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Guidelines for Supporting Teachers in Teaching Digital Literacy

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II Preface

This thesis is the result of a research I have conducted for Stichting Leerplan Ontwikkeling (SLO) in collaboration with schoolboard Consent. The research was part of the finalization of my master Educational Science and Technology and focused on defining guidelines for supporting teachers in teaching digital literacy.

This research was conducted between may 2016 and august 2017. During this period, I have received help from many people I am very grateful to. In this way, I want to thank these people. First, I would like to express my gratitude to Petra Fisser and Nienke Nieveen from SLO for their support and feedback and for providing the opportunity to conduct this research at SLO. I also want to thank Allard Strijker for providing me a lot of information about the subject. I have enjoyed performing this research in a real-life context while being part of the organization.

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I hope you enjoy reading this thesis!

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III Summary

A digital revolution caused an upswing of information and communication technology (ICT) and made digital literacy one of the key topics in future-oriented education. Digital literacy includes ICT basic skills, media awareness, information skills, and computational thinking. Large-scale implementation of teaching digital literacy is still not achieved. A platform named “Onderwijs2032” was established by the Dutch Ministry of Education, Culture and Science (Ministerie van OCW) to redesign the curriculum for more future-oriented education. Stichting Leerplan Ontwikkeling (SLO) contributes to this curriculum change and also wants to support teachers to effectuate changes at the classroom level. Therefore, the first part of this study aimed to describe to what extent digital literacy is addressed in primMary education, reveal possible barriers that withhold teachers from paying (more) attention to digital literacy, and identify teachers’ need for support in future implementation of digital literacy. Quantitative results from a sample of 244 primary school teachers showed that teachers from the age of 46 onward have significantly lower self-reported knowledge and skills of all aspects of digital literacy than younger teachers. Similar results were found for the teaching of these aspects, although the younger teachers also scored rather low on teaching computational thinking. Qualitative results showed that most teachers do not teach digital literacy, except for a limited number of occasional projects. The main barrier for the group of older teachers was their low knowledge and skills, and these teachers voiced a desire for face-to-face training. Younger teachers indicated that they needed such training only for computational thinking. In addition, both older and younger teachers wanted to engage in design activities, for example in teacher design teams (TDTs), and would appreciate an inspirational online platform. Other qualitative data showed that several prerequisites, such as sufficient time for ICT-coordinators and more learning materials, should be met in order for this support to be effective. Based on these findings, guidelines for supporting teachers were formulated. These guidelines were evaluated by teachers and curriculum experts in the second part of the study, which resulted in a set of final guidelines for the preparatory phase, face-to-face training, designing activities and the online platform. In future research, the guidelines can be evaluated on their effectiveness by designing and testing the forms of teacher support.

1. Introduction

1.1 Background

In the past few years, western society was part of a digital revolution which had great impact on many different areas, including education (van den Oetelaar, 2012). Learners are now used to being surrounded with new technology and have access to a network that connects them to anything or anyone on this planet. Especially because of the upswing of information and communication technology (ICT), this revolution had great impact on education. ICT is now seen as one of the key educational content topics for the 21st century and is crucial to participate effectively in society (Fraillon, Ainley, Schulz, Friedman, & Gebhardt, 2014). The digital revolution resulted in several gaps in the current curriculum (Prensky, 2001), which is no longer equipped to accommodate the changing needs of the new learners (Dede, 2005). Voogt and Odenthal (1997) already stated that the curriculum needs to be adapted to the 21st century, and this need still exists today. Recent research showed that, although youths are surrounded by a multitude of electronic devices and applications, only thirty percent of the students in secondary education is able to gather and process digital information without additional guidance (Meelissen, Punter, & Drent , 2013). This suggests that education is lagging behind in this digital revolution. The importance of ICT is growing, but large-scale implementation of teaching learners how to effectively use ICT is still not achieved (Thijs, Fisser, & van der Hoeven, 2014). Schools therefore have to reconsider what and how teachers prepare their learners for the 21st century. The curriculum needs to be adapted to modern society and teachers have to be supported in implementing this new curriculum (Izzo, Murray, Buck, Johnson, & Jimenez, 2015).

