Managing the Rise of the Digital State:
Implementation of Digital Education by Local Government

Abstract

There is an increasing implementation of digital education programs at the local government level. While internal factors are widely believed to increase the success of such programs, there is little evidence on whether the program structure influences implementation. Using the example of the program "education numérique" (EDUNUM) in the canton of Vaud, we conducted six case studies in the framework of which we talked to thirty school representatives that participated in this education program. The findings show that one of the most important success factors of the EDUNUM project is related to the individual knowledge and resources of the organization implementing the program. The focus of the courses on "unplugged" activities carried out without the use of screens, such as computers and tablets, and the explicit effort of the program instructors to adapt the content of courses to teachers' needs have contributed to the high appreciation of courses by the teachers. Our results show that the implementation of the program can be successful even when the organization structure is unbalanced. These results highlight the need for more research into the implementation of digital education programs that provide digital literacy skills to a new generation of citizens.

Key words: Digitalization, Digital Education, Digital Literacy, Collaborative Governance, Local Government.

Introduction

The current digital transformation is creating immense challenges for modern states despite its significant upsides. Even though the newest generations are commonly described as "digital natives" growing up in media-rich digital environment, they do not naturally acquire digital competencies and have yet to develop digital literacy (Eshet 2012; Porat et al. 2018). As a consequence, efforts have been made to adapt the education system in order to prepare future citizens for the prospects of a digital society. The development and adaptation of education programs belong therefore to the most important responsibilities of local governments, as they are usually responsible for public schools. The trend toward the introduction of digital education has been observed in many countries around the world. Education systems were required to integrate digital platforms, as well as tools for teaching and learning to capitalize on the potential benefits of emerging new technologies (Blau & Shamir-Inbal 2017).

In the last decades, many scholars have investigated the implementation of digital programs in the education sector. These studies show the main challenges have been linked to different internal and external factors. On the one hand, many researchers argue that the most prominent obstacles have been the teachers' low perceived digital self-efficacy and their reluctant attitudes toward the use of technologies in the classroom (Asan 2003; Keane & Keane 2017; Nelson et al. 2019). On the other hand, some studies show that the lack of available technological equipment and inadequate training opportunities for teachers have been found particularly problematic (Binglimas 2009; Ng 2012). However, these studies have mainly focused on the schools' implementation phase and neglected the program level even though the conceptualization and the organization of a program have an important role in the implementation of a policy. This study investigates how digital education programs are implemented and evaluates to what extent the structure of digital programs facilitates or prevents their success. Building on the collaborative governance literature (Emerson et al. 2012; Lang and Brüesch 2020), we argue that the effective implementation of digital education programs relies on five elements: organizational capacity, leadership, interactions, institutional arrangements and shared understanding.

Empirically, our study is based on the digital education program "éducation numérique" (EDUNUM), which has been introduced by the Swiss canton of Vaud in 2018. Our methodological approach consists of six case studies that we conducted in six schools participating in the pilot phase of the EDUNUM project. During this pilot phase, the implementation of the program is limited to twelve schools in order to identify the main aspects that should be modified and improved before proceeding to the project's deployment in all primary and secondary schools of the canton. Based on thirty semi-structured interviews with teachers, contact persons and members of schools' directions, we show which factors have influenced the successful implementation of the program.

Our findings show that, on the program level, the EDUNUM project has been afflicted by insufficient organizational anchoring accompanied by ambiguity related to its leadership structure. The absence of institutional anchoring of the project's management has led to internal conflicts over the spheres of influence. Additionally, the provision of necessary IT equipment to the participating schools has not always been timely and adequate and represents the most important challenge for the future of the project. The expertise of academic partners has contributed substantially to the high acceptance of the project by teachers. The focus of courses for teachers on "unplugged" activities carried out without the use of screens, such as computers and tablets, has been particularly appreciated. However, despite the overall satisfaction with their training, many teachers perceive the use of computers and tablets as harmful, as they are already excessively present in the lives of their students.

The article starts with the discussion of digital education programs in collaborative local governance structures and of factors that influence the successful implementation of such public policy programs. Subsequently, we present the EDUNUM project and our methodological approach that is based on six case studies conducted in schools participating in this digital education program. Further on, we discuss the findings of our research. In the concluding section, we interpret our findings in the light of previous research and discuss their implications for future research on the transformation of the digital state.

Digital Education and Collaborative Governance

The efforts of governments to introduce digital education in their education systems are related to larger tendencies in the public sector aiming to transform its functioning with information and communication technologies. However, the objectives of digital education are not related to increased efficiency or availability of public services; instead, the teaching of digital literacy skills addresses the necessity to prepare younger generations for challenges related to the ever-expanding role of technologies in the society. Moreover, digital education is supposed to enable younger generations to become actors in processes accompanying the digital transformation (CFEJ 2019).

