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Learning Agility as a Predictor of 21st-Century Teaching Skills

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This study investigated the predictive role of teachers' learning agility in explaining their 21st-century teaching skills using partial least squares structural equation modeling. The sample comprised 302 teachers recruited through convenience sampling. Learning agility is mainly/oftentimes conceptualized as a multidimensional construct including self-awareness, people agility, results agility, change agility, and mental agility. Teachers' 21st-century teaching skills were assessed with an 18-item instrument adapted from an established framework and refined for use in the present study. The findings indicated that the dimensions of learning agility do not contribute equally to teachers' 21st-century teaching skills. Self-awareness, people agility, and results agility were significant positive predictors, whereas change agility and mental agility did not show significant direct effects. Collectively, the learning agility dimensions explained 37.8% of the variance in teachers' 21st-century teaching skills, suggesting a meaningful level of explanatory power. Overall, the results suggest that learning agility functions as a higher-order meta-competence that supports the development and sustained enactment of contemporary teaching skills rather than representing the direct content of those skills. The study extends learning agility research to the teaching profession and offers practical implications for teacher education and professional development programs, particularly those aiming to strengthen reflective capacity, interpersonal effectiveness, and performance-oriented learning.

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Introduction

Contemporary educational processes and the core components that constitute these processes, including students, teachers, and educational practices, are currently undergoing rapid transformation. The accelerating pace of knowledge production, population growth, technological developments, and evolving pedagogical approaches have made this transformation increasingly complex and uncertain. As a result, the ability to cope with uncertainty and adapt to new conditions has become a critical requirement for all stakeholders within educational settings (Yoon, 2022). Among these stakeholders, teachers occupy a particularly central role, as they are the primary agents responsible for enacting educational practices in real instructional contexts. The competencies demonstrated by teachers directly influence students' learning processes and outcomes. Therefore, teachers' capacity to adapt to changing educational demands, recognize opportunities for professional development, sustain and optimize their performance, and address novel situations by drawing on prior knowledge is essential for the effective education of future generations.

In this context, learning agility has gained prominence as a critical capability that refers to an individual's capacity to learn from new experiences, transfer acquired knowledge across different contexts, and apply that knowledge flexibly in response to emerging situations (De Meuse et al., 2010; Lombardo & Eichinger, 2000). Similarly, the ability to internalize ongoing transformations in education and respond effectively to change is closely associated with the acquisition of 21st-century skills. These skills are commonly described through competencies such as critical thinking, problem solving, self-regulation, flexibility, and adaptability (Akkoyunlu & Yılmaz Soylu, 2018; Doğu, 2022; Trilling & Fadel, 2009; Wagner, 2008). Additionally, artificial intelligence in education introduces a new competence domain for educators that goes beyond basic digital literacy, requiring data and algorithm literacy, computational and design thinking, and a strong emphasis on ethical and responsible AI use in educational contexts (Mikeladze et al., 2024). Within the context of teaching, 21st-century skills have been conceptualized in various ways. According to the International Society for Technology in Education teacher standards, teachers are expected to function as learners, leaders, digital citizens, collaborators, designers, facilitators, and analysts (ISTE, 2024). These roles require teachers to generate alternative solutions, demonstrate creativity, exhibit effective instructional leadership, implement innovative practices, and adapt to continuously changing educational processes.

Taken together, these requirements point toward the relevance of learning agility and suggest that it may play an important role in shaping teachers' 21st-century teaching skills. However, the concept of learning agility has been predominantly examined within managerial and organizational contexts in the existing literature, where it has been linked primarily to leadership development, managerial performance, career advancement, and organizational adaptability (Lombardo & Eichinger, 2000; DeRue et al., 2012). As a result, its relevance to teachers' instructional practices and teaching competencies has largely remained secondary. In contrast, the teaching profession constitutes a professional context that demands a high level of learning agility due to changing learner needs, rapidly evolving technological tools, and increasingly diversified pedagogical expectations. Despite this alignment, a review of the literature reveals that empirical studies directly examining the relationship between learning agility and pedagogical competencies such as teachers' 21st-century teaching skills remain extremely limited. This gap highlights the need for a deeper understanding of how learning agility operates within the teaching context and how it contributes to the development of contemporary teaching competencies. Accordingly, the present study aims to examine the role of teachers' learning agility in explaining their 21st-century teaching skills.



