Leadership Effects on ICT Integration by Primary School Teachers

"We will have tablets, and you all must use them"

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Organizational Dynamics of the Digital Society (Sociology track)

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Preface

This thesis is the culmination of a research process conducted over the past few months, exploring ICT, education, and leadership themes. It has been an incredible journey of conducting research with writing, planning, collecting data, finetuning, and reading, so much reading. All this has allowed me to acquire new knowledge and skills, finally resulting in this thesis as a final product. I am glad to have had the opportunity to undergo the full experience of conducting this research and am quite pleased with this eventual result. Hopefully, the contents of my thesis will prove useful within (a small fraction of) the academic field and spark the same feeling of enthusiasm I experienced along the way.

In traversing this journey, I have had the privilege of receiving assistance from several individuals without whom this thesis would not have been possible. First, I truly appreciate the help of my supervisors, Claartje, Justien, and Francisca, whose wisdom and guidance enabled me to bring this project to fruition. I would also like to thank my fellow students Nick and Mike for their friendly critiques and insightful advice that shaped the process of this thesis. Next to my supervisors and peers, I must really thank all primary school teachers involved in this study, especially those present during the focus groups. Their input has been essential and provided me with all the valuable and surprising insights within this thesis.

Finally, I want to thank my wife Emma. As my ever-present source of guidance and support she was there every step of the way. I am incredibly thankful for her generosity and willingness to offer her expertise when it was most needed.

Abstract

With the rising demand for digital literacy in the current society, schools are increasingly tasked with improving this literacy in their students. Teachers are expected to use ICT in their classrooms to cater to this need. This study examined the relationships of three different leadership styles with ICT integration in the classroom by primary teachers in the Netherlands. Investigating the relationship between three leadership styles (transformational, adaptive, and servant) and ICT integration through motivation and competency, a three-phase explanatory-sequential mixed methods study was conducted. First, surveys (N = 544) were used to test the hypotheses, and second, focus groups (N=9) were conducted to contextualize the survey outcomes. Finally, the results of the focus groups were used to conduct a post hoc analysis of the survey data. Results demonstrated that while motivation and competency had a substantial and significant relationship with ICT integration, no relationship was found between ICT integration and any of the three leadership styles. Nonetheless, the focus groups revealed that teachers did experience that their level of ICT integration was associated with their school leaders' leadership traits, especially through motivation. However, the quantitative exploratory post hoc analysis based on these outcomes did not uncover this same result and showed that future research is required on this topic.

Keywords: *ICT integration, Transformational leadership, Servant leadership, Adaptive leadership, Motivation, Competency, Primary school*

Leadership Effects on ICT Integration by Primary School Teachers

As children are growing up in a digital environment, with digital and mobile devices as means of daily communication, they need to become proficient in using these digital tools (Maureen et al., 2020). A 2018 UNESCO report highlighted this need to develop digital literacy in children from a young age at schools (UNESCO, 2018). By starting young, in primary school, children hit the ground running regarding their digital literacy and skills and will be better prepared for their digital futures. Furthermore, the future jobs of these children will demand digital skills as jobs are getting increasingly intertwined with algorithms, AI, robotics, and other forms of digital technologies (Parent-Rocheleau & Parker, 2022; Wang & Siau, 2019).

When it comes to the development of digital literacy in children at schools, their teachers' use and integration of information and communication technology (ICT) in the classroom appears to be a substantial factor (Bingimlas, 2009; Kler, 2014; Sutherland et al., 2004; UNESCO, 2018). Teachers can integrate ICT into their lessons in multiple ways. They can, for instance, use online tools as sources of information, collaborative tools like Google Docs, or content-specific tools to support teaching different subjects. A high level of ICT integration has been shown to have multiple benefits, from increasing teaching efficiency by using interactive online methods that adapt to student's skill levels, to specifically learning students how to use digital tools in a safe environment (Bingimlas, 2009; Kler, 2014).

However, despite these benefits, concerns surrounding ICT use in the classroom also emerge. Discussions surrounding ICT in the classroom, such as the use of mobile phones, have been ongoing for some time (Bouwman & Loomans, 2023). Similarly, the impact of ICT use on the social aspects of teaching and learning has caused doubts in some schools (Karstens et al., 2022), and privacy concerns for both students and teachers remain an area of concern (de Jager, 2020). Adding to this challenge, a recent study by EenVandaag shows that teachers and parents lack trust when it comes to teaching children about AI (Cornelisse, 2023).

To reap the benefits and overcome the challenges of ICT in the classroom, both the EU and the Dutch government created policies and plans on how to use ICT to increase the digital literacy of children in primary schools (European Commission, 2018; SLO, 2022). In the Netherlands, this resulted in two prominent publications from the government concerning digital literacy in primary schools. The first one is the creation of content lines on how to develop digital literacy in schools, consisting of four parts that should be covered in primary schools: digital information skills, computational thinking, media literacy, and practical ICT skills (SLO, 2022). The second publication, created by the governmental subsidiary Kennisnet, is a more practical guide on implementing ICT in a school, ranging from creating a schoolwide vision on ICT to the day-to-day use inside of the classroom (Pijpers, 2017). Yet, although these plans, policies, and regulations for integrating ICT into the teaching curriculum exist, only a little over one-third of European teachers implement ICT in their classrooms (OECD,

2019). This is a cause for concern as a lack of integration seems detrimental to the student's digital literacy, as evidenced by Sutherland et al. (2004) and UNESCO (2018).

To understand why not all teachers integrate ICT, it is meaningful to consider the role of school leadership as they are responsible for the creation of a school vision and are able to provide the guidance teachers require to feel empowered to use ICT (Eickelmann, 2011; Leonard & Leonard, 2006). Furthermore, these school leaders act as the bridge between government policies and teachers. They do this by creating school policies, providing support, and planning strategies for successful implementation (Vanderlinde & van Braak, 2010). Several other studies have shown the important role of leadership in the effective implementation of ICT by teachers (e.g. Tondeur et al., 2008; Vermeulen et al., 2017; Yu et al., 2002). They show that teachers who effectively implement ICT experience support from their principals, have a working ICT infrastructure, and experience a good learning climate to develop their skills.

As ICT is important in developing digital literacy in children, and leadership plays a vital role in this, it is essential to study what this leadership should look like. However, studying leadership styles is a difficult task, as a host of leadership style conceptualizations exists in research (Dinh et al., 2014). The present study sets out to shed more light on how different leadership styles are associated with ICT integration in the classroom. In particular, it is focused on three leadership styles that are predominantly present in the literature (Dinh et al., 2014; Northouse, 2021). First, transformational leadership has been the most researched in the last decades, both in and outside of the educational sector (Berkovich, 2016; Dinh et al., 2014). This type of leadership is focused on the connection between leaders and employees to get to optimal organizational performance (Burns, 1978). Within education, it has been linked to multiple positive effects on, amongst others, the well-being of teachers, student performance, level of ICT integration, and overall school climate (Berkovich, 2016; Chou et al., 2019; Håkansson Lindqvist & Pettersson, 2019; Tondeur et al., 2008; Yu et al., 2002).

Even though it is often used in research, transformational leadership also receives some criticism, with the main objection being that the concept of transformational leadership is too broad and unclear (van Knippenberg & Sitkin, 2013). Therefore, as transformational leadership is getting increasingly criticized, this study ventures beyond and will also investigate how two other leadership styles are associated with ICT integration in the classroom.

The second leadership style included is adaptive leadership. Adaptive leadership is a leadership style where leaders help employees to adjust or change to overcome new situations and challenges (Northouse, 2021). It is, just like transformational leadership, focused on organizational change. The inclusion of adaptive leadership in this study stems from its relation with change, as Dutch schools and teachers must change in the wake of digitalization and keep up with changing conditions to successfully teach digital literacy (Karstens et al., 2022). Adaptive leaders are focused on predicting and recognizing potential changes and letting these changes happen fast, efficiently, and harmoniously (Khan, 2017; Northouse, 2021).

The final leadership style included is servant leadership, as commonly found in educational settings (Parris & Peachey, 2013). Servant leadership is a leadership style where leaders are attentive to their employees, empower them, and help them to develop (Northouse, 2021). Due to the important factors of support and personal development for teachers to integrate ICT successfully, servant leaders are shown to have a positive effect on ICT integration and the well-being of teachers during the adoption of ICT (Eickelmann, 2011; Larjovuori et al., 2016). These findings show the possible benefits of servant leadership on ICT integration.

This study will review the three aforementioned leadership styles and test their relationships with ICT integration by teachers in the classroom. Teachers' digital competencies and motivations will be included as explanatory mechanisms during this. Prior to this study, they already have been used to partly explain leadership's effects on the level of ICT integration by teachers (Eickelmann, 2011). Furthermore, studies showed that competency is vital in using ICT, as teachers should know how to use digital means before they are able to integrate them into their lessons (Amhag et al., 2019; Chen et al., 2022; Falloon, 2020; Geijsel et al., 2009; Wei et al., 2016). When it comes to motivation, motivated teachers are more likely to use and integrate ICT into their classroom, as they feel driven to work with new tools (Marangunić & Granić, 2015, 2015; Scherer et al., 2019; Sharma & Srivastava, 2019; Teeroovengadum et al., 2017). By including both motivation and competency as explanatory mechanisms, this study aims to gain a nuanced understanding of how different leadership styles are related to ICT integration. Taking all this into account, the following research question emerges:

> *To what extent are transformational, adaptive, and servant leadership of school leaders related to teachers' integration of ICT into the classrooms of primary schools in the Netherlands, and how can this be explained by teacher motivation and competencies?*

This study aims to answer this by explaining and testing the role of different leadership styles experienced by teachers and the effects of their competencies and motivations in using ICT. By comparing multiple relevant leadership styles in education and using teacher motivation and competency as explanatory mechanisms, this study speaks to previous work on leadership styles in schools and adds insights into the influence of these styles on ICT integration by teachers (Amhag et al., 2019; Han & Yin, 2016; Wei et al., 2016). This study uses an explanatory sequential mixed methods approach, with the quantitative phase deployed to test hypotheses, the qualitative phase to explain results and provide additional context, and a post hoc phase to explore the outcomes further.

In the process of answering the research question, this study contributes to the literature on educational leadership in multiple ways. First, by testing the relationships of three leadership styles on successful ICT integration in primary schools, which has not been done in prior studies. It adds to the discussion by presenting recent empirical data on leadership in primary schools, an area of study that has not been widely explored. Furthermore, by creating a model using both motivation and competency as mediating variables, this study includes two vital prerequisites for teachers to use ICT. It therefore

provides a novel way of researching leadership effects on ICT integration in schools. Finally, it adds to the literature by challenging the leading leadership theory, transformational leadership, by including two other promising leadership theories regarding ICT integration in schools.

Theory

As society is digitizing, an increasing demand is placed on the digital literacy of all citizens, including children (Maureen et al., 2020). Multiple studies further highlight this by showing how work is getting intertwined with digital technologies more and more (Parent-Rocheleau & Parker, 2022; Wang & Siau, 2019). To prepare children for this digitized future, it is important for them to develop their digital literacy from a young age (UNESCO, 2018). To help schools teach children to become digitally literate, policies, guidelines, and implementation strategies are created by governmental institutions (Pijpers, 2017; SLO, 2022). This way, teachers are given tools to have a direct influence on the digital literacy of their pupils. A study by Kler (2014) shows this influence of teachers and highlights the importance of ICT integration by teachers in the development of digital literacy in students. As both the direct influence of teachers and the policies created by governmental institutions influence the digital literacy of students, it places school leaders in the unique position of being the bridge between policies and teachers.