In general, digital literacy is defined as "the awareness, attitude and ability of individuals to appropriately use digital tools and facilities to identify, assess, manage, integrate, evaluate, analyze and synthesize digital resources, construct new knowledge, create media expressions, and communicate with others, in the context of specific life situations, in order to enable constructive social action; and to reflect upon this process" (Martin 2006: 19). It follows that digital literacy belongs to the new literacy and partly overlaps with information, media and computer literacy (Bawden 2008; Koltay 2011). The concept was established by Gilster (1997) who claimed that digital literacy was more about mastering ideas than keystrokes. Even though this idea has been widely accepted, technical skills are still important in the practical discussion on how digital literacy should be implemented in the education system (Huvila 2012). As a consequence, there is an ongoing debate whether digital literacy is perceived as a skill or as a competence (Lankshear & Knobel 2008). While skills refer to the ability to do something specific and include cognitive, motoric and emotional skills (Eshet- Alkalai 2012), competencies are more than a list of abilities; they are a constellation of capacities embodied in the successful implementation of tasks (Hager and Beckett 1995). In the last decade, many scholars have developed literacy models in order to adapt them to the new technologies. According to Iordache et al. (2017), most of these models include the ability to find relevant and credible information and communicate it successfully through written text to others.

Previous studies on the implementation of digital education programs show that the most important influential factors are associated with school context. Internally, the most frequent challenges to the uptake of digital education have been related to the digital literacy skills of teachers (Alarcón et al. 2020; Brush et al. 2008), to the perceived ease of use of technologies (Holden & Rada 2011) and to the beliefs of teachers regarding the pedagogical benefits of technologies (Brush et al. 2008; Russell et al. 2003). The teachers' beliefs correlate positively with their experiences with technologies (Chuang et al. 2020). Furthermore, resource-related factors such as access to technologies (Russell et al. 2003), lack of time and financial constraints (Dinc 2019) have also constituted major barriers. In relation to the external context, digital education programs have been impeded by the lack of their integration in education systems (Cuban 2001) and by the absence of adequate training and support for teachers (Clausen 2007, Dinc 2019).

A fundamental problem of the implementation of digital education programs in schools is the high dependency on external expertise (Lankshear & Knobel 2015). In comparison to higher education levels, elementary school teachers often do not possess the necessary knowledge to teach digital competencies. Moreover, even the local government often does not possess this knowledge, which is why external experts are not only integrated in the conceptualization and implementation of digital education programs, but also in the decision-making process. Ansell and Gash (2008) have defined such governing arrangements as collaborative governance[1], where public administrations directly engage non-state stakeholders in collective decision-making processes. Even though the term "governance" has become an "umbrella concept" for a variety of phenomena (Pierre & Peters 2020: 1), most scholars agree that governance implies that public decisions are not made by one government actor, but by groups of individuals, organizations or systems (Stoker 1998). According to Ansell and Gash (2008), stakeholders include both individual citizens and organizations, which also refer to public agencies. Moreover, the authors stress that collaborative governance implies two-way communication and influence between government agencies and stakeholders.

According to Emerson et al. (2012: 14-16), collaborative governance regimes need four elements in order to generate desired outcomes. First, *procedural and institutional arrangements* provide the processes and organizational structures that allow the regimes to repeat interactions over time. The larger and the more complex a collaborative network, the more explicit the structures and protocols need to be for the arrangement to work. Second, such regimes need *leadership*, which can be an external driver, an essential ingredient of collaborative governance itself or a consequence of the collaboration. Furthermore, the networks need different types of leadership at different stages of the collaboration (Agranoff 2006). Third, *knowledge* can be seen as currency of the collaboration, requiring the aggregation, separation and reassembly of information, as well as the generation of new knowledge. Through a joint evaluation of information, individual knowledge becomes social capital. Forth, *resources* are the final part of joint action. Collaborations can benefit if they share and leverage scarce resources, which do not only concern funding, but also time, technical and logistical support.

