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Examining The Relationship between Transformational Leadership, Organizational Resilience, and Digital Competence

Aslıhan Uzun, İbrahim Kocabaş

Abstract

Background/purpose. The study aims to develop a structural equation model to test the relationships among transformational leadership (TL), digital competence (DTC), and organizational resilience (OR). Furthermore, the inquiry examines the mediating effect of digital competence in the relationship between transformational leadership and organizational resilience.

Materials/Methods. The study employed a quantitative research approach in its data collection and analysis, incorporating a correlational survey model to develop a structural model examining the mediating effect of DTC between TL and OR. This study included 1163 participants selected via random stratified sampling. The data were collected using a personal information form and three scales: OR, TL, and DTC. The R program was used to analyze the SEM model.

Results. The main findings indicate that TL of school principals has a significant, strong direct effect on OR. Furthermore, DTC has a significant mediating role in the relationship between school principals' TL and OR.

Originality/Value. There are few research studies that have examined the research variables. It is the first study to develop an SEM model so far. Theoretical contributions, practical implications, and future research directions have all been reported.

Limitations. The present study is subject to certain constraints, including its restricted scope to schools in Istanbul and its consideration of only the three variables.

1. Introduction

Along with social and technical advances, global events such as pandemics, wars, and migration create uncertainty. In the management of uncertainties, the term resilience (Akgün & Keskin, 2014; Bento et al., 2021; Duchek et al., 2020; Limon, Dilekçi and Demirer, 2021; Limon et al., 2023; Mousa et al., 2020; Vercio et al., 2021; Yurdunkulu, 2023) is a concept mentioned in many international and national top policy documents. The concept of resilience is discussed in the context of improved capacity to manage potential risks and crises in education (Duchek, 2020; Gültekin, 2019, p. 52; UNESCO IIEP, 2021). With each passing year, the education system faces some changes (Akın, 2024; Gültekin, 2019; Yurdunkulu, 2023; Zadok, 2024). This situation makes capacity building inevitable for educational institutions to build resilience (Anderson & Ringer, 2024; Firmansyah et al., 2023; Limon, Dilekçi and Demirer, 2021). When the literature was examined, only a limited number of studies were found on education in the Turkish context (Avcı, 2024; Gültekin, 2019; Karagözoğlu, 2022; Yurdunkulu, 2023).

Digital competencies have become a requirement for lifelong learning, enabling individuals to succeed in professional and academic domains (European Union, 2019; Fidan & Cura Yeleğen, 2022; UNESCO, 2016; Vuorikari, Kluzer, and Punie, 2022). Furthermore, the European Commission (2019) states that digital competence includes the safe, critical, and responsible use and engagement of digital technologies for many stages of life.

In Turkey, the emphasis on developing teachers' digital competencies is growing, demonstrated by initiatives such as the Education Information Network (EBA), Teacher Information Network (ÖBA), Movement for Increasing Opportunities and Improving Technology (FATİH) Project, and Digital Transformation in Higher Education (Council of Higher Education [YÖK], 2019). Reviewing current national efforts, the 2023 Teacher Education Digital Ecosystem Project—organized through collaboration between the Ministry of National Education [MoNE] and UNICEF—and the frequent inclusion of technology and artificial intelligence topics in teacher webinars underscore the subject's timeliness and significance.

School principals' transformational leadership largely reflects their efforts to lead and facilitate digital transformation in educational institutions (Karaköse, Polat, and Papadakis, 2021; Navaridas-Nalda, Clavel-San Emeterio, Fernández-Ortiz, and Arias-Oliva, 2020). According to Tims, Bakker, and Xanthopoulou (2011), transformational leadership is associated with higher levels of employee engagement and satisfaction, all of which contribute to improved organizational success. By ensuring high levels of satisfaction, motivation, and performance, transformational leaders build a culture of trust and commitment and strengthen organizational effectiveness (Díaz-Sáenz, 2011). It provides high performance (Bass, 1990).

Leithwood and Jantzi (2006) present important findings on leadership in their study. The research findings show that transformational leadership has a strong direct effect on teachers' work environments and motivations. Transformational leadership practices, such as setting high expectations, creating a sense of community, and focusing on student learning, have a positive impact on school culture (Sasan et al., 2023). Similarly, transformational leadership has strong direct effects on school and classroom conditions (Leithwood & Jantzi, 1999).

According to the literature, although national or international studies have been conducted on each variable separately, no study has yet established and tested a model including all three variables.

From this point of view, it is predicted to make significant contributions to closing the existing gap and to serve as an important basis for future research. To summarize, this study is:

- current in terms of addressing the issues of OR and DTC, which have recently proven to be important,

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- **current** in addressing TL, a contemporary leadership approach, through the novel examination of the relationship among the three variables using structural equation analysis.
- **significant** in contributing to the resilience literature,
- **novel** and **functional** in covering the digital competence of teachers in the Framework Document of the Century of Türkiye Education Model.
- **functional**, as the research findings are predicted to guide policymakers.

The aim of this study is to develop a structural equation model to test the structural relationships among TL, DTC, and OR based on the opinions of teachers working in primary and secondary schools affiliated with the MoNE. This model tests the mediating effect of DTC in the relationship between TL and OR.