Theoretical Background

21st-Century Teaching Skills

In an era characterized by rapid knowledge expansion, individuals' ability to adapt to change depends not only on possessing information but also on acquiring higher-order skills such as critical thinking, problem solving, communication, collaboration, and effective use of technology. These competencies are commonly referred to in the literature as 21st-century skills and are conceptualized as multidimensional structures encompassing cognitive, affective, and social domains (Akkoyunlu & Yılmaz Soylu, 2018; Trilling & Fadel, 2009). In recent years, the widespread integration of artificial intelligence into everyday life and learning environments has further amplified the importance of these higher-order competencies, as individuals are increasingly expected to evaluate information quality, make evidence-informed decisions, and use intelligent tools effectively and responsibly (Tenberga & Daniela, 2024). Teachers are not exempt from the implications of this rapid transformation. Teaching in the twenty-first century has moved beyond a profession grounded solely in subject matter knowledge and routine classroom practices. Instead, it has become a dynamic professional field that requires continuous learning and high levels of adaptability due to rapidly changing curricula, digital learning environments, increasingly diverse student needs, and evolving assessment approaches. The COVID-19 pandemic accelerated this transformation by forcing schools and teachers into emergency remote teaching and, later, more permanent hybrid models, thereby making flexibility, digital competence, and technology integration central to instructional practice rather than optional add-ons (Ivanov et al., 2025; Purba et al., 2022). International frameworks emphasize that teachers should systematically support skills such as critical thinking, problem solving, communication, collaboration, and digital competence, and integrate these skills into instructional design (Voogt & Roblin, 2012). Moreover, the growing presence of artificial intelligence-based systems (e.g., generative artificial intelligence, learning analytics, adaptive platforms) is reshaping what "effective use of technology" entails, extending expectations toward AI-informed pedagogical decision-making and responsible use of AI in teaching and assessment. This shift highlights that sustaining effective teaching practices under contemporary conditions depends not only on what teachers know, but also on how quickly and effectively they are able to learn and adapt to new situations.

Within this framework, the competencies teachers are expected to possess are commonly addressed under the concept of 21st-century teacher skills. Orhan Göksün and Kurt (2017) conceptualized these skills across five dimensions: confirmatory skills, administrative skills, productive skills, flexible teaching skills, and technopedagogic skills. Confirmatory skills encompass teachers' feedback practices and affirming behaviors that enable students to feel safe and valued within the learning environment. The establishment of a positive classroom climate supports students' active engagement in learning processes and contributes to their academic achievement (Gürültü et al., 2018). As technology-mediated and artificial intelligence supported learning interactions become more common, maintaining confirmatory practices also requires sustaining supportive feedback and socio-emotional safety in digitally enriched environments. Administrative skills refer to effective classroom management, the planning of learning environments, and the organization of instructional processes, all of which facilitate the development of students' communication, collaboration, and problem-solving abilities that are central to 21st-century learning (Astuti et al., 2019). Following COVID-19, managing learning processes often extends across face-to-face and online spaces, increasing the need for systematic planning, coordination, and monitoring of student

engagement within digital platforms (Sing Yun, 2023). Productive skills reflect teachers' capacities to design and develop instructional materials that support the learning process. The effective use of instructional materials enhances learning retention and promotes students' active participation in lessons (Göksün, 2016). In this respect, artificial intelligence tools increasingly function as cognitive and creative supports for teachers in material development (e.g., drafting, adaptation, differentiation), which may enhance productivity while also requiring pedagogical judgment and careful oversight. Flexible teaching skills involve extending learning processes beyond the classroom and supporting instruction through diverse methods and technologies. Such approaches encourage students to engage multiple sensory modalities during learning and foster deeper understanding (Karabulut & Yıldırım, 2018). The pandemic experience highlighted the practical necessity of flexible teaching (Sing Yun, 2023) by normalizing blended and hybrid approaches, and the subsequent spread of AI-supported tools has further expanded the repertoire of methods through which learning can be personalized and extended beyond classroom boundaries. Finally, technopedagogic skills are grounded in the Technological Pedagogical Content Knowledge framework and refer to teachers' ability to integrate content knowledge, pedagogical knowledge, and technological knowledge effectively within instructional practices (Mishra & Koehler, 2006). Given the increasingly prominent role of technology in contemporary educational environments, possessing technopedagogic skills has become critical for ensuring effective and meaningful teaching processes (Asad et al., 2021). In artificial intelligence-rich classrooms, technopedagogic competence also entails understanding how artificial intelligence can support (or constrain) learning, selecting appropriate artificial intelligence-enabled tools, and guiding students toward responsible and ethical use of these technologies within instructional activities (Ning et al., 2024).

Overall, 21st-century teaching skills play a decisive role in strengthening teachers' professional competencies while simultaneously supporting students' acquisition of the skills required by contemporary society. Teachers' demonstration of these competencies not only enhances instructional quality but also positions them as effective role models for learners navigating the demands of the twenty-first century. Against the backdrop of COVID-19-accelerated digitalization and the rapid diffusion of artificial intelligence in education, these competencies become even more consequential, as teachers are expected to sustain learning continuity, foster higher-order skills, and make pedagogically sound choices in increasingly complex, technology-intensive learning ecosystems.

Learning Agility

Although the concept of learning agility was initially examined within disciplines such as organizational psychology and leadership, it has gradually gained relevance for the field of educational sciences. Learning agility is commonly defined as an individual's ability and willingness to derive new learning from experience and to apply what has been learned effectively when encountering unfamiliar situations (Lombardo & Eichinger, 2000). Conceptually, learning agility has been addressed through multiple dimensions, although the specific components of the construct vary across studies. Lombardo and Eichinger (2000), as well as Gravett and Caldwell (2016), conceptualized learning agility in terms of mental agility, social or people agility, results agility, and change agility. De Meuse et al. (2011) extended this framework by incorporating self-awareness as an additional dimension. In a broader perspective, Burke et al. (2016) described learning agility through components such as flexibility, speed, experimentation, risk taking, collaboration, information seeking, feedback seeking, and reflection.



