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A School Improvement Project about Digital Technology and Differentiated Instruction: Outcomes and a Project Model

VETENSKAPLIG ARTIKEL

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ABSTRACT

I den här artikeln identifieras och analyseras resultaten av ett skolutvecklingsprojekt. Det handlade om differentierad undervisning och digitala verktyg i svensk förskola och skola. Skolutvecklingsprojektet omfattade flera olika faktorer och aktiviteter såsom gemensam planering, dagkonferenser, återblickar, forskningscirklar och självskattningar. Det genomfördes av författarna (Mälardalens universitet), och lärare och rektorer i förskolor och skolor i Mälardalsregionen. Sju kommuner deltog. Flera datainsamlingsmetoder användes: Återblickarna och forskningscirklarna som genomfördes i samband med dagkonferenserna genererade beskrivningar och textuella data avseende skolutvecklingsprojektets resultat. En tematisk analys genomfördes. Två resultat var utvidgat yrkesspråk och stärkt engagemang. Självskattningar, som genomfördes innan projektet påbörjades och när det avslutades, genererade numeriska data om deltagares upplevelser avseende skolutvecklingsprojektets resultat. Självskattningarna analyserades genom medelvärden och variationer. Lärarna och rektorerna skattade de egna kunskaperna om och förtjänsterna av differentierad undervisning och digitala verktyg högre efter projektets avslut än före. I den här artikeln diskuteras även modellen för storskalig samverkan som användes i skolutvecklingsprojektet. Den har tre så kallade linjer och lämnar implikationer till dem som planerar att genomföra samverkan och skolutvecklingsprojekt.

Nyckelord: digitala verktyg, pedagogisk differentiering, samverkan, samproduktion, skolutveckling

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INTRODUCTION

In this paper, we (the authors) report on a school improvement project about digital technology and differentiated instruction conducted in Sweden. The project was between Mälardalen University and teachers and headteachers in preschools and schools in the Mälardalen region. The project aimed to facilitate and enhance these teachers' and headteachers' knowledge about and usages of digital technologies and differentiated instruction, and, in so doing, promote school improvements in the Mälardalen region. The question posed for this paper is the following: What are the outcomes of the school improvement project? The paper highlights outcomes such as described changes in perspective, professional acquaintances, experiences, opinions, and professional language regarding digital technology and differentiated instruction. The paper also monitors outcomes such as changes in perceived knowledge, usages and skills of the participants in this regard. Further, we present and discuss the project model which was implemented to promote school improvement in the region. We pay attention to its usage and value as well as its form. The rationale is to provide an example of how a large-scale school improvement project (on differentiated instruction and digital technologies) can be implemented and produce several types of outcomes.

Education in the Swedish preschool and school

The first step in the Swedish education system is preschool. Almost all children attend a preschool when their parents work or study. The second step is one year in a compulsory preschool class, and the third step is compulsory school grade 1. Thus, all children attend a preschool class for one year after preschool and before grade 1. In this study, the term school refers to both preschool class and compulsory school (grades 1, 2 and 3).

According to education policy in Sweden, children in preschools and schools should be provided with an education that includes teaching and digital technologies (Swedish National Agency for Education [SNAE], 2018a, 2018b). The teaching ought to be meaningful and interesting for all children, and digital technologies should facilitate teachers' work and children's learning towards curriculum goals. Additionally, children in Swedish preschools and schools should be offered opportunities to develop their digital competencies (SNAE, 2018a, 2018b). To achieve all this, teachers and headteachers need not only content knowledge but also pedagogical knowledge and knowledge about digital technologies. This can be understood as Technological Pedagogical Content Knowledge (TPACK, Mishra & Koehler, 2006; Willermark, 2018).

Digital technologies

Today, children grow up in a digital world and in an age of digital culture (Unicef, 2017; Zimic, 2009). They attend preschools and schools where digital technologies are understood to be useful and valuable instruction and learning aids (Agélii Genlott & Grönlund, 2013; Grönlund, 2014; Lundqvist et al., 2021; Nilsén, 2018; Tallvid, 2015) as well as facilitators of differentiated instruction (Lundqvist et al., 2021; Mahoney & Hall, 2017). Mahoney and Hall (2017, p. 291) wrote that "teachers can use technology to individualize and differentiate instruction", for example the contents, processes, and products of a learning activity.

The term digital technology is wide-ranging. It refers to, for example: computers, laptops, tablets, projectors, mobile phones, platforms for collaborations, internet, educational programs and other

applications and videos/films. It relates to the theoretical concept Technological Knowledge (TK) in the TPACK theory (Mishra & Koehler, 2006; Willermark, 2018).

Differentiated instruction

Differentiated instruction refers to a way of teaching which is meaningful and interesting for all children (Kotte, 2017; Strogilos et al., 2017; Tomlinson, 2016). They, as well as others who advocate for differentiated instruction, explain, that a teacher can differentiate instruction by adapting the contents of a learning activity so that both those children who are unfamiliar and those children who are familiar with the contents can benefit and learn new knowledge. A teacher can also differentiate instruction by adapting the process of a learning activity to the needs of specific children. The process refers to how children learn the contents of a lesson, project or theme. One example is to provide both textbooks and audiobooks. Moreover, a teacher can differentiate by varying the products. A product is what children create to demonstrate their knowledge and skills. Further, a teacher can differentiate by arranging a supportive learning environment. One example is to have classroom spaces for discussions and group work as well as classroom spaces where it is quiet and has few distractions. They, as well as others who advocate for differentiated instruction, also explain, that when instruction is differentiated, children with various knowledge and abilities, both those children with difficulties in learning and those children with high ability, can work with the same topic and learn together (Kotte, 2017; Strogilos et al., 2017; Tomlinson, 2016). This means that differentiated instruction enables inclusive education. Currently, inclusive education, for example in preschool and school, is valued and a worldwide Sustainable Development Goal to be reached by 2030 (United Nations [UN], 2015, Goal 4).

