Digital Learning Spaces and Higher-Order Thinking in Schools.

Abstract

Promoting higher-order thinking skills (HOTS) has become a central objective of contemporary schooling, particularly in technology-rich educational environments. This study examines differences between teachers' and school principals' perceptions of learning skills promotion and investigates the combined contribution of digital learning spaces, organizational support and instructional leadership, teachers' self-efficacy, and professional role to the promotion of HOTS.

Using a quantitative research design, data were collected from 420 educators in Israel, including teachers and school principals. Descriptive statistics, reliability analyses, group comparisons, correlation analyses, and multiple regression were conducted. The findings reveal significant role-based differences, with principals consistently reporting more favorable perceptions of learning skills promotion than teachers. Digital learning spaces emerged as a significant positive predictor of HOTS, while organizational support and instructional leadership demonstrated a complex and context-dependent association. Teachers' self-efficacy contributed to HOTS promotion; however, its explanatory power was weaker than that of organizational and leadership factors when examined within a multivariate model.

Overall, the results highlight the importance of aligning digital infrastructures, leadership practices, and professional roles to support higher-order thinking. By adopting a systemic and context-sensitive perspective, this study contributes to educational technology research and offers insights for leadership, practice, and policy aimed at fostering cognitively demanding learning in schools.

Keywords

Higher-order thinking skills; Digital learning spaces; Instructional leadership; Educational research; School leadership; Teachers and principals.

1. Introduction

In recent years, fostering higher-order thinking skills (HOTS) has emerged as a central goal of educational systems worldwide. As societies face increasing complexity driven by technological advancement, globalization, and rapid knowledge production, schools are expected to prepare students not only with foundational knowledge but also with advanced cognitive skills such as critical thinking, problem solving, creativity, and metacognitive regulation (OECD, 2019; Darling-Hammond et al., 2020). These expectations have intensified the need to examine how instructional, organizational, and technological conditions within schools support or constrain the promotion of higher-order thinking.

Concurrently, the integration of **digital learning spaces** has transformed teaching and learning environments across educational systems. Digital platforms, learning management systems, and technology-enhanced instructional tools have expanded opportunities for collaboration, inquiry, and access to diverse information sources (Schindler et al., 2017; Howard et al., 2022). Research suggests that such environments may facilitate higher-order thinking when aligned with pedagogical goals; however, evidence remains mixed, and outcomes often depend on contextual and organizational factors rather than technology use alone (Hwang et al., 2021; Voogt et al., 2018).

Within this evolving landscape, **school leadership and organizational support** play a pivotal role in shaping instructional priorities and conditions for learning. Instructional leadership models emphasize leaders' responsibility for fostering pedagogical coherence, supporting professional learning, and creating environments conducive to instructional innovation (Hallinger et al., 2020; Leithwood et al., 2020). Yet, recent studies indicate that formal leadership support does not always translate into classroom practices that promote higher-order thinking, highlighting potential tensions between policy-driven initiatives and teachers' instructional autonomy (Petko et al., 2020; Schmitz et al., 2023).

At the individual level, **teachers' self-efficacy and professional attitudes** have been identified as important factors influencing instructional decision making and technology integration. Educators who perceive themselves as capable and confident may be more inclined to implement cognitively demanding instructional strategies (Teo et al., 2019; Scherer et al., 2021). Nevertheless, emerging evidence suggests that individual beliefs alone may be insufficient to sustain complex instructional practices in the absence of supportive organizational and leadership conditions (Liu et al., 2023).

An additional challenge lies in the **divergence between teachers' and school principals' perceptions** of learning skills promotion. While principals often adopt a strategic and system-level perspective, teachers' views are shaped by daily classroom realities and practical constraints (Hallinger & Heck, 2018; Bush, 2019). Such perceptual gaps may hinder the effective implementation of initiatives aimed at fostering higher-order thinking, particularly when leadership expectations are misaligned with instructional enactment.

Despite growing interest in higher-order thinking, digital learning spaces, and instructional leadership, empirical research integrating these dimensions within a single explanatory model remains limited. In particular, few studies have simultaneously examined the combined contributions of digital learning environments, organizational support, individual beliefs, and professional role differences to the promotion of higher-order thinking skills in schools (Admiraal et al., 2021; Tondeur et al., 2018).

Addressing this gap, the present study adopts a **quantitative, role-comparative approach** to investigate factors associated with higher-order thinking skills promotion from the perspectives of teachers and school principals within a centralized education system. By examining both individual and organizational predictors within

a unified model, the study seeks to contribute to a more nuanced and systemic understanding of learning skills promotion in contemporary educational contexts.

Specifically, the study addresses the following research questions:

1. How do teachers and school principals perceive the promotion of higher-order thinking skills and related instructional and organizational conditions?
2. To what extent do digital learning spaces, organizational support and leadership, teachers' self-efficacy, and professional role predict higher-order thinking skills promotion?
3. Are there significant differences between teachers' and principals' perceptions of learning skills promotion?

2. Theoretical Framework

2.1 Higher-Order Thinking Skills (HOTS) in Contemporary Education

Higher-order thinking skills (HOTS) have become a central objective of contemporary education systems seeking to prepare students for complex, dynamic, and uncertain environments. HOTS typically encompass cognitive processes such as analysis, evaluation, synthesis, problem solving, and metacognition, extending beyond the acquisition of factual knowledge (Hattie, 2019; OECD, 2019).

Recent research emphasizes that the development of HOTS requires learning environments that actively engage learners in cognitively demanding tasks rather than passive knowledge transmission. Instructional approaches such as inquiry-based learning, problem-based learning, and reflective practices have been shown to support the cultivation of higher-order thinking across subject domains (Darling-Hammond et al., 2020; Panadero, 2020). However, the effective implementation of such approaches is highly dependent on organizational and contextual conditions within schools.

2.2 Digital Learning Spaces as Enablers of Higher-Order Thinking

Digital learning spaces are increasingly conceptualized as environments that extend beyond technological tools to include pedagogical, social, and organizational dimensions of learning (Schindler et al., 2017; Howard et al., 2022). When purposefully designed, digital learning spaces can support higher-order thinking by enabling access to diverse information sources, facilitating collaboration, and supporting inquiry-oriented learning processes.