In order to help transform the current curriculum and become more future-oriented, a Dutch platform called "Onderwijs2032" was established by the Dutch Ministry of Education, Culture and Science (Ministerie van OCW). This platform calls for more future-oriented education and aims to develop a new curriculum for primary and secondary education that offers a solid base for schools to provide their students with more relevant and challenging educational content. The new and adjusted goals in this curriculum are labelled as "future-oriented education" (Onderwijs2032, 2016). These new goals should enable schools to provide education that better aligns with modern society and prepares learners for the future labor market, instead of teaching content of which some parts are outdated or irrelevant for the learners who will take part in the future society (Voogt & Roblin, 2010). The platform defined eight different domains which are labelled as: science, language and culture, inter-disciplinary skills, numeracy, language skills, digital literacy, citizenship and social studies. Digital literacy is the domain that includes ICT and is the focus of this study.

The urgency of implementing digital literacy is high. Redesigning the curriculum can stimulate the implementation process, but, to effectuate changes at the classroom level, teachers also need to be supported. Voogt and Roblin (2010) stated that teachers are the most important group to support when it comes to curriculum changes. The importance of supporting teachers was substantiated by Thijs et al. (2014), who stated that teachers do not consider themselves competent to teach digital literacy. This lack of proficiency relates to both content, and didactic knowledge and skills. In addition, Harris (2003) argued that the connection between school or organizational developments and actual changes in the classroom is 'slippery and unreliable', which again underscores the importance of supporting teachers.

The national institute for curriculum development (SLO) contributes to changing the

curriculum in the Netherlands. SLO provides support to curriculum development projects in the educational field, and also plays a role in identifying and evaluating currently used materials that match with future oriented education. Besides playing a role in changing the curriculum, SLO also intends to support teachers in future-oriented education in general, and digital literacy in particular. In the past, there have been several attempts to support teachers, but with regard to digital literacy little is known about the current situation and the needs and preferences of the teachers.

1.2 Goal of the study

According to Thijs et al. (2014), large scale implementation of digital literacy in primary education has not yet been achieved, even though it forms an important aspect of modern society. SLO has used various methods to provide schools and teachers with information that should support them in teaching digital literacy, such as videos and sample lessons. There is a presumption that teachers do not consider themselves competent to teach learners in this domain and struggle with implementing digital literacy in their weekly schedule, but scientific research on the actual existence and possible causes of this problem was never performed. Therefore, SLO wants to further explore the current situation regarding digital literacy in primary education and teachers' needs to support teachers more effectively in the future. The present study therefore aims at identifying the extent to which digital literacy is already present in primary education and also aims to determine teachers' need for support and provide guidelines to SLO about assisting teachers in the future. These needs can refer to the kind of information teachers want, but also address the form in which this information is best delivered. The guidelines should enable SLO and its partners to support teachers effectively in the future, which should eventually bring changes to the classroom level and support teachers in preparing their students for our modern society. Finally, this study aims to determine the conditions that need to be satisfied to make the teacher support effective and successful.

1.3 Organizational context

Because SLO wants to support teachers, this research largely depends on teachers' perceptions and needs. Therefore, a school board named "Stichting Consent" was approached for collaboration. This school board includes 33 primary schools with a total of approximately 600 teachers. The board aims to give digital literacy a more prominent place in education and seeks ways to support its teachers to achieve this. To accomplish this in the future, the school board has designated an ICT-management group that works on the ICT policy and a year plan. The collaboration between SLO and Consent ensures a fairly large group of teachers who can provide important data to this study.

1.4 Research question

The ultimate goal of this study was to identify evidence-informed guidelines for teacher support which can help teachers in teaching digital literacy. The general research question that guided this study is:

What are evidence-informed design guidelines for supporting teachers in implementing digital literacy in the classroom?

An ideal answer to this question is based on a carefully considered combination of the needs and initial situation of teachers and insights from theory. Sub questions that correspond to the general research question are:

(1) What is the initial situation of primary teachers regarding teaching digital literacy?
(2) What should be the substance of the teacher support?
(3) What are important conditions that must be satisfied to support teachers?
(4) What should be the form of this teacher support in order to stimulate professional development of teaching digital literacy?