Differentiation can be related to the theoretical concept of Pedagogical Knowledge (PK) in the TPACK theory (Mishra & Koehler, 2006; Willermark, 2018).

Examples of previous school improvement projects

Previous papers have reported on school improvement projects on matters such as digital technology and differentiated instruction. One example is an ifous project (Hylén, 2017) and another is a project led by Wetso (2014). Two more examples are a project led by Forsling (2020) and a project led by Grönlund (2014; Grönlund et al., 2014).

In the ifous project (Hylén, 2017), the aim was to increase the digital competencies of teachers, headteachers and local authority leaders in eight Swedish municipalities. Researchers and experienced practitioners were enrolled as well as an evaluation company. The outcomes were, for example: increased knowledge of technologies, a confirmation that teachers do a good job, increased collaboration between teachers, and an increased awareness of teacher work and competence among headteachers. Examples of important project factors and activities were concluded to be learning loops and blogs incorporating collaborative learning.

In the project conducted by Wetso (2014), the transition from a traditional teacher leadership in classrooms without digital technologies to an innovative teacher leadership in diverse classrooms equipped with digital technologies (computers) was investigated and promoted. The project was jointly planned by Dalarna University and one municipality and linked to three compulsory school classes in the municipality. During the project, participating headteachers and teachers were enrolled in a university course. The outcomes were, for example, more inclusive classrooms and

fewer elements of segregation as well as increased opportunities for children with reading and writing difficulties to reach the curriculum goals in inclusive classrooms. Examples of important project factors and activities were a university course about special education theory, children's learning, differentiated instruction, school development, digital technologies and leadership attended by the participants; implementations of digital technologies; and collaborative learning and self-reflection among participants.

In the project conducted by Forsling (2020), collegial learning, by dedicated preschool teachers without a special interest in digital technologies, and the use of digital technologies in preschool was investigated and promoted. The project was carried out with Karlstad University and two Swedish preschools. One outcome was that the preschool teachers started to use tablets in preschool as a learning aid and one project activity was collegial learning.

In the Uno's Uno-project led by Grönlund (2014; Grönlund et al., 2014), usages of computers in classrooms, one computer for each child, were investigated and promoted. The project was between Örebro University, twenty schools in eleven municipalities in Sweden and one independent school company. Two positive outcomes were recorded, namely increased digital competencies in the schools and increased skills of children in such matters as reading and writing. Negative outcomes were increased costs and increased stress for teachers and children. One important project factor was collaboration between local authority leaders, headteachers and teachers, and an important activity was the implementation of computers in classrooms. Grönlund et al., (2014) wrote: "You do not learn 1:1 [to implement one computer for each child/student in a classroom] via a course" and stressed the importance of implementation work in a collaborative school improvement project (p. 6, our translation).

Experiences and lessons learned from these previous school development projects (Forsling, 2020; Grönlund, 2014; Grönlund et al., 2014; Hylén, 2017; Wetso, 2014) were considered in our school improvement project about digital technology and differentiated instruction in Swedish preschools and school classrooms.

Examples of ways to make school improvement effective

A previous paper (Bruner, 2018), with relevance to our project, has explicitly reviewed and elaborated on what can make school improvement (more) effective. In the paper, Burner concluded that educational change on matters such as digital technology is necessary at a time when children grow up in a digital age and there are advancements in digital technology. In the paper, Bruner also concluded that school improvement is difficult and contextual, and that several project factors and activities interplay and have great significance. Bruner (2018) wrote: "There are so many different parts that have to work together to make it effective" (p. 132). Some examples of such project factors and activities are the following: "honesty about the difficulties of change", "insisting not merely on a collaborative journey of change but also on an individual one", "ensuring support during transformations (particularly from the leadership)", "acknowledging different trajectories of change", "accepting insecurity/tensions/contradictions as natural elements of change", "integrating the professional development of teachers into their teaching schedule", "time for reflection on changes" and "spending sufficient time in reflective environments" (Bruner, 2018, p. 130 and 132).

As with the experiences and lessons learned from the previous school development projects, this advice from Burner (2018) was considered in our school improvement project. Bruner wrote:

"Research cannot give us the definitive answer as to how educational change can be made more effective, but it can give us some hypotheses as to what has worked in certain contexts" (2018, p. 129-130).

A description of our school improvement project

Our school improvement project about digital technology and differentiated instruction was conducted from 2019 to 2021 and it was between Mälardalen University and seven municipalities in the Mälardalen region. In total, we (the authors) and 243 teachers and headteachers in preschools and schools from the municipalities were enrolled in the project. Teachers refer to preschool teachers, teachers in schools and other preschool and school staff members such as special educators and librarians. The term headteacher refers to principals and development managers.