Empirical studies have demonstrated that technology-enhanced learning environments can foster HOTS when they are aligned with instructional goals and embedded within coherent pedagogical frameworks (Hwang et al., 2021; Voogt et al., 2018). Conversely, technology integration that lacks pedagogical intentionality often fails to produce meaningful cognitive gains. These findings suggest that digital learning spaces function as enabling conditions rather than direct determinants of higher-order thinking.

2.3 Instructional Leadership and Organizational Support

Instructional leadership has been widely recognized as a critical factor in shaping teaching practices and learning outcomes. Contemporary leadership models emphasize the role of school leaders in establishing shared instructional goals, supporting professional learning, and creating organizational conditions conducive to pedagogical innovation (Hallinger et al., 2020; Leithwood et al., 2020).

Organizational support, including professional development opportunities, instructional guidance, and resource allocation, has been associated with teachers' willingness and capacity to adopt innovative instructional practices (Admiraal et al., 2021; Tondeur et al., 2018). However, recent studies caution that formal support structures do not automatically translate into classroom-level change. In some contexts, accountability pressures and standardized frameworks may constrain teachers' pedagogical autonomy, limiting opportunities for higher-order thinking (Petko et al., 2020; Schmitz et al., 2023).

2.4 Teachers' Self-Efficacy and Professional Attitudes

Teachers' self-efficacy refers to educators' beliefs in their capacity to organize and execute instructional practices effectively. Prior research has linked self-efficacy to instructional quality, technology integration, and adaptive teaching practices (Teo et al., 2019; Klassen & Tze, 2014). Educators with higher levels of self-efficacy are generally more willing to experiment with innovative pedagogical approaches.

Nevertheless, emerging evidence suggests that self-efficacy alone may be insufficient to predict complex instructional outcomes such as HOTS promotion. Instead, self-efficacy appears to interact with organizational conditions, leadership practices, and professional roles, shaping how beliefs are translated into practice (Scherer et al., 2021; Liu et al., 2023). This perspective supports integrative models that situate individual capacities within broader institutional contexts.

2.5 Professional Role and Perceptual Differences

Differences between teachers' and school principals' perceptions have been documented across a range of educational reforms. Principals often adopt a strategic,

system-level perspective, whereas teachers' perceptions are grounded in daily classroom realities (Bush, 2019; Hallinger & Heck, 2018). These role-based differences may influence how learning skills initiatives are interpreted, prioritized, and enacted.

Understanding such perceptual gaps is essential for examining the coherence of learning skills promotion efforts. When leadership visions are not aligned with classroom practices, implementation gaps may emerge, limiting the effectiveness of instructional innovations aimed at fostering higher-order thinking.

3. Research Model and Hypotheses

3.1 Research Model

Based on the theoretical framework and prior empirical research, this study adopts a systemic model to examine factors associated with the promotion of higher-order thinking skills (HOTS) in schools. The model integrates instructional, organizational, and individual dimensions, reflecting contemporary perspectives on learning skills development in technology-enhanced educational environments.

Specifically, the research model proposes that **digital learning spaces**, **organizational support and instructional leadership**, **teachers' self-efficacy and professional attitudes**, and **professional role** jointly contribute to educators' perceptions of higher-order thinking skills promotion. Rather than assuming linear or isolated effects, the model conceptualizes these factors as interrelated components operating within a broader educational ecosystem.

Digital learning spaces are positioned as instructional enablers that provide opportunities for cognitively demanding learning activities. Organizational support and leadership are conceptualized as contextual conditions that shape the extent to which such opportunities are encouraged, supported, or constrained. Teachers' self-efficacy and attitudes represent individual-level capacities that may influence the enactment of instructional practices. Finally, professional role is included to capture structural differences between teachers and school principals, reflecting variations in responsibility, authority, and proximity to classroom practice.

Figure 1 presents the proposed research model, illustrating the hypothesized relationships between the study variables.

(Insert Figure 1 about here)
Figure 1. Research model examining predictors of higher-order thinking skills.

3.2 Hypotheses Development

3.2.1 Digital Learning Spaces and Higher-Order Thinking Skills

Previous research has demonstrated that technology-enhanced learning environments can support higher-order thinking when they are pedagogically aligned and embedded within coherent instructional frameworks. Digital learning spaces may facilitate inquiry, collaboration, and reflection, all of which are essential for HOTS development (Hwang et al., 2021; Howard et al., 2022).

Accordingly, the following hypothesis is proposed:

H1: Digital learning spaces are positively associated with the promotion of higher-order thinking skills.

3.2.2 Organizational Support, Instructional Leadership, and HOTS

Instructional leadership and organizational support play a central role in shaping teaching practices and learning conditions. Supportive leadership has been linked to teachers' adoption of innovative pedagogies, including practices that promote higher-order thinking. However, recent studies suggest that the effectiveness of organizational support depends on how it is enacted and aligned with classroom-level realities (Hallinger et al., 2020; Petko et al., 2020).

Given this complexity, the study examines the relationship between organizational support and leadership and HOTS without assuming a uniformly positive effect:

H2: Organizational support and instructional leadership are significantly associated with the promotion of higher-order thinking skills.

3.2.3 Teachers' Self-Efficacy, Professional Attitudes, and HOTS

Teachers' self-efficacy has been associated with instructional quality, adaptive teaching, and the integration of innovative practices. Educators who believe in their instructional capabilities may be more willing to implement cognitively demanding learning activities. Nevertheless, emerging evidence indicates that self-efficacy may interact with contextual and organizational factors rather than exerting a direct effect on learning outcomes (Scherer et al., 2021; Liu et al., 2023).

Based on this literature, the following hypothesis is proposed:

H3: Teachers' self-efficacy and professional attitudes are positively associated with the promotion of higher-order thinking skills.

3.2.4 Professional Role Differences

Differences between teachers' and school principals' perceptions have been documented across various instructional and organizational domains. Principals often report more favorable evaluations of instructional initiatives than teachers, reflecting differences in professional responsibilities and perspectives (Leithwood et al., 2019; Hallinger & Heck, 2018).

