

Article

School Leadership and the Association to Teachers' Digital Competence in Supporting Students with Special Educational Needs

Joacim Ramberg * and Helena Hemmingsson

Department of Special Education, Stockholm University, SE-106 91 Stockholm, Sweden

* Correspondence: joacim.ramberg@specped.su.se

Abstract

The digitalisation of education has introduced new possibilities for inclusive teaching practices, particularly in supporting students with special educational needs (SEN). While digital tools have demonstrated potential to enhance learning outcomes and engagement for these students, the role of school leadership in fostering teachers' digital competence remains underexplored. The aim of the study is to investigate the association between school leadership, as rated by teachers, and teachers' self-reported digital competence in supporting students with SEN. To this end, cross-sectional data from 285 Swedish teachers enrolled in special education training programmes have been used. The data were collected through the SELFIE survey, a European Commission tool designed to assess schools' digital capacity. A stepwise linear regression analysis was conducted to examine the association between perceived school leadership and teachers' self-reported digital competence in supporting students with SEN, controlling for teacher collaboration, infrastructure and equipment, and demographic variables. The results show a consistent and significant positive relationship between school leadership and teachers' digital competence, even when other factors are accounted for. Teacher collaboration also contributed positively, though to a lesser extent, while infrastructure and equipment and demographic variables showed no significant effect. The study contributes knowledge by showing that teachers' digital competence development depends not only on individual efforts but also on organisational factors, such as supportive school leadership, highlighting the importance of recognising school leadership as vital alongside digital resources in schools. Given the cross-sectional design, the findings should be interpreted cautiously and not as evidence of causal relationships. These findings suggest that school leadership is important in enabling teachers to use digital technologies to support students with SEN, highlighting practical and policy implications for strengthening school leadership in developing teachers' digital competence in supporting students with SEN.

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1. Introduction

Digitalisation has become one of the defining features of contemporary education, transforming not only the tools available to teachers but also the pedagogical and organisational demands placed on teachers (Selwyn, 2016). Increasingly, digital competence is

regarded as a cornerstone of professional teaching practice, with implications for curriculum delivery, assessment, and inclusion (Instefjord & Munthe, 2016). This shift has particular significance in relation to students with special educational needs (SEN), where digital technologies hold the potential to enable more adaptive, accessible, and equitable learning opportunities (Eady & Lockyer, 2013; Montenegro-Rueda & Fernández-Cerero, 2023; Yngve et al., 2019).

1.1. European Commission and Digital Development in Education

To foster the development of digital competence and educational innovation at the European level, the European Commission has introduced two key frameworks: the European Framework for Digitally Competent Educational Organisations (DigCompOrg) and the European Framework for Teachers' Digital Competence (DigCompEdu) (European Commission, 2022).

On the basis of the European Commission's framework (DigCompOrg) for promoting digital-age learning in educational organisations, a research-based instrument called SELFIE (Self-reflection on Effective Learning by Fostering the use of Innovative Educational Technologies) was developed (European Commission, 2025). SELFIE measures a school's digital capacity, a term used to describe "the extent to which culture, policies, infrastructure, as well as digital competence of student and staff support the effective integration of technology in teaching and learning practice" (Costa et al., 2021, p. 2). Thus, the term digital capacity includes the technical and infrastructure dimension, teachers' techno-pedagogical knowledge, access to professional development and organisational and leadership (Castaño Muñoz et al., 2023). Overall, SELFIE is a well-used self-reflection tool across Europe for researching and developing schools' digital capacity, even though it has not yet been used to any great extent in the Swedish context.

According to the European Commission's (2022) DigCompEdu framework, digital competence encompasses a broad set of abilities, including data and information literacy, interaction and collaboration in digital environments, the creation of digital content, online safety issues, and problem-solving capacity. In educational practice, these skills translate into designing learning activities that are digitally supported, enabling effective online collaboration, applying critical judgement to digital sources, and cultivating learning environments that are both secure and inclusive (European Commission, 2019, 2022). Based on this, teachers' digital competence appears to be a priority area within the EU, which encompasses all forms of education and teaching, including supporting students with SEN.

1.2. Digital Tools for Supporting Students with SEN

The digitalisation of education has reshaped the conditions for teaching and learning, offering new opportunities for participation and inclusion. For students with SEN, digital technologies can provide crucial support through accessibility functions, adaptive learning environments, and assistive tools (e.g., Cabero-Almenara et al., 2022; Montenegro-Rueda & Fernández-Batanero, 2022).