In the present study, learning agility is conceptualized in line with the framework proposed by De Meuse et al. (2010). According to this framework, mental agility refers to an individual's capacity to cope with complexity, examine problems carefully, maintain curiosity, and establish new connections across different concepts. People agility reflects the ability to remain open-minded toward others, demonstrate strong interpersonal skills, and navigate diverse individuals and challenging situations with ease. Change agility is associated with feeling comfortable with change, showing interest in continuous improvement, and taking initiative in leading change efforts. Results agility refers to the ability to deliver outcomes in first-time or challenging situations, both through individual effort and by inspiring others to perform effectively as part of a team. Finally, self-awareness relates to the extent to which individuals understand themselves, including their skills, strengths, weaknesses, blind spots, and latent capabilities.

Learning Agility as an Antecedent of 21st-Century Teaching Skills

Teaching is widely characterized as a profession shaped by continuous change and uncertainty. In line with this perspective, existing research emphasizes that teachers' adaptability capacity is closely associated with effective and sustainable professional functioning (Collie & Martin, 2017). This view provides a strong theoretical foundation for positioning learning agility within educational contexts. Rather than being limited to the execution of established routines, teachers are increasingly expected to function as adaptive professionals who are capable of reorganizing their practices flexibly in response to new and evolving conditions (Ellis & Boyd, 2015).

By automating routine processes while enriching content delivery, AI offers educators a unique opportunity to reconceptualize their professional roles, representing a marked departure from traditional instructional and decision-making practices. AI-enabled tools—such as chatbots (e.g., ChatGPT and Google Gemini), automated grading, and personalized learning systems—are already transforming teaching in unprecedented ways (Vellaichamy, 2023; Porkodi & Cedro, 2025). In this evolving landscape, teachers' skill acquisition and learning agility remain central to professional growth and to shaping instructional outcomes and their effects on students (Kaya, 2023).

The central argument of the present study is that learning agility does not constitute the content of 21st-century teaching skills. Instead, it represents a meta-competence that enables the development, enactment, and sustained application of these skills under changing conditions (DeRue et al., 2012). From this perspective, each dimension of 21st-century teaching skills is expected to align meaningfully with specific components of learning agility.

Confirmatory teaching skills encompass instructional behaviors such as supporting learners, fostering empowerment, creating a safe learning environment, and providing constructive feedback. The sustained enactment of such behaviors relies on teachers' self-awareness, which involves recognizing personal strengths and limitations and remaining open to feedback, as well as people agility, which reflects adaptive communication with students, parents, and colleagues (Özgenel & Yazıcı, 2020). Teachers who remain sensitive to shifting classroom dynamics and are able to regulate their instructional approaches through relational awareness are more likely to demonstrate high levels of learning agility (DeRue et al., 2012).

Administrative skills include classroom organization, instructional planning, time and activity management, and the structuring of learning processes in alignment with instructional goals. These competencies are theoretically associated particularly with results agility and change

agility. Results agility represents the tendency to maintain goal-oriented progress and sustain performance even under uncertain conditions, whereas change agility reflects the capacity to adapt rapidly to new circumstances and restructure instructional flow accordingly (Özgenel & Yazıcı, 2020). Research on teacher adaptability further highlights that the ability to manage uncertainty and respond functionally to changing conditions constitutes a critical component of effective teaching practice (Collie & Martin, 2017).

Productive teaching skills focus on outcomes such as creativity, innovative instructional design, problem solving, and the development of original learning experiences. This dimension is directly related to mental agility, which refers to the ability to integrate multiple perspectives, analyze complex problems, and generate alternative solutions (Özgenel & Yazıcı, 2020). The concept of adaptive expertise further supports this relationship by emphasizing that professional expertise extends beyond speed and routine accuracy to include the capacity to produce flexible and context-sensitive solutions in novel situations (Ellis & Boyd, 2015). Accordingly, teachers with higher levels of learning agility are expected to demonstrate stronger productive teaching practices.

Flexible teaching skills involve differentiated instruction, the use of alternative methods and techniques, adaptation to learner diversity, and real-time pedagogical decision making. Because this dimension requires teachers to perceive changing conditions as opportunities for learning rather than as threats, it is closely associated with both change agility and mental agility (Özgenel & Yazıcı, 2020). Studies focusing on teacher adaptability similarly underscore that cognitive, affective, and behavioral adjustment to new and uncertain conditions represents a central component of teacher effectiveness (Granziera et al., 2016).

Technopedagogic skills refer to teachers' ability to design instruction by integrating technological knowledge with pedagogical decision making, a capacity commonly explained through the Technological Pedagogical Content Knowledge framework (Mishra & Koehler, 2006). However, the rapid evolution of digital tools has transformed technology integration from a static domain of knowledge into an area that requires continuous learning. As a result, the effective enactment of technopedagogic competencies depends not only on access to technology or technical expertise, but also on the capacity to learn new tools quickly, refine practices through experimentation, and align technological use with instructional goals (DeRue et al., 2012). In this context, change agility and results agility can be considered critical antecedents that enable teachers to adopt new technologies in pedagogically meaningful ways and translate them into classroom-level outcomes.