The project, and this related paper, followed good research practice and it had approval from the Swedish Ethical Review Authority (2019-04003). Before the project started, the teachers and headteachers, in both the first line and second line (which will be explained in a later section), were informed about the project. In written form, they consented to take part. In cases when individual children in a preschool or a school were targeted for a new digital technology/a new usage of a digital technology in an intense way, parents, in written form, were also informed and asked to provide consent.

The school improvement project is part of a large-scale collaboration and co-production project between academia and the surrounding society. It was funded by Mälardalen University's Kompetenscenter för Lärande (MKL) and Samhällskontraktet. All costs, except for the supply of teachers, new digital technologies, and travel expenses to day conferences, were covered by the project.

Project factors

Our project had mandates from local authority leaders in the region, and these stakeholders were involved in the planning of the project and the recruiting of participants. During the planning and recruiting, it was decided to have a first line. A first line refers to a group of first line participants who had direct contact with us (i.e., academia) through day conferences. We (the authors) will come back to the day conferences in a later section. It was also decided to enrol participants with an interest in digital technologies, to include participants from seven municipalities, to have more than one participant from each municipality, to focus on differentiation and digital technologies over a period from 2019 to 2021 and to have a project library.

Further, it was decided to have a second line. The second line enrols colleagues to the first line participants. These colleagues did not attend day conferences and they did not have direct contact with us. Instead, first line participants, who had direct contact with us through day conferences, shared content from day conferences to them in second line. These decisions were referred to as eight project factors (PF a to PF h). These were

- mandates (PF a),
- planning with stakeholders (PF b),
- a so-called first line and a second line (PF c; Figure 1),
- first line participants with an interest in digital technologies (PF d),

- participants from different municipalities and more than one participant from each municipality (PF e),
- explicit attention to pedagogical differentiation and digital technologies over a period (PF f),
- a project library (PF g) and
- day conferences (PF h).

Project activities

The day conferences included activities referred to as six project activities. These were

- recaps at day conferences (PA a). In groups, first line participants from different municipalities shared experiences of what had taken place at their preschools or schools between day conferences and in second line. Each recap lasted for approximately 60 minutes, was voice-recorded, and led by one or two of us. The term recap was created for this study.
- lectures at day conferences (PA b). Concepts related to differentiation and digital technologies, results of several research studies on these topics and evaluation strategies were presented and distributed to first line participants in a popular scientific way. Lectures and PowerPoint presentations were used. Each lecture lasted for approximately 50 minutes. These were led by the first author, invited researchers or staff members from the Swedish Association of Local Authorities and Regions and the National Agency for Special Needs Education and Schools.
- a project library; readings of books and articles at day conferences (PA c). A project library incorporating books and articles on differentiation and digital technologies was established for first line participants.
- meal and social times at physical day conferences (PA d). First line participants from different municipalities had a meal and social events together at physical conference establishments.
- research circles (Lahdenperä, 2011; Persson, 2009) at day conferences (PA e). Split into groups, first line participants from different municipalities discussed concepts and results of research studies as well as circumstances in their preschools or schools. Each research circle lasted for approximately 60 to 90 minutes, was voice recorded and led by one or two of us. Research circles are considered suitable in school improvement projects (Lahdenperä, 2011).
- municipality meetings at day conferences including planning of second line activities (PA f). First line participants from the same municipality reflected on day conferences and planned upcoming second line activities. These ended each and one of the day conferences and were not led by us.

These day conferences and activities were about differentiated instruction; choices and usages of digital technologies; implementation of new or new usages of digital technologies, and evaluations of digital technologies, in the region's preschools and schools. In total, 67 first line participants (teachers and headteachers in preschools and schools) attended the day conferences. Four conferences were arranged for participating teachers and headteachers in preschool, and four conferences were arranged for participating teachers and headteachers in school. Thus, we (the authors) arranged a total of eight day conferences with second line project activities in-between. Due to COVID-related restrictions, four conferences were at physical conference facilities, and four conferences were digital.

As mentioned earlier, contents from the day conferences were cascaded into the preschools and schools when first line participants shared content from the day conferences to their colleagues who

constituted the second line of participants. During second line activities, each first line participant also implemented or encouraged second line participants to implement new or new usages of digital technologies and conducted digital technology evaluations or encouraged colleagues to conduct such evaluations. The second line activities were:

- information to colleagues (PA g). Each first line participant shared experiences and contents from day-conferences to a group of colleagues (second line participants).
- implementations of new or new usages of digital technologies (PA h). First and second line participants implemented new digital technologies or new usages of digital technologies.
- evaluations of digital technologies (PA i). First and second line participants evaluated the use and value of digital technologies in preschools and schools.

These second line participants and activities helped scale up the project. A total of 176 second line participants (teachers and headteachers) were enrolled in the project. Thus, first line participants, on a group level, shared contents and experiences from day conferences as well as provided encouragement to a group of two or three colleagues. We (the authors) were informed about second line activities via recaps and research circles at the day conferences.