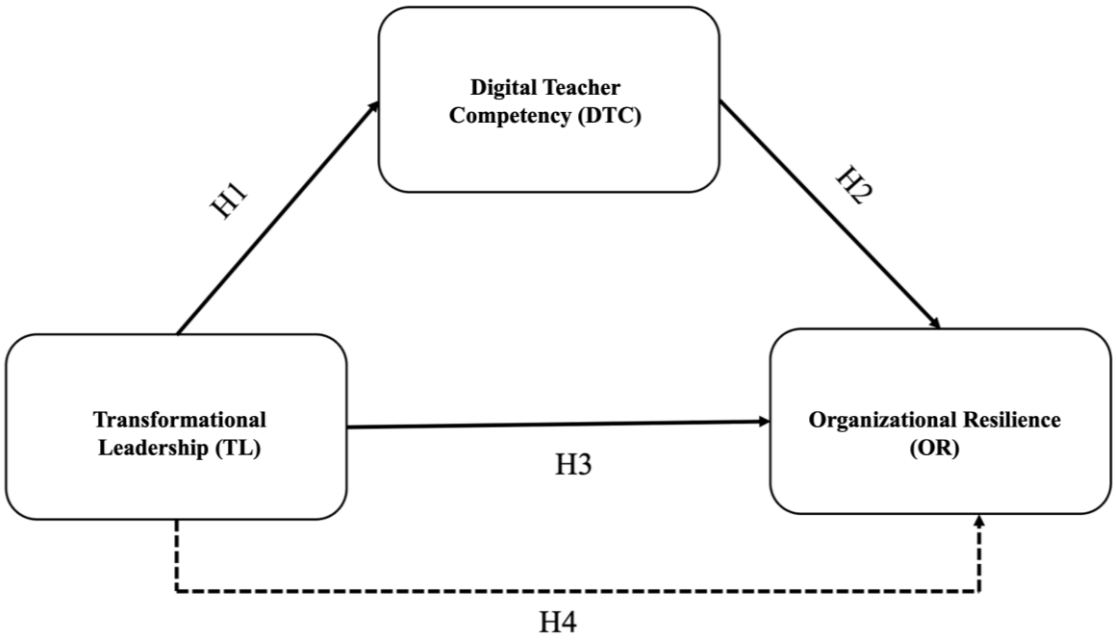


Figure 1. Hypothesized Structural Model

According to the conceptual model described, the hypotheses of the research are stated below:

Hypothesis 1: TL of school principals is positively correlated with DTC.

Hypothesis 2: DTC and OR are positively correlated.

Hypothesis 3: TL of school administrators and OR are positively correlated.

Hypothesis 4: There is a mediating effect of DTC on the relationship between TL of school administrators and OR.

2. Literature Review

In this section, the empirical relationships among the research variables are examined. The conceptual framework is organized under three sub-headings.

2.1. The Relationship Between Transformational Leadership and Digital Competence

TL is a management approach that has gained significant attention, especially in the digital age (Coraci & Abulrub, 2021; Lukito, Suharnomo, and Perdhana, 2022). This leadership style highlights the ability to inspire and motivate followers, fosters a shared vision, and drives organizational change (Ly, 2024; McCarthy, Sammon, and Alhassan, 2021). As digitalization increases across societies, the

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role of TL in shaping organizations' growth is increasing (Cortellazzo, Bruni, and Zampieri, 2019; Ly, 2024).

Digital transformation is a complex and multifaceted process that requires a comprehensive understanding of the strategic, operational, and cultural impacts of emerging technologies (Ly, 2024; Marks, Al-Ali, Atassi, Abualkishik, and Rezgui, 2020; Nadkarni & Prügl, 2020). Effective leaders should not only have a clear digital strategy but also the ability to develop a culture that is open to change and innovation (Ly, 2024; Ready, Cohen, Chiron, and Pring, 2020).

The digital transformation of educational institutions largely depends on school principals' leadership (Karaköse, Polat, and Papadakis, 2021; Navaridas-Nalda, Clavel-San Emeterio, Fernández-Ortiz, and Arias-Oliva, 2020). Effective digital leaders must have a clear vision for their organization's digital future and the ability to effectively communicate that vision to their teams. Beyond vision, digital leaders must also foster a culture that is open to change and new ideas, thereby driving the adoption of digital technologies (Karaköse et al., 2021). In addition to fostering a digital-friendly culture, transformational leaders must ensure that organizations have the agility to respond to the rapid changes driven by digital technologies.

2.2. The Relationship Between Digital Competence and Organizational Resilience

In today's rapidly evolving digital landscape, the relationship between DTC and OR is increasingly of interest to researchers. Teachers play a crucial role in the success of technology integration in education; their ability to research and leverage digital technologies and resources has a significant impact on the resilience of educational institutions (Nguyen & Habók, 2024).

Muñoz Carril et al. (2013) emphasize the need to determine the competencies of higher education officials working in the digital environment. It pinpoints the critical role of these officers in adapting pedagogical, technical, and social competencies to the remote learning context. This role is effective in developing organizations' resilience. Furthermore, the development of digital competencies in pre-service teachers has been recognized as a focal point for teacher training programs (Marais, 2023). Similarly, Basilotta-Gómez-Pablos et al. (2022) state that digital competence is a key skill area that teachers must develop to thrive in the digital age.