School leaders play a vital role within schools and influence different parts of the educational process. Multiple prior papers describe the range of roles these school leaders must fulfill. Leithwood et al. (2020) show this and highlight roles like setting directions for the school, building relationships between colleagues, developing employees and the organization, and improving the instructional program. When doing this successfully, school leaders appear to have a significant effect on teacher efficacy and the learning quality of students (Leithwood et al., 2020). In a study by deVos and Bouckenooghe (2009), school leaders were asked to provide insight into their perceptions of the different roles of school leadership. Here they found that school leaders themselves feel they should provide structure and support, create a vision, should enhance collegial relations and collaboration, and promote innovativeness.

Within these roles, and in current times, school leaders are also increasingly tasked with enhancing the digitalization process within schools (Tondeur et al., 2008; Vermeulen et al., 2017). School leaders have a broad influence in schools, are affecting the learning quality of students, and are required to implement ICT in schools further. This makes them essential in the teachers' ability to integrate ICT into their classrooms. The successful integration of ICT into the classroom is, therefore, heavily influenced by the leadership style of school leaders (Vanderlinde & van Braak, 2010; Vermeulen et al., 2017; Yu et al., 2002).

Based on these findings, a relationship between leadership and ICT integration is expected within the confines of this study. Within this study, the ICT integration is conceptualized utilizing the conceptualization by Tondeur et al. (2007). They note that successful ICT integration in the classroom

entails using ICT tools and systems with the goal of increasing the quality of lessons. And when teachers successfully integrate ICT into their classrooms, multiple benefits emerge. Research by Kler (2014) suggests that ICT can motivate students, increase the effectiveness of assessments and lessons, and open up new ways of teaching. Bingimlas (2009) has also found that ICT use in the classroom can promote digital literacy in students.

From leadership to ICT integration: the role of motivation and competency

With the evidence suggesting a relationship between school leadership and ICT integration, the question remains of how school leaders influence ICT integration in the classroom. The first concept of interest in this case, *teacher motivation*, is provided by Granić and Marangunić (2019). In their study, they used the Technology Acceptance Model (TAM) to research ICT integration in educational settings. They found that motivation within the TAM is highly related to the eventual use and integration of ICT in educational settings. This current study will also employ the conceptualization of motivation included in the TAM as proposed by Davis (1986) and further researched by Sharma and Srivastava (2019). They both state that motivation is the drive that individuals have to take action and complete specific tasks. If someone is motivated, they will reach favourable results compared to those who lack motivation. In the educational sector, motivation by teachers is imperative to improve teaching effectiveness (Sharma & Srivastava, 2019). Furthermore, motivation is shown to be vital for employees to successfully adopt technology in their jobs (Granić & Marangunić, 2019).

In the educational sector, school leaders can influence the motivation of teachers in different ways. Eyal and Roth (2011) show that teachers get motivated when school leaders frame a clear vision, set attainable goals, and obtain support from colleagues. Furthermore, teachers get motivated by the school culture, level of autonomy, and extrinsic values like pay and job security (Han & Yin, 2016). Taking the outcomes of prior research into consideration, motivation could partly explain the relationship between leadership and ICT integration, as relationships between both leadership and motivation, and motivation and ICT integration seem to exist.

Besides motivation, this study includes a second explanatory concept that is potentially important for teachers' integration of ICT in their classrooms. To benefit from the possibilities offered by ICT, the *digital competency* of teachers is key (Amhag et al., 2019; Wei et al., 2016). Wei et al. (2016) state that to accept and use new systems, teachers first should possess the skills and knowledge to use these systems. In researching teachers' digital competencies, the TPACK (Technological Pedagogical Content Knowledge) framework is the most widely used and validated model for measuring teachers' digital competencies and explaining the relationship between digital competencies and the use of ICT in the classroom (Falloon, 2020; Koehler & Mishra, 2009; Schmidt et al., 2009). Using this model, Schmidt et al. (2009) offer a conceptualization surrounding digital teacher competency. They state that competent teachers are able to integrate technology into their teaching,

regardless of the topic or type of technology. This conceptualization is also used within the current study.

The influence of school leaders on teachers' digital competencies has been addressed by multiple studies (Chen et al., 2022; Geijsel et al., 2009). Chen et al. (2022) identified two mechanisms through which this influence is exerted: via an explicit link between leadership and teachers' digital literacy, as well as the organizational climate and vision established by school leaders. Similar results were found in a study in the Netherlands by Geijsel et al. (2009), who also noted the influence of school leaders on the professional learning of teachers as they provide teachers with the possibility to enroll in courses.

Thus, school leaders potentially have an important role in classroom ICT integration by spurring teachers' motivation and facilitating their digital competencies. Yet, not all leadership is created equal. As established in a paper by Dinh et al. (2014), more than 60 theories on leadership exist. This, combined with a school leader's broad range of duties, results in a wide range of researched leadership styles in the educational sector (Arham et al., 2022). The following section elaborates on the three leadership styles included in this study and hypothesizes how they relate to teachers' motivation, competence, and classroom ICT integration. As the meta-analysis on different leadership styles by Arham et al. (2022) shows transformational leadership to be most commonly researched in the educational setting, it will provide a suitable starting point.

Transformational leadership

Since the end of the 1970s, transformational leadership has become increasingly popular due to its ability to motivate and stimulate intellectual thinking through inspiration (Schneider & George, 2011). This implies that the primary objective of transformational leadership is to increase motivation, morale, and overall organizational performance (Burns, 1978). It is therefore conceptualized as the ability of leaders to motivate and encourage intellectual stimulation through inspiration (Schneider & George, 2011). Variants of the concept have been studied in multiple contexts, which have revealed its positive impacts on employers, employees, customers, and other stakeholders (Northouse, 2021). This is particularly evident in the educational setting, where transformational leadership has been employed to examine the influence of school leaders on teachers, students, and learning efficacy. For example, Berkovich and Eyal (2017) posit that transformational leadership can have a significant impact on the emotional well-being of educators. Transformational leadership was also found to have a positive effect on teacher performance throughout the COVID-19 pandemic (Savitri & Sudarsyah, 2021). Despite its advantages, there is a notable amount of criticism against transformational leadership, arguing that its definition and measurement are not readily distinguishable from other related concepts (Bryman et al., 1992; van Knippenberg & Sitkin, 2013).

Previous research has explored the impact of transformational leadership on ICT integration in and out of educational organizations. By encouraging employees to increase their professional

development and create a vision that emphasizes the value of ICT, transformational leaders can promote higher levels of ICT integration (Kumar & Sharma, 2018). Thoonen et al. (2011) reported similar outcomes within school settings, drawing attention to the impact of school leaders' inspirational strategies and their influence on ICT integration among teachers. Accordingly, this study posits the following first hypothesis concerning transformational leadership:

> H1a: *there is a positive relationship between the level of perceived transformational leadership and the level of ICT integration in the classroom by the teacher.*

Transformational leadership, motivation, and competency

In their study, Thoonen et al. (2011) argued that the connection between transformational leadership and ICT integration in classrooms can be partially explained by the motivation of teachers. They, for example, argue that transformational leaders are able to motivate teachers to integrate ICT in classrooms by improving their well-being. This is consistent with the conclusions of Berkovich and Eyal (2017) that transformational leadership can be used to improve the well-being of employees. Furthermore, Aziz et al. (2020) further explored the connection between transformational leadership and employee motivation in schools. They suggested that teachers' motivation to use technology in the classroom can be increased by transformational leaders due to their effect on employees' perceived ease of use and usefulness of technology they use in their classroom. When these findings are merged with the argument that motivated teachers are more likely to integrate ICT into their classrooms (Eyal & Roth, 2011; Granić & Marangunić, 2019), it results in the second hypothesis:

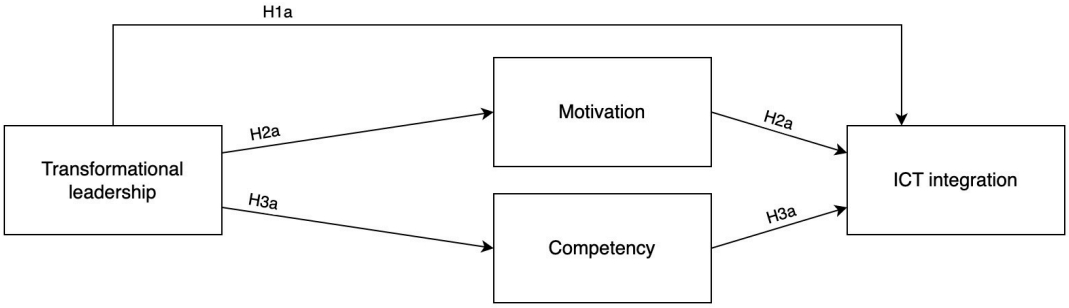
> H2a: *the positive relationship between transformational leadership and teachers' ICT integration in the classroom can partially be explained through teachers' motivation.*

The integration of ICT in the classroom is significantly impacted by both the motivation of teachers as well as their digital competencies. Various studies have explored the interaction between transformational leadership and the digital proficiency of teachers. Geijsel et al. (2009) found that transformational leaders inherently aid teachers in partaking in various learning activities. These leaders do so by instilling confidence in their teachers and by providing support in developing skills (Vanderlinde & van Braak, 2010). These findings, combined with the proposition that competent teachers are more likely to integrate ICT into their classrooms (Amhag et al., 2019; Wei et al., 2016), lead to the final hypothesis about transformational leadership included in this study:

> H3a: *the positive relationship between transformational leadership and actual ICT use in the classroom can be partially explained through teachers' digital competencies.*

Figure 1

Starting point of the conceptual model, showing only transformational leadership as independent variable.



Adaptive leadership

In recent years, organizations have had to adapt to new digital working methods. Huang et al. (2023) highlighted that in recent years, organizations have had to adapt to new digital working methods and that transformational leadership is often not the most suitable leadership style to deal with change. Heifetz et al. (2004) conceptualized adaptive leadership as an approach that encourages stakeholders to collaboratively create a successful and comfortable transformation. Despite adaptive leadership receiving less consideration in education in comparison to transformational leadership, Daly and Chrispeels (2008) showed that this style of leadership is found to be related to improved student achievement. They note that adaptive leaders cater to the achievement of students by being able to adapt policies and visions to new and challenging situations, while maintaining support from teachers.