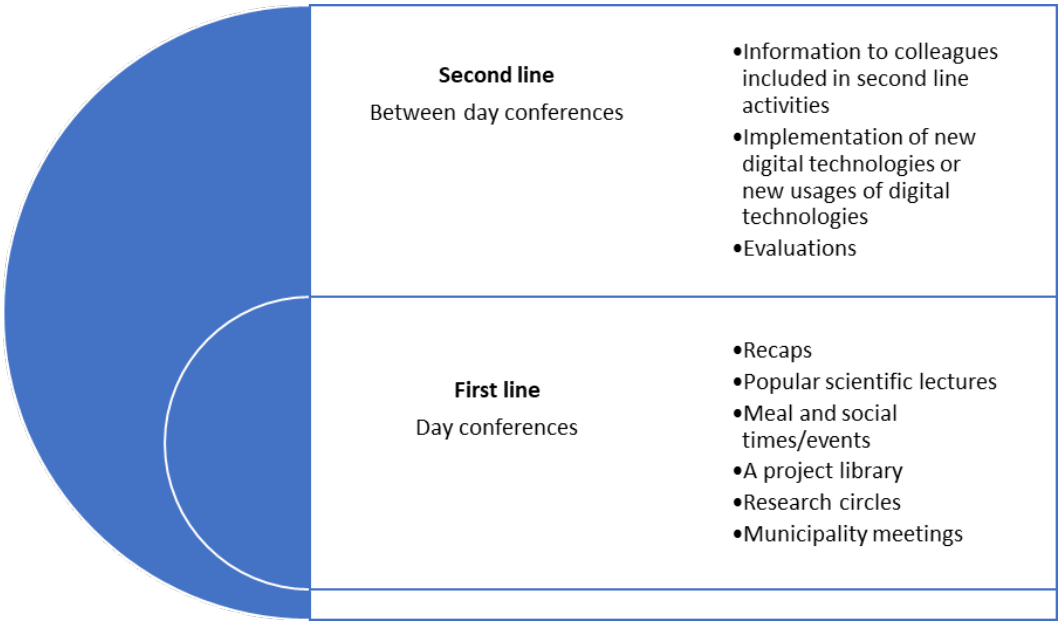

Figure 1. A two lines school improvement project model [Modell för storskalig samverkan, in Swedish]

METHOD

A multi-methods approach was adopted to identify and analyse the reported outcomes of the school improvement project about digital technologies and differentiated instruction. Verbal and textual data obtained from recaps and research circles at day conferences, and numerical data obtained from a structured self-rating questionnaire enabled the description and analyses of outcomes in two complementing ways: One qualitative way including patterns of data, that is, types of outcomes such as new professional acquaintances, courage, improvement efforts and changes in practices. One

quantitative way includes measures of perceived changes, that is, increases or decreases in perceived knowledge, usages, and skills of first line participants.

Textual data and analysis

The recaps and research circles were, as mentioned earlier, voice recorded, and some notes were also taken. Relevant parts of these recordings were transcribed and analysed by means of a six-stage thematic analysis approach (Braun & Clarke, 2006). Firstly, the first author became familiarised with the data. Readings of the data were carried out. Secondly, data related to outcomes was identified and discussed with the other authors. The identification included marking data related to outcomes. Thirdly, the identified outcomes were grouped into themes (i.e., types of outcomes) by the first author and discussed by the authors. In the fourth stage, the themes were given preliminary names and in the fifth stage, the names were decided. In this study, a theme reflects a type of outcome (e.g., Enhancement of professional language). Finally, a presentation of the themes was written, and a result was formulated. To increase the trustworthiness of this qualitative part of the result extracts from recaps and research circles were interwoven into the result.

Numerical data and analysis

Using a questionnaire, *first line* participants self-rated their knowledge about differentiated instruction (question 1) and digital technologies (question 2) as well as their usage of digital technologies in preschools and schools (question 3) on 10-point Likert scales. Here, the term usage refers to the extent to which the benefits of digital technologies were understood to be taken advantage of in preschools or schools. A self-rating of 1 referred to a very low level of perceived knowledge, a novice and low user or no use, and a self-rating of 10 referred to a very high level of perceived knowledge, to an expert and a frequent user. The following items were included in the questionnaire:

- Self-rated level of knowledge related to the implementation of differentiated instruction in preschool/school.
- Self-rated level of knowledge regarding digital technologies.
- The extent to which the benefits of digital technologies are taken advantage of in preschools/schools.

This self-rating was done before the project started, that is, at the beginning of the project's first day conference and when the project had ended using phone calls. Participants who preferred to fill in the questionnaire by post when the project had ended were given this opportunity. The total number of preschool pre-questionnaires was 32 (n=14 teachers; n=18 headteachers), and the total number of school pre-questionnaires was 32 (n=17 teachers; n=15 headteachers). The total number of preschool post-questionnaires was 19 (n=10 teachers; n=9 headteachers; response rate 59%; questionnaire drop out 41 %), and the total number of school post-questionnaires was 28 (n=16 teachers; n=12 headteachers; response rate 88 %; questionnaire drop out 12%). The pre and post self-ratings were analysed using mean (m) and range. The questionnaire was developed for this project and can be obtained from the first author. Second line participants did not fill in the questionnaire.

Both the qualitative part of the result and the quantitative part of the result reveal positive outcomes. This increases the trustworthiness and constitutes a triangulation.

RESULTS

Ten types of outcomes emerged in the analysis of recaps and research circles, and changes in perceived knowledge, usages and skills emerged in the analysis of questionnaires.

Ten project outcomes

In the following ten sections, the types of described outcomes are presented.

