their digital teaching strategies, identify areas for improvements, and implement meaningful changes; all aimed at enhancing student engagement and learning outcomes. Building on this conceptual grounding, this study aims to explore the role of reflective practices in cultivating DLA among teachers. Using a qualitative case study approach, this research involved 20 teachers, five school administrators, and 20 parents selected via purposive sampling. Data were collected through observations, semi-structured interviews, and photographs, portraying a comprehensive understanding reflective practices and DLA. The findings revealed a nuanced portrayal that while teachers acknowledged the importance of technology integration in their classroom, they faced barriers such as theirs and students varied digital literacy levels and insufficient training. Notably, reflective practices were found to be instrumental in overcoming these challenges as it fosters teachers' adaptability and innovation in teachers' digital teaching practices. These findings underscored the necessity of embedding reflective practices into teacher development programs to support digital agility amidst the on-going digital transformation in education.

Keywords: Agility, Digital Education, Digital Learning, Reflective Practices, Teachers Professional Development.

Introduction

The rapidly evolving digital landscape has significantly impacted education, requiring teachers to adapt their teaching practices to meet new demands. Learning Agility (LA) has emerged as a critical concept in this context, defined as the ability to learn, adapt, and apply skills in diverse and dynamic situations (1). Among its dimensions, namely flexibility, speed, interpersonal risk-taking, and reflection; reflection stands out as a particularly essential component in education as it enables teachers to make informed decisions amid rapid technological change. As such, it fosters self-awareness, critical thinking, and continuous improvement, enabling educators to respond effectively to evolving challenges (2). Digital Learning Agility (DLA), a subset of LA, is particularly relevant to teachers as it encompasses the ability to integrate digital tools and strategies effectively into teaching. DLA enables teachers to navigate technology-rich environments, evaluate

digital resources, and refine pedagogical approaches to enhance student engagement and learning outcomes. What distinguishes DLA from general digital competence is the capacity to reflect critically on digital teaching experiences and adapt strategies accordingly, especially when faced with uncertainty or technological change. However, in Malaysia, the integration of technology into education has revealed significant challenges. These include varying levels of digital literacy, inadequate professional development programs, and resistance to change, which hinder teachers' ability to fully leverage digital tools (3,4). Addressing these challenges requires more than technical competence; it demands a mindset oriented toward adaptability, critical reflection, and lifelong learning. Habits of the mind, such as critical thinking, persistence, adaptability, and metacognition, play a pivotal role in fostering such a mindset. These dispositions encourage teachers

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to engage intentionally and creatively with their teaching processes, promoting self-directed growth and innovation. For instance, critical thinking helps educators evaluate the effectiveness of digital teaching tools, while metacognition enables them to reflect on their teaching practices and identify areas for improvement (5). This view is reinforced by the notion that equipping educators with introspective skills and cultivating habits of the mind is essential for continuous self-directed professional development (6). Such dispositions empower teachers to critically assess their practices, adapt to evolving challenges, and sustain professional growth over time. For pre-service and in-service teachers alike, embedding these habits within reflective practices provides a foundation for navigating the complexities of digital education and developing the agility needed to continuously update and realign their teaching approaches within fast-evolving digital learning environments.

Reflective practices serve as the mechanism through which teachers operationalize these habits of the mind. They enable educators to critically assess their digital teaching experiences, identify challenges, and implement strategies for improvement. Research shows that reflection fosters adaptability, creativity, and professional growth, which are essential for thriving in technology-driven educational settings (7,8). In Malaysia, where the Digital Education Policy (DEP) and Malaysian Teacher Standards 2.0 (MTS 2.0) emphasise the need for digitally competent educators, there is notably an increasing recognition that reflective capacity, not just technical skills, is fundamental to cultivating teacher adaptability and resilience in digital contexts. Reflective practices thus provide a pathway for bridging gaps in digital literacy and pedagogical innovation (9).

Despite these frameworks, gaps remain in embedding reflective practices into teacher development programs. Many teachers struggle to integrate reflection into their professional routines due to time constraints and insufficient guidance on reflective methodologies. As a result, the potential of reflective practices to drive digital learning agility remains underutilised. This highlights the need for structured approaches that support teachers in cultivating DLA through reflection, guided by habits of the mind.

While digital competence, digital fluency, and ICT integration are often used interchangeably in the literature, this study distinguishes Digital Learning Agility (DLA) as a broader and more dynamic construct. Unlike digital competence, which emphasises technical mastery, or digital fluency, which stresses ease and flexibility of use, DLA is characterised by the iterative ability to learn, unlearn, and relearn digital practices through reflection. It is also distinct from ICT integration, which primarily addresses pedagogical application, by highlighting the metacognitive and adaptive processes teachers employ when confronted with uncertainty or technological change. In this sense, DLA aligns with established frameworks such as DigCompEdu and TPACK, which emphasise the interplay of technical and pedagogical knowledge, but extends them by positioning adaptability and reflection as central to sustainable digital practice.

This study explores the role of reflective practices in enhancing teachers' Digital Learning Agility (DLA) within Malaysia's educational context. Specifically, it examines how teachers use reflection to adapt teaching strategies and overcome barriers to technology integration, thereby revealing the mechanisms through which reflective engagement fosters agility in digital pedagogy. The study contributes novelty by positioning DLA not only as distinct from digital competence and fluency, but also as a reflection-driven process that aligns with Malaysia's Digital Education Policy and Teacher Standards 2.0. In doing so, it highlights how reflective practices serve as a catalyst for teacher adaptability and continuous professional growth in the face of rapid digitalisation.