In recent years one clear changing and challenging condition in education worldwide emerged. Studies have revealed that the use of ICT during the COVID-19 pandemic has necessitated an increased need for adaptive leadership from school administrators (Haron et al., 2022). Furthermore, research outside of the educational domain has indicated that adaptive leadership can have a positive effect on employee ICT adoption in a workplace setting (Yukl & Mahsud, 2010). Specifically, adaptive leaders face the ability to successfully motivate employees to take on challenging tasks in a timely manner (Nelson & Squires, 2017). As a result, this leads to the first hypothesis which suggests a positive relationship between the level of adaptive leadership and the integration of ICT in classrooms:

> H1b: *there is a positive relationship between the level of perceived adaptive leadership and the level of ICT integration in the classroom by the teacher.*

Adaptive leadership, motivation, and competency

This relationship between adaptive leadership and teachers' integration of ICT in the classroom may be partially explained by teacher motivation, as demonstrated by Khan (2017) in their paper which discusses how adaptive leaders motivate employees by providing challenges and involving them in the decision-making process. This is further supported by Yukl and Mahsud (2010), who suggest that

adaptive leaders can motivate employees by supporting them in adapting to new situations. As motivation has been identified as a factor connected to ICT integration by teachers (Eyal & Roth, 2011; Granić & Marangunić, 2019), the following hypothesis poses that adaptive leadership could be a mediating factor in the relationship between ICT integration by teachers and motivation:

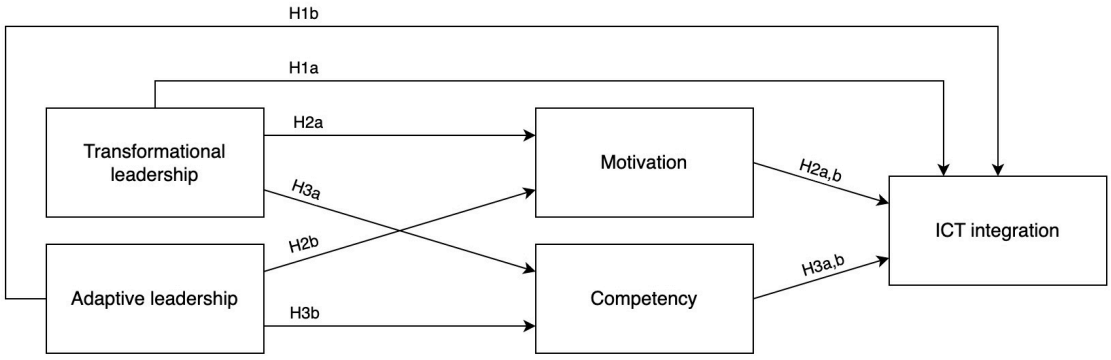
> H2b: *the positive relationship between adaptive leadership and teachers' ICT integration in the classroom can partially be explained through teachers' motivation.*

Adaptive leadership has also been shown to have a positive effect on the competencies of employees by enabling skill training for employees so they can more easily address challenges and change (Heifetz et al., 2004). Randall and Coakley (2007) provide evidence that adaptive leaders are able to create a secure environment in which employees gain ownership of their skills and job positions, allowing them to become competent within a new situation. As such, it can provide an explanation for the relationship between adaptive leadership and competency by teachers. This leads to the third and final hypothesis concerning adaptive leadership. With this third hypothesis, adaptive leadership can be added to the conceptual model (Figure 2).

> H3b: *the positive relationship between adaptive leadership and teachers' ICT integration in the classroom can partially be explained through teachers' digital competencies.*

Figure 2

The addition of adaptive leadership to the conceptual model



Servant leadership

This study's third and final leadership style is servant leadership, which Laub (1999) conceptualizes as leaders who prioritize their employees over themselves and share their leadership power. Servant leaders focus on their employees' personal development, and they involve these employees both in the decision-making and in the formation of the organization's key objectives (Greenleaf, 1970; Laub, 1999; Northouse, 2021).

Comparative studies show an intriguing dialogue between servant leadership and other leadership styles. For example, Choudhary et al. (2013) demonstrate that transformational leadership notably increases worker performance in for-profit organizations more than servant leadership does. In contrast, Schneider and George's (2011) research on voluntary work indicates that servant leadership has the most substantial impact on the dedication of volunteers. Teachers work under neither of these conditions, but servant leaders appear to have a positive effect on them, as research shows a decrease in dissatisfaction and teacher turnover when servant leadership is practiced (Crippen, 2004; Terosky & Reitano, 2016).

Despite the positive effects of servant leadership on education, research on how servant leadership affects ICT integration in organizations is limited. However, studies show that servant leadership impacts the level of innovative work behavior and job satisfaction of employees in high-tech firms (Cai et al., 2018). In the study by Cai et al. (2018), innovative work behavior includes the use and adoption of new and novel ways of working, such as ICT systems at work. In education, this connection is made in a study by van de Bunt-Kokhuis and Sultan (2012) that reveals a significant effect of servant leadership on the use of online digital tools by teachers. These findings bring forth the first hypothesis concerning servant leadership:

> H1c: *there is a positive relationship between the level of perceived servant leadership and the level of ICT integration in the classroom by the teacher.*

Servant leadership, motivation, and competency

From the literature a clear link between servant leadership and teacher motivation emerges. Cerit (2009), Crippen (2004), Parris and Peachey (2013), and Terosky and Reitano (2016) have suggested that servant leadership has an effect on employee motivation by contributing to a positive work climate and improved well-being. This is further supported by Wahyuni et al. (2014) within the educational sector, they found a significant effect of servant leadership on the motivation of high school teachers. On the basis of these studies, and taking the effects of motivation on ICT integration into consideration (Granić & Marangunić, 2019; Sharma & Srivastava, 2019), the second hypothesis on servant leadership can be postulated.

> H2c: *the positive relationship between servant leadership and teachers' ICT integration in the classroom can partially be explained through teachers' motivation*

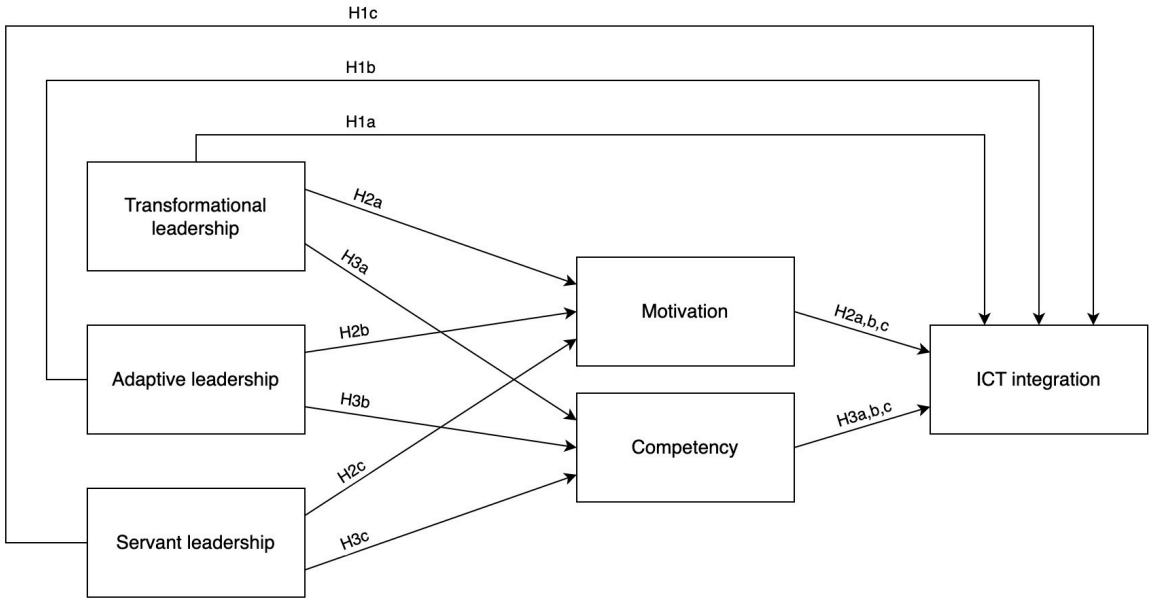
One of the most apparent characteristics of servant leaders is that they invest time in the personal development of their employees (Greenleaf, 1970). Servant leadership has therefore been associated with increased employee competency, as evidenced in a study by Chiniara and Bentein (2016). They note that the focus on employee growth in servant leadership approaches often encourages leaders to

take additional measures to ensure their employees have the opportunity to grow their skills and learn new subjects. Cerit's (2009) study on the effects of servant leadership on primary school teachers provides further evidence of this, asserting that servant leaders provided teachers with the chance to learn and develop themselves. All of these outcomes led to Hypothesis 3c, the final hypothesis included in this study (Figure 3).

> H3c: *the positive relationship between servant leadership and teachers' ICT integration in the classroom can partially be explained through teachers' digital competency*

Figure 3

Complete conceptual model including Transformational, Adaptive, and Servant leadership



Methods

This study uses an explanatory sequential mixed methods approach to explore the role of leadership in integrating ICT into primary school classrooms in the Netherlands. This approach is based on the belief that by combining quantitative data from a survey and qualitative insights from online focus groups, a more comprehensive understanding of this topic can be gained (Creswell & Creswell, 2017). The sequential explanatory mixed methods approach follows a set structure, starting with surveys in the quantitative phase. This is followed by a qualitative part, which is used to provide further context, help explain outcomes, or explore new directions. According to Creswell and Creswell (2017), this approach is valuable for studying topics involving multiple variables, such as the current study, as it enables the researcher to gain insight beyond what either method can provide alone.

Therefore, this study uses multiple phases; phase one is a survey among 544 primary school teachers, and phase two consists of two focus groups with nine participants in total. Herein the survey data is used to test the hypotheses, while the focus groups provide meaningful insights into the

implications and interpretations regarding the detected relationships (or lack thereof). This study also adds a third phase where the outcomes of phases one and two are combined in a post hoc analysis to explore the outcomes further and provide directions for future research.

Case and sample

For this research, primary school teachers in the Netherlands were the target population. A snowball sampling strategy was used where through contact with the public mail addresses of 6070 primary schools in the Netherlands, the recipients were asked to forward the request to the teachers at that school. This sampling method resulted in 544 responses from teachers who filled in the online survey that consists of the variables of interest in this study. Of these respondents, 64 were willing to participate in the focus groups of phase two. Finally, after scheduling, this resulted in two focus groups consisting of 9 participants in total. Only teachers from different schools were included in the focus groups to guarantee participants to talk freely on the potentially sensitive topic of school leadership. The focus groups were conducted online and lasted approximately one hour each. During the sessions, a video recording was made with the permission of the participants to help with transcribing and coding.

Research proceedings

As described before, this research consists of three phases. For the first phase, the aim was to conduct a survey among a minimum of 393 Dutch primary school teachers to reach a power level of 0.80, so the sample is a valid representation of the total population of 154000 primary school teachers (Traag, 2018). During a period of six weeks, teachers were able to fill in the online survey, which in total resulted in 574 responses, of which 30 did not pass the attention checks. The remaining 544 responses were complete and could be used for analysis. Therefore, the aimed sample size was more than adequately reached.

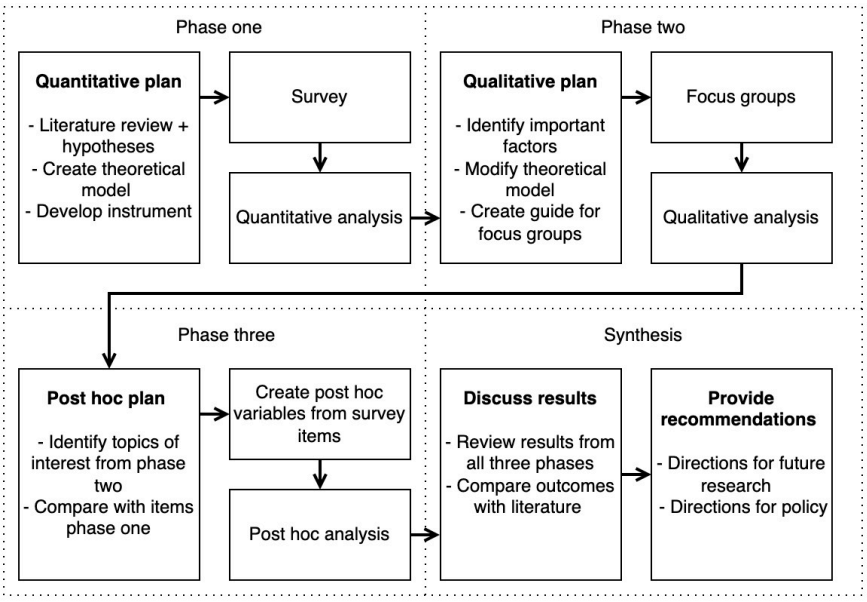
After the data collection of phase one, the quantitative survey data was analyzed and used to create a setup for phase two of this research. In this second phase, focus groups were used to gain a better insight into the survey results and the reasoning behind the ICT integration in the classroom. The aim for this second phase was to conduct three focus groups with eight participants each. This seemed achievable based on the relatively high number of survey respondents. However, of the 64 respondents who indicated they were open to participating, only thirteen responded and filled in the online planning tool. Therefore, the decision was made to continue with two focus groups of respectively six and seven participants. Last-minute cancellations resulted in the two focus groups consisting of three and six participants.