In a recent systematic review that explored how digital tools support learning for students with SEN, it was shown that technologies such as reading and writing support apps, interactive games, and communication aids can significantly enhance academic performance and social interaction learning (Duque et al., 2024). The results also indicated that these technologies not only enhanced communication and academic abilities but also fostered greater student motivation and active participation in learning (Duque et al., 2024).

Mukhtarkyzy et al. (2025) examined the impact of various educational technologies on learning outcomes among diverse student populations, with particular attention to

assistive technologies designed to support students with SEN in school settings. The study finds that tools such as augmented reality, tablets, and mobile devices can significantly enhance learning outcomes, especially for students with autism and communication challenges. Likewise, it is shown in a Swedish case study that digital technologies are described by teachers as an expansion of the professional toolbox for creating inclusive learning environments (Holmgren, 2024).

1.3. Teachers' Digital Competence

Teachers' digital competence has emerged as a critical factor in contemporary education, underpinning their ability to design engaging learning environments and adapt pedagogical strategies to meet varied student requirements.

At the policy level, frameworks such as DigCompEdu and the Nordic concept of Professional Digital Competence (PDC) offer structured approaches for developing and evaluating teachers' digital skills (Ghomi & Redecker, 2019; Norhagen et al., 2024). In the Swedish context, guidelines have also been issued by the government through the Swedish National Digitalisation Strategy (2017–2022), emphasising that teachers "... should have the competence to choose and use appropriate digital tools in education" and that all children and students should acquire "adequate digital competence" (Ministry of Education, 2017, p. 6). These directives clearly indicate a political commitment to strengthening teachers' digital competence at both international and national levels.

However, research indicates that teacher education and professional development often fall short in preparing teachers to apply digital tools specifically for supporting students with SEN (Montenegro-Rueda & Fernández-Cerero, 2023). In addition, personal factors such as teachers' motivation and attitudes have been found to influence teachers' readiness to incorporate digital technology into their teaching (Cabero-Almenara et al., 2022; Montenegro-Rueda & Fernández-Cerero, 2023). This, in turn, may influence teachers' readiness to incorporate digital technology in teaching. Kampylis and Sala (2023) investigated the reasons for teachers having a negative view of using digital technology in their teaching by analysing open-ended responses from over 5000 school leaders, teachers, and students across 14 European countries. The results highlighted the need to strengthen schools' digital infrastructure and provide more training for teachers to effectively integrate technology into teaching (Kampylis & Sala, 2023).

Research focusing specifically on teachers' digital competence to support students with SEN remains more limited (Montenegro-Rueda & Fernández-Cerero, 2023). In a systematic review concerning the level of digital competence among special education teachers during the period 2010–2021, it is shown that strong digital skills among teachers are essential for creating accessible and engaging learning environments for students with SEN.

Taken together, current research suggests that strengthening teachers' digital competence is key to enabling effective pedagogical practices, ensuring that digitalisation becomes a meaningful resource for students with SEN

1.4. School Leadership for Developing the Teaching Profession

At the organisational level, school leadership is widely recognised as a decisive factor in driving educational development (Anderson, 2017; He et al., 2024). School leaders influence whether innovations such as digital technologies are understood as strategic priorities, how resources are allocated, and the extent to which teachers are provided with opportunities to develop their professional practice (Hallinger, 2011; Leithwood et al., 2020). Dexter (2011) also emphasises the responsibility of school leaders to not only manage technological infrastructure but also to cultivate the cultural and pedagogical conditions that enable meaningful digital integration in teaching and learning situations.

Research consistently highlights that good school leadership is a key driver of teacher professional development (e.g., He et al., 2024; Ramberg & Modin, 2019; Ramberg et al., 2018). Effective leaders provide vision, clear goals, and supportive structures that enable teachers to continuously improve their practice and, in turn, enhance student learning (Hallinger & Kovačević, 2019). Recent research also emphasises the role of digital leadership in shaping teachers' digital competence. For example, Antonopoulou et al. (2025) found that school leaders who actively promote digital strategies and support experimentation with technology contribute significantly to teachers' confidence and ability to use digital tools effectively. This highlights the importance of leadership not only in general pedagogical development but also in fostering digital readiness among teachers.