Based on the theoretical considerations outlined above, the dimensions of learning agility are expected to significantly predict teachers' 21st-century teaching skills. Learning agility functions as a meta-competence that supports teachers in reorganizing instructional practices under conditions of change and uncertainty through change agility, structuring pedagogical decisions in more analytical and creative ways through mental agility, maintaining focus on classroom management and instructional goals through results agility, engaging effectively with educational stakeholders through people agility, and sustaining professional development through feedback-oriented self-awareness (Collie & Martin, 2017; DeRue et al., 2012; Özgenel & Yazıcı, 2020). Accordingly, the present study tests the effects of learning agility dimensions on 21st-century teaching skills through the following hypotheses:

H1: Change agility significantly predicts 21st-century teaching skills.



H2: Self-awareness significantly predicts 21st-century teaching skills.

H3: People agility significantly predicts 21st-century teaching skills.

H4: Results agility significantly predicts 21st-century teaching skills.

H5: Mental agility significantly predicts 21st-century teaching skills.

Method

This study used a correlational design to explore how teachers' learning agility is associated with their 21st-century teaching skills. A correlational approach was selected because the purpose was to investigate links among the variables rather than to draw causal conclusions. The hypothesized associations and the overall conceptual model were tested using partial least squares structural equation modeling (PLS-SEM). PLS-SEM was chosen because it allows the concurrent estimation of multiple relationships among latent constructs, offering an integrated evaluation of the proposed model.

Participants

The participants of the study consisted of 302 teachers recruited through a convenience sampling approach. This sampling strategy was preferred due to its practicality and the accessibility of the target population within the study context. Participation was voluntary, and the teachers were invited to take part based on their availability and willingness to contribute to the research. An overview of the participants' demographic characteristics is presented in Table 1.

Table 1. Demographic characteristics of the participants

		<i>f</i>	%
Gender	Female	211	69.9
	Male	91	30.1
Age	20-30	42	13.8
	31-40	111	36.8
	41-50	94	31.1
	50+	54	17.9
Education level	Bachelor's degree	231	76.5
	Master's degree	67	22.2
	Doctorate	4	1.3

Data Collection Tools

Learning agility was assessed using the Marmara Learning Agility Scale. Teachers' 21st-century teaching skills were measured with an instrument developed for the purposes of this study by selecting and adapting 18 items from the 21st-Century Teaching Skills Usage Scale originally proposed by Orhan Göksün and Kurt (2017). The selected items were reviewed and revised to ensure relevance to the present research context, and they were compiled into a single measurement tool administered alongside the learning agility scale. In the present study, 21st-century teaching skills were operationalized as a unidimensional construct because the primary research aim was to examine how learning agility, conceptualized as a meta-competence, predicts teachers' overall 21st-century teaching skills collectively rather than focusing on domain-specific effects. The psychometric quality of this adapted instrument was evaluated within the current sample, and evidence regarding its validity and reliability is reported in the subsequent sections. In addition, a brief demographic

information form was used to obtain descriptive data about the participants (e.g., background and professional characteristics) to support the interpretation of the findings.

The Marmara Learning Agility Scale was developed by Özgenel and Yazıcı (2020) to measure individuals' learning agility levels. It comprises 30 items rated on a five-point Likert-type scale and is organized into five subdimensions: people agility, change agility, mental agility, results agility, and self-awareness. Higher scores indicate greater learning agility, reflecting stronger capabilities in adapting to new situations, learning from experience, and responding effectively to change across these domains.

Data Analysis

IBM SPSS Statistics (Version 23) was used for initial data screening and preparation prior to the main analyses, whereas SmartPLS (Version 4) was utilized to estimate the proposed model and test the study hypotheses. Specifically, partial least squares structural equation modeling (PLS-SEM) was employed to evaluate both the measurement model and the structural model. This approach was considered suitable for simultaneously estimating the relationships among latent variables and examining the overall explanatory power of the proposed framework.

The measurement model was assessed before proceeding to the structural model in order to ensure that the latent constructs met established reliability and validity standards. Convergent validity was examined by reviewing indicator (item) loadings and the average variance extracted (AVE), with additional evidence provided through internal consistency estimates, including Cronbach's alpha (α) and composite reliability (CR). Discriminant validity was evaluated using the Fornell–Larcker criterion as well as the heterotrait–monotrait (HTMT) ratio, which together help determine whether each construct is empirically distinct from the others in the model. These checks were conducted to confirm that the measures adequately represented their intended constructs and that the scales were sufficiently reliable prior to interpreting the hypothesized paths.

After establishing the adequacy of the measurement model, the structural model was tested using a bootstrapping procedure to examine the statistical significance and robustness of the hypothesized relationships. Bootstrapped standard errors and confidence intervals were used to evaluate the stability of parameter estimates and to support inference regarding the proposed effects within the research model.