Teachers' Technology Competence and Digital Learning Agility

Understanding the factors that contribute to teachers' technology competence is essential for effective technology integration in educational settings. Digital competence involves a teacher's ability to effectively use and integrate digital tools into their instructional practices, forming a foundational aspect of Digital Learning Agility (DLA). Although DLA is a relatively new construct, existing studies on Information and Communication Technology (ICT) use, digital literacy, and adaptive pedagogical practices offer valuable insights into its development, particularly

in relation to teachers' capacity for ongoing self-assessment and technological adaptation. It was highlighted that teachers' educational backgrounds, including their exposure to digital tools during professional training, significantly influence their capacity to integrate ICT into teaching (10). This underscores the necessity of ensuring teacher training programmes embed digital literacy modules that are practical, relevant, and continuously updated. Such training also lays the groundwork for digital agility, especially when it encourages reflective engagement with tools rather than one-time skill acquisition. Similarly, it has been argued that understanding teachers' preferences and experiences with digital tools informs effective classroom strategies, emphasising that personalising technology training for teachers can lead to greater engagement and retention of skills (11). It has been further affirmed that ICT integration not only enhances student engagement but also improves instructional practices (12). This is particularly relevant in classrooms where technology is used to differentiate instruction, catering to the diverse needs of learners. However, it has been revealed that many teachers face challenges in adopting these technologies due to inadequate training, limited access to resources, and insufficient institutional support (13). Such barriers hinder not only digital tool usage but also teachers' ability to reflect and adapt their strategies. Both of which are the key components of digital learning agility. Addressing these gaps is critical to fostering teachers' confidence and competence in leveraging digital tools.

Digital tools are also instrumental in facilitating personalised feedback for students. It has been demonstrated that formative assessments and real-time responses improve student learning outcomes, particularly in technology-rich environments (14). For example, tools such as learning management systems and automated grading software can save teachers time while enabling more precise feedback tailored to individual student progress. However, it has been noted that such innovations remain underutilised in many Malaysian schools due to inconsistent training and uneven access to digital infrastructure (13). These limitations not only affect instructional delivery but also restrict opportunities for

teachers to reflect on and refine their digital pedagogical practices.

Recent literature has also emphasised the role of LA in teacher training. It has been argued that adaptability and flexibility are critical traits for navigating technology-driven educational settings (15), aligning with another findings that highlight the need for robust skillsets and mindsets among teachers (10). Reflection, one of LA's core dimensions, plays a vital role in cultivating this adaptability as it enables educators to learn from past experiences and continuously improve their digital instructional practices. By fostering these traits through targeted professional development programmes, educational institutions can equip teachers to not only adapt but thrive in rapidly evolving digital environments. While digital competence and adaptability are key pillars of DLA, it is through reflective practices that these traits are activated and sustained. The next section discusses the theoretical and empirical foundations of reflective teaching.

Cultivating Reflective Practices for Enhanced Teaching and Learning

Reflection is a critical dimension of Learning Agility (LA), is defined as the ability to evaluate and learn from past experiences to improve future actions (1). In educational contexts, reflection is more than an introspective act. It has become a deliberate tool for adapting pedagogy in complex and changing environments. Reflection empowers educators to introspect on their teaching processes, identify areas for growth, and implement strategies for continuous improvement (2).

In the context of Digital Learning Agility (DLA), reflection enables teachers to critically evaluate their digital practices, addressing gaps in their pedagogy and fostering innovation. It supports an iterative process of trial, feedback, and refinement that is essential for thriving in technology-mediated teaching. A study highlights that reflective practices are particularly transformative when coupled with collaborative learning environments, where teachers share experiences and learn from peers (16). For example, reflective practice workshops that incorporate peer feedback can significantly enhance teachers' ability to design and implement effective digital strategies. The importance of cultivating habits of the mind as integral components of reflective

practices has been underscored (6). These include critical thinking, metacognition, and adaptability. These habits not only empower teachers to self-direct their professional development but also foster resilience and creativity in responding to technological and pedagogical challenges. Importantly, they align with the iterative mindset required for DLA, where teachers must continuously adjust their practices based on feedback and evolving contexts. Teachers who consistently engage in metacognitive reflection are better equipped to identify and address biases in their instructional methods, ensuring more equitable learning experiences for their students. Another study expands on the concept of reflexivity, emphasising its role in fostering continuous learning and adaptability (17). Reflexivity allows teachers to draw insights from organisational practices, adapt to uncertain environments, and experiment with innovative approaches. In the context of DLA, reflexivity acts as a metacognitive scaffold that enables teachers to process their digital teaching experiences and revise their strategies accordingly. For instance, schools that encourage teachers to reflect on their implementation of digital tools can foster a culture of experimentation, where failures are viewed as learning opportunities rather than setbacks. Similarly, a study argues that agile learning strategies promote flexibility in lesson planning and instructional delivery (18), which are crucial for managing the dynamic demands of modern classrooms. Reflective practices serve as the engine behind this agility, helping teachers interpret what works, what doesn't, and why – especially when integrating emerging digital tools. This flexibility is especially important in technology-enhanced environments, where rapid advancements often require teachers to continuously update their knowledge and skills. Reflective practices also position teachers as classroom leaders. Research has illustrated that reflective teachers inspire their students by modelling adaptive and innovative behaviours (11). For example, a reflective teacher who experiments with a new digital tool, assesses its effectiveness, and refines its application based on student feedback demonstrates both leadership and a commitment to continuous improvement. Such reflective leadership is a hallmark of DLA, as it exemplifies how digital agility is not just a

technical skill, but a pedagogical stance. These practices contribute to creating an inclusive and adaptive learning environment that benefits all stakeholders. By embedding reflective practices into teacher development programmes, educators can build the agility needed to navigate technology-rich educational environments. Moreover, fostering a culture of reflection within schools can amplify these benefits, encouraging collaboration and shared accountability among teaching staff. These considerations frame the significance of this study, which investigates how reflective practices foster DLA by enabling Malaysian school teachers to adapt, innovate, and improve their teaching strategies in response to digitalisation.