Research shows a significant correlation between DTC and OR (Chen et al., 2023; Firmansyah et al., 2023; Gao et al., 2022; Li & Wang, 2024; Özer, 2017; Velyako & Musa, 2023; Velu et al., 2019; Zhang et al., 2021). Teachers' proficiency in digital tools enhances their adaptability, contributing to the overall resilience of educational institutions.

Firmansyah et al. (2023) found that digital transformation and leadership have a positive and significant impact on OR. Similarly, Velu et al. (2019) state that digitalization is an effective tool for increasing organizations' resilience. Özer (2017) found that an innovative culture significantly mediates the relationship between organizational learning and resilience. The effect of digital competence on the establishment of an innovative culture in educational institutions can be mentioned. The study by Zhang et al. (2021) supports the positive impact of digital transformation on OR. In addition, the findings of some researchers (Chen et al., 2023; Velyako & Moses, 2023; Li & Wang, 2024) confirm the impact of digital competence on OR.

The positive impact of digital orientation on organizational resilience is supported by Liu et al. (2023). It emphasizes that digital competence, defined as the ability to effectively utilize digital technologies, infrastructures, and resources, positively impacts organizational resilience capacity (Gao, Yang, and Li, 2022). Additionally, this research highlights that digital competence enables organizations to enhance their robustness, flexibility, and adaptability, especially during crises such as the COVID-19 pandemic.

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2.3. The Relationship Between Transformational Leadership and Organizational Resilience

OR refers to a set of dynamic capabilities that pave the way for and facilitate change, thereby maintaining the organization's success. It covers both before, during, and after the crisis, including the ability to predict potential problems, cope with them, and learn from experience (Duchek, 2014). In addition, learning supports the importance of OR for organizational success, both as an input and an output (Pulley, 1997; Vogus & Sutcliffe, 2007).

Resilience is a person's capacity to adapt to stressful situations and maintain mental well-being in the face of challenges. It also refers to coping with difficulties and turning them into an advantage to improve the current position (Kantur & İşeri-Say, 2015). In this context, it is important to understand how organizations adapt positively to the challenges and uncertainties brought by the modern world and increase resilience.

TL, on the other hand, maintains its key role in establishing an innovative culture in the social world where digitalization is widespread, fostering a culture of safety that encourages risk-taking, and ensuring the continuity of learning. There is a positive relationship between TL and the sub-dimensions of OR. There are many studies in the literature proving this relationship (Avey, Hughes, Norman, and Luthans, 2008; Balcan & Turliuc, 2024; Dimas, Rebelo, Lourenço, and Pessoa, 2018; Istiqaroh, Usman, and Harjanti, 2022; Karaköse, İmamoğlu and İnce, 2020; Sommer, Howell, and Hadley, 2016; Zadok, Benoliel, and Schechter, 2024).

Furthermore, existing studies show that leadership increases OR. OR and empowering leadership (Karagözoğlu, 2022; Limon, Bayrakcı, Hamedoğlu, and Aygün, 2023), resilience and organizational learning (Mousa, Abdelgaffar, Chaouali, and Aboramadan, 2020), OR and distributed leadership (Limon, Dilekci, and Demirer, 2021), OR and entrepreneurial school (Avcı, 2024), OR and leadership and culture (Abad, 2022; Denyer, 2017; Lim & Gaerlan, 2022), leadership and OR (Bryan & Suchodoletz, 2023; Dong, 2023), quantum leadership and OR (Yurdunkulu, 2023) are among the current researches.

As a result of the research, Moran (2016) found that goal-oriented solution search and the avoidance of suspicion of new ideas, which are among the factors of OR, are effective in maintaining organizational effectiveness in crisis situations. Among the dimensions of TL, intellectual stimulation is associated with the support for the use of new ways to solve existing problems (Díaz-Sáenz, 2011). Inspirational motivation, another dimension of TL, enables leaders to set goals with clearly defined expectations (Díaz-Sáenz, 2011) and motivate employees towards a common goal (Bass, 1990). Leithwood and Jantzi's (2009) TL model in the school context, which increases performance by aligning individual goals with the organization's vision and goals, supports the finding.

3. Method

This section describes the research design, participants, data collection tools, and analysis sections.

3.1. Research Design

This study, which hypothesizes a mediating effect of teachers' digital competence in the relationship between transformational leadership and organizational resilience, was designed using a correlational survey model, a quantitative research method. The correlational survey design is one of the most used research designs in educational research (Creswell, 2019). The correlational survey design aims to determine the degree of change between the variables in the research (Karasar, 2012).

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In this study, a quantitative research design using Structural Equation Modeling (SEM) was used to examine the relationships among the variables. SEM tests complex relationships among multiple variables and latent structures simultaneously (Gürbüz & Şahin, 2018).

3.2. Participants and Sampling

The sample was selected by random stratified sampling, a probability technique. The research universe is divided into subgroups, and samples are drawn from each, reflecting the universe's proportions. Strata are based on the socio-economic status of the districts where schools are located. Drossel et al. (2020) found that some schools achieve high scores in language and mathematics, even with students from challenging socio-economic backgrounds; these schools are seen as highly resilient. Hence, schools are grouped as low, medium, or high based on the district's socioeconomic status. According to the 2022 data from the Socio-Economic Development Ranking Surveys (SEGE), the layers were set. The sample includes 1163 teachers in İstanbul.