A systematic review by Joya et al. (2025) further supports this view, showing that digital competence development is most effective when embedded in school-wide strategies and supported by leadership. Moreover, the use of frameworks such as DigCompEdu is strengthened when school leaders actively engage in digital planning and professional development initiatives (Ghomi & Redecker, 2019).

While the importance of school leadership for teachers' professional development is well established, to our knowledge, no one has examined how school leadership specifically influences teachers' digital competence, in particular in relation to supporting students with SEN. Since school leadership has been shown to influence a range of factors related to teachers' everyday work situations and competencies, it is reasonable to assume that school leaders also have an impact on teachers' digital competence in supporting students with SEN.

To sum up, despite a growing body of literature on both how teachers' digital competence is a cornerstone of professional teaching practice (Cabero-Almenara et al., 2022; Lisborg et al., 2021) and the importance of school leadership for teacher professional development (e.g., He et al., 2024; Ramberg & Modin, 2019; Ramberg et al., 2018), little is known about how these two domains intersect, specifically in the context of supporting students with SEN. In particular, the association between school leadership and teachers' competence to employ digital technology for supporting students with SEN remains underexplored.

This study seeks to contribute to this gap by examining the association between school leadership and teachers' digital competence for supporting students with SEN. The specific research question is addressed: To what extent is school leadership associated with teachers' digital competence for supporting students with SEN?

2. Materials and Methods

The data used in this study were collected using the internationally well-established SELFIE survey as described above (European Commission, 2025).

In this study, we employed the teacher version of the survey in a Swedish context, which was distributed to teachers undertaking further training to become a Special Needs Educator (*specialpedagog*) or Special Education Teacher (*speciallärare*). This group of teachers was chosen because the research questions specifically concern teachers' digital competence in supporting students with SEN, making them particularly suitable participants. The survey was distributed digitally to 598 teachers enrolled in such training during the spring term of 2024 or the autumn term of 2024. A total of 344 teachers completed the questionnaire, corresponding to a response rate of 58%. Teachers who reported working in preschool ($n = 58$) were excluded from the sample for this study, as was one additional teacher who did not specify a workplace. The final sample thus comprised 285 in-service teachers who, at the time of responding to the questionnaire, were undertaking further training to become a Special Needs Educator or Special Education Teacher. These programmes are offered at the advanced level and comprise 90 higher education credits.

Admission to such further education requires a minimum of three years of professional experience following initial teacher training. However, in our sample, the teachers' work experience was substantially higher ($M = 16.6$ years), indicating a solid professional background. Further characteristics of the sample are presented in Table 1 below.

The survey consists of a set of statements rated on a five-point Likert scale and covers areas such as leadership, infrastructure, teaching practices, professional learning, assessment practices, and students' digital competence. In addition to the existing survey items, a supplementary section was added for the purposes of this study, focusing on teachers' ability to use digital technologies when working with students with SEN. All variables used in the study are presented in detail below.

2.1. Dependent Variable

Digital competence in supporting students with SEN is the dependent variable in this study. It was measured using an index comprising 10 items based on the question: "How confident are you in using digital technology when working with children or students in need of special support in the following areas?" The areas included promoting learning and participation, documentation, planning and conducting teaching, assessing needs for digital support, selecting apps to promote learning, designing and adapting digital learning resources, and motivating colleagues to use digital technology. All items were rated on a five-point Likert scale (1 = not confident at all, 2 = not confident, 3 = somewhat confident, 4 = confident, 5 = very confident). A non-response option was also available, and such cases were treated as internal attrition and excluded from the analysis.

2.2. Independent Variable

The independent variable in the analysis is *school leadership*, which consists of three items from the original SELFIE survey reflecting the importance of school leadership in relation to the implementation and use of digital technology in teaching. The items capture whether the school has a digitalisation strategy, whether school leaders involve teachers in the development of this strategy, and whether school leaders support teachers in experimenting with new teaching methods using digital technology. All items were measured on a five-point Likert scale (1 = strongly disagree, 2 = disagree, 3 = somewhat agree, 4 = agree, 5 = strongly agree).

2.3. Control Variables

Several control variables were adjusted for. Two indices were used as control variables, both taken from the original SELFIE survey: *teacher cooperation* and *infrastructure and equipment*. The first index was constructed from three items measuring the extent to which schools promote a culture of collaboration and communication, while the second was based on three items assessing the availability of technological resources for teachers and students. These indices were included as control variables as they may influence the primary association under investigation between *school leadership* and *teachers' digital competence in supporting students with SEN*. The analyses also controlled for *age*, *school provider*, and *gender*.