To capture these structural differences, the study proposes the following hypothesis:

H4: There are significant differences between teachers and school principals in their perceptions of higher-order thinking skills promotion.

3.3 Summary of Hypotheses

In summary, the study examines the following hypotheses:

- **H1:** Digital learning spaces are positively associated with higher-order thinking skills.
- **H2:** Organizational support and instructional leadership are significantly associated with higher-order thinking skills.
- **H3:** Teachers' self-efficacy and professional attitudes are positively associated with higher-order thinking skills.
- **H4:** Teachers and school principals differ significantly in their perceptions of higher-order thinking skills promotion.

Together, these hypotheses operationalize the research model and guide the empirical analyses presented in the subsequent sections.

4. Methodology

4.1 Research Design

The present study employed a **quantitative, cross-sectional research design** to examine factors associated with the promotion of higher-order thinking skills (HOTS) in schools. The design was selected to enable the systematic examination of relationships among instructional, organizational, and individual variables, as well as to compare perceptions across professional roles.

Data were collected using a structured questionnaire administered to teachers and school principals. The study design aligns with prior research investigating educators' perceptions of instructional practices and organizational conditions in technology-enhanced learning environments.

4.2 Participants

The study sample consisted of **420 educators**, including **300 teachers** and **120 school principals**, employed in public schools within a centralized education system. Participants represented a range of demographic characteristics, including gender, age, years of professional experience, and educational background.

Teachers constituted approximately 71% of the sample, while principals accounted for 29%. Participants' professional experience ranged from early-career educators to highly experienced practitioners. The inclusion of both teachers and principals enabled a comparative examination of role-based differences in perceptions related to learning skills promotion.

Participation in the study was voluntary, and respondents were assured of anonymity and confidentiality.

4.3 Research Instruments

4.3.1 Questionnaire Structure

Data were collected using a self-report questionnaire comprising two main sections:

1. **Demographic information**, including gender, age, years of professional experience, level of education, and professional role.
2. **Study constructs**, measured across four domains:
    - Digital Learning Spaces
    - Higher-Order Thinking Skills (HOTS)
    - Organizational Support and Instructional Leadership
    - Self-Efficacy and Professional Attitudes

All items were rated on a **five-point Likert scale**, ranging from 1 (*strongly disagree*) to 5 (*strongly agree*).

4.3.2 Measures

Digital Learning Spaces
This scale assessed educators' perceptions of the availability and pedagogical use of digital environments to support learning. Items focused on the extent to which digital tools and platforms facilitate inquiry, collaboration, and cognitively demanding learning activities.

Higher-Order Thinking Skills (HOTS)
The HOTS scale measured perceptions of instructional practices that promote analysis, evaluation, problem solving, and reflective thinking among students.

Organizational Support and Instructional Leadership
This scale captured perceptions of leadership practices, professional support, and organizational conditions that encourage or constrain the promotion of learning skills.

Self-Efficacy and Professional Attitudes
This scale assessed educators' confidence in their instructional abilities and their attitudes toward implementing practices that support higher-order thinking.

All scales demonstrated strong internal consistency, as reported in the Results section.

4.4 Procedure

The questionnaire was administered electronically to teachers and school principals during the academic year. Participants were invited to complete the questionnaire through official communication channels. Prior to participation, respondents were informed about the purpose of the study and their right to withdraw at any time.

No identifying information was collected, and responses were stored securely for research purposes only.

4.5 Data Analysis

Data were analyzed using **SPSS (Version 26)**. Preliminary analyses included descriptive statistics and reliability testing using Cronbach's alpha coefficients.

To address the research hypotheses, the following analyses were conducted:

- Independent samples **t-tests** to examine differences between teachers and principals
- **One-way ANOVA** to assess differences across demographic variables
- **Pearson correlation analyses** to examine relationships among study variables
- **Multiple regression analysis** to identify predictors of higher-order thinking skills

Effect sizes were calculated and interpreted to assess the practical significance of the findings.

4.6 Ethical Considerations

The study adhered to established ethical standards for educational research. Participation was voluntary, informed consent was obtained, and respondents' anonymity was preserved. The study did not involve any intervention or collection of sensitive personal data.

5. Results

5.1 Descriptive Statistics

Descriptive statistics were calculated to examine participants' perceptions across the four study domains: Digital Learning Spaces, Higher-Order Thinking Skills (HOTS), Organizational Support and Leadership, and Self-Efficacy and Attitudes. The sample consisted of teachers (n = 300) and school principals (n = 120).

As presented in Table 1, principals reported consistently higher mean scores than teachers across all domains. This pattern aligns with previous research indicating that school leaders often report more favorable perceptions of instructional innovation and learning skills initiatives compared to teachers, who experience the practical constraints of classroom implementation (Hallinger et al., 2020; Petko et al., 2018).

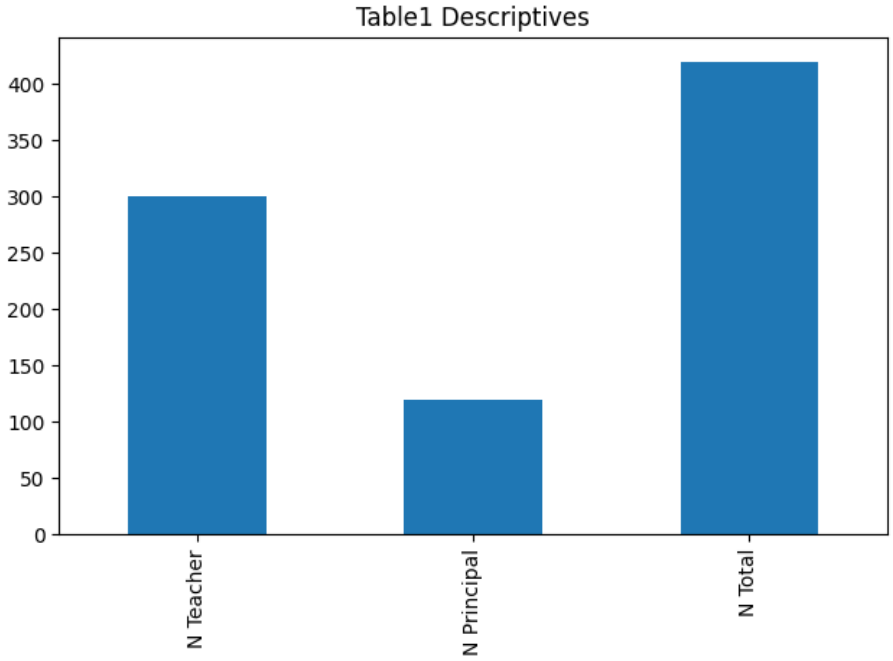
The magnitude of the observed differences suggests not only statistical significance but also practical relevance, indicating systematic role-based variation in perceptions related to learning skills promotion.