Table 1. Demographic Characteristics of Research Sample

Variables	Categories	Frequencies (f)	Percentage (%)
Gender	Male	409	35.17
	Women	754	64.83
Age	20-29	186	15.99
	30-39	444	38.18
	40-49	359	30.87
	50-59	159	13.67
	60+	15	1.29
Seniority	1-5 years	250	21.50
	6-10 years	217	18.66
	11-15 years	221	19.00
	16-20 years	171	14.70
	21+ year	304	26.14
Education Status	Undergraduate	884	76.01
	Graduate	279	23.99
Service Period	1-3 years	479	41.19
	4-6 years	281	24.16
	7-9 years	158	13.59
	10-12 years	112	9.63
	13+ year	133	11.43
District Socio-Economic Status	High SES	327	28.12
	Medium SES	507	43.60
	Low SES	329	28.28
School Level	Primary School	347	29.84
	Secondary School	442	38.00
	High School	374	32.16
Number of Teachers in the School	1-40	520	44.71
	41-80	489	42.05
	81-120	120	10.32
	121+	34	2.92
Working Time with the Current Principal	1-2 years	674	57.95
	3-4 years	338	29.06

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	5-6 years	97	8.34
	7-8 years	38	3.27
	9+ years	16	1.38
Branch Group	Primary School Teacher	330	28.37
	Verbal/Social	307	26.40
	Numeric/STEM	244	20.98
	Foreign Language	113	9.72
	Art/PE	46	3.96
	Vocational Courses	123	10.57
Total		**1163**	**100.00**

The research sample consists of 1163 teachers working in Istanbul. The majority of the participants (64.8%) were women, and more than half (54.1%) were between the ages of 30 and 49. By professional seniority, 26.1% of teachers have 21 or more years of experience. Regarding educational status, 76% of participants are undergraduates, and 24% are postgraduates. In terms of school level, it exhibits a balanced distribution at primary school (29.8%), secondary school (38%), and high school (32.2%) levels; on the basis of branches, Primary Education (28.4%) and Verbal/Social Sciences (26.4%) groups have the highest participation.

3.3. Data Collection Tools

The data were obtained using a personal information form and three scales: organizational resilience (OR), transformational leadership (TL), and digital teacher competence (DTS). Permission was obtained from the ethics committee of Fatih Sultan Mehmet Foundation University Graduate Education Institute for all data collection tools.

1. The Organizational Resilience Scale

In this study, the scale developed by Kantur and Iseri-Say (2015) was used. The organizational resilience scale (OR) comprises 9 items. To test the construct validity of the measurement tools used in the research, a pilot study was conducted with 211 teachers prior to the main study. Cronbach's alpha value is 0.97, indicating good internal consistency (George & Mallery, 2003). CFA fit indices indicate good construct validity, with good fit indices: $\chi 2/df = 2.48$, CFI=0.96, AGFI=0.99, RMSEA= 0.08, SRMR=0.02.

2. Short Transformational Leadership Scale

In this study, the Turkish adaptation of the Brief Transformational Leadership Scale (TL), developed by Berger et al. (2012) and adapted by Okan and Okan (2021), was used. The scale consists of one dimension and eight items. To test the construct validity of the measurement tools used in the research, a pilot study was conducted with 211 teachers prior to the main study. Cronbach's alpha value is 0.99, indicating good internal consistency (George & Mallery, 2003). CFA fit indices indicate good construct validity, with acceptable fit indices: $\chi 2/df = 2.75$, CFI = 1.00, AGFI = 0.99, RMSEA = 0.09, SRMR = 0.01.

3. The Digital Teacher Competency Scale

In this study, the Digital Teacher Proficiency Scale (DTS) developed by Yılmaz, Aktürk, and Çapuk (2021) was used. The Digital Teacher Competency Scale consists of four dimensions: (1) resource development, (2) communication and collaboration, (3) security, and (4) evaluation. To test the construct validity of the measurement tools used in the research, a pilot study was conducted with

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211 teachers prior to the main study. Cronbach's alpha values ranged from 0.82 to 0.93, indicating high internal consistency (George & Mallery, 2003). CFA fit indices indicate good construct validity, with acceptable fit indices: χ2/df= 2.75, CFI = 1.00, TLI = 1.00, GFI = 1.00, AGFI = 0.999, SRMR = 0.013, RMSEA = 0.091.

3.4. Data Analysis

The data were analyzed using structural equation modeling, which was conducted using the SEM module in R (version 4.5.1 (2025-06-13)). The model was estimated using robust maximum likelihood (MLR). Before analysis, the data were examined to identify outliers, missing values, and violations of linearity, homogeneity, and normality. Descriptive statistics (i.e., means, standard deviation, minimum, and maximum values) were computed for all variables to assess the distribution of the data. Model fit was evaluated using standard fit indices, including χ^2/df, CFI, TLI, RMSEA, and SRMR.

In addition, to test the mediating role of digital competence, a mediation analysis was employed. The significance of the mediation effect was tested using the bootstrap method with 5000 samples, and confidence intervals for the indirect effects were obtained. The standardized indirect effect coefficient was calculated as 0.050.

Furthermore, in testing the SEM model, power analysis was conducted to evaluate the adequacy of the sample size (n=1163). The analysis was performed using the semPower package (Moshagen & Erdfelder, 2016) included in R. In selecting the approach, RMSEA-based close fit was chosen (MacCallum, Browne, and Sugawara, 1996).