Findings

Measurement Model

The measurement model was assessed in two sequential steps by evaluating convergent validity and discriminant validity. The results related to convergent validity are summarized in Table 2. Indicator loadings were first examined to establish item-level reliability, whereas Cronbach's alpha and composite reliability (CR) coefficients were reviewed to determine internal consistency at the construct level. Average variance extracted (AVE) values were additionally inspected to evaluate the degree to which the indicators of each construct shared common variance, thereby providing evidence for convergent validity.

Overall, the results suggest that the measures exhibit acceptable psychometric properties. All indicator loadings exceeded the commonly recommended threshold of 0.60, and both



Cronbach’s alpha and CR values were above 0.70 across constructs. These findings indicate that the instruments demonstrate adequate reliability at both the indicator and construct levels (Hair et al., 2017; Kline, 2010; Nunnally & Bernstein, 1994). In terms of convergent validity, AVE values were above 0.50 for all constructs except 21st-century teaching skills, suggesting that the indicators generally captured a substantial proportion of variance in their respective constructs (Hair et al., 2017).

Although the AVE value for the 21st-century teaching skills construct was slightly below the recommended 0.50 threshold (AVE = 0.464), the convergent validity of this construct may still be regarded as acceptable (Van Nguyen, & Habók, 2021). This interpretation is supported by the CR value remaining above 0.70 and by the relatively strong indicator loadings observed for the items representing this construct. Taken together, these results imply that the construct retains adequate internal consistency and that its indicators meaningfully reflect the underlying latent variable despite the marginally lower AVE.

Table 2. Convergent validity

Factors	Item	Item Loading	α	CR	AVE
People agility	People1	0.735	0.713	0.718	0.536
	People 2	0.745			
	People 3	0.740			
	People 4	0.707			
Change agility	Change 1	0.828	0.921	0.929	0.717
	Change 2	0.867			
	Change 3	0.892			
	Change 4	0.848			
	Change 5	0.796			
	Change 6	0.848			
Mental agility	Mental 1	0.712	0.897	0.900	0.583
	Mental 2	0.746			
	Mental 3	0.722			
	Mental 4	0.752			
	Mental 5	0.831			
	Mental 6	0.813			
	Mental 7	0.751			
	Mental 8	0.771			
Results agility	Results 1	0.708	0.875	0.880	0.616
	Results 2	0.804			
	Results 3	0.802			
	Results 4	0.812			
	Results 5	0.830			
	Results 6	0.748			
Self-awareness	Self-awareness 1	0.774	0.882	0.884	0.630
	Self-awareness 2	0.839			
	Self-awareness 3	0.830			
	Self-awareness 4	0.765			
	Self-awareness 5	0.811			
	Self-awareness 6	0.736			
21st-century teaching skills	Skills 1	0.668	0.932	0.935	0.464
	Skills 2	0.711			
	Skills 3	0.626			
	Skills 4	0.708			
	Skills 5	0.639			



Skills 6	0.616
Skills 7	0.719
Skills 8	0.602
Skills 9	0.618
Skills 10	0.683
Skills 11	0.672
Skills 12	0.728
Skills 13	0.774
Skills 14	0.676
Skills 15	0.734
Skills 16	0.750
Skills 17	0.613
Skills 18	0.689

Following the assessment of convergent validity, discriminant validity was examined using the Fornell Larcker criterion and the HTMT ratio. According to the results presented in Table 3, the square root values of the AVE for each construct were higher than the correlations between the constructs. This finding indicates that each construct shares more variance with its associated indicators than with other constructs.

In addition, the HTMT ratio values presented in Table 4 were all below the recommended threshold of 0.90. Taken together, the results obtained from both the Fornell Larcker criterion and the HTMT ratio provide evidence that discriminant validity was adequately established in the measurement model (Fornell & Larcker, 1981; Hair et al., 2017).

Table 3. Fornell-Larcker criterion

	Teaching Skills	Change Agility	Self-Awareness	People Agility	Results Agility	Mental Agility
Teaching Skills	0.681					
Change Agility	0.424	0.847				
Self-Awareness	0.518	0.494	0.793			
People Agility	0.519	0.640	0.511	0.732		
Results Agility	0.559	0.568	0.720	0.569	0.785	
Mental Agility	0.509	0.623	0.654	0.596	0.754	0.763

Table 4. HTMT ratio matrix

	Teaching Skills	Change Agility	Self-Awareness	People Agility	Results Agility	Mental Agility
Teaching Skills						
Change Agility	0.438					
Self-Awareness	0.563	0.535				
People Agility	0.617	0.773	0.636			
Results Agility	0.607	0.622	0.818	0.708		
Mental Agility	0.545	0.676	0.731	0.737	0.854	

As part of the measurement model evaluation, variance inflation factor (VIF) values among the constructs were examined to assess potential collinearity issues. The VIF values ranged between 1.967 and 3.021 and remained below the recommended threshold of 5, indicating that no multicollinearity problem existed among the predictor variables (Hair et al., 2021). Although VIF diagnostics are not a definitive test of common method bias, the consistently low VIF values (all < 5) suggest that common method effects are unlikely to severely distort



the structural relationships. In addition, overall model fit was assessed using the standardized root mean square residual (SRMR). The obtained SRMR value was 0.066, which is below the critical threshold of 0.08. The NFI value for this model is 0.711, which implies that this model improves the fit by 71.1% (Bentler & Bonett, 1980). This result indicates that the proposed model demonstrates an acceptable level of fit (Hu & Bentler, 1999).