Based on these considerations, Lang and Brüesch (2020: 1084-1087) propose a conceptual model that assesses the influence of various governance structures on the implementation of a policy. According to the authors, the collaborative governance process describes both the organizational (capacity, resources) and individual characteristics (trust, leadership), as well as their interaction. The authors present different components that influence the development of a policy; first, organizational capacity does not only increase the interaction between collaborating partners, but it also influences the output of collaborations (Eisinger 2002). Second, leadership skills support the collaboration process, since leaders frame the agenda, convene the involved actors and structure deliberation which leads to more interaction and thus to a higher common understanding and better outputs. Third, institutional arrangements involve mainly management tasks such as standardization and routinization of activities. Managers of collaborative governance regimes allocate responsibilities and, in doing so, they enhance collaboration and outputs. Fourth, shared understandings of objectives and outcomes increases the outputs due to mutual trust between stakeholders (Emerson et al. 2012). In addition, Ansell and Gosh (2008: 561) point out that cooperation is more likely to be successful when the possible objectives and benefits of the cooperation are concrete and when small profits, or intermediate outcomes, from the cooperation can be expected. They define the intermediate outcomes as critical process outcomes that are essential for a successful collaboration. Moreover, the small wins can re-influence the collaborative

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[1] In this article, we define governance as a circumstance, in which collective decisions are made in non-hierarchical independence between public and private actors. Within the so-called cooperative governance, the state does not pursue a sovereign position, but rather tries to steer indirectly and imperfectly policy networks (Rhodes 1997, 53).

process by encouraging a cycle of trust building (Vangen and Huxham: 2003). Figure 1 presents the concept of our theoretical model:

Figure 1: Conceptual Model of the Collaborative Governance Framework
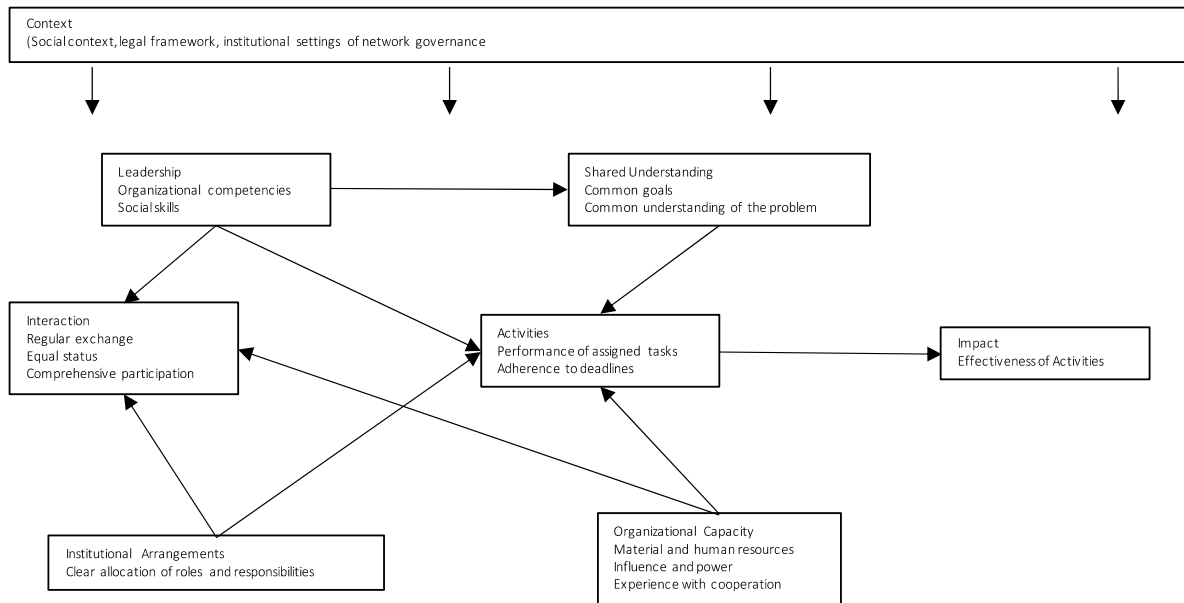
Note: Arrows indicate positive relationship; model adopted from Lang and Brüesch (2020: 108).

In the following sections of the article, we analyze the implementation of a digital education program within the collaborative governance framework postulated in Figure 1 by using the example of the EDUNUM project. This study can be situated at the interface between input and process evaluations, as it not only aims to assess the performance of the EDUNUM program, but also reflect on its implementation (Stufflebeam & Shinkfield 2012: 164). Our evaluation includes both formative and summative aspects, as it also aims to provide accountability to political decision makers (XXX, 2016).

The EDUNUM Project - Implementation of Digital Education in the Canton of Vaud

The EDUNUM project initiated by the government of the canton of Vaud constitutes an ambitious effort to introduce the teaching of digital literacy skills in its primary and secondary schools. The deployment of the project started in the autumn of 2018 and will continue in successive phases until 2025. Its implementation on the cantonal scale is preceded by a test ("pilot") phase during which the project is limited to twelve schools.[2] The objective of the pilot phase consists in identifying the main aspects that should be modified and improved before proceeding to the project's generalization. The selection of participating schools was based on their responses to a call for projects addressed to all cantonal primary and secondary schools by the cantonal government in the summer of 2018.