After the collection and analyses of the outcomes from phase two, the results provided topics of interest to research during phase three. Within this post hoc quantitative analysis, the items of phase one were used to create new variables based on the topics of interest from phase two. This was done by reading each of the items and assigning them to one of these topics. Finally, all three phases were

combined to reach an overall conclusion and provision of recommendations. The entire research proceedings can also be found in the design model of Figure 4.

Figure 4

The design model of this study



Data collection

For phase one of this research a survey was used to measure the six concepts within the conceptual model: three perceived leadership styles (transformational, servant, and adaptive leadership), two mediating variables (motivation and competency), and ICT integration in the classroom, with the first five concepts consisting of items measured on five-point Likert scales ranging from fully disagree (1) to fully agree (5). *Transformational* leadership has been measured using the validated scale of Alimo-Metcalfe and Alban-Metcalfe (2001), which consists of nine items. For *servant leadership*, the SL-7 scale is used (Liden et al., 2015). *Adaptive leadership* is tested using the validated five-item scale of Daly and Chrispeels (2008). *Motivation* is tested using the scale as developed and used by Sharma and Srivastava (2019). Their scale consists of six items that measure the two core indicators of motivation: perceived ease of use and perceived usefulness. *Competency* is measured using the core of the TPACK model, which consists of four items that measure teachers' combined technical, pedagogical, and content-wise competencies (Schmidt et al., 2009). Lastly, *ICT integration* into the classroom is measured using three indicators, ICT usage for information, to support the learning process, and the training of ICT literacy in students (Tondeur et al., 2007). These indicators consist of four items each and are measured on a five-point Likert scale, ranging from never (1) to daily (5). Combined with general demographical questions, this resulted in the final questionnaire, consisting of 51 questions (Appendix A).

For phase two, two online focus groups with primary school teachers were organized to explain possible unusual survey outcomes and delve deeper into the findings of phase one. Using a predetermined topic guide based on the theory and outcomes of phase one, participants were urged to participate in discussions with the other participants (Appendix B). This way, they could share experiences, build on comments from peers, and discuss issues concerning ICT integration in their classrooms (Babbie, 2021). During the online focus groups, a video recording was made, allowing for transcription and coding afterward.

After the coding and analysis of the qualitative data from the focus groups, the results were used in phase three. Using these outcomes, three topics of interest surrounding leadership were selected and connected with the items used in the survey. In this manual process of assigning items, each selection was made based on how the contents of one item matched with one of the topics. This resulted in three "new" post hoc variables: *Open communication, Clear vision,* and *Support from leadership* (Appendix E). These variables were then used in the final quantitative analysis.

Data analysis

The analysis of this research follows the trajectory from figure 4. This means it consists of three stages. First, the quantitative results from the survey were analyzed using SPSS. This part of the data analysis begins with cleaning up the data by checking for incomplete results, respondents who failed attention checks, and for outliers whose values diverted at least three standard deviations from the mean. This was followed by a confirmatory factor analysis to check if the dimensions from the used scales were represented in the survey data of this study. The reliability of these dimensions is measured using Cronbach's alpha. To prevent skewed results due to multicollinearity, the next step was to check for this using the Variance Inflation Factor (VIF). After these checks, the descriptive analyses are run, resulting in means and correlation statistics of all six variables in this research and the demographical data. These are followed by inferential analysis, which consists of multivariate linear regressions to test each of the ten hypotheses. As this research has two mediating variables, a Sobel-test is used to check if these mediations are also significant.

After the quantitative analysis, focus groups were conducted. The results from this qualitative part have been transcribed and coded using Atlas.ti in an inductive manner. Starting with 45 open codes, which are divided into 12 axial codes, this resulted in four overarching themes. These themes were then linked to the quantitative results and used during the third phase of this study. In this phase, the post hoc analysis was conducted similarly to the quantitative analysis of phase one. First the reliability of each dimension was measured, which was followed by a VIF check. Next a correlation analysis of the ad hoc variables, mediating variables, and dependent variables was conducted. Finally, multiple regression analyses were used to investigate how the post hoc variables relate to the mediating and dependent variables.

Validity and reliability

The reliability and validity of this research were ensured through several methods. To ensure internal validity, the scales used during the survey of the first phase were based on validated scales from the literature while also being translated into Dutch and checked by multiple other researchers. Additionally, triangulation was used to further improve this validity, as survey data were cross-checked with the outcomes of the focus groups of phase two. The inclusion of focus groups also ensures a high face validity (Babbie, 2021). However, as this survey is conducted online, and one of the main attributes researched is ICT competency, a nonresponse bias emerges where teachers who are digitally less competent are less likely to respond. Furthermore, the topic of leadership within the survey could evoke respondents to give courteous answers and be less critical of their school leaders. Next to this, self-reported competency and motivations could also skew results and lead to a social desirability bias.

To ensure a reliability of 95%, a sample size of 393 respondents was calculated with a statistical power of 0.8 (Bulus, 2023). In total, 544 usable responses were obtained, providing sufficient reliability for the first phase of this research. On the other hand, the reliability of the second phase of this research could be considered low as the answers given during the focus groups may be socially desirable.

Results

First, the quantitative results will be presented, beginning with the descriptive statistics. Next inferential statistics, correlation and regression, are used in order to test the hypotheses of this study. The second part of this chapter presents the qualitative results that emerged from the two focus groups. Finally, the qualitative explorative results from the post hoc analyses are given.

Quantitative results (phase one)

Prior to testing the hypotheses, a factor analysis was conducted, from which the six variables emerged in line with the variables from the literature. After this, Cronbach's alpha was used to check the reliability of each of the variables (Table 1). Finally, in the preparation phase, the independent variables were checked for multicollinearity, resulting in medium levels of multicollinearity for transformational leadership (VIF = 1,557), servant leadership (VIF = 2,342), and adaptive leadership (VIF = 2,232). As these scores are well below 5, this is no reason for concern (O’brien, 2007).

Descriptive statistics

Table 1 shows the range, means, standard deviations, and Cronbach's alpha of the variables included in this research. Added to this are the two control variables age and experience. From this it follows that the average age of the respondents is 43 years, with the youngest teachers being 20 and the eldest 72. Furthermore, the average length of teaching experience of teachers in this survey is 14,71 years, with one year being the least and 41 years the most.

Table 1

Descriptive statistics

	n	Range	Mean	SD	Cronbach's α
ICT integration	540	6,00	4,773	1,363	0,920
Transformational leadership	541	4,00	4,096	0,699	0,818
Servant leadership	542	3,86	3,734	0,640	0,851
Adaptive leadership	542	4,00	3,915	0,671	0,829
Motivation	544	2,75	4,005	0,554	0,614
Competency	539	3,60	3,875	0,687	0,876
Age	531	52	43,026	12,258	
Experience	529	40	14,710	9,486	

Correlation analysis

Table 2 presents the correlations between all variables included in phase one of this study. It shows significant correlations between almost all variables. The exception to this are transformational leadership and motivation (p = 0,073, r = 0,077) and transformational leadership and competency (p = 0,804, r = 0,011). Other variables correlate highly, with the most prominent correlation between servant and adaptive leadership (r = 0,732). This is followed by the correlation between both servant and transformational leadership (r = 0,564) and the correlation between transformational and adaptive leadership (r = 0,543). However, the high level of correlation between these variables is to be expected as they all measure leadership concepts. Furthermore, the correlation analysis shows a significant correlation between ICT integration and all leadership styles, with servant leadership displaying the strongest correlation (r = 0,137). Finally, the correlation between ICT integration and the mediating variables motivation (r = 0,285) and competency (r = 0,296) is also significant.

Table 2

Correlation matrix

		1	2	3	4	5	6	7	8
1	ICT integration	-							
2	Transformational	0,108**	-						
3	Adaptive	0,128**	0,543**	-					
4	Servant	0,137**	0,564**	0,732**	-				
5	Motivation	0,285**	0,077	0,226**	0,192**	-			
6	Competency	0,296**	0,011	0,133**	0,110**	0,464**	-		
7	Age	0,074	0,157**	0,133**	0,097*	-0,127**	-0,182**	-	
8	Experience	0,100*	0,137**	0,132**	0,083	-0,090*	-0,126**	0,796**	-

Note. scores show the pearson correlation coefficient (r) ** correlation is significant at the 0,01 level (2-tailed), * correlation is significant at the 0,05 level (2-tailed)

Regression analysis

Following the correlation analysis, multiple regression analyses were used to test the hypotheses. Before the analyses in which all three leadership styles were included, linear regression analyses were conducted separately for each leadership style (Appendix C). This unearthed significant relationships from both adaptive (B = 0,221 & p = 0,016) and servant (B = 0,266 & p = 0,005) leadership with ICT integration. Transformational leadership did not show a significant relationship with ICT integration (B = 0,164 & p = 0,061). During the next step, the regression analyses included all three styles to test the hypotheses. First, hypothesis 1 (a,b,c) which states a positive relationship between leadership and ICT integration is expected. This is divided into three sub-hypotheses, each for one of the leadership styles. The results from the first regression are presented in Table 3.

Table 3

Regression leadership styles and ICT integration (H1a, H1b & H1c)

	R^2	B	SE	Sig.
X → Y	0,027			
Constant: ICT integration		3,439	0,420	
Transformational leadership (H1a)		0,029	0,107	0,786
Adaptive leadership (H1b)		0,071	0,135	0,600
Servant leadership (H1c)		0,195	0,144	0,176
Control variables				
Age		-0,007	0,008	0,435
Experience		0,076	0,041	0,061

Note. *** p < 0,001, ** p < 0,01, * p < 0,05

From the initial regression, it follows that H1a, H1b, and H1c can all be rejected as none of the relationships is shown to be significant. Therefore, none of the leadership styles appear to have a positive significant relationship with integrating ICT in the classroom. This means that higher levels of none of the included leadership styles were significantly related to ICT integration by teachers.

The second regression analysis (table 4) tests the relationship between the independent variables and the first mediating variable (M1), which is motivation. Here the results show that servant leadership appears to be the sole independent variable having a significant relationship with motivation, with higher levels of servant leadership relating to more motivation (B = 0,128 & p = 0,011). Therefore, H2a and H2b can be rejected as transformational and adaptive leadership both have no significant relationship with motivation. Furthermore, within this regression, the second mediating variable, competency, was included as a control variable and shows a substantial and significant relationship with motivation (B = 0,329 & p = < 0,001).

Table 4

Regression leadership styles and motivation (H2a, H2b & H2c)

	R^2	B	SE	Sig.
X → M1	0,242			
Constant: Motivation (M1)		2,243	0,183	
Transformational leadership (a)		-0,028	0,037	0,446
Adaptive leadership (b)		0,053	0,047	0,258
Servant leadership (c)		0,128	0,050	0,011*
Control variables				
Age		-0,004	0,003	0,204
Experience		0,003	0,014	0,837
Competency (M2)		0,329	0,032	< 0,001***

Note. *** p < 0.001, ** p < 0.01, * p < 0.05

The regression analysis of the independent variables on the second mediating variable, competency (M2), is shown in table 5. Here no significant relationship between the different leadership styles and competency is found. However, the other mediating variable, motivation, seems to have a strong relationship with competency (B = 0,526 & p = < 0,001). Furthermore, age is a significant predictor of competency, yet the size of the coefficient is negligible. With these results in mind, H3a, H3b, and H3c, can all be rejected, as no significant relationship between the three leadership styles and competency exists.

