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When the push and pull factors in digital educational resources backfire: the role of digital leader in digital educational resources usage

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Abstract
The study investigated the impact of digital leadership on teachers' usage of digital educational resources (DERs). The study collected data from teachers and head-teachers in four pre-tertiary schools in Ghana. Also, trust was included as the interacting variable to examine its mediating role in digital leadership and digital educational resource usage to better disentangle the relationship between digital leadership and digital educational resource. The study used symmetrical (Partial Least Square-Structural Equation Modelling (PLS-SEM) and asymmetrical approaches (fuzzy-set Qualitative Comparative Analysis (fsQCA) for the analysis of the relationships. The results underpin digital leadership's importance in digital educational resource implementation outcomes in developing countries' pre-tertiary schools. The fuzzy-set qualitative comparative analysis findings confirm that exclusively using symmetrical approaches for digital educational resource studies may not be sufficient to understand the expected relationships within a proposed model. Under the partial least squares path modelling (PLS-SEM) analysis, trust did not mediate the relationship between digital leadership and teachers' usage of digital educational resources. Sharply from the PLS-SEM findings, the fsQCA revealed that the presence of digital leadership and trust are necessary conditions to predict teachers' usage of digital educational resources. These results and their implications for theory and practice are discussed.

Keywords Digital educational resources · Digital leadership · Ghana · PLS-SEM · fsQCA

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1 Introduction

The increasing advancement in digital technologies has brought about notable adjustments in the lives and demands of humanity (Li et al., 2019). It has resulted in massive changes in the lives of persons as well as the operations of businesses, of which the educational sector is not an exception (Harerimana & Mtshali, 2020). In the educational sector, digital technologies have facilitated inquiry-based learning and increased educators' access to much more information that is easily retained, reused, revised, remixed and redistributed with no financial cost (Harerimana & Mtshali, 2020).

The prospects and capabilities of digital technologies have enticed many governments in sub-Saharan Africa to invest heavily in digital educational resources (DERs) across schools. DERs witnessed significant investments in Ghana and other African countries, particularly during the Covid-19 era when traditional forms of teaching and learning became impossible due to the restriction on face-to-face meetings (Owusu-Fordjour et al., 2020). Though the high investments channelled into DERs during the Covid-19 pandemic are not decimating post the pandemic, their success continues to remain unsatisfactory in most developing economies (Afful-Dadzie et al., 2022). For instance, Venkatesh et al. (2019) report that nearly 90% of digital technology-led interventions implemented in developing economies have failed to produce the expected outcome. The unsatisfactory results of these DERs interventions confirm the long-held claim that simply buying new technological tools without recourse to the role the headteacher had to play in the implementation process will not automatically translate into better usage (Hsieh et al., 2014). The headteacher must perform more responsibilities if a school seeks to integrate DER effectively into teaching and learning activities. The headteacher's knowledge and competence in digital tools will enable them to institute appropriate strategies to facilitate DER usage within their schools.

Whereas there is a great belief that having in place an effective leader can ease the integration of DER in pedagogy and learning, the literature has continuously ignored the role of institutional leadership in this change outcome (Moran et al., 2010; Bhutto et al., 2021). Particularly at the school level, the head needs adequate competencies in DERs to effectively provide the required leadership to undergird the successful integration of DERs into schools' curricula (Castañeda & Corredor, 2016). Therefore, in this digital educational revolution era, headteachers must be the frontrunner in the digitalisation process, display a thorough understanding of the digital educational policy, institute prudent administrative plans to enhance its usage and identify the issues likely to restrict teacher's usage of these digital tools (Apsorn et al., 2019). Even though digital leadership has emerged as a new wave of leadership to help spearhead digitalisation in contemporary organisations (Duze, 2012; Lawrence & Tar, 2018), empirically, there is little understanding of the impact of this new category of leadership on schools' DERs implementation outcomes (Borah et al., 2022). Often most of the studies exploring the determinants of DERs implementation success have placed more nuances on the push factors: perceived risk, learning accessibility and cost and the pull factors: compatibility, complexity, attitude and user knowledge (e.g., Abbasi et al., 2022; Afful-Dadzie et al., 2022; Bai & Jiang, 2022).

Undoubtedly, these pull and push factors are quintessential to users' intention and actual usage (Asante & Achiaa, 2018; Venkatesh et al., 2019); as rightly indicated by Baaren et al. (2008), the relevance of the push and pull factors are time bound and may not suffice to induce full DERs usage especially when the users begin to develop some doubts in the tool's capabilities. Therefore, to strengthen teachers' ongoing interest in DERs, a higher-level administrative catalyst would be needed to create the necessary environment to ensure the practical application of these technologies into teachers' pedagogy. While the existing literature acknowledges the role of leadership in easing fixed positions in institutional change activities (Bhutto et al., 2021), there is a scant understanding of the importance of digital leadership to DERs implementation outcomes, particularly in the school setting. The digital competence of a headteacher will become fundamental to DERs implementation success, particularly in a region characterised by low technological infrastructure and support (Apsorn et al., 2019). This void in the literature must be filled as a school's digitalisation agenda's outcome does not solely depend on the pull and the push factors but equally on the digital savviness of the headteacher leading the adoption process (Borah et al., 2022). Addressing this gap in the literature is the main objective of this study.

Even though DERs promise tremendous opportunities, their applications in schools are characterised by various social, physical and economic challenges, particularly for the intended user (Nundy et al., 2019). Scholars and technology advocates underscore the relevance of trust in undermining the consequences of these challenges in technology application (Winfield & Jirotka, 2018). Therefore, drawing on the theory of trust, the study theorises that a teacher's decision to accept the uncertainties of DERs will be informed by the positive expectations of the intentions or behaviour of the other party, i.e., the headteacher (Rousseau & Tijoriwala, 1999). Although contemporary studies have considered the consequence of trust in many domains, such as close relationships (Simpson, 2007), community involvement (Rahn & Transue, 1998), and organisational behaviour (Kramer, 2007), little is known about its mediating effect on DERs implementation outcomes. Considering the consequence trust has on a person's acceptance of the fears in a new relationship (Rousseau & Tijoriwala, 1999), understanding its impact on digital leadership and DERs relationship will strengthen the literature on the social forces that can improve digital leadership influence on teachers' usage of DERs in a developing economy.