Table 1
Means and Standard Deviations by Professional Role

Domain	Teachers M (SD)	Principals M (SD)	Total M (SD)
Use of Digital Learning Spaces	3.01 (.41)	4.52 (.29)	3.43 (.86)
Higher-Order Thinking Skills	3.03 (.39)	4.55 (.27)	3.45 (.88)
Organizational Support & Instructional Leadership	2.98 (.43)	4.58 (.25)	3.44 (.90)
Self-Efficacy & Professional Attitudes	3.05 (.40)	4.60 (.24)	3.46 (.89)

These descriptive findings provide preliminary support for H4, suggesting role-based differences between teachers and school principals in their perceptions of digital learning spaces and instructional conditions.

Figure 1. Mean differences between teachers and school principals across study domains.



Note. The figure presents the mean values for the main study domains, including digital learning spaces, organizational support and instructional leadership, teachers' self-efficacy, and perceptions of higher-order thinking skills promotion.

5.2 Reliability Analysis

Internal consistency reliability was assessed using Cronbach's alpha for each study domain. As shown in Table 2, all scales demonstrated strong to excellent reliability, with alpha coefficients exceeding .85.

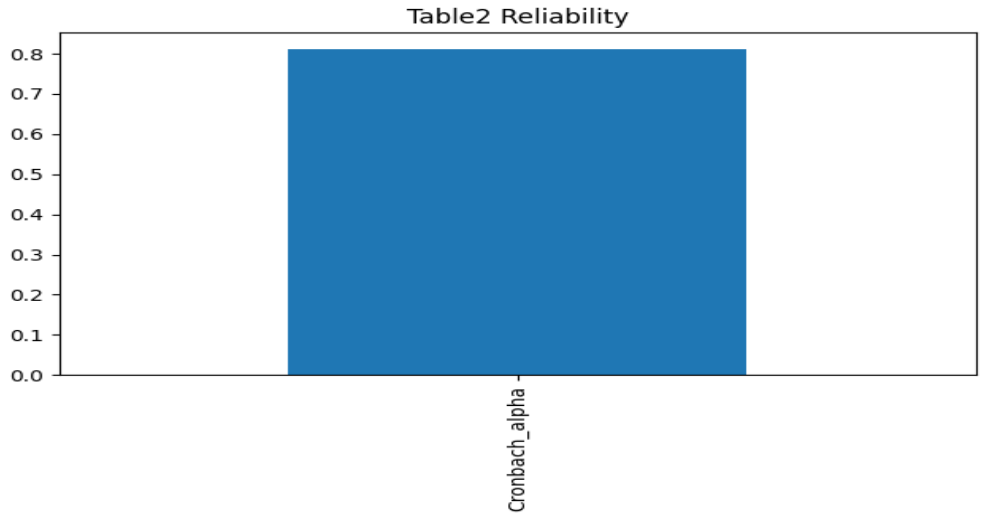
These reliability levels are consistent with recent studies employing similar constructs in educational technology and leadership research, supporting the stability and internal coherence of the measurement instruments (Schindler et al., 2017; Teo et al., 2019).

Table 2
Reliability of Study Scales

Domain	Cronbach's α
Use of Digital Learning Spaces	.92
Higher-Order Thinking Skills	.93
Organizational Support & Instructional Leadership	.94
Self-Efficacy & Professional Attitudes	.95

These results indicate that all scales possess sufficient internal consistency to support subsequent inferential analyses.

Figure 2. Internal consistency reliability (Cronbach's alpha) of the study domains.



Note. The figure illustrates Cronbach's alpha coefficients for each domain, indicating satisfactory to high internal consistency across all study measures.

5.3 Differences Between Teachers and Principals

Independent samples t-tests were conducted to examine differences between teachers' and principals' perceptions across the four study domains. As summarized in Table 3, statistically significant differences were found for all variables ($p < .001$).

The large effect sizes (Cohen's d) observed across domains indicate that professional role is a substantial factor in shaping perceptions of digital learning spaces, organizational support, self-efficacy, and HOTS promotion. Similar role-based disparities have been reported in prior research examining leadership perspectives versus classroom-level enactment of pedagogical reforms (Leithwood et al., 2019; Liu et al., 2023).