Table 5:

Regression leadership styles and competency (H3a, H3b & H3c)

	R^2	B	Std. Error	Sig.
X → M2	0,231			
Constant: Competency (M2)		1,783	0,254	
Transformational leadership (a)		-0,050	0,047	0,291
Adaptive leadership (b)		0,042	0,060	0,482
Servant leadership (c)		0,059	0,064	0,358
Control variables				
Age		-0,011	0.004	0,003**
Experience		0,020	0,018	0,262
Motivation (M1)		0,526	0,051	< 0,001**

Note. *** p < 0.001, ** p < 0.01, * p < 0.05

The final regression analysis analyzes the relationship of all three independent variables and both mediating variables with ICT integration (table 6). This way both hypotheses H2a, H2b, H2c, and H3a, H3b, H3c are tested. The results from this analysis show a strong and significant relationship from both motivation (B = 0,418 & p < 0,001) and competency (B = 0,493 & p < 0,001) with ICT integration. None of the independent variables show a significant relationship with ICT integration.

Table 6

Regression including all independent and mediating variables on ICT integration

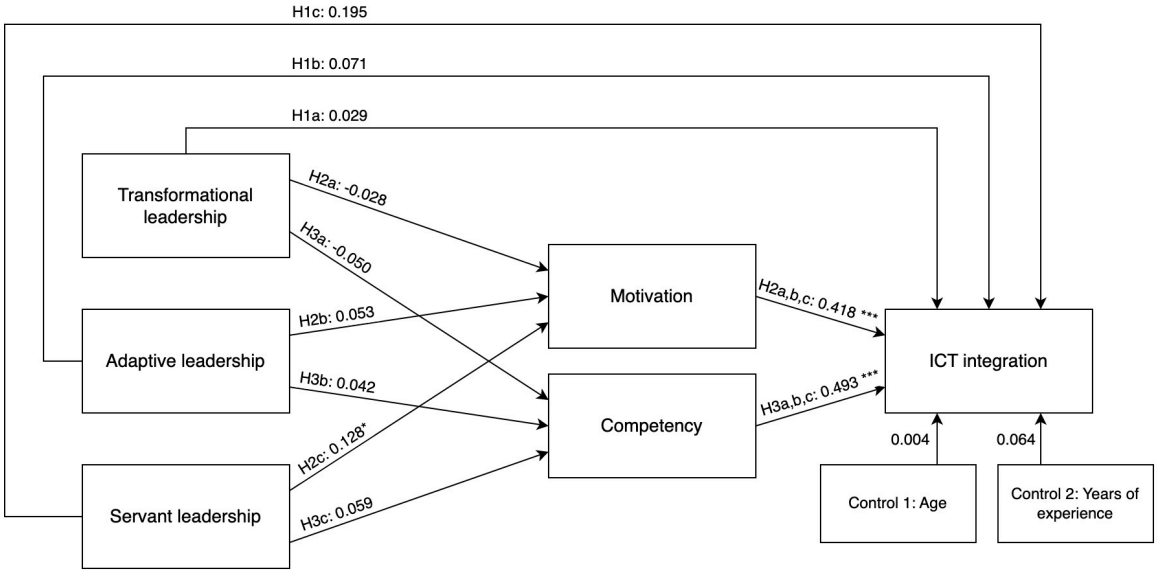
	R^2	B	Std. Error	Sig.
X, M1, M2 → Y	0,147			
Constant: ICT integration		0,086	0,566	0,879
Transformational leadership (a)		0,099	0,100	0,323
Adaptive leadership (b)		0,010	0,126	0,936
Servant leadership (c)		0,065	0,135	0,629
Motivation (M1)		0,418	0,119	< 0,001**
Competency (M2)		0,493	0,094	< 0,001**
Control variables				
Age		0,004	0,008	0,611
Experience		0,064	0,038	0,095

Note. *** p < 0.001, ** p < 0.01, * p < 0.05

Finally, a Sobel test is used to investigate the significance of both mediations within the model. From this test, the mediation through competency is insignificant for both transformational leadership (p = 0,297), servant leadership (p = 0,364), and adaptive leadership (p = 0,488). This further rejects hypotheses H3a, H3b, and H3c. The mediation through motivation shows only a significant mediation with servant leadership (p = 0,039), but not for transformational leadership (p = 0,459) or adaptive leadership (p = 0,283). Therefore, rejecting both hypotheses H2a and H2c. When it comes to hypothesis H2b, even though the relationship between servant leadership and motivation (X → M1), and the relationship between motivation and ICT integration (M1 → Y) are both significant, this hypothesis is still rejected as the relationship between servant leadership and ICT integration (X → Y) is not significant. A visual representation of all the quantitative results of phase one can be found in Figure 5.

Figure 5

A visual representation of the quantitative results



Note. *** p < 0.001, ** p < 0.01, * p < 0.05

Qualitative results (phase two)

During the quantitative phase of this study, none of the hypotheses could be confirmed. The quantitative results revealed no significant relationship between the variables in phase one. However, as the correlation analysis showed high correlations between variables and relationships were expected from the literature, the following qualitative results of phase two can provide some insight into why the hypotheses could not be confirmed. Furthermore, these results are able to shed light on possible other explaining variables that are associated with motivation, competency, and in the end, ICT integration in the classroom. The codes resulting from the focus groups can be found in the code tree (Appendix D).

Leadership

From the quantitative results, no significant relationship between one of the three leadership styles and ICT integration is found. However, during the focus groups, leadership was mentioned several times. This shows how the participants do think leadership plays a vital role in their ICT integration into the classroom. From the focus groups, three categories within the role of leadership emerged: communication, vision, and leadership style.

The category of *'communication'* was most prevalent when it came to leadership. Within this category, the respondents showed a need for clarity. Multiple teachers highlight this need as this gives them security and insight into where they stand. This is further supported by numerous teachers who experience a lack of understanding and unclear expectations from school leaders. They state that they don't always understand the direction that school leadership takes when it comes to ICT integration into the classroom. The following quote from an experience of one the teachers shows how unclear

communication can even lead to frustration using ICT: *'At one of the schools I worked at, we just got the announcement over the weekend: "Starting Monday, we will have tablets in the classroom, and you all must use them". That's when I experienced resistance as I didn't know what to do.'* This quote also shows how employee involvement plays a vital part in communication with school leadership, as this teacher was not involved in the decision-making process of using tablets. Other teachers were more satisfied and shared their experiences of how they were able to be part of the decision-making surrounding ICT: *'During 3 - 4 moments each year all school employees get together [to discuss and test ICT tools], and we look what is useful and enriching for educating our students.'*

The second category within leadership that emerged from the participants is the *'vision'* surrounding ICT and digital literacy within the school. Here a distinct difference is noticeable between teachers, while multiple teachers experience a clear vision, others note that in their school no vision exists. However, all teachers agree on the importance of a solid vision of ICT in schools. This importance is highlighted by a quote from one of the teachers: *'I think it really starts with a vision, and doing it together, that way you get everyone on board and the importance [of ICT in the classroom] becomes visible.*

The final category within leadership is *'leadership style'*, where the focus groups delved deeper into the styles of leadership that they experience and find helpful in the integration of ICT in the classroom. Here not one specific leadership style is observed. However, certain preferred leadership characteristics are mentioned amongst the focus group participants. Almost all participants show that they have a clear preference for leaders who work in a more bottom-up manner. While some teachers shared negative experiences with more top-down leaders, others shared positive experiences with bottom-up leaders. This is captured in a quote by one of the teachers showing the importance of bottom-up leading in getting teachers motivated to use ICT in the classroom:

'When decisions are made from the top down, then everyone thinks "Now we must do this on top of all our other work", and motivation suffers. However, if they [school leaders] listen and I am catered to, then I might become even more motivated."

Furthermore, multiple teachers aimed attention at their preference for school leaders who keep the students in mind and are more relaxed as opposed to strict leaders.

All in all, in contrast to the outcomes of the quantitative results, the way leadership is organized appears to be related to the teachers' ICT integration in the classroom. However, no distinct leadership style emerges from the focus groups. Instead, three main elements of leadership materialized, with teachers stating they want their school leaders to communicate clearly, provide a well-thought-out vision, and use a more bottom-up approach while leading the school.

Motivation

The previous section already showed how teachers experienced that leadership can have a positive or negative association with the integration of ICT by teachers. This second theme will delve deeper into

the role of motivation. When looking at the first category influencing motivation, *'leadership'*, it is apparent that the participants experience that their motivation is influenced by their school leaders. They feel that school leaders get teachers motivated when they show the importance of the tools that are used. Also, some schools enthuse teachers by showing examples and providing them with time and other means to keep motivation high. One teacher clearly states the importance of leadership in motivation: *'I get motivated to use and discover things when they [school leaders] show me the possibilities and importance, and even more when I can do this with other colleagues.'* However, other teachers stated how leadership could also lead to decreased motivation, especially when the goal of a specific tool isn't clear, school leaders demand teachers to use ICT, or when teachers are not given enough time to adjust.

Next to the role of leadership on motivation, the category of '*personal traits'* also appears to play a big role in the motivation of teachers to use ICT. Especially as most of the participants seem to have a high level of digital interest. This indicates that most of the participants in the focus groups are motivated to use new technologies in the classroom as they are interested in digital trends. Furthermore, most teachers state that they are open to change and want to go along with this change. One teacher compares themselves with colleagues: *"for me it's more that society is changing and we have to go along with that, but some teachers are really resistant and don't want to change."* This quote shows how their openness to change is connected with their motivation to change and use ICT in their lessons. Finally, all participating teachers get motivated by their pride in being a teacher. They feel they should keep up and do what is best for their students.

The final category within motivation to use ICT is *'positive experiences'*. The teachers are starting to use more ICT tools and increasingly experience the benefits it brings. They feel that can increase relevance and efficiency in the classroom. These positive experiences get the participants to want to try and use more ICT. However, negative experiences can also influence the motivation to use ICT. From the focus groups followed that most negative experiences stem from time issues. One teacher shows how a lack of time might negatively impact the motivation of colleagues to use ICT: *'I hear everyone talking about time, that they need time to get into it, time to develop, and time to get used to the idea. Unfortunately, there just isn't enough time.'*

Overall motivation appears to be affected by the school leaders; however, other elements also play a big role in the motivation of teachers to use ICT in their classrooms. Both the teachers' personal traits and their experiences can both negatively and positively impact their motivation.

Competency

Next to motivation, the focus groups were also aimed at unearthing a possible connection between leadership and competency. As the qualitative results show no relationship between leadership and competency, this section also provides two other elements influencing the ICT competency of teachers, their ICT knowledge and background.

The category *'leadership'* within the theme of competency was not heavily discussed during the focus groups as the teachers felt little connection between the school leadership and their ICT competencies. Multiple teachers came to the conclusion that their school leaders do not enable them to train their skills. In other schools, training programs do exist, but teachers working there state that you have to take it into your own hands. They have to search for it as it is not offered by their school leaders, and they feel that the content of most training programs is lacking. One of the teachers shows this with the following quote: *"If you want to improve your skills, you can. But you really must be interested, and then only broader and more advanced topics are taught. We have nothing aimed at basic skills..."* Other teachers paint the same picture, where teachers are able to train and develop their skills, but these pieces of training are mostly aimed at teachers already passionate about ICT, and offer more advanced topics.

This leads to the second category within the theme of competency, '*knowledge'*. The focus groups showed a difference in knowledge level between teachers when it comes to the basic use of ICT, the possibilities of ICT in their classes, and finding online places for information. During the focus groups, some teachers got into depth about how familiar they are with ICT, know how to use it inside of the classroom, and know what possibilities it offers. On the other side, some participants also explained how ICT can become frustrating as they sometimes struggle to use technology or notice colleagues who are struggling. One of the participants talks about frustration from colleagues when something new is introduced: *'when they don't know how it works, often not very complicated at all, they find it hard to figure out themselves. They give up and say: "You see, this doesn't work, it worked better before".'* It shows how big differences between teachers exist, leading to frustration and differences in the eventual use of ICT in the classroom.