Third, concerning methodology, most DERs studies used symmetrical approaches for their data analysis (El-Masri & Tarhini, 2017; Tang, 2021). However, emerging evidence has demonstrated that using only symmetrical techniques such as multiple regression analysis (MRA) and partial least square structural equation modelling (PLS-SEM) provides an imperfect picture of an outcome (Mehran & Olya, 2020). In response to the call for new studies to use two different analytical approaches, the study uses both a symmetrical (i.e., PLS-SEM) and an asymmetrical technique (i.e., fuzzy set qualitative comparative analysis (fsQCA) to explain better the hypothesised relationships in the study model. Using these two methodological approaches in a single study will help address the shortfall of earlier studies and consequently enable us to identify the contrarian cases often ignored in symmetrical studies (Pappas & Woodside, 2021).

The present study expands the literature on the predictors of DERs in various ways. First, considering the expiration of most of the pull and push to DERs applications (Baaren et al., 2008), the study examines a new leadership antecedent, digital leadership, on teachers' usage of DERs, which has received little attention in the extant literature. Again, it integrates a key social antecedent into the study model to explore its mediating role in digital leadership and teachers' usage of DERs relationships. Lastly, the study uses symmetrical (i.e., SEM) and asymmetrical approaches (i.e., fsQCA) to identify the different combinations of conditions that predict teachers' use and non-use of DERs in their pedagogy and professional development. In seeking to address the gap enumerated above, the following research questions are proposed:

1. What is the influence of digital leadership on teachers' usage of DERs?
2. How does trust in digital leadership affect teachers' usage of DERs?
3. What mediating effect does trust in a digital leader has in the relationship between digital leadership and teachers' usage of DERs?

2 Literature review

This section commences with the conceptualisation of the main themes of the study: DERs and digital leadership. Afterwards, the theory underpinning the hypothesised relationship is identified and justified. The section ends with the hypothesised relationships.

2.1 Digital educational resources (DERs)

In the educational literature, DERs have been conceptualised with different terminologies. While earlier scholars categorised them as information communication tools, others classified them as e-learning tools and have recently been relabelled as DERs or open educational resources (OERs) (Wang et al., 2019). The only difference between earlier and current categorisation is that with DERs and OERs, their systems are more sophisticated with new add-ons such as algorithms and artificial intelligence. The capabilities of DERs make it possible to assign learning programs to the user's or learner's peculiar needs. Given the complexity of the conceptualisations, Ramos et al. (2011) identified some typical characterisations among these categorisations. The joint description among these concepts is that they are objects or information kept and made accessible to learners, teachers and educators via digital tools and applications. From this description, DERS become programs and applications developed explicitly for educational purposes and may include collections of digital resources such as digital video, digital audio, multimedia software, sites, learning management systems, simulation programs, online discussions and databases (Yang, 2014).

2.2 Digital leader

The rate at which DERs are gaining momentum in curriculum development and pedagogy is putting new demands on headteachers and policymakers (Hensellek, 2020). Since DERs implementation is multifaceted and different from traditional educational materials, headteachers must modify their management approach to make the best of this digital revolution (Fitzgerald et al., 2014). Avolio et al. (2000) explained digital leadership as a new social influence process reinforced by technological progress to change workers' attitudes, feelings, thinking, behaviour, and performance with individuals, groups, and organisations. The increasing use of digital tools in educational setup demands that every academic head develops a digital mentality, allowing them to articulate better the capabilities of DERs and how their application will benefit the school (Hensellek, 2020). Therefore, one of the core roles of the digital leader is to have a clear digital vision for his school (Parviainen et al., 2017). Because a headteacher needs to get the support of every teacher, he should build a digital vision that is well communicated and, in the end, logical (and acceptable) by all teachers.

However, a well-articulated vision may not suffice for DERs implementation success; hence, the digital leader should have concurrent strategies to break down the idea into actionable plans to facilitate DERs actual use. Kollmann (2019) argued that apart from vision, the digital leader should possess a digital skillset to speed up the execution of the actional plans. Though the right digital attitude is central, a digital leader will still need a digital skillset to appreciate DERs better, deal with them quickly and justify how DERs support teachers and school effectiveness. Kollmann (2019) contends that adequate digital skills help leaders recognise DERs' opportunities and the probable dangers their usage may pose to their teachers. A headteacher with a digital attitude can use his abilities to facilitate DERs implementation by setting a good example and taking full accountability for the DERs adoption (Crummenerl & Kemmer, 2015). Though emerging evidence has recognised the importance of digital leadership to digital tool implementation outcomes (Avolio et al., 2000), the empirical impact of this new form of leadership on schools' DERs implementation outcomes remains less explored (Cortellazzo et al., 2019; Borah et al., 2022).

2.3 Theoretical underpinning and hypotheses

The leading theory used in this study is the Social Exchange Theory (SET). SET is one of the behavioural theories often used to describe how the interactions between leaders and followers yield a sense of obligation, belief, and appreciation (Emerson, 1976). The SET posits that through support and positive interactions, managers can guide their subordinates' actions and inaction toward one common goal (Karim & Nadeem, 2019). According to O'Keefe et al. (2018), the positive exchanges between the leader and subordinates produce the social consequences of obligation, allegiance, and trust, which lead to shared responsibility. The actions of a superior, which become visible to the subordinates through his direct exchanges with them, could either inspire or discourage the subordinates from supporting a new organisational change (Liden et al., 2008). Per the SET, a headteacher who demonstrates a strong commitment towards DERs through his actions and exchanges can induce that same

enthusiasm in the minds of their teachers (Tatlah & Iqbal, 2012). Hence, the antecedent of interactions in the SET recognises that when teachers regard their headteachers' interest and support towards using DERs as high, they are most likely to replicate that feeling by using it in their teaching and learning activities. Therefore, a headteacher, through his digital leadership: vision, planning, training and development, technological support and articulation, can inspire teachers to support the usage of DERs (O'Keefe et al., 2018). The study relies on the SET theory to lay the groundwork for hypotheses development. Figure 1 shows the proposed research model for the study.