Overview of resources and priorities

The first theme is termed overview of resources and priorities. During the project, first line participants begin to look at their preschools and schools from a broader perspective. For example, they begin to critically reflect upon staff-child ratios, teacher competencies and number of digital technologies available in their preschool and school, and, in so doing, conclude that resources and priorities are not always the same.

New professional acquaintances

The second theme is termed new professional acquaintances. During the project, first line participants, get to know each other and learn from each other. One participant says: "I have gotten to know a teacher from another municipality |…|. We have similar [work] tasks". Another participant says: "I did not know about this before [refers to a digital technology described by a participant/a new professional acquaintance]. I will have a look at it, very interesting". They share experiences and opinions, ask each other questions, and listen to one another. They show respect, and interest in each other's work, and provide positive feedback. They give each other advice on matters such as putting differentiation into practice and good usage of digital technologies. One example is a participant who shares positive experiences of educational software about sign language. This is appreciated by another participant.

Enhancement of professional language

The third theme reflects that both first line and second line participants say they learn new concepts during the project and enhance their professional language. One example of such a concept is enrichments. One of them says: "We really like the term enrichment |…| it is very exciting. We have not talked about this before". Another such concept is differentiation/ differentiated instruction: "At the beginning [of the project], I assumed that differentiation was negative and was about dividing children into different groups. Now, I know it is not". Three more examples of such concepts are weak framing-of-an-application, strong framing-of-an-application, and write-to-learn. A weak framing-of-an-application refers to an application of mathematics which does not contain numbers or other mathematical symbols, for example. Write to learn refers to a method in which children use digital technologies to learn to write; in this method, they do not use paper and pen.

Confirmations, insights, and new knowledge

The fourth theme and type of outcome is termed confirmations, insights, and new knowledge. During the project, the participants identify similarities between their own work and research results as well as between their work and the work of other participants. These similarities confirm their activities in preschools and school classrooms and increase their professional confidence. For example, they say that they have come to realise their work is of good quality and is also evidence-based.

During the project, they also come across research results and opinions of other participants which increase their understanding and awareness. One example is the importance of parallel extra support to children with special educational needs *and* enrichments to children who are gifted and talented. One of them says: "Before we did not think about the children who learn easily and who have a lot of knowledge. Today, we talk about them |…|. Before, we were more focused on the children who needed extra support". Another insight is related to educational software: There are participants who are no longer sure educational software integrated into their instruction is of good quality, is handled and used in a good way and facilitates children's learning towards curriculum goals. One more example of an insight is related to young children in preschool. Headteachers say that "as much [digital technologies] as possible [shall be implemented] as soon as possible" without a necessary reflection of "why, what for and for whom" is no good, and point out the need to safeguard other needs of young children, for example, a need to develop gross motor skills. They argue that digital competencies should not be the priority during the early years in preschool. One more example, expressed by the participants, is that digital technologies that create virtual realities in preschool are not necessarily always good for young children since they cannot always tell the distinction between reality and fiction.

During the project, teachers and headteachers express that they learn new pedagogical and technical knowledge. For example, how to differentiate an instruction and how to use digital technology in preschool or school.

Increase in engagement

One more theme (number 5) is an increase in engagement. It refers to changes in attitudes towards digital technologies amongst second line participants during the project. The following description reflects the theme: During the project, a first line participant meets several special educators. In the beginning, she notices a resistance towards digital technologies, even to talk about digital technologies. However, this circumstance changes and they become more positive and curious. They for example reflect on how digital technologies could be useful for teachers and children. "This makes me very happy", the participant says.

Courage, improvement efforts and changes in practices

The next theme (number 6) reflects a sense of courage developed among first line and second line participants during the project to initiate improvement efforts and changes without knowing for sure what will happen. During the project, they implement new digital technologies and use available digital technologies in new ways. Changes at a preschool and school classroom level in practices come about. Examples of available digital technologies and new/new usages are meetings and consultation rooms, green screens, reading pens, Creaza™, speech synthesis with a child's voice, google form, Polly Glutt™, programming robots to carry out physical tasks and improve programming, usb-eggs, a combination of digital tools for work with documentation of the children's knowledge development and Ugglo™.

Experiences of setbacks and development challenges

Outcome type and theme number 7 is experiences of setbacks and development challenges. When participants initiate and make changes at a preschool or school classroom level, during second line activities, they are not always successful. They come across hinders such as digital technology that does not work, or colleagues who do not always value digital technologies. One participant describes an implementation of digital technology in a preschool as follows: It did not work. "It is very

important to try [a technology] over and over again" and other participants agree. They say: "[You need to try] over and over, and over and over again". "You have to try at least five to ten times". "It is important to play with the digital technology as a teacher. This I have come to understand". Another participant describes the implementation of digital technology as follows: It did not work out well. Instead, papers and pens were used. An additional participant describes a challenge and a negative attitude related to screen time. This has limited the possibility to implement new technologies/new usages of technologies incorporating screens.

New and revised guidelines and policies

Theme number 8 reflects the creation of new written guidelines and policies on the topic of digitalisation and the revision of existing policies on the same topic. During the project, participants write guidelines and policies, and other participants discuss and revise existing guidelines and policies. Two participants say: "I will create a guideline [about digital work in preschool]". "I will have a look at our policy [a school plan for digital technologies] to see if evaluation aspects are part of the policy. I do not think so". They tell other participants about their conclusions and show their guidelines and policies.