2.4. Statistical Method

To address the research question, stepwise linear regression analyses were conducted using SPSS 29.0. This analytical approach was chosen in order to examine the unique contribution of school leadership to teachers' digital competence in supporting students with SEN, while gradually introducing other relevant contextual and individual factors as control variables. By presenting the models step by step, it becomes possible to identify whether the relationship between school leadership and teachers' digital

competence in supporting students with SEN is robust when additional variables are taken into account. The analyses were carried out in four stages. Model 1 (M1) assessed the bivariate association between school leadership and teachers' digital competence in supporting students with SEN. In Model 2 (M2), teacher cooperation was added as a control variable, followed by infrastructure and equipment in Model 3 (M3). Finally, Model 4 (M4) included three background variables—age, school provider, and gender—in order to test whether demographic or institutional characteristics explained additional variance.

2.5. Methodological Considerations and Limitations

Stepwise linear regression analyses were employed to examine the relative contribution of school leadership compared to other contextual and demographic factors. This approach was considered appropriate given the limited prior evidence on the hierarchical ordering of predictors in this context. Stepwise procedures allow for a systematic assessment of whether the association between school leadership and teachers' digital competence remains robust when additional variables are introduced. However, we acknowledge that stepwise regression has been criticised for its exploratory nature and potential risk of overestimating effect sizes, as well as for capitalising on chance. Therefore, the findings should be interpreted with caution and primarily as indicative of patterns rather than definitive causal relationships. Prior to conducting the regression analyses, key assumptions of linear regression were examined (Schmidt & Finan, 2018). Multicollinearity was assessed using Variance Inflation Factors (VIF), with all values below 2.0, indicating no problematic collinearity among predictors. Homoscedasticity was evaluated visually through residual plots, which showed satisfactory variance across fitted values. However, the assumption of normality was not fully met. To address this, sensitivity analyses were performed using square root transformations. The results from these analyses were highly similar to those obtained with the original data, suggesting that the findings are robust despite minor deviations from normality.

Cases with missing data on any of the variables included in the regression models were excluded through listwise deletion, resulting in an analytic sample of $n = 234$ in the final regression analyses. The missing data were evenly distributed across the indices used in the study, rather than concentrated in any specific index, suggesting that the attrition is unlikely to reflect systematic differences related to the core concepts under investigation. Because the missingness was not clustered around a particular variable, it is reasonable to assume that the reduced sample size did not bias the estimated associations.

Both the dependent and independent variables were measured using self-reported data, which introduces a potential risk of common method bias. This limitation is inherent in survey-based research where data are collected from a single source (Kock et al., 2021). To mitigate this risk, the study employed distinct item sets for school leadership and digital competence, and both scales demonstrated high internal consistency (Cronbach's $\alpha = 0.72$ and 0.93 , respectively). Nevertheless, the possibility of inflated associations due to common method variance cannot be ruled out.

Although the dependent and independent variables in this study are based on Likert-type scales, which are technically ordinal, they were treated as interval-level data for the purposes of linear regression analysis. This approach is widely accepted in educational and social science research (Harwell & Gatti, 2001), particularly when scales demonstrate high internal consistency. Furthermore, previous methodological research has shown that parametric tests such as linear regression are robust to violations of the assumption of interval-level measurement and can yield valid results when applied to Likert-scale data (Norman, 2010). Therefore, the use of linear regression is considered appropriate and justified in this context.

3. Results

Table 1 presents the descriptive statistics for all variables included in the study. The index measuring teachers' digital competence in supporting students with SEN ranges from 10 to 50, with a mean of 36.64 and high internal consistency (Cronbach's $\alpha = 0.93$). The school leadership index ranges from 3 to 15, with a mean of 9.60 and acceptable internal consistency (Cronbach's $\alpha = 0.72$). Among the control variables, teacher cooperation shows a mean of 8.92 (Cronbach's $\alpha = 0.69$), while infrastructure and equipment have a mean of 13.08 (Cronbach's $\alpha = 0.71$). Notably, the high mean for infrastructure and equipment (close to the upper end of the 3–15 scale) indicates that the teachers in this sample work in schools with very high access to digital infrastructure and equipment.