2.4 Digital leadership and teacher's usage of DERs

The duties of a headteacher in recent times have evolved from being principally that of a manager (Iaconelli & Anderman, 2021) to that of an instructional and curricular leader (Tapala et al., 2021) and currently to that of a digital leader (Petko et al., 2018). Looking at governments' unceasing investments in DERs, headteachers' ability to transition from conventional school administrators to required digital leaders has become a prerequisite to schools' digitalisation success (Lawrence & Tar, 2018). According to the SET, the leader's credentials and capabilities can empower his followers, grant them autonomy, and enable them to proffer proper feedback, which the employee reciprocates by undertaking the effort required to make the dream a reality. Through the arguments of the SET, leaders can positively shape subordinates' attitudes towards a new change outcome not only through modification of the work environment but also directly through inspiring, aligning, and solidifying subordinates' identity towards the new change process (Schaufeli, 2015). Generally, because the usage of DERs may be characterised by varied forms of social, physical and economic challenges, it becomes crucial for the headteacher first to strengthen the teacher's identity towards the new change to gain their support for the technological advancement (Nundy et al., 2019). Accordingly, by maintaining subordinates' connection to the new initiatives, subordinates may feel energised and agree to follow the leader's direction. Therefore, a headteacher's competence and knowledge of

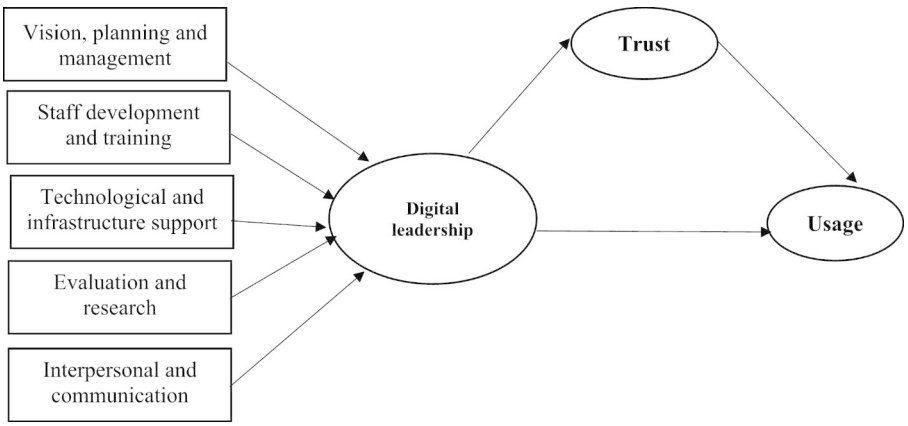

Fig. 1 Proposed Conceptual Framework

DERs become essential in facilitating its usage among teachers (Apsorn et al., 2019). Earlier studies on traditional leadership styles such as transformational, ethical, transactional and paternalistic suggest that using the requisite leadership style in a change process can inspire the required change in followers' attitudes and performance outcomes (Ng, 2017). Nonetheless, how digital leadership, which has emerged as a new form of contemporary leadership style, is modifying subordinates' digital technology application, particularly in the school setting, remains unexplored. Accordingly, a positive relationship can be expected, and the following hypothesis is proposed:

Hypothesis 1 Technological leadership positively affect teacher's usage of instructional media.

2.5 Trust in Digital leadership and teachers' usage of DERs

From psychologists' perspective, trust has become a leading social construct with far-reaching implications for many interpersonal relationships (Evans & Krueger, 2009). Therefore, the ability to trust one another becomes a requisite when building relations in the social world. From the theory of trust argument, risks are integral to every social circumstance. Therefore, without the capacity to trust one another, parties will not accept the uncertainties that characterised the social relationship (Rousseau & Tijoriwala, 1999). Trust is therefore construed as a psychological condition encompassing the intention to be in a position of defencelessness because of the positive expectations of the choices or behaviour of the other (Rousseau et al., 1998). Although DERs promise tremendous opportunities, their application may come with challenges, especially when a teacher is introduced to them for the first time in their career. Teachers may be reluctant towards its application, particularly when they fear its impact on their social, physical and economic well-being (Winfield & Jirotka, 2018). Looking at the uncertainties that DERs may pose to teachers in terms of social, physical and financial challenges (Nundy et al., 2019), trust in the headteacher becomes crucial for the teacher's acceptance of the uncertainties of the DERs (Gille et al., 2014).

Clercq et al. (2014) underscore that when there is more leader–subordinate trust, leaders can spark the necessary behavioural change within their subordinates. Studies have confirmed that when subordinates have sufficient trust in their leaders based on previous experiences, they tend to align with their new vision even when the outcome of the vision is not clear (Shu, 2015; Decuypere et al., 2019). Therefore, teachers' level of trust in their headteachers could stimulate their acceptance of DERs, especially when spearheading its implementation (Dulebohn et al., 2017). This suggests that trust in digital leadership may be an essential conditional factor to inspire teachers' usage of DERs (Yukl, 2012). Therefore, a positive relationship is expected, and the following hypothesis is proposed:

Hypothesis 2 Trust in digital leaders positively affect teacher's usage of DERs.

2.6 The mediating role of trust

Trust is described as a disposition to be defenceless and agree to be the recipient of a risk in a relationship (Mayer et al., 1995). In a leader-subordinate relationship, trust becomes the most treasured asset which underpins a leader's effectiveness (Hartog, 2018). Without sufficient trust, a leader's ability to induce the desired influence on their subordinates becomes nominal. The two main antecedents of trust are cognitive and affective (McAllister, 1995). Cognitive trust constitutes the objective evaluation of qualities such as capacity and dependability nurtured from the consequences of previous exchanges and the professional credentials of the person involved (Legood et al., 2021).

On the other hand, affective trust showcases the emotional connections in an interactive affiliation. Perceptions of the different individual motivations create it, the degree to which they provide assistance and care, and the regularity of exchanges (Legood et al., 2021). Unlike cognitive trust, which evolves from the leader's capabilities and past experiences, affective trust is built through positive feelings and the extent of openness in the exchanges.

From the SET, the actions of one party are usually paid back in kind, and this is expected to persist through a sequence of mutual interactions (Cropanzano et al., 2017). Trust, the primary antecedent of risk-taking, is likely to deepen positive social exchanges, spur obligation and consistently minimise uncertainty surrounding reciprocation (Konovsky & Pugh, 1994). Considering the uncertainties surrounding DERs, teachers may be willing to follow the digital leader through with his vision when they trust his present capacities and earlier judgements. Research suggests that trust between a leader and a subordinate is connected with increased subordinate performance and additional work roles and is negatively associated with unwanted outcomes, such as employees' intention to resign or resist change (Yang, 2014). Therefore, the presence of subordinate trust in digital leaders is theorised to inspire teachers to use DERs and minimise their reluctance towards DERs application in their pedagogy and professional development. A significant relationship is anticipated, and these hypotheses are therefore proposed:

Hypothesis 3 Trust mediates the relationship between digital leadership and teachers' usage of DERs.