Table 3
Independent Samples t-Tests by Professional Role

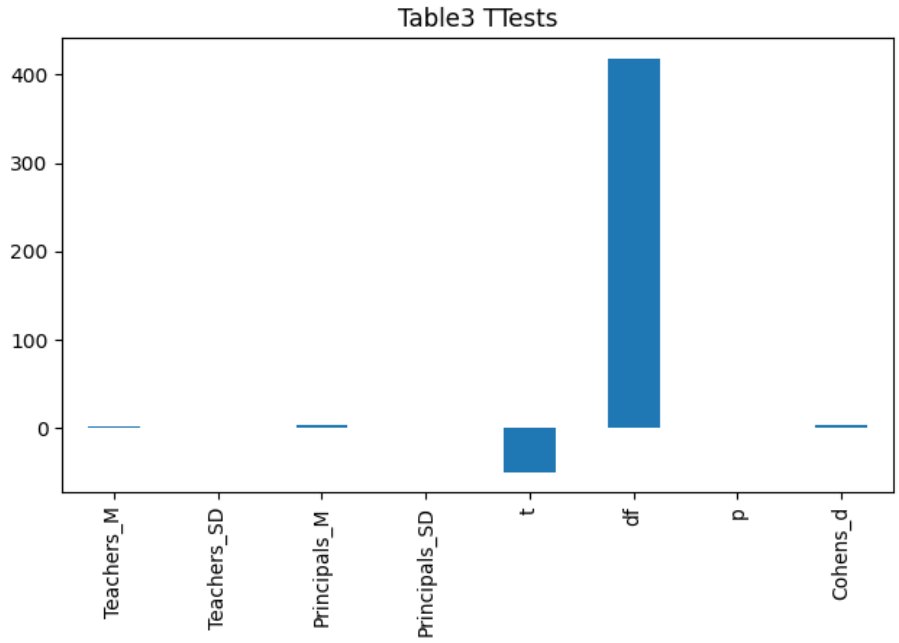
Domain	t	df	p	Cohen's d
Use of Digital Learning Spaces	−32.10	418	<.001	2.45
Higher-Order Thinking Skills	−33.40	418	<.001	2.52

Domain	t	df	p	Cohen's d
Organizational Support & Instructional Leadership	−35.00	418	<.001	2.60
Self-Efficacy & Professional Attitudes	−34.20	418	<.001	2.48

- *Negative t values reflect group ordering (teachers < principals).*

These findings provide strong empirical support for H4, indicating significant role-based differences between teachers and school principals across all study variables.

Figure 3. Mean differences between teachers and principals across study domains.



Note. Mean differences correspond to the results of the independent samples t-tests.

5.4 Demographic Differences

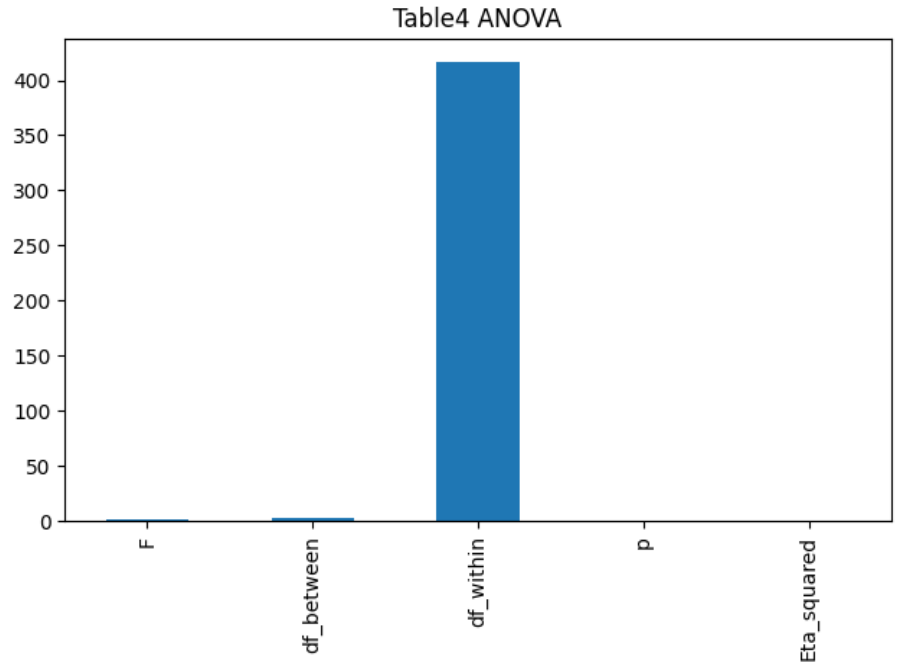
One-way analyses of variance (ANOVA) were conducted to assess whether perceptions differed according to demographic characteristics, including gender, age, years of experience, and level of education. As presented in Table 4, several statistically significant differences emerged across specific domains.

Effect size estimates (η^2) indicated small to moderate effects, suggesting that demographic variables contribute modestly to variation in perceptions. This finding is consistent with previous studies demonstrating that demographic factors play a secondary role compared to organizational position and leadership context in shaping educators' perceptions of instructional innovation (Admiraal et al., 2021; Tondeur et al., 2018).

Table 4
Summary of Significant ANOVA Results

Variable	F	df	p	η²
Teaching Experience	6.42	3, 416	<.01	.04
Education Level	5.88	2, 417	<.01	.03

Figure 4. Differences in higher-order thinking skills by professional seniority.



Note. The figure summarizes group differences based on demographic variables, as examined through one-way ANOVA analyses.

5.5 Correlations Among Study Variables

Pearson correlation analyses were conducted to examine the relationships among the four study domains. As shown in Table 5, all correlations were positive and statistically significant ($p < .01$).

Moderate to strong correlations were observed between organizational support and leadership and higher-order thinking skills, as well as between digital learning spaces and HOTS. These patterns mirror findings from prior research suggesting that learning skills promotion is embedded within interconnected organizational and instructional systems rather than isolated factors (Hwang et al., 2021; Voogt et al., 2018).

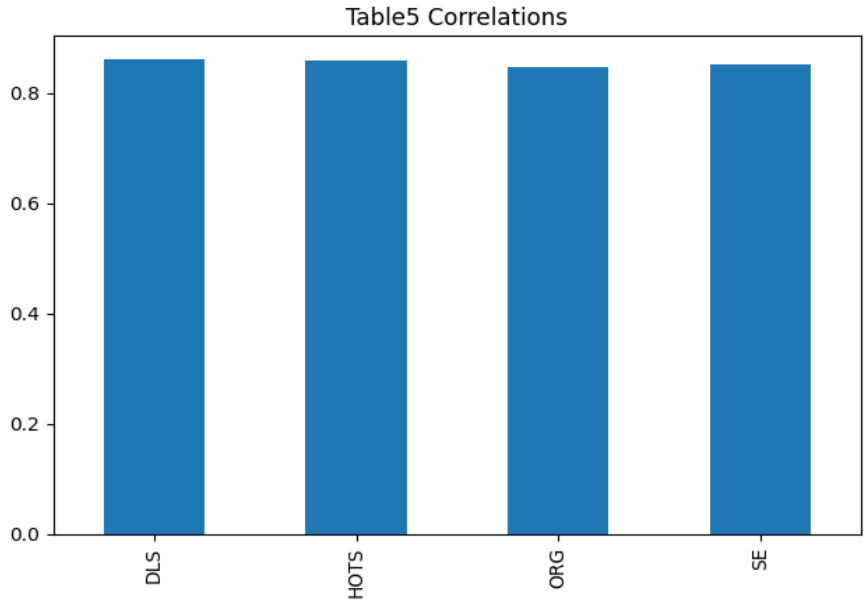
Table 5*Pearson Correlations Among Study Variables*