Evaluation efforts and new tools for self-reflection

Evaluation efforts and new tools for self-reflection constitute theme number nine. During the project, there are participants who create new self-reflection tools and who use these with the aim to identify strengths and improvement needs in preschool and school on matters such as differentiation and usages of digital technologies. During the project, there are also participants who make evaluations to better understand the possible benefits gained by integrated digital technologies. They use different evaluation strategies from a project lecture such as structured observation and interviews with children.

Third line participants and activities

Theme number 10 is the broadest theme. It reflects several efforts and activities that take place in the municipalities in parallel with the project. These efforts and activities are initiated by first line participants and have roots in the project. The theme, therefore, is termed third line participants and activities. We will come back to the third line in the discussion. Some examples of third line efforts and activities are the following:

- Information to colleagues not included in second line activities. First line participants inform broadly about the project in preschools and schools. They use the project's popular scientific lectures and PowerPoint presentations.
- Information to parents in preschools and schools. First line participants use the project's popular scientific lectures and PowerPoint presentations.
- The creation of a new work team, appointed with the task to review the usage of educational software, is created in one of the municipalities.
- Knowledge gained from the project is interwoven with other ongoing preschool and school projects.
- A decision to have differentiation and digitalisation as a theme of the year in one municipality.

Enhancement of perceived knowledge, usages, and skills

In Table 1, the self-rated knowledge and usages of teachers and headteachers in preschools and schools participating in first line are presented. On a group level, the teachers and headteachers in both preschools and schools rate their knowledge and usage higher after the project was finished than before the project. So, on a group level, no perceived decreases in knowledge, uses and skills were found. Further, there are several examples of decreases in variations (i.e., ranges in perceived knowledge, usages and skills).

The implementation of differentiated instruction in preschool/school

According to the teachers, there is an increase in knowledge, related to the implementation of differentiated instruction, from 6.50 to 6.90 (preschool) and from 7.06 to 7.31 (school). According to the headteachers, there is an increase in knowledge from 6.29 to 7.38 (preschool) and from 7.00 to 7.66 (school). The change in perceived knowledge is greater for headteachers than for teachers. The decreases in variations (i.e., ranges) are the teachers' (preschool) and headteachers' (preschool) knowledge related to the implementation of differentiated instruction.

Knowledge regarding digital technologies

According to the teachers, there is an increase in knowledge regarding digital technologies from 7.57 to 7.60 (preschool) and from 6.71 to 7.81 (school). According to the headteachers, there is an increase in knowledge from 6.44 to 6.75 (preschool) and from 6.67 to 6.92 (school). The change in perceived knowledge is greatest for the teachers in schools. The decreases in variations are the teachers' (preschool and school) and headteachers' (preschool) knowledge regarding digital technologies.

The extent to which the benefits of digital technologies are taken advantage of

Another example of a great reported change is the extent to which the benefits of digital technologies are taken advantage of in preschools. According to the headteachers in preschools, there is an increase in use from 5.00 to 7.25. The headteachers in schools also reported a change from 5.87 to 5.92. According to the teachers, there is an increase in the extent to which the benefits of digital technologies are taken advantage of from 4.71 to 5.20 (preschool) and from 6.59 to 7.31 (school). The decrease in variation relates to the headteachers in preschool.

Table 1. Pre and post self-rated knowledge, uses and skills, by preschool and school, by teachers and headteachers

Questionnaire item	Preschool				School			
	Teachers		Headteachers		Teachers		Headteachers	
	Pre	*Post*	*Pre*	*Post*	*Pre*	*Post*	*Pre*	*Post*
Self-rated level of knowledge related to the implementation of differentiated instruction in preschool/school								
m	6.50	6.90	6.29	7.38	7.06	7.31	7.00	7.66
range	4; 8	6; 8	2; 9	7; 8	5; 8	6; 9	4; 8	5; 9
Self-rated level of knowledge regarding digital technologies								
m	7.57	7.60	6.44	6.75	6.71	7.81	6.67	6.92
range	4; 10	5; 9	3; 10	5; 9	4; 9	6; 9	4; 9	4; 9
The extent to which the benefits of digital technologies are taken advantage of in preschools/schools								
m	4.71	5.20	5.00	7.25	6.59	7.31	5.87	5.92
range	2; 6	3;7	3; 8	5; 9	2; 9	2; 10	3; 8	2; 9

Note. A self-rating of 1 refers to a very low level of perceived knowledge, a novice and low usage or no usage, and a self-rating of 10 refers to a very high level of perceived knowledge, to an expert and frequent user.

DISCUSSION

In this final part of the paper, we (the authors) will discuss the outcomes and project factors and activities that appear to have generated these outcomes. We will also present a three lines project model, discuss similarities with previous school improvement projects and discuss the main contributions from our project.

An effective project

Overall, the results suggest that the project was successful and effective. First, the results displayed several types of outcomes. These were

- *individual* outcomes such as an overview of resources and priorities (theme 1), confirmations, insights, and new knowledge (theme 4), increase in engagement (theme 5), courage (theme 6) and experiences of setbacks and development challenges (theme 7).
- *interpersonal* outcomes such as new professional acquaintances (theme 2) and enhancement of professional language (theme 3).

- *material* outcomes such as material changes at a preschool and school level (theme 6), new and revised guidelines and policies (theme 8) and new tools for self-reflection (theme 9).