4. Findings

4.1. Data Cleaning and Preliminary Analysis

a. Descriptive Statistics and Univariate Normality

Descriptive statistics of each item were obtained. Kurtosis and Skewness values were used to assess normality.

Table 2. Descriptive Statistics of Transformational Leadership, Digital Teacher Competency, and Organizational Resilience Scales

Items	n	Mean	SD	Skew	Kurtosis
TL1	1325	3.93	1.28	-1.28	0.61
TL2	1325	4.01	1.24	-1.38	0.98
TL3	1325	4.01	1.24	-1.36	0.94
TL4	1325	4.08	1.19	-1.53	1.56
TL5	1325	4.13	1.17	-1.66	2.02
TL6	1325	4.00	1.25	-1.39	0.97
TL7	1325	4.06	1.20	-1.52	1.51
TL8	1325	3.95	1.29	-1.29	0.60
DTC1	1325	4.29	0.75	-1.15	2.22
DTC2	1325	4.28	0.77	-1.19	2.18
DTC3	1325	3.94	0.98	-0.83	0.33
DTC4	1325	3.63	1.09	-0.49	-0.42
DTC5	1325	3.99	0.97	-0.95	0.62
DTC6	1325	4.21	0.81	-1.05	1.47
DTC7	1325	4.08	0.86	-0.94	1.01

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Items	n	Mean	SD	Skew	Kurtosis
DTC8	1325	3.81	1.01	-0.63	-0.15
DTC9	1325	4.22	0.86	-1.20	1.63
DTC10	1325	4.08	0.86	-0.96	1.17
DTC11	1325	3.91	0.95	-0.80	0.44
DTC12	1325	4.10	0.91	-1.11	1.28
DTC13	1325	4.03	0.99	-1.09	1.00
DTC14	1325	4.00	0.92	-0.87	0.68
DTC15	1325	4.01	0.94	-0.93	0.76
DTC16	1325	4.15	0.87	-1.09	1.37
DTC17	1325	4.01	0.91	-0.88	0.74
DTC18	1325	4.21	0.83	-1.16	1.72
DTC19	1325	4.29	0.81	-1.32	2.31
DTC20	1325	4.15	0.89	-1.07	1.11
OR1	1325	4.05	1.07	-1.34	1.36
OR2	1325	4.07	1.07	-1.39	1.49
OR3	1325	4.02	1.08	-1.26	1.13
OR4	1325	3.83	1.18	-1.02	0.26
OR5	1325	4.01	1.11	-1.26	1.02
OR6	1325	3.81	1.21	-0.86	-0.19
OR7	1325	3.82	1.19	-0.90	-0.06
OR8	1325	3.92	1.12	-1.08	0.53
OR9	1325	4.01	1.09	-1.27	1.11

The skewness and kurtosis values for the TL scale are within the range of -2 to +2, indicating that the data are close to a normal distribution. On the DTC scale, it is understood that the 1st and 19th items deviate slightly in kurtosis within the range of -2 to +2. The fact that the sample size was 1325 and that only 2 items slightly exceeded the limit does not disturb the normality assumption. The OR scale is similarly at the limit of -2 to +2. Briefly stated, the assumption of normality is approximately accepted.

b. Multivariate Normality

Multivariate normality analysis was also performed to assess normality. In large samples (n=1325), the p-value is often significant, and normality is often assumed to be violated.

Table 3. Mardia Multivariate Normality Analysis

Test	Values	p
Mardia Multivariate Skewness (b1p)	208.82	< .001
Mardia Multivariate Kurtosis (b2p)	2288.57	< .001
Multivariate skewness (skew)	46114.81	< .001
Multivariate kurtosis	286.47	< .001

Mardia's kurtosis p-value of < 0.05 indicates that normality has been violated (Muthén & Muthén, 2017). The MLR estimator is applied because of univariate deviations.

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c. Mahalanobis Distance

The Mahalanobis distance calculation was applied to ensure data quality. The detection of 162 of 1325 observations as approximately 12% multivariate outliers ($p < 0.001$) could seriously distort the SEM results for these observations. Hence, the updated dataset of 1163 observations was used for further analyses.

4.2. Reliability and Validity

a. Reliability and Convergent Validity Results of the Measurement Model

The internal consistency of the scales was assessed using Cronbach's Alpha and McDonald's Omega. Cronbach's alpha values ranged from 0.86 to 0.98, and McDonald's omega values ranged from 0.87 to .99, indicating high internal consistency (George & Mallery, 2003). This proves that the items of the scales measure the same structure extremely consistently and that the reliability of the data collection tool is high.

Table 4. Reliability and Convergent Validity Results of the Measurement Model

Scale / Sub-Dimensions	Cronbach Alpha	Omega Total (ωt)	Omega Hierarchical(ωh)	CR	AVE
Transformational Leadership (TL)	**0.989**	0.992	0.952	0.989	0.921
Organizational Resilience (OR)	**0.976**	0.985	0.941	0.971	0.808
Digital Teacher Competency (DTC)	0.973	0.973	-	0.973	0.646
Sub-Dimensions					
1. DTC– Resource Development	0.951	0.962	0.919		
2. DTC – Communication and Collaboration	0.862	0.880	0.837		
3. DTC– Security	0.897	0.925	0.830		
4. DTC– Evaluation	0.871	0.874	0.012		

According to McDonald's Omega analysis results, all scales and sub-dimensions show high internal consistency (ωt = 0.874–0.992). The hierarchical omega values of the TL and OR are also quite high (ωh = 0.941–0.952), indicating that these scales are strongly explained by a single dominant factor. Reliability is also high in the Digital Competence sub-dimensions, with the resource sub-dimension exhibiting a particularly strong hierarchical structure (ωh = 0.919). Construct Reliability (CR) values ranged from 0.97 to 0.98, indicating good internal consistency (Hair et. al., 2019). The Average Variance Extracted (AVE) values ranged from .64 to .92, all exceeding the recommended threshold of .50.