Initially conceived as a project with an important political dimension, the EDUNUM project is developed and implemented by the cantonal government in cooperation with the Swiss Federal Institute of Technology in Lausanne (EPFL) and the University of Teacher Education of the canton of Vaud (HEP). The main responsibilities of the cantonal administration involve the conception of the project and the

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[2] The first phase of the project's generalization is scheduled for the school year 2020/2021. Given that we analyzed the developments that occurred during the first two years of the project's deployment, our findings reflect uniquely on the pilot phase of the project.

provision of necessary technological equipment to the participating schools. Moreover, the cantonal authorities coordinate the different aspects of the project and prepare its generalization in all schools of the canton. The EPFL and the HEP are responsible for the organization of courses for the concerned teachers. The main objective of the courses is to help teachers develop teaching skills in the field of digital education. During the first year of the project's deployment, the courses focused on "unplugged" activities that are conducted without the use of computers and tablets (Chessel-Lazzarotto & El Hamamsy 2019). During the second year, the focus has shifted to activities conducted with tablets. With the objective of facilitating the acceptance of the project, each participating school was asked to appoint contact persons who serve as the first point of contact for the teachers. The contact persons are mostly teachers themselves. In some cases, they are members of schools' directory boards. Besides offering courses to the teachers, the two academic partners provide specialized courses for the contact persons focused on their role in the project.

The EDUNUM project defines its main objective as "the development of digital and transversal skills of all students with the objective of increasing their emancipation so that they are able to evolve as active and enlightened citizens in the informational society of today and tomorrow" (Caneva 2019: 12). The development of digital literacy skills of both teachers and students is guided by three pillars constituting their main components such as they are understood in the framework of the EDUNUM project (HEP 2018). In the framework of the first pillar, students familiarize themselves with the fundamental concepts related to computer science, such as algorithms and data coding, and with the principal components of technological devices. The objective of the second pillar is to develop digital literacy skills of students in relation to the relevant use of technological devices. Students discover progressively the functioning of adequate technologies and acquire skills related to the use and functioning of software. The third pillar of the project focuses on the sensitization of students in regard to their behavior in the virtual environment. They familiarize themselves with the ethical and critical use of technologies, in particular, regarding information management (Parriaux et al. 2019).

To facilitate the management of the project, several internal working groups were created. Each working group focuses on one aspect of the project and comprises five to eight members representing the local government, EPFL, HEP and the University of Lausanne[3]. The aspects of the project that the working groups manage include: 1. the preparation of digital literacy skills' catalogues for the three cycles of obligatory education, 2. the organization of courses for teachers and contact persons, 3. the delivery and installation of technological equipment in the participating schools, 4. the coordination of the project's practical deployment and 5. the evaluation of the project. The last working group is headed by the University of Lausanne that is responsible for the project's evaluation. Even though each group comprises the representatives of all project partners, the expertise is not distributed in an equal manner. The EPFL and HEP are considered experts in the field of digital education and are also the dominant actors involved in the preparation of digital literacy skills catalogues.

Methodology

Our methodological approach consists in six case studies that we conducted in six primary and secondary schools participating in the pilot phase of the EDUNUM project. A case is therefore defined as a school that participates in the pilot phase of the project (Yin 2014). The cases were selected on the basis of their initial level of technological equipment (preceding the deployment of the EDUNUM

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[3] The University of Lausanne is responsible for the evaluation of the EDUNUM project. The first evaluation report was published in the first year of the project (xxx et al. 2019).

project), geographical position (rural or urban) and socio-economic context.[4] In the framework of the EDUNUM project, all participating schools received the same technological equipment, instructions and training for teachers. Therefore, the input treatment of all schools was identical. The case selection was consequently made with regard for variety in the studied sample allowing for the appreciation of contextual conditions and limiting the risks of bias. The cases focus on a causal-process observation, which provides information about whether an intervening event posited by our theoretical considerations can be observed (Mahoney 2010, 128-129). Our case selection method is therefore based on a most different systems design that seeks to explain a similar outcome within the sample of different systems (Berg-Schlosser & De Meur 2012). Since we analyze the EDUNUM project using the concepts of collaborative governance, our approach is deductive; we are not primarily concerned with explaining all variation in the dependent variable (Anckar 2008).