Methodology

Research Model

This study employed a qualitative case study approach to investigate the role of reflective practices in cultivating Digital Learning Agility (DLA) among Malaysian school teachers. The qualitative case study method was chosen for its ability to explore complex phenomena within real-world contexts, allowing for an in-depth examination of the dynamic interactions between educators, digital tools, and pedagogical practices (19). By facilitating the collection of rich, descriptive data, this approach provided nuanced insights into participants' lived experiences, strategies, and challenges as they navigated technology-rich educational environments (20).

Participants

To capture a holistic perspective of the educational ecosystem, the study engaged three distinct groups of participants: teachers, school administrators, and parents. Each group contributed unique insights, enriching the understanding of how reflective practices enhance DLA. Teachers formed the core participant group, with 20 individuals evenly divided between primary and secondary levels. These teachers were purposively selected based on their active engagement with digital tools during the COVID-19 pandemic. Representing a spectrum of career stages from novices to experienced professionals, their inclusion ensured diverse insights into the impact of reflective practices on DLA. Geographical diversity was achieved by selecting participants from five zones across Malaysia - Central, North, South, East Coast,

and East Malaysia. This approach accounted for differences in access to digital resources and infrastructure, highlighting regional variations in reflective practices. School administrators were also purposively sampled, with five participants representing leadership roles during the transition to online teaching. Their perspectives provided essential context for understanding the institutional policies, support structures, and leadership strategies that influenced teachers' reflective practices and DLA. These insights connected individual teacher experiences to broader systemic factors, offering a comprehensive view of the educational landscape. Parents were recruited using advertisements in Telegram groups, with selection criteria including the ages of their children and their geographical location during the Movement Control Order (MCO) period. Twenty parents participated, offering valuable perspectives on the home learning environment and how teachers' reflective practices impacted students' educational experiences. Their contributions bridged classroom strategies with real-world outcomes, providing a critical dimension to the study.

Data Collection Tool

Data collection methods were tailored to align with the roles and expertise of each participant group, ensuring a comprehensive understanding of reflective practices and their role in enhancing DLA. Teachers, as the primary focus of the study, participated in observations, semi-structured interviews, and photo analysis. For administrators and parents, semi-structured interviews were employed to contextualise and complement the data gathered from teachers.

For teachers, observations were conducted using an adapted ICT Readiness Assessment Model (21). These focused on two critical components: personal devices and physical ICT structures. Observations provided baseline insights into the availability and functionality of digital infrastructure, revealing its impact on reflective practices. Semi-structured interviews allowed teachers to elaborate on their experiences with digital tools, their reflective practices, and their adaptations during online teaching. Photo analysis further enriched the data by visually documenting

teaching practices and digital environments, offering additional context to their reflective strategies.

For school administrators, interviews explored their roles in shaping institutional policies, providing administrative support, and leading during the pandemic. These discussions contextualised teachers' experiences within systemic practices, highlighting the interplay between individual reflections and institutional frameworks.

For parents, interviews examined their involvement in facilitating online learning, their perceptions of digital tools, and the challenges they encountered during the MCO. These conversations provided a complementary perspective on how teachers' reflective practices translated into effective home-based learning experiences, underscoring the broader implications of DLA.

Data Triangulation

The integration of data from teachers, administrators, and parents was central to addressing the study's objective of exploring how reflective practices enhance DLA. Teachers' data offered direct insights into how reflective practices were employed to adapt teaching strategies, improve the use of digital tools, and overcome challenges in online learning. These individual-level experiences were enriched by administrators' perspectives, which contextualised teachers' reflections within broader institutional practices, highlighting systemic enablers and constraints. Parents' contributions bridged the gap between classroom strategies and their real-world impact, illustrating how reflective practices shaped students' home-based learning experiences. By triangulating these perspectives, the study constructed a comprehensive narrative of DLA development, capturing both individual and systemic factors that influence reflective practices. This approach ensured a holistic understanding of the educational ecosystem, aligning the findings with the study's objective of fostering adaptable and innovative teaching in technology-rich environments. Table 1 summarises the types and number of participants, including teachers, school administrators, and parents involved in the study.

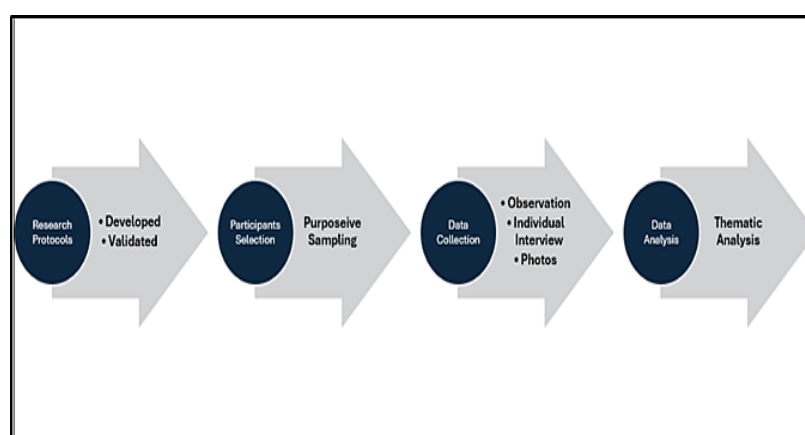
Table 1: Number of Participants Involved in the Study based on Their Geographical Locations