The average age of respondents is 46.3 years, and the majority (216 out of 285) work in public schools. Regarding gender distribution, approximately 97% of the sample are female, which largely reflects the demographic composition of Swedish special education programmes.

Table 1. Descriptive statistics of the data ($n = 285$).

<i>Dependent variable</i>	M	SD	Range	n	Cronbach's Alpha (α)
Digital competence in supporting students with SEN	36.64	7.17	10–50	265	0.93
<i>Independent variable</i>					
School leadership	9.60	2.87	3–15	265	0.72
<i>Control variables</i>					
Teacher cooperation	8.92	2.66	3.15	267	0.69
Infrastructure and equipment	13.08	1.81	3–15	284	0.71
<i>Age</i>	46.3	7.95	28–61	285	
28–41	$n = 84$				
42–51	$n = 114$				
52–60	$n = 87$				
<i>School provider</i>				285	
Public	$n = 216$				
Independent	$n = 66$				
Other	$n = 3$				
<i>Gender</i>				285	
Female	$n = 276$				
Male	$n = 9$				

In Table 2, the correlations between the variables used are presented. As shown in Table 2, all variables used are significantly correlated with each other.

Table 2. Correlations.

	Digital Competence to Support Students with SEN	School Leadership	Teacher Cooperation	Infrastructure and Equipment
Digital competence in supporting students with SEN	-	0.374 ***	0.345 ***	0.243 ***
School leadership		-	0.636 ***	0.453 ***
Teacher cooperation			-	0.439 ***

*** $p < 0.001$.

Table 3 presents the results of the stepwise linear regression analysis. In the first model (M1), the focus was solely on examining the relationship between the independent

variable, school leadership, and the dependent variable, teachers' digital competence in supporting students with SEN. The results demonstrate a positive association between the two variables, with an estimate of $b = 0.912$, highly significant. This initial model indicates that teachers who perceive good leadership in their schools also report higher levels of digital competence in supporting students with SEN.

Table 3. Stepwise Linear Regression Analyses of Teachers' Digital Competence to Support Students with SEN ($n = 234$).

Digital Competence in Supporting Students with SEN	M1	M2	M3	M4
School leadership	0.912 ***	0.733 ***	0.686 ***	0.659 ***
Teacher cooperation		0.442 *	0.449 *	0.448 *
Infrastructure and equipment			0.140	0.093
Age				−0.987
School provider				2.635
Gender				−0.993
Adjusted R2	13.7	17.8	17.8	21.0

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$.

In Model 2 (M2), the control variable, teacher cooperation, was added. With this addition, the estimate for school leadership decreased slightly ($b = 0.733$), but remained highly significant. Moreover, teacher cooperation itself was also found to have a significant and positive association with teachers' digital competence in supporting students with SEN, although the strength of this association was weaker compared to the effect of school leadership. This suggests that teacher cooperation is positively associated with teachers' digital competence in supporting students with SEN, but that the association between school leadership and teachers' digital competence in supporting students with SEN is stronger.

In the third model (M3), infrastructure and equipment were introduced as an additional control variable. The results show that this variable was not significantly associated with teachers' digital competence in supporting students with SEN. Importantly, the previously observed significant association between school leadership and teachers' digital competence in supporting students with SEN remained stable. This finding implies that the availability of digital infrastructure and equipment, although necessary for classroom practice, was not associated with variations in teachers' digital competence levels in supporting students with SEN. This result may reflect the very high and consistent level of infrastructure and equipment in this sample.

Finally, in the fourth model (M4), three further control variables were included: age, school provider, and gender. None of these variables were significantly associated with teachers' digital competence in supporting students with SEN. However, the positive association ($b = 0.659$) between school leadership and teachers' digital competence remained significant, even after controlling for all additional variables. The results indicate that higher levels of perceived school leadership are associated with an increase of approximately 0.66 units in teachers' reported digital competence in supporting students with SEN. The coefficient of $b = 0.659$ in the fully adjusted model represents a substantial shift within the 10–50 scale measuring digital competence. In practical terms, this means that even moderate improvements in perceived school leadership are associated with noticeable differences in teachers' digital competence in supporting students with SEN. Compared to the other predictors included in the models, school leadership consistently showed the strongest association, suggesting that its association is not only statistically significant but also practically relevant for teachers' everyday work.