In order to investigate the cases, we gathered data from a document analysis and from guideline-based interviews. In doing so, we analyzed internal documents related to schools and to the project. These additional documents were often created by the contact persons with the objective of facilitating the implementation of prescribed activities in classes. Typically, they provided roadmaps and practical tips related to different activities. In addition, we conducted semi-structured interviews with primary school teachers, contact persons and members of schools' directory boards during the months of July 2019 and February 2020. Five interviews were conducted in each school and thirty in total. In each school, two teachers, two contact persons and one member of the directory board were interviewed. The selection of interviewees was made based on the recommendation of schools' directors. The interviews took place at the sites of the six schools and lasted between thirty and sixty minutes depending on the role and the extent of experience of the interviewed person. The interviews were recorded, and a summative protocol was elaborated for each interview with partial word-to-word transcriptions. The resulting documents were subsequently analyzed using the thematic approach (Braun and Clarke 2006).

The definition of themes that were sought for in the interviews was based on key dimensions of the collaborative governance framework. However, in order to enhance the presentation of the findings, we have decided to group the different dimensions in four groups that are commonly used in the literature (Emerson et al. 2012): Procedural and institutional arrangements, leadership, knowledge and resources. When needed, new categories and themes were added to include additional pertinent findings resulting from the data analysis.

In the next section, we present the most important results related to the program-level factors influencing the implementation of the EDUNUM project. Each finding is assigned to the corresponding concept of the collaborative governance framework to accentuate links with the theoretical underpinning. Interview excerpts are used as examples of larger tendencies manifested in the collected data. The interviews were originally conducted in French and the used excerpts were translated into English by the authors. To minimize the distortion of original statements, the use of neutral words was preferred, and no interpretation efforts were made in the translation stage.

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[4] See the Appendix for a list of our cases with their characteristics.

Collaborative Governance Framework in the EDUNUM Project

The installment of a collaborative regime that generates desired outcomes is conditioned by the provision of precise **procedural and institutional arrangements** allowing for the reproducibility of the deployed measures (Emerson et al. 2012, Lang & Brüesch 2020). Our findings indicate that at the beginning of the EDUNUM project, the deployed measures were not systematically traced and recorded. Moreover, organizational structures allowing for the precise division of responsibilities between the EPFL, the HEP, and the local government were missing. As a consequence, tensions related to the organization of courses and the role of the two academic partners were palpable. Given that one of the objectives of the pilot phase consists in testing and improving the deployed approaches, a certain level of uncertainty is acceptable and, in the words of one of the directors of the participating schools, "constitutes a part of the deal." However, after the first year of EDUNUM's implementation, it was evident that the procedural and institutional arrangements had to be concretized in order to avoid cases of "stepping on one's toes." The findings from the case studies therefore corroborate that organizational structures in collaborative arrangements need to provide a sufficiently precise framework for the roles of all partners. If this is not the case, internal conflicts may impede progress of the collaboration. Furthermore, the routinization of deployed activities and a clear institutional anchoring of collaborative regimes allow for the repetition of actions that perpetuates the arrangement.

The absence of precise procedural and institutional arrangements discussed in the previous section is linked to the second dimension of a good collaborative governance regime: **leadership**. In the framework of the EDUNUM project, it is the governmental department of obligatory education that is the principal actor responsible for the project's implementation. However, the results of our analysis show that the role of the project's leader has not been assigned. For this reason, the presence of a single actor with the overview of the whole project and apt to coordinate its main aspects was missing. Pursuant to the collaborative governance concepts developed by Lang and Brüesch (2020), the resulting lack of interactions between stakeholders led to the emergence of knowledge disequilibria. Whereas the EPFL and HEP teams were best informed about the organization of courses for teachers, the governmental actors held information related to resources and to the coordination with the participating schools. Due to the absence of a coordinator, the exchange of information has not been regularized despite the existence of the working groups. Hence, our findings show that the absence of leadership impeded on the development of a shared understanding (Lang & Brüesch 2020) that is especially critical in situations where different actors in a collaborative regime provide expertise in a distinct field.

The third dimension of a collaborative governance regime that we analyzed is related to the **knowledge** of different stakeholders and to the transmission of information inside the organizational structure. Based on the findings related to the first two dimensions of collaborative governance, we conclude that, in relation to the EDUNUM project, knowledge disequilibria emerged due to insufficiencies on the level of organizational structure and of leadership. The EPFL and HEP were involved in the project because of their expertise related to the creation and implementation of digital curricula. The cantonal administration holds monopoly on knowledge related to the school system, legal guidelines and existing study plans.

Despite the shortcomings related to the lack of regularized information exchange, our findings show that the EDUNUM project has been well accepted by the participating teachers. Results from the data analysis indicate that the high levels of teachers' satisfaction are related principally to the content of courses offered by the EPFL and HEP. The expertise, or knowledge, of the two academic partners has therefore been decisive for the success of the project. During the first year of the EDUNUM's

implementation, the courses provided to the teachers and contact persons focused dominantly on the so-called unplugged activities that are implemented without the use of screens, such as computers and tablets. The results of the case studies show that the absence of screens from the program constituted an important success factor for the project. The teachers appreciated particularly the practical and ready-to-use character of the unplugged activities. One of them commented in the following manner:

> "(...) we try, we touch, we are confronted with the same questions as the children and it is like this that it should work. (...) Often, [in other courses] there is a lot of theory and we are overwhelmed by the amount of information. Here [in the EDUNUM courses], it is not the case."