Structural Model

PLS-SEM was employed to examine the role of learning agility dimensions in explaining 21st-century teaching skills and, in other words, to test whether the theoretically proposed hypotheses were supported. The results of the structural model are presented in Table 5.

The findings indicate that self-awareness, people agility, and results agility exert significant positive effects on 21st-century teaching skills, whereas change agility and mental agility do not demonstrate a significant effect. In terms of effect size (f^2), self-awareness shows a small effect ($f^2 = 0.022$), people agility exhibits a small-to-moderate effect ($f^2 = 0.055$), and results agility has a small effect ($f^2 = 0.032$). By contrast, the effects of change agility ($f^2 = 0.000$) and mental agility ($f^2 = 0.002$) are negligible, consistent with their non-significant path coefficients. Accordingly, hypotheses related to self-awareness, people agility, and results agility were supported, whereas the hypotheses concerning change agility and mental agility were not supported. To evaluate predictive validity, Stone–Geisser’s Q^2 statistic was computed using a blindfolding / cross-validation procedure. The Q^2 value for Teaching Skills was approximately .35, which is clearly above zero and thus indicates meaningful predictive relevance of the model for the criterion construct (Geisser, 1974; Stone, 1974).

Within the proposed PLS-SEM model, change agility, self-awareness, people agility, results agility, and mental agility together explain 37.8 percent of the variance in 21st-century teaching skills. The explanatory power of the model is illustrated in Figure 1.

Table 5. Structural model results and hypothesis testing

Path	Coefficient	t-value	p-value	VIF	f^2	Result
Change Agility → Teaching Skills	-0.003	0.047	0.962	2.024	0.000	Not supported
Self-Awareness → Teaching Skills	0.175	2.325	0.020	2.237	0.022	Supported
People Agility → Teaching Skills	0.257	3.439	0.001	1.967	0.055	Supported
Results Agility → Teaching Skills	0.246	3.011	0.003	3.021	0.032	Supported
Mental Agility → Teaching Skills	0.057	0.680	0.496	2.845	0.002	Not supported