Taken together, these findings highlight that school leadership is associated with teachers' capacity to effectively use digital tools and resources in supporting students with SEN. While factors such as teacher collaboration and access to infrastructure may contribute, leadership consistently emerged as the strongest predictor among those examined. This suggests that supportive and effective school leadership, as perceived by teachers, coincides with higher levels of teachers' digital competence in supporting students with SEN and, by extension, their ability to support students with SEN.

4. Discussion

This study examined the association between school leadership and teachers' digital competence in supporting students with SEN. The results demonstrate a consistent and statistically significant association between perceived school leadership and teachers' self-reported digital competence in supporting students with SEN, even when controlling for other relevant factors such as teacher collaboration, infrastructure and equipment, and demographic characteristics. These findings contribute to a growing body of research emphasising the importance of school leadership in educational development, and extend it by highlighting its specific relevance in the context of teachers' digital competence in supporting students with SEN. Some studies report that teachers hold negative attitudes towards digital technology (Cabero-Almenara et al., 2022; Montenegro-Rueda & Fernández-Cerero, 2023), and similarly, that teacher education and professional development often fail to adequately prepare teachers to use digital tools, particularly for supporting students with SEN (Montenegro-Rueda & Fernández-Cerero, 2023). Although teacher education and teachers' personal views are important factors, such findings need to consider the organisational prerequisites in schools that may shape both attitudes and competence. The findings of this study suggest that the development of digital competence is not merely an individual responsibility but is associated with organisational conditions such as school leadership.

Previous research has established that digital tools can enhance learning outcomes for students with SEN, particularly when used to support communication, engagement, and individualised instruction (Duque et al., 2024; Mukhtarkyzy et al., 2025). However, the effectiveness of these tools depends not only on their availability but also on teachers' ability to integrate them meaningfully into pedagogical practice (Cabero-Almenara et al., 2022; Montenegro-Rueda & Fernández-Cerero, 2023). In this regard, the findings of this study contribute by demonstrating that such competence is not developed in isolation but is associated with organisational conditions such as school leadership. These findings are consistent with Joya et al. (2025), who emphasise that digital competence development is most effective when it is embedded in whole-school strategies and supported by leadership. Without such strategic alignment, professional development efforts risk becoming fragmented and less impactful.

The results also align with broader literature on professional development, which emphasises the role of school leadership in fostering collaborative cultures, providing strategic direction, and enabling sustained learning opportunities (Hallinger & Kovačević, 2019; Darling-Hammond et al., 2017). However, it is important to note that in this study, school leadership is operationalised only through the variables included in our index, whereas in other contexts, the concept may encompass broader and more multifaceted dimensions of school leadership.

In this study, teacher collaboration was positively associated with digital competence for supporting students with SEN, but school leadership remained the strongest factor across all models. This suggests that while peer support is valuable, perceived school leadership shows a stronger association with teachers' digital competence in supporting students with SEN. Ghomi and Redecker (2019) similarly argue that frameworks such as

DigCompEdu are most successful when school leaders actively engage in digital planning and support teachers in applying digital tools in pedagogically meaningful ways. Their findings reinforce the idea that school leadership is not only structural but also pedagogical in nature.

Interestingly, the availability of infrastructure and equipment did not show a significant association with teachers' digital competence in supporting students with SEN in this study. This may be due to the relatively high and uniform levels of reported access to digital resources among participants, which limits the explanatory power of this variable. This reflects the Swedish context, where schools have generally reached a high level of digitalisation, particularly regarding infrastructure and equipment. This contrasts with many other European contexts, where significant differences in digital technology use have been observed between school types and across ISCED levels (Munoz et al., 2018). In previous European studies using SELFIE, the need to strengthen schools' digital infrastructure has been emphasised (Kampylis & Sala, 2023). In Sweden, however, the high levels of digital infrastructure and equipment seem to have allowed this study to move beyond these initial concerns and identify other factors, such as school leadership, that tend to co-occur with higher reported ability to integrate digital tools in pedagogically meaningful ways. Thus, access to digital equipment and infrastructure may be a prerequisite, but it does not guarantee its use. The findings of this study indicate that school leadership is important for this to happen.

Nevertheless, schools' digital equipment and infrastructure remain important and may shape teachers' perceptions of the usefulness of digital technology for learning. Furthermore, without the necessary prerequisites for digital education in place, teachers' digital competence may not be fully used or developed.