Location	Peninsular/ West Malaysia			East Malaysia (Sabah, Sarawak, Labuan)	Total
Zone	Central (Kuala Lumpur, Selangor, Putrajaya)	North (Perlis, Kedah, Penang, Perak)	South (Johor, Negeri Sembilan, Malacca)		
Primary School Teachers	2	2	2	4	10
Secondary School Teachers	2	2	2	4	10
School Administrators	1	1	1	2	5
Parents	4	4	4	8	20

Data Analysis

Thematic analysis, following Braun and Clarke's six-phase framework, was employed to systematically identify and interpret patterns within the data (22). The analysis began with a thorough familiarisation process, where interview transcripts, observation notes, and photographs were reviewed repeatedly to identify initial ideas. Key features of the data were then systematically coded using Atlas.ti software, ensuring that critical insights were captured across all participant groups. Codes were organised into potential themes, which were refined and reviewed to ensure alignment with the study's objectives. Themes were clearly defined, with descriptive names that captured their essence. The final narrative synthesised these themes into a coherent

account, contextualising the findings within the broader literature on reflective practices and DLA. Direct excerpts from participants provided rich, evidence-based support for the analysis (23, 24). This robust methodological approach enabled the study to construct a nuanced narrative of how reflective practices contribute to DLA among Malaysian school teachers. By integrating diverse perspectives and employing a rigorous analytical framework, the study offered valuable insights into the individual and systemic factors influencing reflective practices, providing a foundation for future research in this area. As illustrated in Figure 1, the research process was carried out in multiple stages, moving from participant recruitment and data collection to systematic analysis and validation. This step-by-step design ensured methodological rigour and contextual depth.

**Figure 1:** Research Process

Validity and Credibility

This study applied Lincoln and Guba's four trustworthiness criteria to ensure rigour: credibility, transferability, dependability, and conformability (25). Credibility was enhanced

through prolonged engagement with participants, triangulation of data sources (interviews, observations, photo analysis), and member checking during analysis. Transferability was supported by detailed descriptions of participants,

settings, and contextual variations across five Malaysian zones, allowing readers to assess relevance to other contexts. Dependability was addressed through clear documentation of methodological procedures and the use of Atlas.ti for systematic coding. Conformability was strengthened by maintaining an audit trail, using reflexive journaling, and conducting peer debriefings to reduce researcher bias.

Results and Discussion

Reflection is widely recognised as a cornerstone of professional growth, enabling educators to critically evaluate their teaching practices, identify areas for improvement, and implement meaningful changes. Conventional reflective practices often involve structured approaches, such as written reflections, lesson evaluations, and post-lesson reviews. However, this study found that in technology-rich environments, teachers are evolving beyond traditional formats adopting more flexible and context-sensitive reflective approaches to overcome constraints like time limitations and procedural rigidity. These evolving practices signal an important shift toward more agile and integrated forms of teacher reflection. Three significant sub-themes emerged from the data: Informal Reflective Practices, Goal-Oriented Reflective Practices, and Adaptive Reflection for Enhanced Teaching. Each theme highlights distinct yet interrelated strategies through which teachers operationalize reflection to support their digital

pedagogy. Together, they address the study's objective by revealing how Malaysian teachers cultivate DLA through reflective adaptation, problem-solving, and responsiveness in their teaching practices.

These findings suggest that Digital Learning Agility (DLA) is best understood as an iterative, reflection-driven process rather than solely as digital competence, fluency, or ICT integration. In this sense, DLA aligns with frameworks such as DigCompEdu and TPACK, but advances beyond them by emphasising adaptability and reflection as the core mechanisms through which teachers sustain digital practice in evolving educational contexts.

Additionally, observational investigations provided valuable insights into the physical and digital resources that facilitate reflective practices. Observations focused on two critical components: personal devices and physical ICT structures. These elements were identified as essential enablers for teachers' reflective practices, helping them adapt and innovate their teaching strategies effectively. These infrastructural elements are not merely background conditions. Instead, they play a pivotal role in sustaining reflection-in-action, thereby enhancing DLA through continuous feedback and experimentation. The findings from these observations, summarised in **Table 2**, add depth to the study by illustrating how infrastructure and technology support reflection.

Table 2: The Summary of Observations on Schools' Digital Preparedness

Schools' Digital Preparedness	Notes
Personal Devices	Teachers have their own personal devices, which they bought on their own. These gadgets, which include laptops, tablets, and other personal technology, differ in kind and functionality according to each buyer's budget. The devices also vary in terms of screen size, RAM capacity, and other features. This diversity shows the teachers' intentional attempts to remain digitally competent while also reflecting their varying financial capacities.
Physical (ICT) Structures	Ministry of Education of Malaysia have invested in physical ICT infrastructure, such as computer labs, multimedia projectors, Wi-Fi networks, and other critical technological capabilities for schools. These are critical for facilitating digital learning settings. However, the quality and availability of these tools might vary by school, typically dependent on finance and location.

Informal Reflective Practices

Among the sub-themes, Informal Reflective Practices emerged as a significant finding, highlighting alternative methods adopted by educators to reflect on their teaching. These practices often bypass conventional written approaches, focusing instead on dynamic and immediate strategies that are more compatible with fast-paced digital teaching environments. They represent a shift from static to fluid forms of reflection, where teachers engage in real-time evaluation and collaborative meaning-making. Two key types of informal reflective practices were identified: interpersonal reflection and informal discussions. Interpersonal reflection involves individual, self-directed evaluations facilitated by digital tools, enabling teachers to critically assess their teaching experiences in real-time. Informal discussions, on the other hand, are unstructured, conversational reflections among teachers, administrators, and parents, fostering the exchange of ideas and collaborative problem-solving.

Observations of schools' digital preparedness revealed that personal devices and ICT infrastructures played a pivotal role in enabling both types of reflective practices. The findings demonstrate how these practices contribute to the development of Digital Learning Agility (DLA) among Malaysian school teachers, particularly in their ability to adapt and improve teaching strategies in response to digitalisation.