The importance of unplugged activities for the acceptance of the project was confirmed during the second year of courses that had involved activities accomplished with tablets. Our findings suggest that the use of screens led to the feelings of disenchantment within the group of participating teachers. The findings emphasize two important aspects of the teachers' resistance. Firstly, it is the negative connotation of screens due to the supposedly excessive amounts of time that children spend using them outside of school. Secondly, the data analysis shows that the interviewed teachers often perceived their own digital literacy skills as insufficient and, for this reason, feared to find themselves in the position of incompetence in their own classroom. The importance of teachers' perceived technology skills for the integration of technologies into teaching has been previously emphasized in the literature (Brush et al. 2008).

Overall, our findings indicate that it is difficult for teachers to perceive the pedagogical benefits of tablets. The explanations of this tendency may be linked to insufficient experiences or lack of interest in the pedagogical use of technologies. The teachers who were motivated to use tablets in their classes were also more often able to distinguish between their pedagogical use and the use that children make of them at home. In the words of one of the interviewed contact persons:

> "(...) it [the EDUNUM project] should take another approach and say ´yes, the children use tablets a lot at home, but now the school has a role to play in it´. (..) It is necessary to show them [other teachers] what we can do with the tablets."

In relation to the practical implementation of activities in classes, the results of the case studies show that the role of contact persons has been primordial. This finding is coherent with the study of Fuller (2000) who showed that the amount of support provided to teachers had positive effect on computer use in the classroom. Because the delivery of the necessary technological equipment to the participating schools was sometimes delayed and its quantity did not always correspond to the real needs, the contact persons took it upon themselves to create additional material for teachers. These efforts facilitated substantially the practical implementation of activities in classes. However, despite the importance of the contact persons, the tasks of these crucial actors have not been precisely defined.

Insufficient acknowledgement of the role of contact persons is linked to the lack of certification that would recognize their attendance of courses and additional efforts that these actors made to be able to perform their role. The shortcoming related to the role of contact persons points at the inability of the project's partners to agree on the institutional anchoring of this aspect of the project.

The fourth dimension of the collaborative governance framework is related to **resources** that different stakeholders have at their disposition. Moreover, the provision of technological equipment and access to adequate infrastructure condition the implementation of digital education (Dinc 2019). Our findings show that the timely and well-organized delivery of the necessary technological equipment constitutes the most important challenge that the project EDUNUM risks to face in the future. All interviewed actors agree that the delivery of material must follow immediately after the courses for teachers.

During the second year of the project's deployment, there was a time lag of several weeks between the delivery of tablets to the schools and their set-up in classes. Due to this delay, teachers were not able to implement the activities shown during the courses immediately and therefore partly lost their motivation. One of the teachers commented in the following manner:

> "If the resources do not follow, we will end up just pretending (…). The problem is that teachers become dependent on the equipment around them and if it does not work, there is no alternative."

Moreover, once the set-up of tablets was finished, the teachers found out that the installation of certain pedagogical applications had required a further authorization from the cantonal administration. Consequently, teachers' discontent with the tablets and the approach of the administration increased.

One of the principles of the pilot phase of the EDUNUM project is linked to the flexibility of implementation of the teaching of digital literacy skills. On the one hand, the choice to not to fix the place of digital education in the study plan allows teachers to implement new activities in their classroom according to their own preferences. On the other hand, however, the flexibility of the arrangement provides an escape strategy to unmotivated teachers and causes confusion over the choice of discipline that would best accommodate the activities related to digital education. Our findings show that participating teachers often feel overcome with their other responsibilities and do not perceive digital education as priority. The director of one of the studied schools linked the place of digital education in the study plan to the perceptions of teachers:

> "If we want to (…) perpetuate the digital education, we have to revise the implicit contracts with teachers. What are their real values?"

For teachers to be able to accept the use of technologies as a part of their instructional practices, they have to understand the benefits and risks related to different applications, as well as their concrete usefulness for the teaching of different disciplines. It seems that this aspect has not been sufficiently clarified in the framework of the EDUNUM project, particularly in regard to the utility of tablets. Pursuant to the findings of Cuban (2001), the teaching of digital literacy skills is by the interviewed teachers still often perceived as a one-time event and an addition to the regular study plan.