3 Research design

3.1 Participants and procedure

The study used a cross-sectional design. Unlike the other research approaches, cross-sectional designs provide adequate controls over the measurement process, thereby ensuring that the field data is collected at the same time and in the same way for all participants minimising the possibility of measurement inaccuracies (Bryman, 2016). Judging from its flexibility in measuring several outcomes or exposures concurrently,

it becomes very beneficial to explanatory studies such as this and the study's research questions. The study population was drawn from four senior high schools within the Greater Kumasi Metropolis of the Ashanti region of Ghana. The metropolis was selected as the study context based on the following reasons. The metropolis was one of the primary beneficiaries of the Government of Ghana's Information and Communication Technology for Accelerated Development (ICT4AD) policy (Ministry of Education, 2008). In the last three years, most senior high schools within the metropolis have seen massive investments in their digital educational infrastructure to improve IT skills among teachers and students. Considering the significant investments the government have channelled into the metropolis DERs, it becomes essential to explore how the digital leadership role exhibited by the school's heads in the policy implementation process impacted the teachers' actual usage of DERs. The study population comprised all teachers within the metropolis's selected senior high schools. These four schools are the primary recipients of the ICT4AD intervention. Since these schools have a staff strength of 450 teachers, the study targeted all 450 teachers. Simple random sampling was used to improve the generalizability of the study's conclusions.

However, to determine the sample size, an a priori power analysis was computed to identify the suitable sample required to produce a medium effect size of 0.15, a power of 0.90 and an alpha value of 0.05 (Hair et al., 2019). Guided by a priori power analysis, a study model of three predictors required a sample size 108 to produce the medium effect size of 0.15. The projected sample size of 108 was way below the actual sampled teachers as the study obtained 195 valid responses demonstrating an effective response rate of 43.3%. Among the surveyed teachers, their mean ages were 27.5 years (Table 1). Again, the gender distribution of the respondents was reasonably balanced, with 56.7% as males and 43.3% as females. Also, the minimum academic qualification of the surveyed teachers was a bachelor's degree. Regarding the frequency with which the teachers used DERs, most teachers (52.5%) used DERs a few times within a month. Lastly, the DERs that the teachers predominantly used

Table 1 Demographic Profile

Demographic variable	Category	Per cent
Gender	Male	56.7%
	Female	43.3%
Age	21–30 years	61.9%
	31–40 years	38.1%
Education	Bachelor's degree	70%
	Master's degree	30%
Number of years they have been teaching	1–5 years	68.0%
	6–10 years	32.0%
Frequency of usage of instructional media	Daily	26.8%
	Few times in the week	20.7%
	Few times a month	52.5%
Instructional media used	Scientific repositories	49.5%
	e-learning platforms	32.0%
	Interactive whiteboard	12.4%
	video websites	6.2%

were scientific repositories (i.e. 49.5%), followed by e-learning platforms (32.0%) (Table 1).

3.2 Research instruments

The measuring items were adapted from validated scales used in previous studies. Except for the demographic profile, all the other items were measured by a five-point Likert scale (1 = strongly disagree to 5 = strongly agree). Digital leadership was assessed by a five-dimensional sub-scale of vision, planning and management, staff development and training, technology and infrastructure support, evaluation and research and interpersonal and communication skills (Kalsoom et al., 2018). Occam's razor recommendation guided us; the simpler the model, the better. Therefore, to ensure parsimony and ease the reproduction of the model in other studies, the five sub-scales of digital leadership were joined to produce one major scale (Sharman et al., 2019; Benitez et al., 2020). With trust, five items were adapted from Rawlins (2009). The trust items assessed teachers' belief in the headteacher management approach and confidence in their capabilities. The usage of DERs was measured with five items adapted from Majeed and Othman (2012).

3.3 Data analysis

The study used partial least squares path modelling (PLS-SEM), a tool suitable for modelling variance-based structural equation modelling. Since the proposed model has many constructs, using PLS-SEM, as recommended by many scholars, becomes very useful in assessing a relationship of such nature (Hair et al., 2019; Benitez et al., 2020). Unlike first-generational tools such as linear regression analysis (Iacobucci, 2009), PLS-SEM provides a more robust approach to concurrently assess all the relationships between the observed and latent variables (Benitez et al., 2020). Following the recommendations of Hair et al. (2019), the data were analysed in two folds; first, the measurement model was performed to establish the validity and reliability of the constructs, and afterwards, the proposed hypotheses were tested to identify the extent of the relationship between the variables.

With the asymmetrical approach, fsQCA was used to re-analyse the data to disentangle the cases better often ignored in symmetrical analysis (Pappas & Woodside, 2021). The configuration analysis comprised three processes; data calibration, truth tabulation, and counterfactual analyses (Mehran & Olya, 2020). With the first process guided by the suggestions of earlier works, the data was calibrated into three sets of conditions; full membership, cross-over point and full non-membership (Ragin, 2008; Mehran & Olya, 2020). Because of the skewness of the data, the percentile function in SPSS (Frequencies> Statistics> Percentiles) was used to calibrate the data into the three needed thresholds: ninety-fifth -full membership, fiftieth-cross-over point, and fifth-full non-membership (De Crescenzo et al., 2020; Pappas & Woodside, 2021). The results of the data calibration are presented in Table 2. The next step, the truth table, constitutes a list of all likely conditions defining an outcome (i.e., teachers' usage of DERs). Subsequently, the truth table was reduced into conditions that resulted in a better result (Mehran & Olya, 2020) by defining the frequency cut-

Table 2 Construct indicators and measurement

Constructs	Alpha	Rho_A	AVE	CR	Factor Loading
Digital leadership	0.967	0.976	0.599	0.970	
Vision, planning and management					
Our headteacher clearly articulates a shared vision for technology use.					
Our headteacher empowers a diverse and inclusive technology planning team.					0.681
Our headteacher advocates for school technology resources.					
Our headteacher manages technology change effectively.					0.630
Our headteacher uses technology to manage administrative operations within the school efficiently.					0.619
Staff development and training					
Our headteacher encourages in-service technology training.					0.619
Our headteacher supports technology in-service training program design.					0.603
Our headteacher supports technology in-service training delivery.					0.729
Our headteacher provides all teachers permission to undertake studies in computing.					0.860
Our headteacher ensures that the appropriate technology facilities have been installed.					0.851
Technology and infrastructure support					
Our headteacher ensures equal access to technology resources.					0.867
Our headteacher ensures that technical support is provided to the teaching personnel when assistance is required.					0.886
Our headteacher ensures that all instructional media tools are repaired and maintained promptly.					0.855
Our headteacher considers effective technology use as one of the performance assessment components of instructional staff.					0.835
Our headteacher continuously evaluates our school technology plans.					0.906
Evaluation and research					
Our headteacher evaluates technology in terms of costs/benefits.					0.850
Our headteachers evaluate our computer operating systems within the classrooms and laboratories.					0.836
Our headteacher uses district-level data to assess the usage of digital educational resources within our school.					0.825
Interpersonal and communication skills					
Our headteacher demonstrates an understanding of the technology needs and concerns of teaching staff and students.					0.786
Our headteacher maintains positive relationships with all teaching staff and students concerning the usage of instructional media.					0.841