One type of informal reflective practices identified is Interpersonal reflection which involves individual or one-on-one reflective practices, often facilitated by digital tools. These reflections enable teachers to critically evaluate their teaching experiences in real-time, addressing immediate challenges and opportunities for growth.

Teachers frequently utilised personal devices such as laptops, tablets, and smartphones to engage in interpersonal reflection. These tools allowed educators to document quick notes, access teaching applications, and evaluate their strategies on the go. SecondaryTeacher2 described her approach: "There is no documented reflection in writing, but we do reflect every class on what pros and cons we face with a class or lesson when using the apps." (SecondaryTeacher2)

Observational data corroborates this, revealing that most teachers had access to personal devices.

While the specifications of these devices varied based on financial capacity, their availability demonstrated teachers' intentional efforts to remain digitally competent.

Parents also highlighted the importance of interpersonal reflection. Parent11 commented: "I think it's important for teachers to evaluate themselves after every class, especially with the digital tools they're using. It helps them adjust faster." (Parent11)

The presence of ICT infrastructures observed in schools, such as Wi-Fi networks and multimedia projectors, further supported interpersonal reflection. These resources provided an environment conducive to experimentation with digital tools and refinement of teaching strategies. This aligns with the concept of reflective practitioner, where professionals engage in real-time thinking and adjust their practice in situ (26). Another study also highlighted the importance of reflection on experience for deeper professional learning. These foundational ideas remain relevant, particularly as reflection increasingly occurs through technology-enhanced, informal channels (27).

Recent research reinforces this shift. A study demonstrated that structured digital self-reflection tools encouraged both individual and collaborative reflection (28). This supported teacher agency and pedagogical awareness in digital settings. Teachers who used the tool informally, even outside required training, reported increased motivation to refine their digital practices.

Interpersonal reflection, as observed in this study, empowers teachers to engage in immediate, self-directed evaluation using accessible digital tools. These quick, often undocumented reflections allow educators to respond to classroom challenges in real time, promoting continuous professional growth. Supported by personal devices and school ICT infrastructure, such practices demonstrate how individual reflective habits contribute meaningfully to the development of DLA.

Another type of informal reflective practice identified is informal discussions, which refers to unstructured, conversational, reflective practices among teachers, administrators, and parents. These interactions provide a platform for sharing insights, brainstorming solutions, and fostering collective professional growth.

Informal discussions were identified as a critical practice among teachers. SecondaryTeacher8 shared her experience: “After every big project or lesson series, we gather in the FrogVLE (Frog Virtual Learning Environment) classroom and discuss what worked and what didn’t. Everyone contributes, and we come up with ideas for improvement.” (SecondaryTeacher8)

Observational data supported this, highlighting how schools with FrogVLE-enabled classrooms and robust ICT infrastructures facilitated structured yet informal reflective sessions. These discussions fostered a sense of community among

teachers, encouraging the exchange of ideas and collaborative problem-solving. **Figure 2** was shared by SecondaryTeacher8, showing reflective practices practised by her and her colleagues, utilising their personal devices and also physical (ICT) structures in their school – FrogVLE classroom. **Figure 2** exemplifies how teachers engaged in group reflective sessions, using both personal devices and ICT infrastructure. This illustrates the collaborative and informal dimension of reflective practices, which supports shared problem-solving and professional growth.



Figure 2: A Picture of Teachers' Group Reflective Session

Administrators also valued informal discussions as a foundation for professional development. SchoolAdministrator2 stated: “When teachers reflect together, they’re able to support each other and come up with innovative solutions. It’s a key part of our professional development strategy.” (SchoolAdministrator2) Parents echoed this sentiment, highlighting the broader implications of informal discussions. Parent15 noted: “Teachers should collaborate more. It’s better when they share ideas and help each other improve.” (Parent15)

These findings align with a recent study showing how a teacher-led community of practice, sustained over two years, enhanced collaborative problem-solving and reflective dialogue among primary school teachers (29). In the present study, the availability of ICT resources such as multimedia tools and digital platforms, including FrogVLE, enabled similar informal discussions by creating spaces for ongoing peer reflection and co-construction of strategies for teaching improvement. More broadly, this evidence supports earlier work highlighting the role of

dialogue and collaboration in fostering expansive learning (8). Together, these findings confirm that informal, dialogic reflection enhances adaptability and collective problem-solving in technology-rich environments. Collectively, Informal Reflective Practices demonstrate how flexibility and immediacy are central to developing DLA. Through spontaneous evaluation and social learning, teachers are able to test ideas, revise strategies, and build confidence in using digital tools. These practices reflect a form of “everyday agility” that supports iterative growth in rapidly changing educational settings.

Goal-Oriented Reflective Practices

The sub-theme Goal-Oriented Reflective Practices explores how teachers engage in purposeful and structured reflection to evaluate specific aspects of their teaching, such as lesson effectiveness, student engagement, and the integration of digital tools. Such intentional reflection is critical to developing DLA, as it moves beyond surface-level adjustments toward data-informed decision-making in digital instruction. Instead, this focused approach enables educators to identify strengths

and areas for improvement, fostering the development of DLA in response to digitalisation. By triangulating data from observations, interviews, and photographs, this study demonstrates how goal-oriented reflection enhances teaching strategies and promotes continuous professional growth.

Observational data revealed that schools' digital preparedness, including personal devices and ICT infrastructures, played a pivotal role in facilitating goal-oriented reflective practices. Teachers used personal devices, such as laptops and tablets, to document their reflections, experiment with teaching applications, and evaluate the effectiveness of their methods. ICT infrastructure, including Wi-Fi networks and multimedia projectors, provided additional support by enabling the integration of digital tools into reflective practices. These resources allowed teachers to reflect on their strategies systematically and adapt to the dynamic needs of technology-rich classrooms.