The issues related to the insufficiency of equipment and time provide an interesting link to the previously outlined concepts of collaborative governance (Emerson et al. 2012). Because of the late delivery of tablets, the satisfaction of teachers with the project overall decreased even though the courses and the approach of instructors were otherwise perceived positively. Thus, this finding shows that resource-related matters affect the efficiency of collaborative arrangements and may endanger the achievement of the desired outcomes in the framework of digital education projects.

Conclusion

The objective of this study was to analyze the introduction of a digital education program in the Swiss canton of Vaud. Our findings show that the EDUNUM project constitutes a successful initiative that managed to avoid a number of pitfalls encountered by similar projects in other contexts. The analysis of case studies that we conducted in six participating schools shows that the focus of courses for teachers on unplugged activities and the creation of the role of contact persons have been decisive for the acceptance of the project by participating teachers. The timely delivery of necessary material to the participating schools has not always been straightforward and constitutes the most important challenge related to the future development of the project. Furthermore, the integration of teaching of digital

literacy skills into the existing study plan would help resolve challenges related to the lack of time for the implementation of activities in classes. In our analysis, we relied on the four dimensions of the collaborative governance framework: procedural and institutional arrangements, leadership, knowledge and resources (Emerson et al. 2012; Lang and Brüesch: 2020). Our findings indicate that the knowledge and expertise of the academic stakeholders have been decisive for the success of the project. The resource dimension constitutes, on the contrary, the most important risk for the future of the project.

The analysis of collected data allows us to formulate conclusions that could inspire future efforts in the field of digital education. The affinity of teachers for unplugged activities constitutes an important contribution to the existing literature and confirms the importance of teachers' attitudes toward different types of technologies for the acceptance of digital education programs. In the framework of the EDUNUM project, teachers' resistance toward the use of screens has been particularly prominent. The creation of the role of contact persons who facilitate the practical integration of digital education in the existing study plan is innovative and, as our findings indicate, highly beneficial for the teachers' acceptance of digital education. Furthermore, experiences made in the framework of the EDUNUM project show that the timely delivery of necessary technological equipment constitutes the cornerstone of a successful digital education initiative.

Furthermore, our findings revealed a greater issue regarding the individual perceptions of teachers. Resistance toward the use of tablets in courses, their late delivery and the necessity to obtain authorization for their specific uses have led teachers to question their own role in the education system. It seems that the issues related to the use of tablets have triggered feelings related to the loss of autonomy and a heightened sense of control within the group of participating teachers. Our findings indicate that the teachers had harbored these sentiments already before the arrival of the EDUNUM project, principally due to the growing digitalization and standardization of their tasks that, in turn, limit their capacities to freely choose and implement their preferred teaching methods. Consequently, it seems that it is not uniquely the attitude of teachers toward technologies that has an impact on the acceptance of the project, but also the attitude of responsible authorities toward the teachers. Teachers are the key actors determining whether and how digital education is practically implemented. For this reason, their point of view should be taken into account in the development of digital curricula. In addition, the teaching of digital literacy skills should be integrated in the existing study plans. If this is not the case, digital education may not constitute a priority when viewed together with other responsibilities of teachers. Overall, the human-centered approach toward the development of digital curricula seems to be more promising and durable than the approach focused on the provision of technological equipment (Cour des comptes 2019).

Our case also shows important implications for the collaborative governance approach. The implementation of digital education programs usually needs actors that possess competencies in the field of digitalization. While we have shown that both procedural and institutional arrangements, as well as leadership, are important for such projects, the sharing of knowledge and resources might be risky in such contexts. Most public administrations do not possess digital competencies, and this is even more problematic for transformations of the education system that rely on the role of street-level bureaucrats (Zhan et al. 2014). Scott and Thomas (2016) argue that that public managers use collaborative governance to achieve policy goals, but the decision to devote resources to collaborative arrangements is finally influenced by structural constraints and strategic interest. In order for such complex projects to be successful, it is important that local governments play a counterpart to the specific interests of organizations that have a knowledge monopoly. This can be achieved by

systematically sharing their resources. However, more research has to be done in order to study the consequences of unequal knowledge distribution in collaborative governance structures.

Our research design provided a deep insight in the implementation of the EDUNUM program, but it also bears limitations. First, since our empirical analysis is based on six case studies, we should be very careful in generalizing our results due to its low external validity (Yin 2014, 48-49). Even though the case selection was based on a most different systems design that included different school settings, it is uncertain whether the EDUNUM project can be compared to other digital education programs. Second, the case studies are mainly conducted with involved stakeholders' teachers. Literature on elite surveys and interviews suggests that the answers of stakeholders are not always reliable, which might also be a problem for the value of the interviews (XXX et al. 2018). Third, since we conducted our analysis through the lens of the collaborative governance framework, we may have insufficiently studied other external factors that have an impact on the implementation of digital education programs. In particular, access to technologies and financial and legal constraints have been found influential in this study field (Dinc 2019, Russell et al. 2003). Even though these factors did not seem to play an important role in our case, they should be considered in future studies. Overall, although we presented a strong case that structures matter for the implementation of digital education programs, more research has to be done in order to understand the success of such programs in schools.