Table 2 (continued)

Constructs	Alpha	Rho_A	AVE	CR	Factor Loading
Our headteacher communicates effectively with its teaching staff and students about using instructional media in the classroom.					0.840
Our headteacher encourages school personnel to use the available information sources about instructional media for our professional development.					0.871
Trust	**0.794**	**0.855**	**0.57**	**0.863**	
During a policy change, I will let the head teacher decide for people like me.					0.856
I trust the headteacher to care for people like me during a new policy change.					0.849
Whenever the headteacher makes a vital decision during the change, I know it will concern people like me.					0.815
Our headteachers can be relied on to keep their promises during the change.					0.783
Usage	**0.773**	**0.826**	**0.606**	**0.857**	
I use digital educational resources (e.g., e-learning platforms, scientific repositories, video websites, and interactive whiteboards) for all my teaching activities.					0.866
I use digital educational resources for most of the pedagogical and learning activities.					0.842
I use digital educational resources for classroom management (e.g., setting exam questions, preparing lesson notes and researching).					0.828
I hardly use digital educational resources for teaching and learning activities.					0.530

off at >1 (Ragin, 2008). Therefore, events with two or more representations were used for the subsequent analysis. Moreover, the causal combinations were refined based on coverage and consistency indexes, equivalent to coefficient determination and correlation in symmetrical investigation (Mehran & Olya, 2020). Lastly, the necessary conditions were analysed to find the recipes required to cause teachers' usage of DERs (Gannon et al., 2019).

3.4 Common method bias (CMB)

The data were subjected to a CMB test by first computing the Harman single-factor test (Podsakoff et al., 2003). With this statistical procedure, the total variance showed by a single factor component stood at 33.4%, suggesting a lower threshold (Malhotra et al., 2017). However, in recognising the limitation of the single-factor test, a more vigorous test for CMB in PLS-SEM was computed using the measured latent marker variable. With this approach, the five items scale of the social desirability scale of Crowne and Marlowe (1960) was used as the measured latent market variable (MLMV) (Chin et al., 2013). Results from the model suggest that including the MLMV as part of the model did not lead to any substantial difference in the R square values for trust and DERs usage. Specifically, with its inclusion, the R square value for trust and DERs usage changed from 0.357 to 0.373 and from 0.205 to 0.206,

respectively, confirming that CMB is not a vital issue to be worried about in this study (Chin et al., 2013).

4 Results

4.1 Analysis of measurement model

The traditional measurement parameters: convergent validity, discriminant validity and construct validity, were used to measure the study model (Benitez et al., 2020). To assess convergent validity, Average variance extract (AVE) and factor loadings were used (Benitez et al., 2020). Generally, an AVE value of 0.5 or higher has been suggested to support convergent validity empirically (Fornell & Larcker, 1981). Additionally, an indicator factor loading of 0.6 or higher has been acknowledged to be adequate, implying that more than 50% of the variation in a single indicator can be explained by the equivalent latent variable (Benitez et al., 2020). Results in Table 3 suggest that except for the first four items under the vision, planning and management scale, all the other items under digital leadership factor loadings were above the recommended threshold of 0.70, confirming evidence of strong discriminant validity (Hair et al., 2019). Following the suggestions of Hair et al. (2019), these items were included in the model estimation since their inclusion did not limit the model predictability (Benitez et al., 2020). With internal reliability, all the constructs' alpha values surpassed the recommended threshold of 0.70, confirming high internal reliability (Hair et al., 2019): digital leader ($\alpha = 0.967$), trust ($\alpha = 0.794$) and DERs usage ($\alpha = 0.773$). Also, with AVE, the scores of the constructs were higher than the recommended threshold of 0.5, with the lowest value being 0.57. Composite reliability (CR) produces an internal consistency reliability coefficient based on the share of the differences predicted by the test items in connection to the total variance of the composite test score (McNeish, 2018). Hair et al. (2019) posit that CR values within the range of 0.60 and 0.70 are deemed more acceptable in exploratory studies. The study constructs all attained satisfactory reliability with their CR values above 0.85. Lastly, heterotrait-monotrait (HTMT) was used on discriminant validity over the Fornell and Larcker criterion, as recent evidence has criticised it for its inconsistency (Henseler et al., 2015). According to the HTMT criterion, a study achieves discriminant validity when all its construct values are lesser than 0.85. Results in Table 3 confirm that the constructs values are below the stricter recommended threshold of 0.7 (Henseler et al., 2015).

Table 3 Heterotrait-Monotrait Ratio (HTMT)

	TL	Tr	Usa
DL			
Tr	0.634		
Usa	0.432	0.480	

Table 4 Structural model results

Constructs	R^2	Adj. R^2	F^2	Q^2
DL→Tr	0.357	0.350	0.554	0.221
DL→Usa	0.206	0.189	0.053	0.192