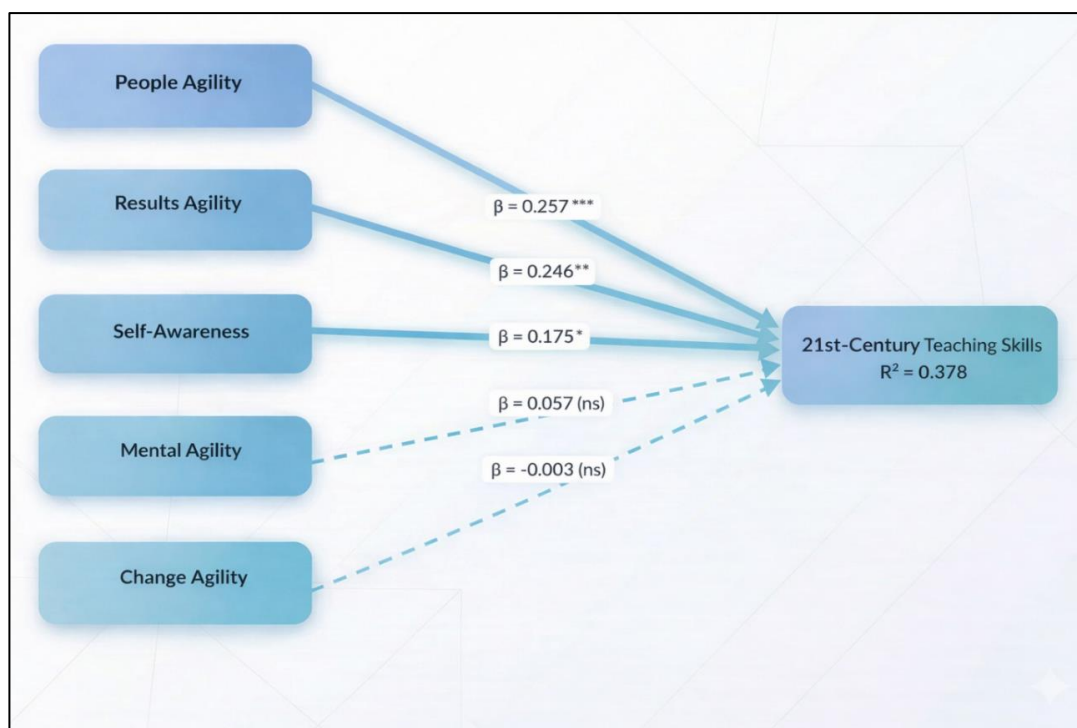


Figure 1. Path diagram

Discussion

This study investigated the predictive roles of teachers' learning agility dimensions on their 21st-century teaching skills using a PLS-SEM approach. The findings indicate that learning agility provides a meaningful explanatory framework for understanding contemporary teaching competencies, while also revealing that its effects vary across dimensions. Specifically, self-awareness, people agility, and results agility emerged as significant positive predictors of 21st-century teaching skills, whereas change agility and mental agility did not demonstrate direct effects. This pattern suggests that learning agility does not operate as a uniform or linear construct within the teaching context. Given the COVID-19–accelerated normalization of hybrid teaching practices and the rapid diffusion of artificial intelligence-supported tools in education, this differentiated pattern may reflect which aspects of agility are most readily translated into day-to-day instructional enactment under heightened complexity and accountability (Ivanov et al., 2025; Purba et al., 2022; Vellaichamy, 2023; Porkodi & Cedro, 2025).

The significant contribution of self-awareness highlights the importance of reflective capacity in contemporary teaching practice. Teachers who are aware of their strengths, limitations, and developmental needs appear more capable of regulating their instructional practices and aligning them with evolving pedagogical expectations. This finding is consistent with theoretical accounts that position self-awareness as a central mechanism through which learning from experience and professional self-regulation occur (Lombardo & Eichinger, 2000; DeRue et al., 2012). Moreover, the reflective teaching literature emphasizes that awareness of one's own instructional actions is a key driver of pedagogical effectiveness and professional growth (Day, 2017). In this respect, the present findings suggest that learning agility in teaching functions strongly through reflective and self-regulatory processes. Importantly, as artificial intelligence systems increasingly shape content generation, assessment support, and instructional decision-making, self-awareness may also function as a

safeguard for calibrating trust in AI outputs, recognizing one's own biases and blind spots, and maintaining ethical and responsible pedagogical judgment beyond basic digital literacy (Mikeladze et al., 2024; Ning et al., 2024).

People agility also emerged as a significant predictor of 21st-century teaching skills, reflecting the increasingly relational nature of teaching. Contemporary instructional environments require teachers to engage in effective communication and collaboration with students, colleagues, and other educational stakeholders. The significance of people agility aligns with frameworks that emphasize communication and collaboration as core components of 21st-century teaching (Voogt & Roblin, 2012; Orhan Göksün & Kurt, 2017). Furthermore, learning agility research associates people agility with social adaptability, feedback responsiveness, and interpersonal effectiveness, providing theoretical support for its role in shaping pedagogical practice (Özgenel & Yazıcı, 2020). This result is also consistent with the post-pandemic expansion of technology-mediated interactions, where sustaining supportive feedback and socio-emotional safety, especially in digitally enriched and artificial intelligence-supported learning contexts becomes a core condition for effective teaching and student engagement (Sing Yun, 2023; Ning et al., 2024).

Results agility was also found to significantly predict 21st-century teaching skills, underscoring the importance of outcome-oriented instructional practices. This finding indicates that teachers' ability to maintain focus on instructional goals, structure learning processes systematically, and translate pedagogical intentions into observable outcomes plays a critical role in contemporary teaching competence. The emphasis on goal alignment and instructional effectiveness is consistent with international frameworks that highlight the role of results-oriented pedagogy in supporting student learning (OECD, 2018). From this perspective, results agility appears to function as a mechanism that connects instructional planning with sustained pedagogical performance. In hybrid and artificial intelligence-rich classrooms, results agility may be especially salient because teachers are expected to manage dispersed learning activities, monitor progress through digital traces, and strategically leverage AI-enabled tools (e.g., chatbots, automated grading, personalization systems) to sustain instructional continuity and measurable learning outcomes (Ivanov et al., 2025; Purba et al., 2022; Vellaichamy, 2023; Porkodi & Cedro, 2025).

In contrast, the lack of significant effects for change agility and mental agility warrants careful consideration. Although these dimensions are theoretically associated with adaptability and cognitive flexibility, their nonsignificant effects suggest that such capacities may not directly translate into classroom-level teaching behaviors. Teachers may possess openness to change and cognitive flexibility at an individual level, yet institutional constraints such as curriculum demands, time pressure, and limited pedagogical autonomy may restrict the enactment of these capacities in practice. In this sense, change agility and mental agility may operate more strongly at the level of potential rather than direct pedagogical enactment. Additionally, the pace of artificial intelligence innovation may create a "moving target," where being open to change or cognitively flexible is insufficient unless teachers have access to sustained professional learning opportunities that develop artificial intelligence-related competencies (e.g., data/algorithm literacy and artificial intelligence ethics) and provide clear institutional guidance for classroom integration (Mikeladze et al., 2024; Tenberga & Daniela, 2024). It is also plausible that some elements of mental agility (e.g., rapid ideation, generating alternatives) are increasingly scaffolded by artificial intelligence tools, which may shift mental agility from a direct predictor of visible teaching behaviors to a background capacity that requires deliberate pedagogical structuring to become observable in practice (Ning et al.,

2024).