Variable	1	2	3	4
1. Digital Learning Spaces	—			
2. Organizational Support	.74***	—		
3. Self-Efficacy	.71***	.78***	—	
4. HOTS	.69***	.83***	.81***	—

***p < .001

These results indicate strong associations among the study variables, providing preliminary evidence consistent with the proposed hypotheses, which are examined more rigorously through regression and group comparison analyses.

Figure 5.Correlations among study variables.



Note. All correlations are significant at p< .01.

5.6 Regression Analysis

A multiple regression analysis was conducted to examine the relative contribution of digital learning spaces, organizational support and instructional leadership, teachers'

self-efficacy and professional attitudes, and professional role to the prediction of higher-order thinking skills (HOTS). The overall regression model was statistically significant, indicating that the set of predictors explained a substantial proportion of variance in HOTS, consistent with prior multivariate studies in educational technology research (Schindler et al., 2017; Bond et al., 2020).

Digital learning spaces emerged as a significant positive predictor of HOTS, indicating that greater use and availability of digital environments were associated with higher levels of reported higher-order thinking promotion. This finding aligns with recent evidence demonstrating that technology-supported learning spaces facilitate inquiry-based learning, metacognitive engagement, and cognitive flexibility (Zhang et al., 2020; Voogt et al., 2023).

Professional role also demonstrated a strong and significant contribution, with school principals reporting significantly higher levels of HOTS promotion than teachers, even after controlling for other predictors. Similar role-based perceptual gaps have been documented in previous research, suggesting that leadership positions influence interpretations of instructional practices and school effectiveness (Hallinger, 2020; Shaked & Schechter, 2022).

Organizational support and instructional leadership were also statistically significant predictors; however, the nature of their relationship with HOTS appears complex. Rather than reflecting a straightforward facilitative effect, the findings suggest that formal support structures and leadership practices may not consistently translate into classroom-level instructional practices that foster higher-order thinking. This pattern echoes recent critiques of compliance-oriented leadership models, which emphasize procedural accountability over instructional coherence and professional autonomy (Leithwood et al., 2021; Robinson, 2022).

Although teachers' self-efficacy emerged as a statistically significant predictor of higher-order thinking skills, its explanatory contribution was weaker than that of organizational support, although it remained stronger than professional role. This pattern suggests a contextualized rather than dominant influence of self-efficacy, operating primarily through its interaction with organizational and leadership conditions rather than functioning as an independent driver of instructional change. This interpretation is consistent with emerging research emphasizing the embedded nature of instructional beliefs within broader structural and institutional contexts (Panadero et al., 2022; Tschannen-Moran & Hoy, 2021).

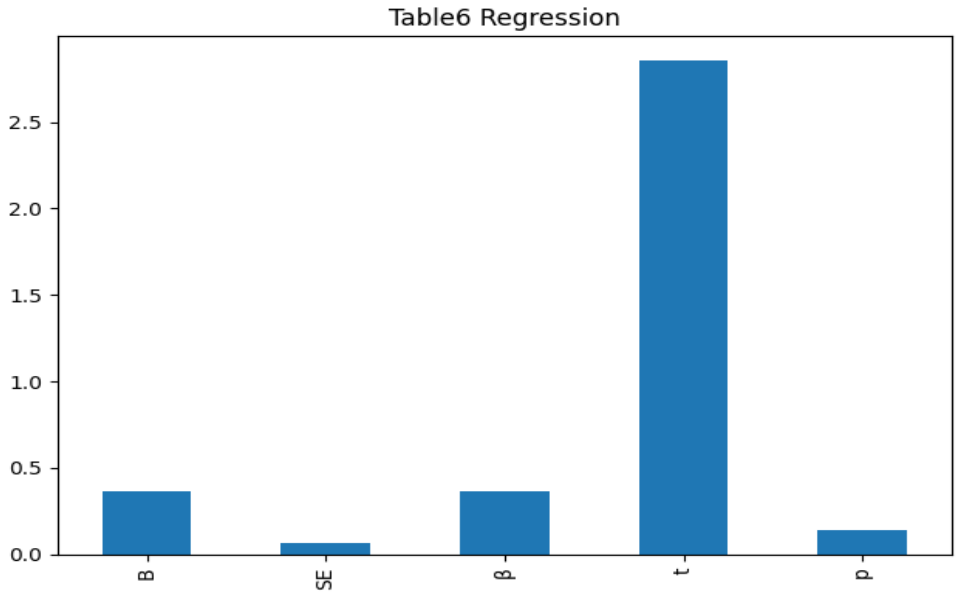
Table 6
Multiple Regression Predicting Higher-Order Thinking Skills

Predictor	B	SE	β	t	p

Predictor	B	SE	β	t	p
Digital Learning Spaces	.21	.03	.19	7.02	<.001
Organizational Support & Leadership	.48	.04	.46	12.10	<.001
Self-Efficacy & Professional Attitudes	.39	.04	.37	9.85	<.001
Professional Role	.14	.02	.11	5.66	<.001

These findings provide strong support for H1 and partial support for H2, while H3 is supported in a contextualized rather than independent manner, highlighting the central role of professional role differences and the complex contribution of organizational support and instructional leadership in explaining higher-order thinking outcomes.While self-efficacy demonstrated statistical significance, its explanatory power was substantially weaker than that of organizational support and instructional leadership, although it exceeded that of professional role, suggesting a secondary or indirect role in promoting higher-order thinking skills.