Participants consistently emphasised the importance of reflection in improving their teaching strategies. SecondaryTeacher6 highlighted:

"It will be helpful for teachers in terms of knowing what to do in future lessons... I think educators will also get important insights on what to use in terms of delivering their lessons to their students in the future, especially on online learning platforms."

(SecondaryTeacher6)

This statement illustrates how goal-oriented reflection provides actionable insights for refining lesson delivery and integrating digital tools.

Observations confirmed that personal devices were indispensable for facilitating such reflections, enabling teachers to assess their teaching methods in real-time and make informed adjustments.

This aligns with Gustafsson and Fagerberg's perspective that intentional reflection enhances self-awareness and strengthens professional competence (30). Teachers in this study articulated how they reflected on outcomes to inform future lesson planning and technology integration. This approach is supported by recent literature as well. For example, researchers developed the ReflAct formative reflection tool, which helped teachers in video-coaching settings align their reflections with specific learning goals (31). The study showed that providing structured prompts and goal-based scaffolding led to deeper and more actionable insights. Similarly, it has been illustrated how digital storytelling was used by teachers working with migrant and refugee students to assess how their pedagogy supported students' sense of belonging (32). By linking visual storytelling to learning objectives, teachers became more intentional in both lesson design and reflective analysis. Teachers also employed innovative methods to reflect on specific teaching outcomes, demonstrating how goal-oriented reflection can incorporate creative tools. For instance, SecondaryTeacher4 created a collage documenting a project-based learning activity involving TikTok (see **Figure 3**). This visual tool enabled her to assess students' engagement, learning outcomes, and attitudes towards social media, demonstrating how goal-oriented reflection can be supported by innovative digital tools.



Figure 3: A Collage by SecondaryTeacher4 Assessing Student Engagement and Learning outcomes through Tiktok

This innovative approach exemplifies how teachers use creative tools to evaluate teaching outcomes in a targeted manner. Such practices resonate with a study that emphasises the role of openness and praxis in fostering reflective innovation (33). By integrating visual documentation, teachers engage in deeper, more goal-oriented reflections, addressing specific objectives such as enhancing student engagement and evaluating the effectiveness of digital platforms. The significance of goal-oriented reflective practices was echoed by school administrators and parents, who recognised their value in improving teaching effectiveness. SchoolAdministrator5 observed: “For me, reflection is actually very important because we (will) know what problems we face and need to overcome. Sometimes that can be done in terms of student involvement... Maybe our method is too advanced.” (SchoolAdministrator5)

Parent9 added: “They (teachers) have to reflect whatever they have done before especially just after the class so that they know what mistake they did and then their weakness and their strength so that they can improve in the next class.” (Parent9) These insights underscore how goal-oriented reflection fosters collaboration and shared responsibility among educators, administrators, and parents, supporting a cohesive approach to teaching improvement. Such practices contribute to a reflective culture that promotes the development of DLA in technology-rich educational environments.

The findings also demonstrate how goal-oriented reflection supports intentional evaluation of teaching strategies. This resonates with research showing that intentional reflection strengthens professional competence (30). Formative reflection tools have been shown to prompt teachers to align their practice with specific learning objectives (31), while digital storytelling has been used to support goal-driven reflection and improve pedagogy for migrant and refugee students (32).

In summary, the sub-theme of Goal-Oriented Reflective Practices highlights the intentional and targeted reflection teachers employ to improve their teaching strategies and adapt to technological advancements. By leveraging digital tools, ICT infrastructure, and innovative approaches like visual documentation, teachers engage in

actionable reflections that align with specific educational objectives. These practices not only enhance teaching effectiveness and student engagement but also contribute significantly to the development of DLA, addressing the study’s objective of fostering adaptable and innovative teaching in technology-enhanced environments.

Adaptive Reflection for Enhanced Teaching

This sub-theme, Adaptive Reflection for Enhanced Teaching, highlights the iterative and student-centered nature of reflective practices that teachers engage in to evaluate and improve their teaching strategies. These reflections focus on assessing the effectiveness of digital tools, evaluating student engagement, and incorporating feedback from diverse sources to adapt teaching practices in response to digitalisation.

Observations revealed that schools’ digital preparedness, including personal devices and ICT structures, supported teachers in engaging in adaptive reflection. Personal devices such as laptops and tablets allowed educators to evaluate teaching methods and assess student engagement in real time, while ICT infrastructures, like Wi-Fi networks and multimedia projectors, provided opportunities to test and refine digital tools in classroom settings. This infrastructure enabled teachers to incorporate student feedback and evaluate the effectiveness of their strategies systematically.

Teachers frequently reflected on the suitability of digital tools for enhancing student learning. SecondaryTeacher8 shared: “Yes, I did reflect on whether it was suitable for me in terms of using iPad... I think they learned better when I use that device as a teaching tool in my classroom.” (SecondaryTeacher8)

This response illustrates how adaptive reflection involves evaluating the impact of instructional tools on student engagement and learning outcomes. The process allows teachers to refine their strategies, ensuring that digital tools are effectively integrated into their teaching.

Another participant, SecondaryTeacher9, emphasised the importance of addressing challenges during teaching sessions: “Yes, I do reflect in terms of either the ability of the students to use the digital platform method that I use or the problems that the students face throughout the teaching and learning session.”

(SecondaryTeacher8). A teacher shared Figure 4 to illustrate her adaptive reflective practice. Figure 4 provides an example of adaptive reflection, where teachers used student feedback from Google

Classroom to refine lesson strategies. This underscores how digital platforms can facilitate iterative reflection-in-action and reflection-on-action.