Therefore, the types of outcomes of this project are on different levels and differ from individual to interpersonal and material. Second, the results, on a group level, displayed a perceived increase in knowledge regarding digital technologies and differentiation amongst participating teachers and headteachers in preschools and schools. There is also a reported increase in the extent to which the benefits of digital technologies are taken advantage of in preschools and schools. On a group level, no knowledge, usage, or skills of teachers and headteachers in preschools and schools were lower after the project was finished than before the project. Further, there were several examples of decreases in variations in perceived knowledge, usages, and skills. This is probably because the participants' self-perceived level of knowledge, on a group level, increased and became more even during the project. Third, the project grew larger than intended and came to incorporate third line participants and activities (theme 10).

A three lines project model

Theme 10 is an unexpected aspect of the results which challenges a two lines project model and can provide a starting point for a three lines project model (Figure 2). A three lines project model suggests a first line and second line in a (collaboration and school improvement) project to produce and endorse a third line. This is important knowledge for the area of educational change and those planning, implementing, and evaluating school improvement projects.

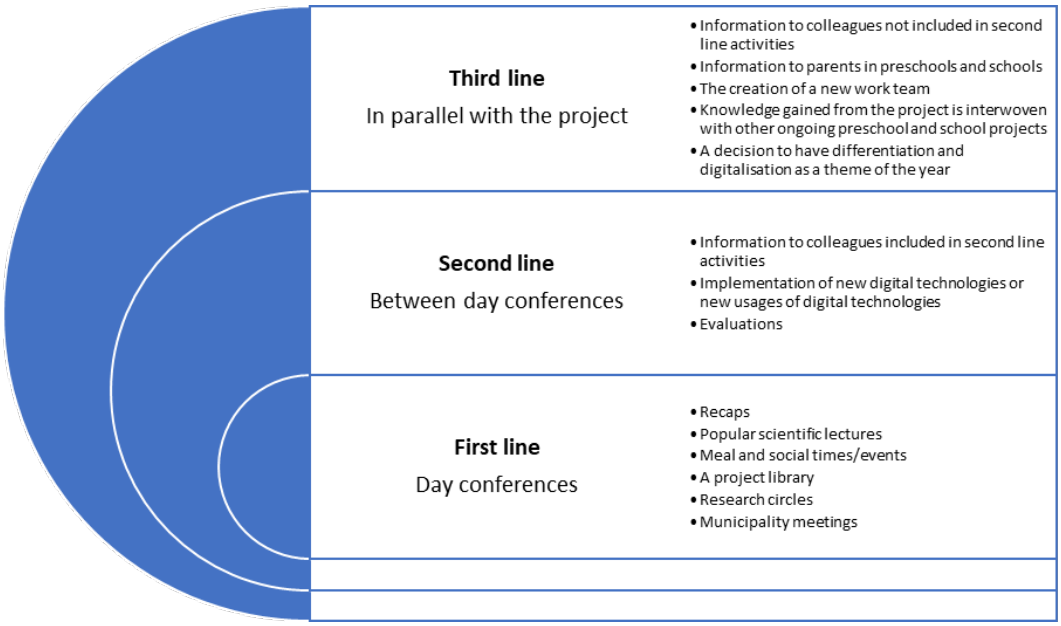

Figure 2. A three lines school improvement project model with a basis in the project model [Modell för storskalig samverkan, in Swedish]

Interplaying and influential project factors and activities

The several outcomes of this project would probably not have been achieved if the mandates from local authority leaders and headteachers had been lacking (PF a), if stakeholders had not been

involved in the planning (PF b), if only a first line had been utilised (PF c), if first line participants had not been interested in digital technologies (PF d), if the project had not included participants from different municipalities and more than one participant from each municipality (PF e), if the project had not focused on differentiated instruction and digital technologies over a period (PF f), if the project library had been omitted (PF g), and if day conferences had not been chosen (PF h).

It would probably also not have been possible to achieve the outcomes without the recaps (PA a), the popular scientific lectures and PowerPoint presentations (PA b), some reading of books and articles and the library (PA c), the meal and social times at physical day conferences (PA d), the research circles (PA e), the municipality meetings (PA f), and the practically oriented second line activities (PA g to h).

Two examples are as follows: It can be assumed that new professional acquaintances (theme 2) relate to at least three project factors (PF d, e and h) and three project activities (PA a, d and e), and that enhancement of professional language (theme 3) relates to at least four project factors (PF c, f, g and h) and five project activities (PA a, b, c, e and g).

This means the project factors and activities can be understood as interplaying and influential project factors and activities. As suggested by Bruner (2018), several components of a collaborative school improvement project "have to work together to make it effective" (p. 132).

When the project was finished, we (the authors) discussed what project factors were the most important for the outcomes. We agreed that the most important factors were to have a first and second line since it helped scale up the project, to have participants from different municipalities since participants could build professional relationships and learn from each other, and to have day conferences so that participants could spend time together, meet us and work together to bring about development in the region. Three implications for the area of educational change and those conducting school improvement projects on such matters as differentiated instruction and digital technologies is to have a first and second line, to have participants from different municipalities and to have day conferences.