The final category emerging from the focus groups is the importance of the '*background'* of teachers. This starts with teachers who have more experience than others regarding ICT competency. While some teachers state they were already used to using ICT in different aspects of their lives, others note that they had not as much experience. When having less experience, they note, the step to start learning new ICT competencies is harder. One teacher who grew up with ICT tells about how easy it was to adjust to using ICT in the classroom: *'ever since high school, everything was digital. For me not working digitally in class would be weird, and using new tools is not a big step for me.'* This also shows the importance of age, as not all teachers have grown up using ICT. Teachers in the focus groups state how they mainly see older teachers struggle and miss the competencies to use ICT in the classroom.

Other influential factors

Next to the variables from the literature, the focus groups showed three other factors of importance regarding ICT integration in the classroom. First, the most noted and highlighted category is '*time'*, which has also already been noted as influencing motivation. Multiple participants noted that time constraints hinder their use of ICT in the classroom. They shared that this has become even more apparent through the shortage of teachers. Using new ICT tools and teaching digital literacy is

experienced by most as an additional task. In this environment of high workload, other topics, like maths and grammar, are prioritized, and digital topics get little attention. This is further supported in the following quote: *'often the topic of digital literacy is proposed, but then there is not enough time and the priority remains with maths and grammar.'*

The second additional factor is the need for a working ICT infrastructure, as especially teachers who experienced problems with ICT shared. When tools stopped working, they got caught by surprise and had to call on the ability of colleagues to solve issues, disrupting both their lessons. One teacher notes: *'things should work, you need a good network, proper resources, and people who are able to solve potential problems swiftly.'* All teachers agree that a working infrastructure is one of the most important prerequisites, as without it, it is impossible to teach in the current teaching climate.

Finally, the last category, '*national policies'*, is broader than the previous factors but, according to the focus groups, not less important. Numerous teachers who participated in the focus groups think that the national government should provide schools and teachers with more possibilities. They feel digital literacy should be integrated into school inspections to ensure the quality of ICT integration. Furthermore, most teachers agree that the importance of digital literacy in schools should be made more evident by the government. It also became clear that teachers feel that an investment of time and money in education is needed. This way schools can be provided with time needed to develop skills of teachers and make sure they are better prepared for the future. This sentiment is captured well in the following quote by one of the teachers: *'look, I feel digital literacy doesn't get enough attention from the government, it should be a mandatory part of every school. But I also think there should be a steady vision from the government, so it won't become just another thing to tick off as a school without results.'*

All in all, the teachers show how they not only need leadership, motivation, and competency but also require time, a working ICT infrastructure, and supportive policies from the national government.

Post hoc quantitative results (phase three)

The quantitative results show three categories that the participants experienced as important when it comes to leadership and ICT integration. To explore if these outcomes might also emerge from the survey data multiple items were used to create three variables to conduct a post hoc analysis. These variables were created using the results from the focus groups and comparing outcomes with the items of each of the three leadership styles and dividing the items over these three post hoc variables. This resulted in three new variables that can be found in Appendix E, including the items used to construct them. The first exploratory post hoc variable, *open communication*, consists of six items ($\alpha = 0{,}839$) and aims to measure the level of experienced open communication from the school leadership. Secondly, the post hoc variable *clear vision*, made up of five items ($\alpha = 0{,}724$), measures to what extent teachers experience the existence of a clear vision. The final post hoc variable, *support from leadership,*

is measured using five items (α = 0,777). Using these exploratory post hoc variables instead of the leadership styles, the main analyses were conducted for a second time.

The first result from the post hoc analysis follows from the correlation analysis (Appendix F). It shows how the need for a clear vision (r = 0,127), open communication (r = 0,116), and support from leadership (r = 0,143) all correlate with the level of ICT integration in the classroom. This also holds true for the correlations with motivation and all three post hoc variables. However, competency only correlates with support from leadership (r = 0,082) and open communication (r = 0,110).

Even though multiple correlations exist between most variables, no significant relationship is found during the regression analysis (Appendix G). The regressions from open communication (p = 0,969), clear vision (p = 0,913), and support from leadership (p = 0,097) on ICT integration are not significant. Furthermore, the regression analyses investigating a possible relationship between the three post hoc variables and both motivation and competency show no significant relationship. However, as this is only an explorative analysis, the results from both analyses still show promise for future research.

Discussion

In this research, the role of leadership in the integration of ICT in education was investigated. The objective was to add to the existing body of literature regarding ICT integration in education by examining the role of leadership in this integration and how it is affected by the teachers' digital competency and their motivation to use ICT (Tondeur et al., 2008; Vanderlinde & van Braak, 2010; Vermeulen et al., 2017). It was theorized that this research could shed light on how to improve ICT integration in classrooms. Specifically, transformational, adaptive, and servant leadership styles were evaluated in the confines of this study. In the following section, the most important findings are discussed.

The quantitative phase of this study revealed that, when studied together, none of the three leadership styles studied was directly related to ICT integration in the classroom. When analyzed separately, both adaptive and servant leadership appear to have a significant relationship with ICT integration. These relationships disappear, however, when all three leadership styles are included. This suggests a rejection of hypotheses 1a, 1b, and 1c. The survey data further indicated that teacher motivation and competencies were essential for ICT integration. Although none of the leadership styles showed any relationship with the competencies of the teachers, thereby denying hypotheses 3a, 3b, and 3c. A mediating effect of teacher motivation between servant leadership and ICT integration was evidenced. However, as the relationship between servant leadership and ICT integration is only found to be significant when it is isolated from the other independent, this mediating effect has little meaning, thus leading to the rejection of hypotheses 2a, 2b, and 2c. All of the hypotheses are thus rejected during the quantitative phase of the research.

The outputs from focus groups, however, showed that teachers did, in fact, experience an influence from the school leaders, just not limited to one leadership style. When it comes to leadership,

they note that clear communication, a proper school vision, and support when needed are all essential. Furthermore, participants expressed the important role of school leaders in motivating teachers to integrate ICT. Teachers experience this through the leaders' behavior, where they exhibit good practices and provide the necessary support when integrating ICT. However, in line with the first phase of this study, where no significant relationship between any of the leadership styles and teacher competency was found, participants acknowledged that there was insufficient emphasis from school leaders on raising teacher competency in navigating and utilizing ICT. Further factors resulting from the focus groups that prove to be important in facilitating ICT integration include time availability, an operational ICT infrastructure, and demand from national policies.

The third phase of this study built on the outcomes of the focus groups to explore the outcomes further and give direction for future research. This phase was focused on what teachers want from their school leaders when it comes to ICT integration. Surprisingly, none of the three themes from the focus groups had a significant relationship with ICT integration, motivation, or competency. This could possibly be explained by the exploratory nature of this phase, as the items were not the best suited to measure these concepts. However, another explanation could be that a discrepancy exists between what teachers think/state they want from school leaders and what works in schools. This could also explain the difference in outcomes between the first two phases of this study.

The findings yielded by this research were not only in disagreement with the hypotheses of the present study, as no significant relationship was observed between any of the three included leadership styles and the level of ICT integration in the classroom, but also run contrary to the conclusions made in previous studies. This includes Yukl and Mahsud (2010), de Bunt-Kokhuis and Sultan (2012), Tondeur et al. (2008), and Kumar and Sharma (2018), in which a link between the three styles of leadership and ICT integration by teachers was reported. A potential explanation for this discrepancy could be due to the fact that three different forms of leadership were analyzed in this study, such that each style was only able to explain a limited portion of the relationship between leadership practices and ICT integration, resulting in none of the individual styles being statistically significant. To that end, and with the results from the post hoc analysis in mind, it may be useful to further examine the distinct characteristics of each leadership style instead of evaluating them as overarching styles.

Next to the absence of a relationship between the leadership styles and ICT integration, only limited support was found indicating that leadership styles are related to teaching motivation. Specifically, servant leadership was indicated to have a noteworthy relationship with motivation, which corresponds with the findings of Wahyuni et al. (2014) that servant leadership from school leaders has a positive effect on the job motivation of teachers. The other leadership styles, however, were not shown to be related to motivation, contradicting Eyal and Roth (2011), who observed a link between transformational and adaptive leadership styles and employee enthusiasm. It is worth noting, though, that this study was not conducted in primary schools, which may potentially provide a basis for these conflicting results.

The relevance of servant leadership is further explained via the results of the focus groups, in which teachers voiced a preference for school leaders who permit them to partake in decision-making and who are perceived as being accessible to their colleagues. These characteristics are in line with the nature of servant leaders (Greenleaf, 1970). Furthermore, the results from this research illustrate a strong and significant relationship between motivation and ICT integration, which aligns with existing research and theories (Davis, 1986; Granić & Marangunić, 2019; Sharma & Srivastava, 2019). Evidently, when teachers are inspired to use ICT, they are more likely to do so. Though, it is important to note that the focus groups highlighted the need for prerequisites such as time and a functioning ICT infrastructure for their motivation and successful integration.

Also, within the results, no relationship is identified between any of the leadership styles and the digital competency of teachers. This contradicts the papers by Chen et al. (2022) and Geijsel et al. (2009), who both find a connection between school leadership and the professional learning of teachers. The participants of the focus groups believe leaders may not prioritize the training of ICT, which can explain the lack of this relationship. However, when looking at the relationship between competency and eventual ICT integration by teachers, the results show a clear picture. The quantitative results show a strong and significant relationship, and this is further aided by the results from the focus groups. Therefore, this study shows an increased likelihood for competent teachers to integrate ICT into their lessons. This corresponds to prior research that displays how competent teachers can reap the benefits of ICT (Amhag et al., 2019; Wei et al., 2016). The same result also emerges from the focus groups, as the teachers show how their experience and knowledge lead to them using ICT more and experiencing more of the benefits as described by both Bingimlas (2009) and Kler (2014).

Theoretical implications

As this study differs from the existing literature in multiple ways it advances the literature on the effects of leadership on ICT integration. This research contributes to the literature as it is the first to compare multiple leadership styles while also considering the mediating impact of teachers' motivation and competency. This offers the surprising result that the relationships of both servant and adaptive leadership with ICT integration disappear when multiple leadership styles are included during the analysis. The way of researching multiple leadership styles in this study differs from prior research, and results in different outcomes. Huang et al. (2023), for example, compared both transformational and servant leadership and their effect on employees during digital transformation, and did find relationships of both with this digital transformation. However, this might also stem from the fact that their research was not focused on the educational sector. Other research has centered on the educational sector, but has only explored one leadership style, as showcased in Yu et al. (2002). When it comes to the explanatory variables in the current study, there has been limited research including both variables as explanatory mechanisms to research the relationship between leadership and the integration of ICT. Nonetheless, Amhag et al. (2019), Granić and Marangunić (2019), and Wei et al. (2016) have all studied

the impact of motivation and competency on the integration of ICT in the classroom and found clear links between both of the mechanisms and ICT integration. The qualitative analysis also reaches a similar conclusion, highlighting the importance of both motivation and competency. This is in line with both the survey data and literature (Amhag et al., 2019; Granić & Marangunić, 2019; Wei et al., 2016; Yu et al., 2002).

When it comes to the qualitative phase in this study, contrary to the quantitative results, many outcomes are in line with prior research. They further show the importance of support, proper ICT infrastructure, and possibilities to develop skills (Tondeur et al., 2008; Vermeulen et al., 2017; Yu et al., 2002). Finally, it shows how teachers experience that other factors may have more of an influence on their motivation and competency compared to school leadership.