Note. DL=digital leadership, Tr=Trust, USa=digital educational resources usage

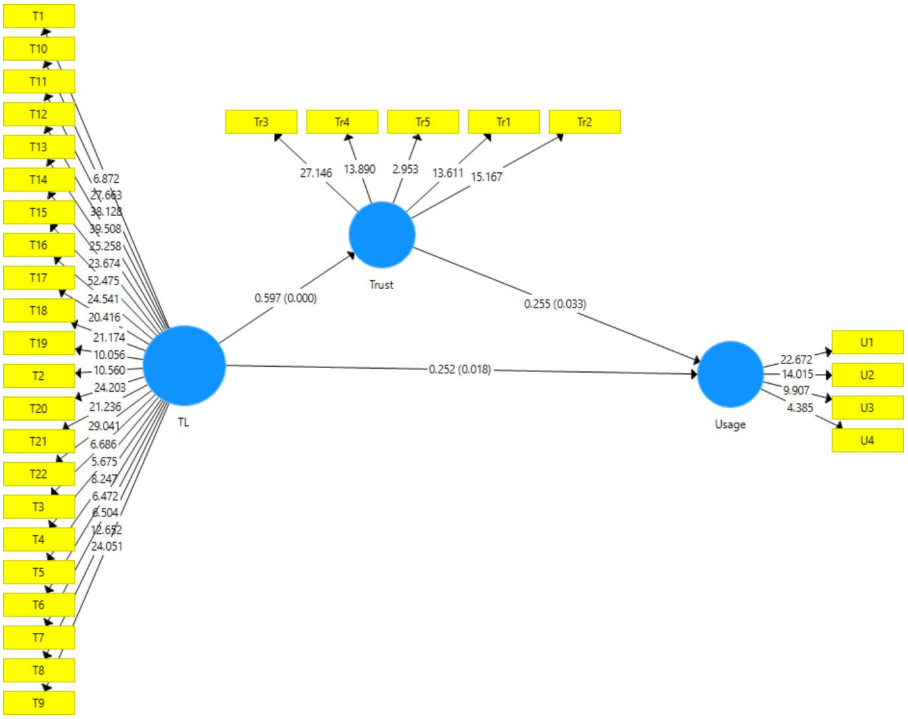

Fig. 2 Research model explanatory power

4.2 Assessment of the Structural Model

The study used the standardised root mean square residual (SRMR) to assess the total fit of the proposed model (Henseler et al., 2015). The SRMR value for our model was 0.08 with NFI of 0.721, d_ULS of 0.513 and d_G of 0.393 with χ^2=214.354, indicating that the study model is appropriately fit to produce the relevant evidence for the proposed theory (Hayduk, 2014). Afterwards, the bootstrapping approach recommended by Streukens and Leroi-Werelds (2016) (10,000 resamples) was followed to establish the statistical significance of the various pathways. Table 4 presents the result of the structural model assessment. The study revealed that the endogenous variables' R-squared value ranged from 0.206 to 0.357. Also, the path coefficient for the hypothesised relationships ranged from 0.252 to 0.597 and were all statistically significant at a 5% significant level (Fig. 2). Results from the study also established that the Q^2 values for trust (0.221) and DERs usage (0.192) were above the

Table 5 Relationship between variables (direct effect)

Structural path	Coeff (β)	Std. deviation	P values	95% BCa CI	Conclusion
DL→Tr	0.597	0.073	0.000	0.460, 0.717	H1 supported
DL→Usa	0.402	0.081	0.025	0.013, 0.445	H2 supported
Tr→Usa	0.255	0.125	0.042	0.013, 0.474	H3 supported

Note. DL=digital leadership, Tr=Trust, USa=digital educational resources usage

Table 6 Relationship between variables (indirect effect)

Structural path	Coeff (β)	SD	T Statistics	P values	95% BCa CI	Conclusion
DL→Tr→Usa	0.152	0.0785	3.099	0.051	0.004, 0.294	H4 not supported

Note. DL=digital leadership, Tr=Trust, USa=digital educational resources usage

recommended value (i.e., >0), confirming that the proposed model had a predictive relevance.

4.3 Hypothesis testing

Results in Table 5 indicate that all the hypotheses were supported. Precisely, the relationships between DL→Tr (β=0.597), DL→Usa (β=0.252) and Tr→Usa (β=0.255) were significant at p=.001 indicating that H1 and H2 were supported.

4.4 Mediation analysis

The indirect effect was estimated to identify trust's mediating impact on the relationship between digital leadership and teachers' usage of DERs. The procedure suggested by Cepeda et al. (2017) was used to compute trust's mediating role in the hypothesised relationship. The indirect effect of DL→Tr→Usa was positive but statistically insignificant (β=0.152, t=1.956, 95% CI=0.017–0.277). Results from PLS-SEM analysis suggest that trust did not mediate the relationship between digital leadership and teachers' usage of DERs, therefore failing to support H4 (Table 6).

4.5 Reanalysis of the data using fsQCA

The fsQCA results of the configurations for teachers' usage of DERs are presented in Tables 7, 8 and 9 for calibration, configurations, and necessary conditions, respectively. For every pathway, consistency and overall coverage are presented. The consistency value is comparable to the correlation coefficient in SEM, while the coverage index is equivalent to the R^2 in PLS-SEM and multiple regression analysis (Fang et al., 2016). Consistency is expected to be higher than 0.75; in this study, all the values were more significant than this recommended threshold. It can be observed from Table 8 that teachers' usage of DERs arises from the recipe of five equifinal configurations.

Table 7 Data calibration membership cut-off points

Construct	Full non-membership score	Cross-over point	Full membership score
DL	2.00	3.00	5.00
Tr	2.00	4.00	5.00
Usa	1.00	3.00	5.00
Respondents age, binary condition; 1 = 21–30 years, 2 = 31–40 years	No need for calibration		
Years of teaching experience; binary condition; 1 = 1–5 years, 2 = 6–10 years	No need for calibration		

Pathway 1 (Model 1) Indicates that teachers' usage of DERs can be realised through digital leadership and teachers' trust in the digital leader (coverage: 0.76, consistency: 0.97). The pathway coverage of 0.76 implies that teachers' usage of DERs emerges from the presence of digital leadership and users' trust in the digital leader. **Pathway 2 (Model 2)** suggests that the use of DERs is achieved when there is digital leadership and minimal or absence of teachers' trust in the digital leader (coverage: 0.714, consistency: 0.714). Therefore, the headteacher's digital savviness will signal to teachers that they have the necessary competencies to lead the entire DERs implementation.

Pathway 3 (Model 3) Indicates that teachers' usage of DERs can be ensured when there is digital leadership, trust in the digital leader, and when the teacher's age and years of teaching experience are receptive to using DERs. The pathway coverage of 0.756 suggests that 75.6% of the teachers' decisions to use DERs come directly from the recipe of digital leadership, teachers' trust in the digital leader, age, and years of teaching experience. The result is significant because a teacher's decision to be defenceless towards DERs usage may come mainly from their trust in a digital leader. However, trust is not earned by a person's position but rather nurtured through the outcomes of earlier interactions and pronouncements made by the leader in similar circumstances and the professional competencies of the person involved. Accordingly, the teacher's perception of these trust criteria could influence his decision to remain defenceless towards the propositions of the digital leader. Similarly, young teachers may have more fondness for digital tools than older teachers because of their increasing use of smartphones for daily communications.