Discriminant validity was tested using the Heterotrait-Monotrait (HTMT) ratio. HTMT values below .85 reveal established discriminant validity (Henseler et al., 2015). The findings were reported in Table 5.

Table 5. Discriminant Validity Results Based on Heterotrait-Monotrait (HTMT) Ratio

Scale	TL	OR	DTC
Transformational Leadership (TL)	-		
Organizational Resilience (OR)	0.717	-	
Digital Teacher Competency (DTC)	0.266	0.368	-

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The findings demonstrate that the study's variables represent distinct constructs.

b. Confirmatory Factor Analysis (CFA)

To validate the measurement models of the study's variables, Confirmatory Factor Analysis (CFA) was used. In this context, although the DTC Scale has a four-subdimensional structure in its original form, very high correlations between the sub-dimensions, ranging from 0.956 to 0.997, were observed in analyses of the main data set (N=1163). This indicates that the sub-dimensions are not sufficiently differentiated and measure the same underlying concept. Therefore, to avoid multicollinearity and ensure statistical validity, the scale was treated as unidimensional. According to the measurement model results, the scale's one-dimensional structure yielded acceptable fit indices (see Table 6).

Table 6. Fit Indexes

Fit Indexes	Value	Threshold Values	Status
Chi-square/df	5.86 (3668.526 / 626)	Acceptable	Acceptable*
CFI (Comparative Fit Index) Robust	.932	≥0.90 (Acceptable); ≥0.95 (Good)	Good Fit
TLI (Tucker-Lewis Index) Robust	.927	≥0.90 (Acceptable); ≥0.95 (Good)	Good Fit
RMSEA (Root Mean Square Error of Approximation) Robust	.074	≤0.08 (Acceptable); ≤0.05 (Good)	Good Fit
SRMR (Standardized Root Mean Square Residual)	.029	≤0.08 (Good)	Excellent fit

**The x2 /df ratio is sensitive to large sample sizes (N >1000). Other robust indices confirm a good model fit.*

When the fit indices are evaluated against the recommended threshold values in the literature, the model demonstrates acceptable agreement with the data.

Table 7. Standardized Factor Loadings for the Measurement Model

Variable	Item	Loadings (λ)	p
TL	TL1-TL8	.935 - .976	< .001
OR	OR1-OR9	.798 - .951	< .001
DTC	DTC1-DTC20	.724 - .868	< .001

The table confirms that all item factor loadings surpass the .70 cut-off and are statistically significant (p<.001). These findings establish the construct validity of the scales and affirm the items' ability to represent the relevant latent variables.

4.3. Correlation Analysis

Pearson's correlation analysis was used to determine the linear relationships among the OR, TL, and DTC scales.

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Table 8. Pearson correlation analysis

Scale	1	2	3
Organizational Resilience	-		
Transformational Leadership	.703**	-	
Digital Teacher Competency	.357**	.262**	-

***p < .01*

These correlation matrix results show strong, moderate, and weak positive associations among the three variables. The strongest positive relationship observed was between TL and OR (r = 0.70), which revealed that the visionary and motivating leadership style of the school management supports the organization's resilience and ability to succeed in the face of challenges and changes at the highest level. The second important relationship was moderately positive between OR and DTC (r = 0.36), indicating that increasing teachers' digital skills contributed to resilience, but this effect was not as strong as that of leadership. Finally, the relationship between TL and DTC is weakly positive (r = 0.26), indicating that leadership's impact on digital competence is more limited than in other relationships. In summary, to increase schools' resilience, it is strategic to implement a strong transformational leadership model and develop digital competencies to support it.

4.4. Structural Model and Hypothesis Testing

a. SEM

The structural model is presented in Figure 2.