This invites reflection on what might be most critical for countries still investing in digital infrastructure. While such investments remain necessary, our findings suggest they may not be sufficient on their own; organisational conditions such as school leadership appear to play an important role in ensuring that technology becomes a meaningful resource for teaching. This is particularly relevant for students with SEN, as previous research suggests that digital tools only reach their full potential when teachers have both the competence and the organisational support to use them effectively (Cabero-Almenara et al., 2022; Lisborg et al., 2021).

This study makes a theoretical contribution by extending existing frameworks on teachers' digital competence to the specific context of supporting students with SEN, a learner group for whom teachers' digital competence has been shown to be particularly crucial. In addition, while previous research has predominantly conceptualised digital competence as an individual or pedagogical construct, our findings indicate that it is also closely associated with teachers' perceptions of supportive school leadership.

Based on the findings of this study, a key policy implication is that investments in technological resources should be accompanied by school leadership that develops and involves staff in a clear digital strategy at the school level. Schools need not only access to digital tools but also well-developed plans and structured support systems that enable teachers to integrate these technologies into their teaching. Without such strategic and pedagogical support, technological investments risk remaining underused and failing to contribute to meaningful improvements in teaching and learning.

4.1. Limitations and Future Research

Survey data were collected from $n = 285$ in-service teachers taking part in a professional development programme focused on special education. Most participants have substantial teaching experience ($M = 16.6$ years) and are dedicated to supporting students with SEN. However, since the sample consists mainly of experienced women working in

Sweden's metropolitan areas, it does not represent the wider teacher population. In addition, the pronounced gender imbalance in the sample (97% female) reflects the demographic composition of Swedish special education programmes, but due to this lack of variation, gender did not exert any meaningful effect on the analyses. An additional source of potential selection bias is that the sample consists of teachers currently undertaking further training to become Special Needs Educators or Special Education Teachers, a group likely to have a particularly strong interest in supporting students with SEN. Therefore, the findings should be interpreted cautiously; a more diverse sample might have led to different results.

Although the explained variance in our models is relatively low (Adjusted $R^2 = 0.21$ in the final model), this is common and often acceptable in social science research. Complex human behaviours and organisational phenomena are influenced by numerous factors beyond those included in the model, which typically result in modest R^2 values. Previous methodological literature emphasises that the primary focus should be on the significance and direction of relationships rather than on achieving high explanatory power (Ozili, 2023). Therefore, while the R^2 values indicate that much variance remains unexplained, the consistent and significant associations observed, particularly for school leadership, are theoretically meaningful and relevant for practice.

As the study was based on cross-sectional data, we cannot make any claims about causality with support in the data. For instance, we cannot rule out the risk that teachers rating their digital competence to support students with SEN as high may affect the levels of school leadership. To draw conclusions about the causal link between teachers' digital competence to support students with SEN and school leadership, it is desirable that future studies also collect data over time. It is also desirable that studies be conducted in other educational contexts and countries, particularly in settings characterised by lower levels of digital infrastructure and equipment.

4.2. Conclusions

This study demonstrates that school leadership is associated with teachers' digital competence for supporting students with SEN. Findings suggest that digital competence development is not merely an individual responsibility but is associated with organisational conditions, such as the supportive school leadership examined in this study. In light of this, it becomes important for both policy and practice to recognise the value of school leadership in addition to digital resources accessible in schools. Such leadership is not only central for the overall development of schools' digital capacity, but is also associated with teachers' competence in supporting students with SEN. In the longer term, this association implies that strengthening school leadership may contribute to improving learning opportunities and outcomes for students with SEN, ensuring that digital technologies are used in ways that enhance inclusion and learning.

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Institutional Review Board Statement: Ethical review and approval were waived for this study because the study was conducted in accordance with established ethical principles for research involving human participants. All participants were adults who provided informed consent prior to participation. No personal data were collected, and all responses were recorded anonymously, ensuring that individuals could not be identified. Under the Swedish Ethical Review Act (SFS 2003:460), formal ethical approval is required when research involves the processing of sensitive

personal data, personal identification numbers, physical interventions, or procedures that may cause physical or psychological harm or discomfort to participants. Our study did not meet any of these criteria. Consequently, it was assessed that an application for ethical review was not necessary. Nevertheless, the research adhered to fundamental ethical standards as outlined by the Swedish Research Council and international frameworks such as the Declaration of Helsinki, including principles of voluntariness, informed consent, and respect for participant integrity.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data presented in this study are available on request from the corresponding author.

Conflicts of Interest: The authors declare no conflicts of interest.

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