The configurations for non-usage of DERs are presented in models 4 and 5. As illustrated in **Pathway 4 (Model 4)**, 76.3% of teachers' non-usage of DERs emerged from the absence of digital leadership and teachers' mistrust of the digital leader. The result implies that teachers will likely refuse to use DERs when the headteacher charged with the supervision of DER has limited digital aptitudes and again doubts his capabilities to lead the process effectively. **With pathway 5 (Model 5)**, it was established that a teacher's demographic profile, age and experience were not sufficient to influence a teacher's use of DERs. The result suggests that the presence of age, years of working experience, the absence of digital leadership, and mistrust

Table 8 Configurations Leading to the Usage of Digital Educational Resources

Configurations	Models for predicting usage of digital educational resources		
	Raw coverage	Unique coverage	Consistency
M1. Usa = f (DL, Tr)			
TL*Tr	0.754	0.7549	0.971
Solution coverage: 0.7549			
Solution consistency: 0.974064			
M2. Usa = f (DL, Tr)			
TL*~Tr	0.285	0.1071	0.667
Solution coverage: 0.714			
Solution consistency: 0.588			
M3. Usa = f (Ag, Exp, DL, Tr)			
DL*Tr*Ag*Exp	0.7041	0.7041	0.978
Solution coverage: 0.754			
Solution consistency: 0.978			
Models for predicting non-usage of digital educational resources			
Configurations	**Raw coverage**	**Unique coverage**	**Consistency**
M4. ~Usa = f (DL, Tr)			
~TL*~Tr	0.7631	0.7631	0.9354
Solution coverage: 0.7631			
Solution consistency: 0.9355			
M5. ~Usa = f (Ag, Exp, DL, Tr)			
~DL*~Tr*Ag*Exp	0.763	0.3158	0.935
Solution coverage: 0.947			
Solution consistency: 0.77			

*Note: Usa – digital educational resources usage, DL – digital leadership, Tr – trust, Ag – respondents age, Exp-years of working experience, * – logical conjunction AND, ~ – negation or absence, M1 – model 1, M2 – model 2, M3 – model 3, M4 – model 4, M5 – model 5*

in the digital leader accounted for teachers' non-usage of DERs (coverage: 0.947, consistency: 0.77). Results from the study suggest that all five pathways (i.e., three for teacher's usage of DERs and two for teacher's non-usage of DERs) are accepted based on the suggestions of Ragin (2008) and De Crescenzo et al. (2020).

Table 9 Results of necessary conditions

Configurations	Consistency	Coverage
Usage of digital educational resources (Usa)		
DL + Tr	0.886	0.876
DL + Tr + Ag + Exp	0.978	0.808
Non-usage of digital educational resources (~ Usa)		
~DL + ~ Tr	0.934	0.54

5 Discussion

The study investigates the role digital leadership plays in DER implementation outcomes in pre-tertiary schools in the context of a developing economy exemplified by Ghana. To achieve the study's primary objective, we adopted all five digital leadership sub-scales: vision, planning and management, staff development and training, technology and infrastructure support, evaluation and research and interpersonal and communication skills and added trust as the mediating variable. The results from the study provide insightful revelation to support theory development and DERs policy formulation in a developing economy.

5.1 What is the influence of digital leadership on teachers' usage of DERs?

Particularly on the first research question, the result demonstrates a significant positive relationship between digital leadership and teachers' usage of DERs. Our results suggest that pre-tertiary school teachers are likelier to use DERs in their pedagogy and professional development when the headteacher responsible for supervising the technology possesses sufficient digital capabilities. Therefore, for a headteacher to ensure the effective use of DERs among his teachers, they must have adequate competence in digital tools to allow him to communicate better about the abilities of DERs and consequently demonstrate how they can benefit the school and the teachers. The absence of this digital capability among headteachers could discourage teachers from using it because of the informed perception that the frontrunners have inadequate proficiencies to oversee its practical use (Castañeda & Corredor, 2016).

More specifically, the result has demonstrated that digital leadership, which has evolved as a new form of leadership, substantially impacts teachers' use of DERs, particularly in a developing economy where digital infrastructure does not have the same profile as developed economies. Unlike developed economies, in developing economies, educational reforms are usually initiated by the central government with limited participation of teachers. Teachers who are direct implementers of this reform will likely resist its execution, especially when they doubt the person leading it. Headteachers could halt teachers' resistance towards the reform, especially by demonstrating sufficient knowledge about it and developing practical measures to smooth its implementation at the school level. Similarly, with DERs implementation in developing economies, headteachers become the face of its performance by demonstrating sufficiency in their digital know-how. For headteachers to ensure the effective use of DERs among teachers in a developing economy, they must have an

exhaustive understanding of the digital educational policy, able to effectively communicate the policy to the teachers to get their buy-ins, identify the issues likely to restrict teacher's acceptance of these digital tools and assume full accountability of DERs implementation (Apsorn et al., 2019).

From the theoretical point of view, this study confirms the relevance of the SET to the investigation of digital leadership's influence on teachers' use of DERs. Earlier traditional leadership styles such as transformational, ethical, transaction and paternalistic mainly depended on the antecedents of the SET to explore leadership influence on subordinate behaviour and attitude (Ng, 2017). The suitability of the SET for digital leadership studies remains largely untested. Accordingly, using it as the study's primary theoretical antecedent affirms the importance of leader-employee exchanges in predicting subordinates' behaviour and attitude. Therefore, the antecedent of exchanges in the SET recognises that when teachers perceive their headteachers' interest and support towards DERs as high, this synergy will likely inspire teachers to demonstrate that same commitment by adopting DER for their teaching and learning activities.

Empirically, most of the extant studies investigating DERs adoption determinants in developing economies focused more on the push factors: perceived risk, learning accessibility and cost and the pull factors: compatibility, complexity, attitude and user knowledge (e.g., Asante & Achiaa, 2018; Abbasi et al., 2022; Afful-Dadzie et al., 2022; Buabeng-Andoh, 2022). Looking at the legal arrangement, school management style, and IT infrastructure of developing economies, the sufficiency of these pull and push factors to translate to the effective use of DERs among teachers may not always suffice. Therefore, this study contributes to the extant literature by exploring a vital leadership attribute overlooked in most DERs studies (Borah et al., 2022). Providing empirical support for this new form of contemporary leadership gives a fresh perspective to the existing literature, thereby reckoning the need for institutional heads to build their digital savviness to improve their influence on their organisation's digitalisation agenda.