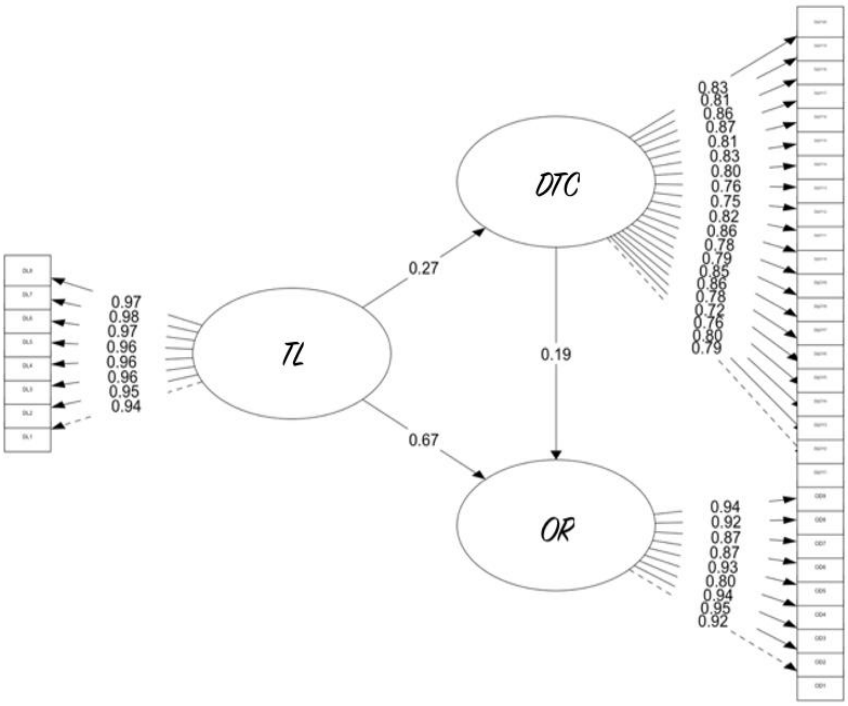


Figure 2. Standardized Path Diagram of the Structural Model

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Standardized factor loadings ranged from .72 to .98, and all items were found to represent the relevant factors significantly and strongly. Examining the standardized path coefficients in the model provides further insight into these relationships. Specifically, the TL variable has a positive and moderate effect on DTC (β = .27). Furthermore, the effect of TL on OR was high and positive (β = .67). By comparison, the effect of teachers' digital competence on OR was lower but remained positive (β = .19).

b. Hypothesis Testing

The findings of hypothesis testing are reported in Table 9.

Table 9. Results of Hypothesis Testing for the Structural Model

Path	β	SE	p-value	Std.all	Result
DTC~TL	0.142	0.023	0.000	0.269	Supported
OR~DTC	0.306	0.054	0.000	0.187	Supported
OR~TL	0.574	0.035	0.000	0.667	Supported

H1 Test (Transformational Leadership -> Digital Teacher Competency: Transformational Leadership of school principals positively and significantly predicted teachers' perceptions of Digital Competence (β=0.269, p<0.001).

H2 Test (Digital Competence -> Organizational Resilience): Teachers' Digital Competence has a positive and significant effect on Organizational Resilience (β=0.187, p<0.001).

H3 Test (Transformational Leadership -> Organizational Resilience): Transformational Leadership of school administrators has a significant and strong direct effect on Organizational Resilience when all other predictors are controlled for (β=0.667, p<0.001).

Assessing the Mediating Effect (H4): The indirect effect of Transformational Leadership on Organizational Resilience was found to be significant, with a standardized coefficient β= 0.044 and p < 0.001. The fact that the indirect effect is significant shows that teachers' perceptions of digital competence have a significant mediating role in the relationship between school administrators' transformational leadership and organizational resilience. Since the effect of TL on OR occurs both directly (β= 0.684) and indirectly (β=0.044), this indicates partial mediation.

c. Variance Explained

The findings regarding the explained variance are described in Table 10.

Table 10. Explained Variance (R^2) Results

Latent Variable	R2 Estimate
OR	54.7
DTC	7.2

OR accounts for about 54.7% of the variance in the variables TL and DTC (R2 = 0.547). It is quite high for social science research and shows that the model has a strong explanatory power. 7.2% of the variance in the DTC variable is explained by OR and TL (R2 = 0.072). All these results confirm that they strongly and statistically significantly support all your hypotheses.

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4.5. Advanced Robustness Tests

a. Bootstrap

Bootstrap analysis was performed to test the mediating role of DTC in the impact of TL on OR. The bootstrapping approach is robust to violations of multivariate normality. The mediating effect (H4) of DTC was tested using a bootstrap analysis with 5000 resamplings. The standardized indirect effect coefficient was calculated as 0.050. Bootstrap data are presented in Table 11.

Table 11. Bootstrapping Results for Path Coefficients

Pathway	Std. all	p value	Bootstrapping %95 CI
a Path (TL → DTC)	0.269	0.000	0.098 – 0.189
b Path (DTC → OR)	0.187	0.000	0.203 – 0.412
c' Path (TL → OR) (Direct)	0.667	0.000	0.503 – 0.640
Indirect Impact (a × b)	0.050	0.000	0.026 – 0.065
Total Impact	0.717	0.000	0.551 – 0.678

The most critical finding is that the 95 % confidence interval for this indirect effect was 0.026 to 0.065. The fact that this interval does not include zero indicates that the mediating effect of Digital Competence is statistically significant at the 95 % confidence level, and the hypothesis could not be rejected. In the structural model, both the indirect effect (0.050) and the direct effect (0.667) were statistically significant. This shows that partial mediation takes place in the model.

With a total impact coefficient of 0.717, the overall impact of TL on OR is quite high. The finding shows that some of the impact of TL on OR is direct, but a significant part is achieved indirectly through DTC.

b. Power Analysis

To test the SEM model established in the research, a power analysis was performed to evaluate the adequacy of the sample size (n=1163). The analysis was performed using the semPower package (Moshagen & Erdfelder, 2016) in R. In selecting the approach, RMSEA-based close fit was chosen (MacCallum, Browne, and Sugawara, 1996). The parameters and values used in the analysis are presented in Table 12.