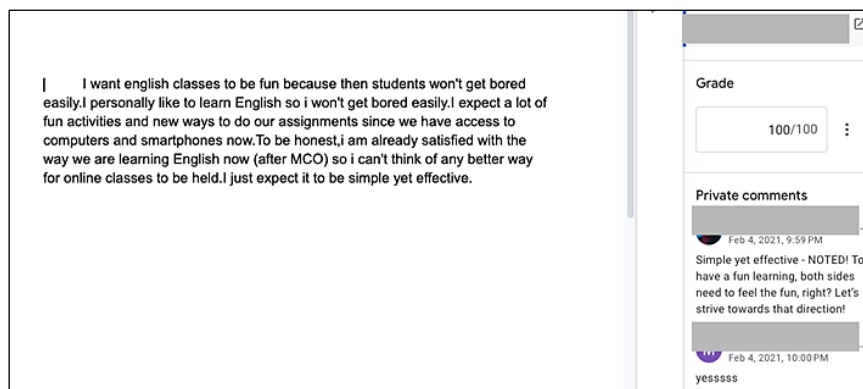


Figure 4: A Screenshot of a Teacher doing Adaptive Reflective Practice through Student's Feedback on Google Classroom

This practice demonstrates how adaptive reflection enables teachers to identify and address obstacles, ensuring that digital tools are accessible and effective for all students. Participants also highlighted the value of student and parental feedback in shaping their teaching methods. PrimaryTeacher1 shared:

"I did get feedback from my students and their parents regarding my lessons right. So, during that moment I do reflect (pause)... I do self-reflection after the school reopens. Additionally, I did ask my colleagues whether my way of teaching is correct." (PrimaryTeacher1)

This iterative process of gathering feedback from multiple stakeholders reflects the dynamic and adaptive nature of reflective practices, demonstrating how teachers continuously refine their strategies to meet diverse needs.

The findings illustrate how adaptive reflection directly contributes to the development of DLA by enabling teachers to iterate and refine their teaching strategies. Through self-assessment, feedback integration, and evaluation of digital tools, teachers build agility in navigating technology-rich educational environments. These

practices foster continuous improvement, ensuring that teaching methods remain effective and responsive to the demands of digitalisation.

These findings echo the distinction between reflection-in-action and reflection-on-action (26). Video-based reflection has also been shown to improve teachers' responsiveness to student needs (34), while structured formative tools such as ReflAct have helped teachers iteratively refine strategies (31). Taken together, this evidence highlights adaptive reflection as a critical driver of agility in technology-enhanced classrooms.

The sub-theme Adaptive Reflection for Enhanced Teaching underscores the iterative and diverse nature of reflective practices that enable teachers to adapt their methods to meet the needs of students and the challenges of digitalisation. By leveraging digital tools, incorporating feedback, and systematically evaluating teaching strategies, teachers enhance their DLA, fostering a culture of continuous learning and improvement in technology-enhanced educational environments. Table 3 presents a summary of the study's overall findings, synthesising insights from all three sub-themes to illustrate how different forms of reflection contribute to the development of Digital Learning Agility (DLA) among teachers.

Table 3: The Summary of the Study's Findings

Sub-theme	Key Findings	Observational Data
Informal Reflective Practices	Educators bypass traditional written reflection by engaging in interpersonal reflection and informal discussions. These methods leverage real-time and	Personal devices (laptops, tablets, and smartphones) and ICT infrastructure (Wi-Fi, FrogVLE classrooms) enable practices.

Goal-Oriented Reflective Practices	collaborative feedback to address immediate challenges and share ideas. Teachers engage in intentional reflection focusing on specific goals, such as evaluating teaching outcomes, student engagement, and digital tool integration. Creative methods like visual documentation enhance targeted evaluations.	Teachers frequently use personal devices to document reflections. ICT tools support systematic assessment and feedback.
Adaptive Reflection for Enhanced Teaching	Iterative and feedback-driven reflective practices, including evaluating digital tool effectiveness and incorporating student and parental feedback, ensure continuous improvement. Emphasises addressing obstacles in teaching sessions and refining methods based on diverse inputs.	Personal devices and ICT structures support iterative evaluations and experimentation.

Building on these findings, the analysis further reveals that enhanced digital agility is closely linked to specific reflective practices such as journaling, peer dialogue, and self-evaluation. For instance, journaling enabled teachers to systematically document challenges and solutions, creating a feedback loop that informed future practice. Peer discussions, whether formal or informal, provided collective sense-making opportunities that encouraged innovation and risk-taking. Self-evaluations, often carried out immediately after lessons, allowed teachers to critically assess their digital strategies and make agile adjustments. Taken together, these practices illustrate how reflection functions not only as a retrospective exercise but also as a proactive driver of agility in digital teaching.

Beyond individual classroom practices, these insights also carry implications for professional development (PD). Embedding reflective practices directly into PD initiatives could help teachers systematise and sustain their agility. For example, digital reflection journals can provide a structured way for teachers to document and analyse their classroom experiences over time. Peer-coaching cycles and collaborative workshops may further encourage shared reflection, offering spaces for feedback, problem-solving, and innovation. By institutionalising such reflective approaches, PD programmes can move beyond technical skill training to cultivate the metacognitive and adaptive capacities that underpin DLA.

At the institutional level, reflective practices can be sustained through policies and structures that

normalise ongoing reflection as part of professional culture. For example, schools can integrate reflective dialogue into staff meetings, adopt digital platforms that facilitate ongoing self- and peer-reflection, and develop communities of practice supported by school leadership. At the systemic level, ministries and policy agencies could embed reflection into national teacher standards, evaluation frameworks, and professional development requirements, ensuring that reflective engagement is recognised as a core competency of digital teaching. Embedding reflection across these levels ensures that DLA extends beyond individual practice and becomes a shared and sustainable feature of the education system.