Furthermore, as shown before by Carnoy (2004), the educational sector is proven to be significantly different compared to for-profit organizations regarding integrating ICT. This also seems to follow from this study, as the results differ from prior research conducted outside of the educational sector that does, in fact, find clear relationships between different leadership styles and motivation, competencies, and ICT usage of employees (Chiniara & Bentein, 2016; Choudhary et al., 2013; Kuluski et al., 2021; Nelson & Squires, 2017). This study, therefore, reinforces the belief that the educational sector requires a different approach regarding the effects of leadership on employees.

Practical implications

As digitalization is increasingly finding its way into society and education, it is vital to improve the digital literacy of citizens. The children currently in schools will have to be prepared for the future and should have digital skills to be prepared for future jobs. As advised by UNESCO (2018), schools should take part in the development of digital literacy of children at a young age. One important way of preparing children is through the level of ICT integration in the classroom (Bingimlas, 2009; Kler, 2014; Sutherland et al., 2004; UNESCO, 2018). However, prior research shows that not all teachers implement ICT in their classroom (OECD, 2019). This study evaluated the impact of school leadership on the integration of ICT in the classroom.

The results of this study show no definitive and clear relationship between transformational, servant, or adaptive leadership and the level of ICT integration exists. However, within the focus groups it appeared that teachers did, in fact, experience an influence from the school leaders, just not limited to one leadership style. For instance, they indicate a desire for a clear and concrete vision towards ICT. In this, the teachers appreciate knowing the added value of digital resources in their classrooms and want to be part of the decision-making process. Therefore, this paper shows how it is important to not limit school leaders to using specific leadership styles but instead use traits that fit with the school leader. Furthermore, this study shows how important the motivation and competency of teachers are in integrating ICT into their classrooms. It shows that it is vital for school leaders and policymakers to motivate teachers to use ICT and give them opportunities to develop their digital competencies.

With these implications, the outcomes of this study also warrant some policy recommendations. First and foremost, it is important for both schools and the government to create a clear and concrete vision for using ICT in classrooms. To ensure the creation of these visions, teachers should be part of the decision-making process, as they are the ones having to use ICT. Furthermore, to increase the digital competency of teachers, it is important a good training offering exists. Especially on the more basic skills, little training is available. To really reap the benefits of these training offerings, it is crucial for teachers to have time in their schedules. This form of basic ICT training should also be part of the teacher's education (Pabo) so new teachers are prepared to use the tools they are offered in a useful way that adds to their lessons.

Limitations

It is important to note that the outcomes and implications of this study do have their limitations, partly due to the scope and methods used. First and foremost, due to the nature of a cross-sectional study, like the current study, no cause-effect conclusions can be reached. Conclusions can only be drawn regarding possible relationships. As the scope of this study is exclusively aimed at primary school teachers in the Netherlands, generalizability is limited to comparable countries and situations. Additionally, only teachers were included and questioned on how they experience the school leadership and use ICT. The experiences of school leaders and students were not included, resulting in an incomplete picture of the complex interplay between school leaders, teachers, and students. Also, the inclusion of three leadership styles leads to limitations in two ways. Firstly, it is reductive as other, not included leadership styles might have a more significant relationship with the ICT integration by teachers. Secondly, by including multiple leadership styles, an overlap between them might occur, leading to nonsignificant results. This seems to happen as significant relationships between isolated leadership styles and ICT integration dissolve when multiple relationships are analyzed simultaneously.

Within the methods used in this research, multiple limitations reside. The main limitation of this research is the fact that the sampling strategy could have led to a non-response bias. Teachers who are less proficient in using ICT possibly didn't respond, as both the survey and the focus groups were conducted online and digitally. This might have skewed the results as more digitally proficient teachers are more likely to integrate ICT in their classrooms. To counteract this, the participants for the focus groups were purposively selected to try and include a range of different skill levels. Unfortunately, due to scheduling issues, the final focus groups mainly comprised highly proficient teachers. Furthermore, the sensitive topic of leadership could have led to socially desirable answers, even though no school leaders were present. Finally, the use of an explanatory sequential mixed method could have influenced the researcher during the focus groups, as the outcomes of the surveys were used to guide the focus groups. This may have caused the researcher to seek confirmation of the survey outcomes, steering the participants and leaving little room to examine other factors.

Suggestions for future research

The discussed outcomes and limitations of this current research led to some recommendations for follow-up research. First, as no significant relationship between the three leadership styles and the ICT integration in the classroom is found, it is recommended to delve deeper into the measuring devices used in this and prior research. This can be done by investigating how the separate items of each leadership style are related to each other and related to the ICT integration by teachers. By analyzing the items separately, the most influential leadership traits might emerge. This links to the second recommendation for future research, which is to research the traits of leaders who successfully enable teachers, or employees, to integrate ICT into their work. The fixed nature of a leadership style can thereby be uncovered further, which could lead to a more flexible way of researching leadership. The post hoc analysis within this study already provides a first explorative step in this direction, but this can be further analyzed in future research. Additionally, the outcomes from the post hoc analysis show a second topic of interest to investigate further. As a possible mismatch exists between what teachers state they need from school leaders, and what seems to work for them in integrating ICT in the classroom. Further research could delve deeper into this to check if this difference indeed exists, and why that is the case.

Concretely, with the results from this study, many new directions can be explored. Future studies can, for example, take separate leadership traits as multiple independent variables to investigate how they relate to the independent and mediating variables of this study. Furthermore, additional research could focus on the differences between school types, cultures and how that relates to the desires of school teachers. Also, it would be valuable to conduct longitudinal research following multiple schools while they integrate ICT in their classrooms. This way, more causal connections can be unearthed. To gain further insight into the roles of school leaders in the integration of ICT in classrooms, future research is also advised to include the perceptions of school leaders. This could, for instance, be done by discussing the results of the current study with multiple school leaders. Furthermore, future research could also investigate the actual behavior of teachers and how they use ICT in the classroom in the form of more ethnographic research. This way, the possible mismatch between perception and reality can be further investigated. Finally, as the results of this research differ from research papers investigating ICT integration in for-profit organizations, it is interesting to research this topic in other non-profit organizations.

Conclusion

In conclusion, the answer to the research question on the relationship between leadership styles and the integration of ICT in the classroom by teachers is hard to answer. First, no relationship between any of the three included leadership styles and ICT integration by teachers emerged. The only hypothesis that could not be rejected during the quantitative part of this explanatory sequential mixed methods research was that the relationship between servant leadership and ICT integration by teachers is mediated by

teacher motivation. However, as the relationship between servant leadership and ICT integration is not significant, this outcome has little meaning. Therefore, it could be concluded that school leadership has little to no effect on the level of ICT integration in the classroom. However, the qualitative part of this research suggests that teachers do feel influenced by their school when it comes to their motivations, competencies, and eventual ICT integration in the classroom. As these findings are not fully in line with existing prior research, this study offers an exciting starting point for future research on leadership effects on ICT integration by teachers.

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Appendix A: Survey questions

Part 0: Introductory questions

Intro 1:

In what province do you teach?

Intro 2:

What is the size of the school you teach in?

Intro 3:

Do you teach at a school labeled "excellent school"?

Intro 4:

What is the educational concept of the school you teach in?

Part 1: ICT integration in the classroom

Integration 1:

The students use digital means during class to search for information

Never	Less than once per month	once per month	multiple times per month	Once per week	Multiple times per week	Dayly	I don't know	Not applicable

Integration 2:

Students use digital means to store information for later use (e.g., text files, photos or videos)

Never	Less than once per month	once per month	multiple times per month	Once per week	Multiple times per week	Dayly	I don't know	Not applicable

Integration 3:

Students use digital means to show/demonstrate something

Never	Less than once per month	once per month	multiple times per month	Once per week	Multiple times per week	Dayly	I don't know	Not applicable

Integration 4:

Students use digital means to write text

Never	Less than once per month	once per month	multiple times per month	Once per week	Multiple times per week	Dayly	I don't know	Not applicable

Integration 5:

Students use digital resources to conduct further research on a particular topic

Never	Less than once per month	once per month	multiple times per month	Once per week	Multiple times per week	Dayly	I don't know	Not applicable

Integration 6:

Students use digital resources to work through learning material

Never	Less than once per month	once per month	multiple times per month	Once per week	Multiple times per week	Dayly	I don't know	Not applicable

Integration 7:

Students use digital resources to address learning delays.

Never	Less than once per month	once per month	multiple times per month	Once per week	Multiple times per week	Dayly	I don't know	Not applicable

Integration 8:

Students use digital resources to practice knowledge or skills

Never	Less than once per month	once per month	multiple times per month	Once per week	Multiple times per week	Dayly	I don't know	Not applicable

Integration 9:

I teach students to use ICT terms correctly

Never	Less than once per month	once per month	multiple times per month	Once per week	Multiple times per week	Dayly	I don't know	Not applicable

Integration 10:

I teach students the basics of digital systems used at school

Never	Less than once per month	once per month	multiple times per month	Once per week	Multiple times per week	Dayly	I don't know	Not applicable

Part 2: Transformational leadership

TL 1:

The school leadership is always looking for new opportunities for the school

Fully disagree	Disagree	Neutral	Agree	Fully agree	No opinion	Not applicable

TL 2:

School leadership has a clear picture of the goals that are important at school

Fully disagree	Disagree	Neutral	Agree	Fully agree	No opinion	Not applicable

TL 3:

The school leadership succeeds in motivating teachers

Fully disagree	Disagree	Neutral	Agree	Fully agree	No opinion	Not applicable

TL 4:

The school leadership always acts as the guiding force of the school

Fully disagree	Disagree	Neutral	Agree	Fully agree	No opinion	Not applicable

Part 3: Servant leadership

SL 1:

The school leadership sees it when something goes wrong at work.

Fully disagree	Disagree	Neutral	Agree	Fully agree	No opinion	Not applicable

SL 2:

School leadership makes my career development a priority.

Fully disagree	Disagree	Neutral	Agree	Fully agree	No opinion	Not applicable

SL 3:

I would seek help from the school administration if I had a personal problem.

Fully disagree	Disagree	Neutral	Agree	Fully agree	No opinion	Not applicable

SL 4:

School leaders stress the importance of giving back to the community.

Fully disagree	Disagree	Neutral	Agree	Fully agree	No opinion	Not applicable

SL 5:

The school administration puts my interests above its own.

Fully disagree	Disagree	Neutral	Agree	Fully agree	No opinion	Not applicable

SL 6:

The school administration gives me the freedom to handle difficult situations in the way that seems best to me.

Fully disagree	Disagree	Neutral	Agree	Fully agree	No opinion	Not applicable

SL 7:

School leadership values ethical principles, even when they get in the way of success.

Fully disagree	Disagree	Neutral	Agree	Fully agree	No opinion	Not applicable

Part 4: Adaptive leadership

AL 1:

School leadership is able to make unpopular decisions in the interest of the development of student learning.

Fully disagree	Disagree	Neutral	Agree	Fully agree	No opinion	Not applicable

AL 2:

School leadership has conversations with staff about beliefs and values

Fully disagree	Disagree	Neutral	Agree	Fully agree	No opinion	Not applicable

AL 3:

School leadership engages with staff about assumptions about teaching and learning.

Fully disagree	Disagree	Neutral	Agree	Fully agree	No opinion	Not applicable

AL 4:

School leaders are honest and open about knowledge they do not have themselves and consult with staff

Fully disagree	Disagree	Neutral	Agree	Fully agree	No opinion	Not applicable

AL 5:

School leadership is open about potentially painful effects of change.

Fully disagree	Disagree	Neutral	Agree	Fully agree	No opinion	Not applicable

AL 6 (Attention check):

This statement is different, enter "No opinion" here if you have read this.