We (the authors) also reflected on what projects activities were most important for the outcomes. We agreed that recaps at day conferences were important since experiences of what had taken place at preschools and schools in second line between day conferences were shared. During recaps, we could show our interest in what was happening at the preschools and schools, provide encouragement and collect data about second line activities. The participants could also ask each other questions and advise each other. In this way, knowledge and expertise that already exist in a region are taken advantage of. Lectures presented in a popular scientific manner and distributed to first line participants using PowerPoint presentations were also important. Through these, participants in first line were given an opportunity to grasp key concepts and results from research studies. They could also use these PowerPoint presentations when they described the content of day conferences to colleagues and conducted presentations about differentiation and digital technologies. Thus, in this project, second line activities did not depend on participants taking notes at day conferences. Like recaps, research circles were important since the results of research studies as well as circumstances in their preschools and schools were discussed. Finally, municipality meetings at the end of each day conference including planning of second line activities were crucial since first line participants from the same municipality could meet and reflect upon day conferences

and plan upcoming second line activities. Thus, the second line activities did not depend on participants making plans during their working hours at their preschools and schools. Two more implications for the area of educational change and those conducting school improvement projects on such matters as differentiated instruction and digital technologies is to implement recaps, research circles and municipality meetings and to have lectures presented in a popular scientific manner and distributed to first line participants using PowerPoint presentations.

What could have been done differently?

When the project was finished, we (the authors) also discussed what could have been done differently to make the project even more successful and effective. Two suggestions are the following: Firstly, to plan for some meetings between teachers in preschools and schools and between headteachers in preschool and school. This can promote collaboration between preschools and schools as well as continuity and progression in the development and learning of children. None of the outcomes explicitly refers to smooth educational transitions or improved transitions between preschools and schools. Secondly, to take part in some second line activities to meet and provide encouragement to second line participants. However, this would have required considerably more resources. In this project, the resources were sufficient for day conferences with first line participants. Therefore, the three lines model can be understood as cost-effective but not as an optimal model when an academia (e.g., university staff members) plans to have direct contact with all participants, both in first line and second line, and provide direct support and encouragement at a second line level. The first line and second line participants experienced setbacks and development challenges in second line, and they were not always successful. They came across hinders such as digital technology that did not work, and first line participants also came across second line participants (colleagues), who did not always value digital technologies.

Similarities with previous school improvement projects

In several ways, the outcomes of the project match the outcomes of previous projects about differentiated instruction and digital technologies in preschools and schools.

Both in this project and in the ifous project (Hylén, 2017), the outcomes were, for example, increased knowledge of technologies, a confirmation that teachers are doing a good job and increased collaboration between teachers.

Similarities between this project and the project conducted by Wetso (2014) were, for example, a facilitating of inclusive classrooms, and one similarity between this project and the project conducted by Forsling (2020) was usage of digital technologies in preschool.

The outcomes of the project also matched the outcomes of the Uno's Uno-project (Grönlund, 2014; Grönlund et al., 2014); the outcome was increased digital competence.

Project activities that seem to play a key role both in this project and in previous projects (Forsling, 2020; Hylén, 2017; Grönlund, 2014; Grönlund et al., 2014; Wetso, 2014) are: collegial conversations and learning; collaboration between local authority leaders, headteachers and teachers, and the implementation of digital technologies.

These similarities confirm our own reflections and illuminate features which should not be forgotten about when school improvement projects are being planned and implemented as well as evaluated.

These seem to be significant in projects, for example in projects about digital technologies and differentiated instruction.

The main contribution

The main contribution of this project and paper is an example of how a large-scale school improvement project about differentiated instruction and digital technologies can be implemented and produce several types of outcomes.

It is also the provision of a three lines model since a project can grow larger than intended. More research on the model is needed to better understand the usage and value of the model for different projects and contexts. That which works in this project and in Sweden may not work in other projects and countries.

At a time when all children are to be provided with meaningful and interesting teaching incorporating digital technologies (SNAE, 2018a, 2018b), and when teachers need Technological Pedagogical Content Knowledge (TPACK, Mishra & Koehler, 2006; Willermark, 2018), the paper has relevance for local authority leaders, headteachers and teachers in preschools and schools, both in Sweden and other countries. It also has relevance for researchers and others who plan to conduct school improvement projects.

In recent years, the interest in collaboration between academia and the surrounding society has increased in Sweden. One example is the national ULF project (Utveckling, Lärande, Forskning, in Swedish) which develops and tests project models. Another example is Mälardalen University's Kompetenscenter för Lärande [Mälardalen Skills Centre for Learning] and Samhällskontraktet [the Social Contract] which values and calls for school improvement projects and collaboration in the Mälardalen region.

This paper may form a basis for interesting discussions in the areas of school development, educational change, co-production and collaboration between academia and the surrounding society in which school improvement is aimed.

One limitation is that the reported outcomes of the project have not been confirmed using research observations. Part of the project was also conducted during a pandemic. Two additional limitations are that the sustainability of change was not investigated, and that the numerical analysis conducted was not deep. Mean and range were calculated.

Further research is needed on such matters as interplaying and influential project factors and activities, the three lines model and the sustainability of educational change in collaborations between academia and the surrounding society. Further research is also needed on the usage and value of self-rated knowledge and uses and skills in school improvement projects. It would, for example, be interesting to conduct a deeper and statistical analysis of the numerical data related to this project and paper as well as to provide a deeper discussion on the usage and value of self-ratings in this school improvement project.

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Conference presentation

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