Table 12. RMSEA-Based Power Analysis Results

Statistical Analysis	Degrees of Freedom(df)	Basic Hypothesis (H0 RMSEA)	AlternativeHypothesis(H1 RMSEA)	Significance Level (α)	Sample Size (N)	CalculatedPower(1−β)
SEM/ DFA (Model Fit)	622	0.05	0.08	0.05	1163	1.00

Power analysis shows that the power calculated with 1163 samples was determined as (1−β) 1.00. The obtained value was higher than the acceptable power threshold (.80), indicating that the study's sample size was sufficient to avoid a Type II error.

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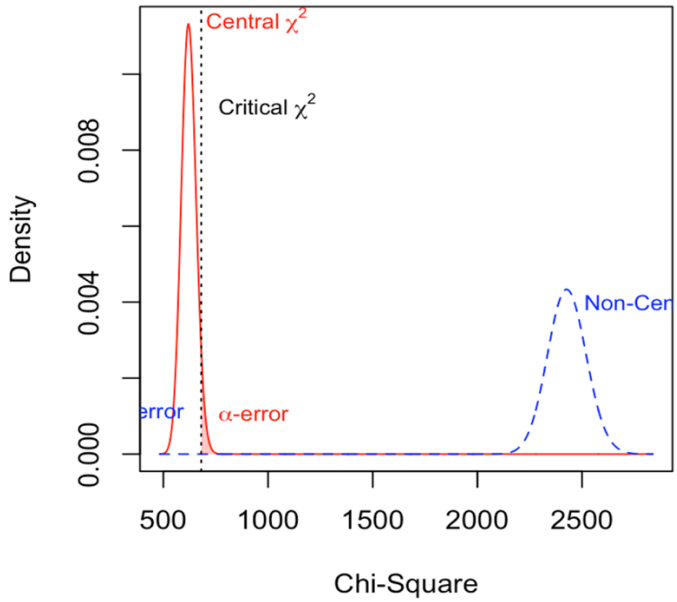


Figure 3. Noncentral Chi-Square Distribution for Power Analysis

The graph illustrates the distinction between centralized and decentralized chi-square distributions, demonstrating the high statistical power of the chi-square distribution.

5. Conclusion and Discussion

The present study focused on OR and investigated DTC, which serves as a mediator in the relationship between TL and OR. Our findings demonstrate that TL of school leaders directly predicts DTC. This dynamic relationship aligns with existing research (Antonopoulou et al., 2025; Chong & Zainal, 2024; Darko, Qi and Wang, 2026; Ersoy & Penpece Demirer, 2025; Masry-Herzallah, Sarhan and Gross, 2025). As Çebi, Nebioğlu, and Koçhan (2026) note, although top-down digital legislation is critical, such strategies are limited without integration. While policies are developed at the macro level, the instructional environment shapes their outcomes. Instructors and principals, as agents of change, interpret the impact of their actions (Açıkalın et al., 2022). Hence, leadership traits significantly influence teachers.

Another key finding reveals the substantial effect of teachers' DC on OR. The result is consistent with prior studies (Gao, Yang and Li, 2022; Gull, Parveen, and Sridadi, 2024; Velyako & Musa, 2024; Wu & Li, 2024). Furthermore, Xue and his colleagues (2026) claim digital capability as an antecedent of organizational resilience. The relationship could be clarified by adaptive capacity, knowledge management, resource redundancy, and flexibility. Schools with higher levels of DTC, even with deprivation of physical facilities, could continue uninterruptedly in the digital ecosystem, as encountered during the Covid-19 pandemic. These schools collaborate with digital platforms and process data rapidly, supporting the learning organization structure. Teachers' DC provides resilience not only through resource redundancy but also through adaptability, enabling schools to deploy technological infrastructure to meet evolving needs.

Finally, our study elucidates a strong, direct influence of TL on OR. The finding supports earlier research (Bai, You and Sun, 2025; Vasayangkura & Sisan, 2026; Wang, Zhao and Zhang, 2023; Yu & Xiang, 2024; Zadok, Benoliel and Schecter, 2024a; Zadok, Benoliel and Schecter, 2024b). It could be explained with psychological empowerment (Spreitzer, 1995). Transformational leaders steer followers through instability, encourage innovative solutions, and cultivate resilient organizations.

Although the results of this research offer important implications, they should be evaluated within some limitations. First, the collection of data based on teachers' self-reports may have led to

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a "social desirability" effect. This could be mitigated by data triangulation using teacher images, administrative evaluations, or observation forms. Secondly, due to the cross-sectional nature of the study, the relationships between TL, DTC, and OR reflect only a certain period; this restricts tracking the change in causal processes between variables over time. Although the sample included 1163 participants, the data were restricted to Istanbul public schools, which requires caution when generalizing the conclusions.

Based on the findings, several recommendations emerge for practitioners and researchers. Practically, implement training programs to enhance both school principals' administrative skills and teachers' "digital leadership" and "transformational leadership" capabilities, preparing them for technological shifts, and disseminate these via MoNE. Academically, future studies should employ mixed-methods approaches, including qualitative interviews, to complement quantitative data. Furthermore, it is recommended to include various control variables in the analysis to test the validity of the model in future research.

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Declaration of Generative AI Usage (GenAI): During the preparation of this work, the author(s) used generative AI solely to improve language and readability. All analyses, core manuscript drafting, and findings were conducted and generated entirely by the authors.

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