From the practical point of view, the results indicate that a headteacher's digital savviness concerning his ability to communicate better the capabilities of DERs and how they will benefit the teachers is crucial in urging teachers to use DERs in their pedagogy and professional development. The result implies that headteachers' digital competence plays the same important role in predicting teachers' use of DERs. Therefore, the Ghana Education Service and the Ministry of Education, who appoint persons for the pre-tertiary schools' management positions, should ensure that the appointee has this leadership competence since this capability is a requisite skill in today's DERs management. Again, to improve the development of these new leadership capabilities, educational institutions that train school managers should have courses that build teachers' and headteachers' knowledge of digital leadership.

5.2 What mediating effect does trust in a digital leader has in the relationship between digital leadership and teachers' usage of DERs?

With the second research question, results suggest a significant positive relationship between trust in digital leadership and teachers' use of DERs, supporting H2.

Moreover, on the third research question, trust in digital leadership was statistically insignificant despite having a positive effect. The result contradicts earlier studies where trust in traditional leadership styles reported a significant mediating impact on subordinate performance, work roles, and support for organisational change (Yang, 2014). The possible explanations for this positive relationship but the statistically insignificant mediating effect could be linked to the following reasonings.

Trust takes two forms, namely, cognitive and affective trust. Whereas cognitive trust is created through the leader's track record and professional capabilities, affective trust is built through the quality of interactions, the authenticity of care, and the help the leader provides to parties in the exchanges. According to Legood et al. (2021), for subordinates to accept being vulnerable to the leader's instructions, their trust in the leader should develop from all the two aspects of trust, cognitive and affective. In this regard, it can be argued that the teachers' trust in their headteachers was incomplete. The teachers mainly had a cognitive or affective trust in the leader or none. Results from the study suggest that headteachers need to foster and develop cognitive and affective trust among their subordinates to gain their willingness towards their direction, especially when it comes DERs implementation. Failure on the part of the leader to foster these aspects of trust concurrently could minimise teachers' desire to accept the uncertainty characterised by DERs usage. Therefore, it is recommended that headteachers overseeing the implementation of DERs should ensure that their subordinates have sufficient trust in their judgement and capabilities since distrust could limit their acceptance and usage of DERs.

Lastly, the study extends earlier DERs studies that predominantly used symmetrical approaches for data analysis (El-Masri & Tarhini, 2017; Tang, 2021). Results from the PLS-SEM analysis confirm that using only symmetrical techniques for DERs studies may be inadequate in providing a complete understanding of the expected relationships within a proposed model (Pappas & Woodside, 2021). In the PLS-SEM results, trust did not mediate statistically significantly on digital leadership and teachers' usage of DERs. Sharply from the PLS-SEM findings, the fsQCA found five equifinal recipes or combinations that accounted for both teacher use and non-use of DERs. With fsQCA, it revealed that the presence of digital leadership and trust are necessary conditions for teachers' actual usage of DERs. For instance, a headteacher may exhibit sufficient digital leadership attributes towards his teachers. Yet, teachers' mistrust in his judgement to make the right call could dissuade them from accepting his guidance on DERs usage. Although, with the PLS-SEM estimation, a headteacher's digital leadership attributes are critical to a teacher's use of DERs; however, with fsQCA, digital leadership is necessary but not a sufficient condition to induce the expected influence on a teacher's usage of DERs.

Again, unlike PLS-SEM, which only came out with conditions that resulted in teachers' usage of DERs, fsQCA identified both the conditions that resulted in teachers' non-usage of DERs. For instance, results from the fsQCA established that the absence of digital leadership and trust leads to teachers' non-usage of DERs. Also, it was revealed that age, years of experience, the absence of digital leadership and mistrust in the digital leader lead to teachers' non-usage of DERs. The results from fsQCA clarified the necessary and sufficient conditions likely to influence teachers' usage and non-usage of DERs, which PLS-SEM failed to recognise (Table 9). Com-

paring these opposing analytical approaches suggests that PLS-SEM may not provide a deeper understanding of the causality between variables as it does not account for the contrarian cases (i.e., the conditions that will lead to the absence of an outcome). Results from the study extend earlier studies by demonstrating the importance of using two methodological approaches (i.e., symmetrical and asymmetrical) in a single study (Afful-Dadzie et al., 2022). This result, therefore, confirms the relevance of the usage of fsQCA in educational technology studies.

5.3 Limitations and future studies

Even though the study has achieved its objectives, it still has some limitations. Notwithstanding the chosen research approach to provide reasonable control over the measurement issues tackled in this study, the one-point data collection characteristics of the cross-sectional design could limit the study from making a more reliable causal inference about the relationship between digital leadership and teachers' usage of DERs. Therefore, to address this problem, future studies should use a longitudinal approach allowing data collection at two different times. Also, though a priori and posterior decisions were performed to restrict the incidence of common method bias, it is still recognised that gathering both endogenous and exogenous data from the same respondent may affect the study conclusion. Accordingly, future studies should employ a more robust way of collecting these data from different sources to improve the study's validity. Finally, future studies could extend this study's model by investigating how DER functionalities and digital leadership and leadership trust contribute to teachers' usage and continuous usage of DERs.

6 Conclusion

Predominantly, studies exploring the determinants of DERs usage among teachers in developing countries have placed more attention on the push factors: perceived risk, learning accessibility and cost and the pull factors: compatibility, complexity, attitude and user knowledge. Considering the increasing report that 90% of information technology-led interventions implemented in developing economies have failed to produce the expected outcome, this study took a new perspective by looking at how digital leadership improve teachers' usage of DERs in Ghana. The study used two opposing analytical approaches (symmetrical and asymmetrical) to provide a better perspective on this research question. Three main research findings include (1) headteachers' level of digital leadership substantially improved their teachers' use of DERs in their pedagogy and professional development; (2) trust in digital leadership had a significant positive relationship with teachers' usage of DERs; (3) trust in digital leadership did not mediate the relationship between digital leadership and teachers use of DERs. The significance of this research lies in being one of the first studies to provide empirical support on digital leadership's impact on DERs implementation outcomes in a developing economy.

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Data Availability The dataset generated during and analysed during the current study are not publicly available due to privacy or ethical restrictions but are available from the corresponding author upon reasonable request.

Declarations

Conflicts of interest None.

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