Taken together, these implications show that reflection operates at multiple levels, from individual classrooms and professional development initiatives to institutional policies and national standards. Framing reflection in this way highlights its role not only in shaping immediate teaching strategies but also in sustaining DLA as a systemic and long-term feature of educational transformation, thereby setting the stage for the broader conclusions of this study.

Conclusion

The novelty of this study lies in its conceptualisation of Digital Learning Agility (DLA) as distinct from digital competence or literacy, its empirical exploration of how reflective practices foster agility among Malaysian teachers, and its situating of these insights within a national policy

context shaped by the Digital Education Policy and Malaysian Teacher Standards 2.0. Building on this contribution, the study further illuminates the critical role of reflective practices in developing teachers' DLA within the dynamic context of education. The findings demonstrate that reflective practices enable teachers to adapt their teaching strategies, overcome barriers to technology integration, and enhance student engagement. By leveraging observations of schools' digital preparedness, qualitative interviews with teachers, school administrators, and parents, as well as photo analysis, this study provides a comprehensive understanding of how reflective practices cultivate DLA.

The findings identified three sub-themes that define how teachers engage in reflection: Informal Reflective Practices, Goal-Oriented Reflective Practices, and Adaptive Reflection for Enhanced Teaching. These reflective approaches highlight the innovative and diverse strategies employed by teachers to address challenges and seize opportunities in technology-rich environments.

Informal Reflective Practices underscore the importance of interpersonal reflections and informal discussions among teachers, administrators, and parents. Teachers utilised personal devices and ICT infrastructures to reflect in real-time, fostering collaborative problem-solving and adaptability. These findings align with the necessity for dynamic reflection to navigate digitalisation effectively.

Goal-oriented Reflective Practices illustrate the intentional and targeted nature of reflection, focusing on evaluating teaching strategies, student engagement, and the integration of digital tools. Teachers demonstrated creativity in their reflective approaches, employing innovative tools such as visual documentation to assess and refine their practices. This intentionality supports the development of DLA by enabling educators to align their methods with specific educational objectives. Adaptive Reflection for Enhanced Teaching highlights the iterative and feedback-driven aspects of reflection. Teachers continuously refined their teaching strategies by evaluating digital tools, addressing challenges, and incorporating input from students, parents, and colleagues. These practices ensure that educators remain responsive to the evolving demands of

digitalisation, fostering continuous improvement in their teaching approaches.

Observational data further underscored the role of digital preparedness in supporting these reflective practices. Personal devices and ICT infrastructures provided the foundation for effective reflection, enabling teachers to innovate and enhance their methods systematically. This intersection of infrastructure and practice reflects the critical relationship between resources and the development of DLA.

Despite these contributions, this study is not without limitations. The qualitative case study design provided rich, contextualised insights but limits the generalizability of findings. Participant self-reports may also have been subject to bias, and the scope of the study was confined to Malaysian schools, restricting cross-cultural comparisons. In addition, the absence of longitudinal tracking limited insights into how teachers' digital agility evolves over time. Recognising these limitations provides directions for future research to expand and test the framework across wider contexts.

Future research should further expand this study in several directions. Cross-cultural comparisons would be valuable for examining how reflective practices for digital agility vary across education systems. Longitudinal studies could also capture how teachers' digital agility develops over time, providing insights into sustained professional growth. In addition, the development of diagnostic or evaluative instruments would enable more systematic assessment of Digital Learning Agility (DLA), strengthening both research and practice in this emerging field.

In conclusion, reflective practices serve as a catalyst for cultivating teachers' DLA, empowering them to adapt, innovate, and thrive in technology-enhanced educational settings. This study underscores the need for a culture of continuous reflection, where teachers engage in diverse and dynamic practices to improve teaching effectiveness and student learning outcomes. Future research could further explore the integration of digital tools in reflective practices, investigating how technology can facilitate real-time feedback and support teachers' ongoing development. By expanding the understanding of reflective practices and their role in fostering DLA, educators and policymakers can create

environments that support professional growth and optimise student learning in the digital age.

Abbreviations

DEP: Digital Education Policy, DLA: Digital Learning Agility, FrogVLE: Frog Virtual Learning Environment, ICT: Information and Communication Technology, LA: Learning Agility, MCO: Movement Control Order, MTS 2.0: Malaysian Teacher Standard 2.0, PD: Professional Development.

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Author Contributions

Kamilah Abdullah: data collection, data analysis, manuscript drafting, Mas Nida Md. Khambari: lead researcher of this project, research design, literature review, data analysis and interpretation, manuscript editing, Su Luan Wong: data analysis and interpretations, conducted member checking, performed proofreading, Noor Syamilah Zakaria: data analysis and interpretations, conducted member checking, performed proofreading, Nur Dania Mohd Rosli: assisted in data collection, Priscilla Moses: data analysis and interpretations, conducted member checking, performed proofreading, Nur Aira Abdrahim: data analysis and interpretations, conducted member checking, performed proofreading. All authors reviewed and approved the final version of the manuscript.

Conflict of Interest

The authors declare that there are no conflicts of interest regarding the publication of this article.

Declaration of Artificial Intelligence (AI) Assistance

During the preparation of this manuscript, the authors used ChatGPT (OpenAI) only for language editing and formatting support (e.g., rephrasing sentences into passive voice for consistency with journal style, improving cohesion, and standardising reference formatting). After using this tool, the authors reviewed, verified, and edited

all content and accept full responsibility for the manuscript's accuracy and integrity. No generative AI tools were used to generate or analyse data, to create results or conclusions, or to draft original scholarly claims. No confidential or personal data were provided to the tool.

Ethics Approval

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