Abstract in German

In jüngster Zeit sehen sich lokale Regierungen vermehrt gezwungen digitale Bildungsprogramme in den Schulen einzuführen. Zwar wird allgemein davon ausgegangen, dass interne Faktoren den Erfolg solcher Programme erhöhen, doch gibt es kaum Hinweise darauf, ob die Programmorganisation die Umsetzung beeinflusst. Am Beispiel des Programms "Education numérique" (EDUNUM) des Kantons Waadt führten wir sechs Fallstudien durch, in denen wir mit insgesamt 30 Schulvertretern gesprochen haben, die an diesem Bildungsprogramm mitmachen. Die Ergebnisse zeigen, dass einer der wichtigsten Erfolgsfaktoren des EDUNUM-Projekts mit den individuellen Kompetenzen und den Ressourcen der externen Organisation zusammenhängt, die das Programm umsetzt. Der Schwerpunkt der Kurse liegt auf sogenannten "unplugged" Aktivitäten, die ohne den Einsatz von Bildschirmen wie Computer und Tabletts durchgeführt werden. Zusätzlich tragen die Bemühungen der Ausbildner des Programms, den Inhalt der Kurse an die Bedürfnisse der Unterrichtspersonen anzupassen, zu einer hohen Wertschätzung der Kurse durch die Lehrer bei. Unsere Ergebnisse zeigen, dass die Umsetzung des Programms erfolgreich sein kann, auch wenn die Organisationsstruktur eigentlich suboptimal ist. Diese Ergebnisse unterstreichen den Bedarf an mehr Forschung über die Umsetzung von digitalen Bildungsprogrammen, die einer neuen Generation von Bürgerinnen und Bürgern digitale Kompetenz vermitteln soll.

Abstract in French

La mise en route des projets d'éducation numérique augmente au niveau des gouvernements locaux. Bien que l'importance des facteurs internes pour le bon déroulement des projets soit largement acceptée, l'impact de la structure organisationnelle sur l'implémentation n'a pas été suffisamment étudiée. Prenant l'exemple du projet « éducation numérique » (EDUNUM) de l'État de Vaud, nous avons mené six études de cas dans le cadre desquelles nous avons interviewé 30 représentants des écoles participantes au projet. Les résultats montrent que le facteur le plus important pour la réussite du projet est lié aux connaissances individuelles et aux ressources de l'organisation responsable de la mise en œuvre du projet. La mise en place de formations basées sur des activités débranchées réalisées sans écrans, tels que des ordinateurs ou tablettes, et l'effort explicite des formateurs d'adapter le contenu des formations aux besoins des enseignants ont contribué à l'appréciation élevée des formations par les enseignants. Nos résultats montrent que l'implémentation d'un projet peut être réussie malgré une structure organisationnelle déséquilibrée. Ces résultats soulignent le besoin pour davantage de recherches dans le domaine de l'implémentation des projets d'éducation numérique qui développent les compétences numériques de la nouvelle génération des citoyens.

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Appendix: List of case studies with their key characteristics

	Socio-economic context	Geographic context	Initial level of IT equipment	Size
School 1	Privileged, favorable attitude of the municipal authorities toward the project[5]	Rural	High, but unequal across different school sites	Approx. 1000 students and 120 teachers
School 2	Privileged, high resistance of teachers toward the project	Urban	Mid-range at all school sites	1024 students, 123 teachers
School 3	Privileged and innovative, favorable attitude of the municipal authorities toward the project	Urban	High at all school sites	Approx. 1000 students and 120 teachers
School 4	Neither privileged nor underprivileged, favorable attitude of the municipal authorities, high resistance of teachers toward the project	Urban	Mid-range, unequal across different school sites	Approx. 1300 students and 120 teachers
School 5	Underprivileged, unfavorable attitude of the municipal authorities toward the project	Rural	Low and unequal across different school sites	1285 students, 143 teachers
School 6	Underprivileged, unfavorable attitude of the municipal authorities toward the project	Rural	Low and unequal across different school sites	1430 students, 65 teachers

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[5] The favorable attitude of the municipal authorities implies that the latter were willing to support the school in their efforts to introduce digital education, for example, by providing additional technological equipment.