This interpretation aligns with the view that learning agility supports teaching practice not by constituting the content of teaching skills, but by enabling their development and sustainable application under conditions of uncertainty and change. The differentiated effects observed across learning agility dimensions reinforce the argument that learning agility should be conceptualized as a context-sensitive and multidimensional construct. Rather than assuming that all components of learning agility exert uniform effects, the present findings suggest that certain dimensions are more readily translated into pedagogical action, while others may require supportive organizational conditions to become visible in instructional practice. Accordingly, strengthening the practical impact of change agility and mental agility may depend on systemic supports such as time, autonomy, and targeted professional development especially those addressing artificial intelligence-supported instructional design and responsible use, which can convert adaptive potential into consistent classroom enactment (Sing Yun, 2023; Mikeladze et al., 2024; Ning et al., 2024).

Conclusion and Implications

Overall, the results indicate that learning agility contributes meaningfully to explaining teachers' 21st-century teaching skills, while also highlighting its complementary role alongside other professional and contextual factors. This interpretation directly supports the conclusion that learning agility functions as a higher-order meta-competence that facilitates the development, enactment, and sustainability of contemporary teaching skills, rather than serving as a direct substitute for pedagogical knowledge or instructional technique. In doing so, the study helps clarify the theoretical status of learning agility in education by positioning it as an enabling capacity that shapes how teachers mobilize and renew their competencies in response to change, rather than as another set of discrete teaching behaviors.

The results suggest that learning agility does not operate as a single or linear construct within the teaching context. Rather, certain components appear to be more directly reflected in pedagogical practice. The significance of self-awareness, people agility, and results agility indicates that reflective thinking, relational engagement, and alignment with instructional outcomes play a central role in teachers' enactment of contemporary teaching skills. In contrast, the nonsignificant effects of change agility and mental agility imply that these dimensions may function primarily at the level of potential and may not translate directly into classroom practices unless supportive conditions are present.

From a theoretical perspective, this study contributes to the literature by extending the concept of learning agility beyond its predominantly managerial and leadership-oriented focus and examining it within the context of the teaching profession. The findings suggest that learning agility should not be conceptualized as a direct component of 21st-century teaching skills. Instead, it can be understood as a higher-order meta-competence that supports the development and sustainable enactment of these skills across different instructional contexts. The differentiated roles of learning agility dimensions further underscore the need to conceptualize learning agility as a context-sensitive and multidimensional construct in educational research. More specifically, the results provide empirical support for a hierarchical view in which learning agility functions as an upstream capability that conditions teachers' capacity to acquire, refine, and sustain 21st-century teaching skills over time, thereby complementing competence frameworks that primarily specify what teachers should do by explaining how teachers remain capable of doing it as conditions evolve. The findings



also offer boundary-condition evidence by indicating that not all agility dimensions yield direct pedagogical payoffs under typical school constraints, which refines theory by discouraging uniform assumptions about the effects of learning agility in education. In this sense, the study advances a more precise conceptual model in which learning agility operates through dimension-specific pathways and may require contextual moderators to become visible in classroom practice. This theorization opens avenues for future research to test mediated and moderated mechanisms, for example, whether the effects of change agility and mental agility are realized indirectly through innovation-oriented instructional design, technology integration, or professional learning engagement, and whether these effects strengthen under supportive school climates and higher pedagogical autonomy.

From a practical standpoint, the results indicate that teacher education and professional development programs should not be limited to instructional techniques or pedagogical content alone. Reflective practices that support self-awareness, professional learning communities that strengthen collaboration and communication skills, and instructional designs that emphasize alignment between goals and learning outcomes may play a critical role in enhancing teachers' 21st-century teaching skills. At the same time, enabling qualities such as openness to change and cognitive flexibility to be reflected in instructional practice requires the provision of pedagogical autonomy, opportunities for experimentation, and supportive school climates. Creating such conditions may allow the full potential of learning agility to be realized within teaching practice.

Limitations and Future Research

Despite its contributions, this study has several limitations that should be acknowledged. First, the research was conducted with teachers selected through convenience sampling, which limits the generalizability of the findings to the broader teacher population. The results should therefore be interpreted with caution when considering different educational contexts or teacher groups.

Second, the data were collected using self-report measures, which may introduce common method bias and social desirability effects. Although self-report instruments are widely used in educational research to capture perceptions and self-assessments, they may not fully reflect teachers' actual instructional practices.

Third, the cross-sectional design of the study restricts the ability to draw conclusions about the temporal or causal direction of the relationships among the variables. As a result, changes in learning agility and teaching skills over time could not be examined within the scope of the present research.

Future studies may address these limitations by employing longitudinal research designs and mixed-method approaches to explore how learning agility develops and influences teaching practices over time. In addition, the dimensions of change agility and mental agility, which did not demonstrate direct effects in this study, may exert indirect influences through other variables such as technology acceptance, pedagogical innovativeness, or teacher autonomy. Testing such mediating mechanisms could provide a more comprehensive understanding of how learning agility operates within the teaching profession.

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Declarations

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