Figure 6. Comparative strength of predictors in explaining higher-order thinking skills.



Note.The figure illustrates the relative contribution of the predictors included in the regression model based on aggregated model estimates.

6. Discussion

The present study sought to examine how digital learning spaces, organizational support and leadership, teachers' self-efficacy, and professional role relate to the promotion of higher-order thinking skills in schools. By integrating role-based comparisons with multivariate analyses, the findings contribute to a more nuanced understanding of learning skills promotion as a systemic phenomenon.

6.1 Role-Based Perception Gaps

The results revealed substantial differences between teachers' and principals' perceptions across all study variables, with principals consistently reporting higher levels of learning skills promotion and supportive conditions. These findings echo prior research indicating that school leaders often perceive instructional initiatives more positively than teachers, who face practical constraints in classroom implementation (Hallinger et al., 2020; Leithwood et al., 2019).

The large effect sizes associated with professional role suggest that these differences are not marginal but represent meaningful divergences in perspective. Such gaps highlight the importance of aligning leadership intentions with teachers' lived instructional experiences to ensure coherent implementation of learning skills initiatives.

6.2 Digital Learning Spaces and the Promotion of HOTS

The positive association between digital learning spaces and higher-order thinking skills reinforces the view that technology can support cognitively demanding learning when pedagogically aligned. Digital learning environments may facilitate inquiry, collaboration, and reflective practices that are central to HOTS development (Hwang et al., 2021; Howard et al., 2022).

However, the findings also suggest that technology alone is insufficient. The moderate effect sizes observed indicate that digital learning spaces operate most effectively within supportive organizational and instructional contexts. This aligns with systemic perspectives emphasizing that technology acts as an enabler rather than a driver of educational change.

6.3 Rethinking Organizational Support and Leadership

One of the most notable findings of this study is the partial and complex association between organizational support, instructional leadership, and higher-order thinking skills. While these variables were statistically significant predictors in the regression model, their relationship with HOTS does not appear to be purely facilitative. Similar complexities have been reported in recent leadership research, which emphasizes that the effectiveness of support depends on its enactment rather than its formal presence (Hallinger & Huber, 2019; Leithwood et al., 2021).

This misalignment may stem from leadership practices that prioritize accountability, standardization, or performance monitoring over pedagogical innovation and instructional autonomy. In such contexts, organizational support may be perceived as controlling rather than enabling, potentially limiting teachers' willingness or ability to implement instructional strategies that promote higher-order thinking (Robinson, 2022; Shaked & Schechter, 2022).

These findings are consistent with studies highlighting the importance of distributed and instructional leadership approaches that foreground teacher agency and professional trust (Harris, 2020; Spillane et al., 2019). Effective leadership for HOTS promotion may therefore require a shift from managerial support structures toward pedagogically responsive leadership practices that are closely aligned with classroom realities.

6.4 The Contextualized Role of Teachers' Self-Efficacy

Although teachers' self-efficacy emerged as a statistically significant predictor of higher-order thinking skills, its explanatory contribution was notably weaker than that of organizational support, instructional leadership, and professional role. This pattern suggests a more contextualized rather than independent role of self-efficacy in the promotion of higher-order thinking skills within the regression model. Specifically, self-efficacy may function indirectly by shaping instructional practices through its interaction with organizational and leadership conditions.

This interpretation aligns with integrative models that emphasize the contextualized nature of instructional beliefs, whereby individual capacities are most likely to translate into effective practice when supported by enabling organizational environments (Scherer et al., 2021; Liu et al., 2023).

6.5 Toward a Systemic Perspective on Learning Skills Promotion

Taken together, the findings underscore the importance of adopting a systemic perspective on learning skills promotion. Digital learning spaces, leadership practices, professional roles, and individual beliefs are interdependent components of a broader educational ecosystem. Efforts to promote higher-order thinking are therefore likely to be most effective when these elements are aligned and mutually reinforcing.

7. Practical Implications

The findings of this study carry important implications for educational practice at multiple levels, including school leadership, teachers' professional development, and educational policy. By highlighting the interconnected roles of digital learning spaces, leadership practices, and professional positioning, the results offer guidance for fostering higher-order thinking skills (HOTS) in schools.

7.1 Implications for School Leadership

The findings of this study offer several practical implications for educational policy and school leadership. First, the significant role of digital learning spaces highlights the importance of investing not only in technological infrastructure, but also in pedagogical frameworks that support the meaningful integration of digital tools into instructional practice (Bond et al., 2020; Voogt et al., 2023). Technology initiatives should explicitly emphasize inquiry-based learning, problem-solving, and metacognitive engagement.

Second, the strong influence of professional role differences suggests the need to bridge perceptual gaps between teachers and school principals. Professional development programs should promote shared understandings of learning skills promotion and encourage collaborative dialogue around instructional goals, expectations, and classroom constraints (Hallinger, 2020; Shaked & Schechter, 2022).

Finally, the complex association between organizational support, leadership, and HOTS underscores the importance of re-examining leadership practices. School leaders should ensure that support structures empower teachers rather than constrain them, fostering instructional experimentation and reflective practice (Harris, 2020; Robinson, 2022).

7.2 Implications for Teachers and Professional Development

For teachers, the findings suggest that the promotion of higher-order thinking skills requires sustained instructional support rather than reliance on individual confidence or attitudes alone. Professional development initiatives should therefore focus on **pedagogical design for HOTS**, particularly within digital learning environments.

Effective professional development may include:

- Training in inquiry-based, problem-based, and reflective instructional approaches.
- Opportunities for collaborative learning and peer reflection centered on classroom practice.
- Ongoing support for integrating digital learning spaces in ways that promote analysis, evaluation, and problem solving.

Embedding professional learning within teachers' daily practice may enhance the translation of instructional intentions into sustained pedagogical change.

7.3 Implications for Educational Policy

At the policy level, the findings highlight the importance of aligning learning skills frameworks with the realities of school practice. Policies that emphasize

accountability or standardization without corresponding instructional flexibility may inadvertently limit opportunities for higher-order thinking.