Fully disagree	Disagree	Neutral	Agree	Fully agree	No opinion	Not applicable

Part 5: Motivation

Motivation 1:

In general, I believe technology is useful in education

Fully disagree	Disagree	Neutral	Agree	Fully agree	No opinion	Not applicable

Motivation 2:

It's fun for me to become proficient in using technology

Fully disagree	Disagree	Neutral	Agree	Fully agree	No opinion	Not applicable

Motivation 3:

I believe the use of technology will improve my teaching.

Fully disagree	Disagree	Neutral	Agree	Fully agree	No opinion	Not applicable

Motivation 4:

I believe that using technology in my teaching will help me in my future growth.

Fully disagree	Disagree	Neutral	Agree	Fully agree	No opinion	Not applicable

Motivation 5:

When I want to use technology in teaching, I often gather knowledge about it from colleagues

Fully disagree	Disagree	Neutral	Agree	Fully agree	No opinion	Not applicable

Part 6: Competency

Competency 1:

I am able to teach lessons in which content, technology and teaching approach complement each other.

Fully disagree	Disagree	Neutral	Agree	Fully agree	No opinion	Not applicable

Competency 2:

I am able to select technologies for use in my classroom that reinforce the content of my lessons.

Fully disagree	Disagree	Neutral	Agree	Fully agree	No opinion	Not applicable

Competency 3:

I am able to select technologies for use in my classroom that improve the way I teach.

Fully disagree	Disagree	Neutral	Agree	Fully agree	No opinion	Not applicable

Competency 4:

I am able to support others in using technologies at my school.

Fully disagree	Disagree	Neutral	Agree	Fully agree	No opinion	Not applicable

Competency 5:

I am able to select technologies for use in my classroom that improve learning efficiency in students.

Fully disagree	Disagree	Neutral	Agree	Fully agree	No opinion	Not applicable

Competency 6 (Attention check):

If you read this statement, enter "No opinion" once again here.

Fully disagree	Disagree	Neutral	Agree	Fully agree	No opinion	Not applicable

Part 7: Policy knowledge

Policy 1 (SLO):

Commissioned by the Dutch Ministry of Education, Culture and Science, SLO has created content lines related to digital literacy in education. To what extent are you familiar with these "content lines digital literacy"?

Not familiar	Somewhat familiar	Familiar	Quite familiar	Very familiar	I don't know	Not applicable

Policy 2 (Kennisnet):

In 2017, Kennisnet produced a handbook commissioned by the Ministry of Education, Culture and Science to help schools with digital literacy. To what extent are you familiar with this Handbook about digital literacy?

Not familiar	Somewhat familiar	Familiar	Quite familiar	Very familiar	I don't know	Not applicable

Part 8: Personal information

Personal 1:

What is your age?

Personal 2:

What is your gender?

Female	Male	Other	Prefer not to say

Personal 3:

For how many years have you been teaching?

Part 9: Closing

Closing 1:

Thank you for completing this survey, for the continuation of this research we are looking for teachers who would like to participate in focus groups. In this way we would like to create more depth in our research by covering different extended perspectives. Are you willing to participate in a focus group for a later stage in this research?

Yes	No

Closing 2 (only shown if the previous answer is "Yes"):

If you are willing to participate in the focus groups, please leave your mail address here

If you rather don't want to share your mail address, you can leave this field empty.

Closing 3:

This is the end of this survey. Thank you for your response. Please click "Next Page" to close the survey.

If you have any comments about this survey, you can leave them in the text box below.

Appendix B: Topic guide

Focus group (1 hour)

Topics of interest:

- The role of leadership in ICT integration in the classroom
- Experiences of teachers with using ICT in the classroom
- Discuss results from the survey

Guide:

1. opening, welcome people (± 10 minutes)
    - Welcome everyone, introduce myself, ask if everyone is okay with me making recordings, and check if I have everyone's consent form.
    - Question 0: Introduce yourself, say who you are, how long you have been in front of the class, and what you enjoy most about your work as a teacher

2. General questions on ICT usage in the classroom: (± 10 minutes)
    - Question 1: All of you have been in front of the classroom for a while, could you explain a bit about how you look at ICT in the classroom? (Think of ICT as both software and hardware)
    - Question 2: How much and what kind of experience do you have working with ICT?
    - Question 3: How is this arranged at your school? (and how are the experiences of colleagues?)
    - Question 4: What is your school's position on ICT in the classroom?
    - Question 5: How much adaptability and time does it take to integrate ICT into the classroom effectively?
    - Question 6: In what way(s) does using ICT affect your lessons?
    - Question 7: How did you learn to use ICT, and how did you learn to use it in your classroom?
    - Question 8: How do you feel about the level of attention digital literacy receives? (in your school, on a national level)

3. Discuss results (± 30 minutes)
    - Are you motivated to integrate ICT in your classroom, and how are you motivated?
    - Doe you all have the skills to integrate ICT in the classroom, how did you develop these skills?
    - In what way do you notice an influence of school leadership in your use of ICT in the classroom? (also, discuss that the results from the survey show little to no relationship between leadership and ICT integration)

- Does school leadership motivate you to use ICT in your classroom, in what way?
- Does school leadership help you develop your ICT skills, and in what way?
- Explain the three leadership styles and how only servant leadership appears to have some effect. Ask for opinions and possible reasons for why this leadership style, do they recognize this?
- Age does not play any role, according to the data, how do you think this could come about?
- How familiar are you with both Kennisnet and SLO? (when it comes to digital literacy)
- Do you have any recommendations for schools/government/other agencies that you would provide regarding ICT use in the classroom?

4. Time for additional questions and concluding the focus group (± 10 minutes)
    - Explain again in what way I will use their data and that they are free to redact things if they want to.
    - Thank everyone for their participation and close the focus group

Appendix C: Seperate regression analyses per leadership style

Regression of transformational leadership on ICT integration

	R^2	B	SE	Sig.
X → Y	0,018			
Constant: ICT integration		3,985	0,403	
Transformational leadership		0,163	0,163	0,061
Control variables				
Age		-0,006	0,008	0,481
Experience		0,075	0,041	0,067

*Note. *** p < 0,001, ** p < 0,01, * p < 0,05*

Regression of adaptive leadership on ICT integration

	R^2	B	SE	Sig.
X → Y	0,023			
Constant: ICT integration		3,793	0,408	
Adaptive leadership		0,221	0,091	0,016*
Control variables				
Age		-0,006	0,008	0,482
Experience		0,074	0,041	0,071

*Note. *** p < 0,001, ** p < 0,01, * p < 0,05*

Regression of servant leadership on ICT integration

	R^2	B	SE	Sig.
X → Y	0,026			
Constant: ICT integration		3,666	0,409	
Servant leadership		0,266	0,095	0,005**
Control variables				
Age		-0,006	0,008	0,443
Experience		0,078	0,041	0,055

*Note. *** p < 0,001, ** p < 0,01, * p < 0,05*

Appendix D: Code Tree

Code tree resulting from the focus groups

Theme (selective codes)	Category (axial codes)	Code (open codes)
Leadership	Communication	Need for clarity Lack of understanding Unclear expectations
	Vision	Lack of vision Clear vision Importance of vision
	Style	Dislike top down Bottom up Student is central Relaxed/open
Motivation	Leadership	Show importance Enthuse employees Visibility
	Personal traits	Digital interest Open to change Pride of being a teacher
	Experiences	Positive effects of ICT Lack of time Good practices
Competency	Leadership	Training offering Attention to skill issues Education
	Knowledge	familiar with technology ICT possibilities Ease of use Frustration Fear of technology Insecurity
	Background	Experience Age
Other influential factors	Time	Workload Additional task Priority
	Working infrastructure	Not working Problem solving
	National policies	Importance digital literacy Future proof Investment

Appendix E: Constructing post hoc variables

Variable 1	**Open communication**
6 items	α = 0,839
Transformational 3	The school leadership succeeds in motivating teachers
Servant 1	The school leadership sees it when something goes wrong at work.
Adative 2	School leadership has conversations with staff about beliefs and values
Adaptive 3	School leadership engages with staff about assumptions about teaching and learning.
Adaptive 4	School leaders are honest and open about knowledge they do not have themselves and consult with staff
Adaptive 5	School leadership is open about potentially painful effects of change.
Variable 2	**Clear vision**
5 items	α = 0,724
Transformational 1	The school leadership is always looking for new opportunities for the school
Transformational 2	School leadership has a clear picture of the goals that are important at school
Servant 4	School leaders stress the importance of giving back to the community.
Servant 7	School leadership values ethical principles, even when they get in the way of success.
Adaptive 1	School leadership is able to make unpopular decisions in the interest of the development of student learning.
Variable 3	**Support from leadership**
5 items	α = 0,777
Transformational 4	The school leadership always acts as the guiding force of the school
Servant 2	School leadership makes my career development a priority.
Servant 3	I would seek help from the school administration if I had a personal problem.
Servant 5	The school administration puts my interests above its own.
Servant 6	The school administration gives me the freedom to handle difficult situations in the way that seems best to me.

Appendix F: Post hoc correlation analysis

Correlation matrix post hoc analysis

		1	2	3	4	5	6
1	ICT integration	-					
2	Clear vision	0,127**	-				
3	Open communication	0,116**	.732**	-			
4	Support from leadership	0,143**	.721**	0,766**	-		
5	Motivation	0,285**	.155**	0,193**	0,190**	-	
6	Competency	0,296**	0,082	0,110*	0,085*	0,464**	-

Note. scores show the pearson correlation cefficient (r) ** correlation is significant at the 0,01 level (2-tailed), * correlation is significant at the 0,05 level (2-tailed)

Appendix G: Post hoc regression analysis

Regression post hoc variables and ICT integration

	R^2	B	SE	Sig.
X → Y	0,028			
Constant: ICT integration		3,606	0,463	
Open communication		0,006	0,156	0,969
Clear vision		0,018	0,163	0,913
Support from leadership		0,252	0,151	0,097
Control variables				
Age		-0,006	0,008	0,472
Experience		0,076	0,041	0,062

*Note. *** p < 0,001, ** p < 0,01, * p < 0,05*

Regression post hoc variables and motivation

	R^2	B	SE	Sig.
X → M1	0.237			
Constant: Motivation		2,266	0,203	
Open communication		0,053	0,054	0,331
Clear vision		0,021	0,057	0,709
Support from leadership		0,076	0,053	0,149
Control variables				
Age		-0,004	0,003	0,210
Experience		0,002	0,014	0,088
Competency		0,337	0,032	<0,001***

Note. *** p < 0.001, ** p < 0.01, * p < 0.05

Regression post hoc variables and competency

	R^2	B	Std. Error	Sig.
X → M2	0.231			
Constant: Competency		1,925	0,272	
Open communication		0,104	0,069	0,129
Clear vision		0,01	0,072	0,889
Support from leadership		-0,064	0,067	0,337
Control variables				
Age		-0,011	0.004	0,003**
Experience		0,019	0,018	0,286
Motivation		0,534	0,051	< 0,001**

Note. *** p < 0.001, ** p < 0.01, * p < 0.05

Regression including all post hoc variables

	R^2	B	Std. Error	Sig.
X, M1, M2 → Y	0,15			
Constant: ICT integration		0,067	0,604	0,912
Open communication		-0,118	0,146	0,418
Clear vision		0,018	0,152	0,904
Support from leadership		0,259	0,141	0,067
Motivation		0,413	0,118	< 0,001**
Competency		0,501	0,094	< 0,001**
Control variables				
Age		0,005	0,008	0,542
Experience		0,065	0,038	0,088

Note. *** p < 0.001, ** p < 0.01, * p < 0.05