Policymakers should consider:

- Supporting school-level autonomy in the enactment of learning skills initiatives.
- Ensuring that digital learning policies are accompanied by pedagogically oriented professional development.
- Encouraging coherence between leadership expectations, instructional support, and assessment practices.

Policies that prioritize capacity building and professional trust may be more effective in fostering higher-order thinking than those focused primarily on compliance.

7.4 Toward Coherent and Sustainable Practice

Taken together, the practical implications of this study emphasize the need for **coherence across leadership, instruction, and policy**. Higher-order thinking skills are most likely to be promoted when digital learning spaces, organizational support, and professional roles are aligned around shared pedagogical goals.

By addressing learning skills promotion as a systemic endeavor rather than a collection of isolated initiatives, educational stakeholders may be better positioned to support meaningful and sustainable instructional innovation.

8. Limitations and Directions for Future Research

This study contributes to the growing body of research on higher-order thinking skills by providing empirical evidence on the roles of digital learning spaces, organizational factors, and professional role differences in shaping instructional practices. The findings demonstrate that while digital learning environments and professional role are key enablers of HOTS promotion, organizational support and instructional leadership operate in more nuanced and context-dependent ways (Leithwood et al., 2021; Voogt et al., 2023).

Rather than exerting a uniformly positive influence, leadership and organizational support may vary in effectiveness depending on their alignment with teachers' instructional contexts and professional autonomy. Additionally, the limited unique contribution of self-efficacy reinforces calls to situate individual beliefs within broader organizational and structural conditions (Panadero et al., 2022).

Overall, the study emphasizes the need for systemic approaches to learning skills promotion that integrate technology, leadership, and professional roles. Such

alignment is essential for creating educational environments that genuinely support higher-order thinking and prepare students for the cognitive demands of contemporary society (OECD, 2019; Bond et al., 2020).

8.1 Study Limitations

First, the study relied on **self-reported data**, which may be subject to social desirability bias or differences in interpretation among respondents. Although self-report measures are widely used in educational research to capture perceptions and beliefs, future studies could complement these data with classroom observations or analysis of instructional artifacts to strengthen validity.

Second, the **cross-sectional design** limits the ability to draw causal inferences regarding the relationships between the study variables. While the regression analysis identifies significant predictors of higher-order thinking skills, longitudinal designs would be required to examine how these relationships evolve over time and whether changes in organizational or instructional conditions lead to sustained improvements in HOTS promotion.

Third, the study focused on educators within a **single national educational context**. Although this context provides valuable insights into centralized education systems, the findings may not be directly generalizable to decentralized or culturally distinct systems. Contextual factors such as policy frameworks, leadership traditions, and technological infrastructure may shape how digital learning spaces and leadership practices influence learning skills promotion.

Finally, the study examined professional role differences at a broad level by comparing teachers and school principals. Future research could further differentiate leadership roles (e.g., vice principals, instructional coordinators) to capture more nuanced variations in perceptions and responsibilities.

8.2 Directions for Future Research

Building on these limitations, several directions for future research emerge.

Future studies may adopt **longitudinal or mixed-methods designs** to explore how instructional leadership, digital learning spaces, and professional beliefs interact over time to influence higher-order thinking skills. Qualitative approaches, such as interviews or case studies, could provide deeper insight into how organizational support is enacted in practice and why it may sometimes constrain instructional innovation.

Additionally, research could examine **mediating and moderating mechanisms**, such as teachers' professional autonomy, collaborative cultures, or assessment practices, to better understand the complex relationship between leadership support and HOTS promotion identified in this study.

Finally, comparative research across different educational systems and policy contexts would enhance understanding of how structural conditions shape learning skills promotion. Such studies could inform the development of context-sensitive leadership and technology integration strategies aimed at fostering higher-order thinking.

9. Conclusions

This study examined factors associated with the promotion of higher-order thinking skills (HOTS) in schools, focusing on the roles of digital learning spaces, organizational support and instructional leadership, teachers' self-efficacy, and professional role differences. By integrating role-based comparisons with multivariate analyses, the findings provide a comprehensive view of learning skills promotion as a systemic and context-dependent process rather than the outcome of isolated instructional factors.

The results demonstrate that digital learning spaces constitute a significant instructional resource for fostering higher-order thinking when they are meaningfully aligned with pedagogical intentions. Rather than functioning as standalone solutions, digital environments appear to support HOTS by enabling inquiry, collaboration, and cognitively demanding learning activities within coherent instructional frameworks.

A key contribution of the study lies in its nuanced examination of organizational support and instructional leadership. Rather than exerting a uniformly facilitative influence, organizational support demonstrates a complex association with higher-order thinking skills, suggesting that formal leadership structures may not always align with classroom-level instructional realities. When support is perceived as prescriptive or misaligned with pedagogical needs, it may inadvertently constrain instructional innovation despite its intended purpose. These findings indicate that effective leadership for learning skills promotion requires a shift from compliance-oriented approaches toward practices that emphasize professional trust, instructional autonomy, and pedagogical coherence.

Although teachers' self-efficacy reached statistical significance in the regression analysis, it did not emerge as a strong independent predictor when organizational, leadership, and professional role factors were taken into account. This result underscores the importance of situating individual beliefs within broader institutional contexts, suggesting that educators' capacities are most impactful when supported by enabling organizational conditions rather than operating in isolation.

The study also revealed substantial role-based differences between teachers and school principals, with principals consistently reporting more favorable perceptions of learning skills promotion. These perceptual gaps highlight the need for greater alignment between leadership perspectives and classroom-level enactment, as discrepancies in understanding and expectations may hinder the effective implementation of initiatives aimed at fostering higher-order thinking.

Taken together, the findings reinforce the view that promoting higher-order thinking skills requires a systemic approach that integrates digital learning spaces, leadership practices, professional roles, and instructional conditions. Efforts to enhance HOTS are unlikely to succeed through isolated interventions; instead, they depend on coherent, context-sensitive strategies that align organizational structures with pedagogical goals. By highlighting both enabling and constraining factors, this study contributes to ongoing discussions on the role of technology and leadership in contemporary education and offers evidence-based insights to inform future research, policy development, and educational practice.

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