2. Theoretical framework

2.1 What is digital literacy?

The education curriculum is facing major changes, mostly because of the digital revolution (Fraillon et al., 2014; van den Oetelaar, 2012). This digital revolution introduced a range of new concepts such as "ICT", "computer literacy", and “digital literacy” that all refer largely to the same kind of content. As the terms "computer literacy" and "ICT" can be associated with just computer skills, this project will use the term "digital literacy", which is more comprehensive and also used by SLO and the platform Onderwijs2032. Based on the definition of Fraillon et al. (2014), digital literacy is the degree to which an individual is able to use ICT to collect, create and share digital information at home, at school, at work and in society as a whole to participate effectively in society. Digital literacy can be divided into "collecting and managing information" and "producing and exchanging information". The former category involves ICT-use and understanding, accessing and evaluating information, and managing the gathered information. The category “producing and exchanging information” focuses more on using ICT to think, create and communicate as well as to share and use information safely.

The platform Onderwijs2032 defined digital literacy as the ability to work with the computer to gather, process and share information in a safe and conscious manner (Onderwijs2032, 2016). Consistent with the classification of Fraillon et al. (2014), the platform Onderwijs2032 divided digital literacy in four areas: "ICT basic skills", "information skills", "media awareness" and "computational thinking".

ICT basic skills denote the knowledge and skills needed to understand the operation of computers and networks to cope with different types of technologies and to understand the limitations of technology. Learners learn the names and functions of computer components, but also learn to work with multiple applications. The term computer refers not only to desktop computers or laptops, but also to smartphones, tablets and any other device in which a microprocessor is used. In order to successfully function in modern society, it is important that learners know the basic concepts of ICT and can effectively use technology.

Information skills refers to formulating and analysing information from sources and using a critical and systematic approach to search and use this information. This also involves determining if information is relevant and reliable. Because the internet infrastructure is improving rapidly, the amount of available information increases. Therefore, it becomes harder to distinguish reliable and unreliable information. It is important to teach learners to determine if information is correct or how to discover fake news.

The third aspect of digital literacy, media awareness, is the knowledge, skills and attitudes that people need to behave consciously, critically and actively in the mediated world. This implies activities like searching for a job or keeping in touch with friends by using social media, but also understanding the impact of media on society. It is important to make learners aware of the possibilities but also the threats that social media carries.

The fourth aspect of digital literacy, computational thinking, implies the skills that are essential to solve problems that require a lot of information, variables and computing. Therefore, it is important to be able to think in a stepwise fashion, understand algorithms but also to write a computer program. This can help learners in understanding the development of information to optimally make use of computer systems.

A first elaboration of these four aspects of digital literacy was materialized in a draft curriculum (Strijker, 2017). This document can be requested at the website of SLO since

February 2017. The document specifies the learning goals for every phase in primary education and seeks to provide structure for schools in implementing digital literacy. The document also provides sample activities for some of the goals, which could help teachers in implementing digital literacy. SLO is still working on this document and wants to add more examples of activities. This document could possibly be used in a support program for professional development of teachers because it clarifies and provides structure in the learning goals for students. The required conditions for this professionalization of teachers are explained below.

2.2 Conditions for professional development in digital literacy

Implementing new curricula and integrating new topics such as digital literacy in teachers' daily routine calls for professional development. Since the early 21st century, teacher quality improvement became a concern. Requirements for starting a teacher education program were increased and pre-service teachers nowadays have to take additional tests to demonstrate their proficiency and knowledge. The teacher education program is being reformed to be in line with modern society and 21st century skills, including digital literacy. However, these reforms do not reach in-service teachers, who are assumed to be the group most in need of support. According to Thijs et al. (2014), it is needed to support teachers in professional developing their knowledge, skills and attitudes about (teaching) digital literacy. However, effectively supporting teachers in professional development of teaching digital literacy requires that several conditions are met.

According to Deci and Ryan (2000), stimulating any kind of growth or development starts by guaranteeing the basic needs for competence, relatedness and autonomy. Competence can refer to domain specific knowledge and skills, as well as the ability to teach. Relatedness refers to being curious and motivated to the subject whereas autonomy implies ones freedom about what to learn and when to learn. Also, professional development should be voluntary and easy accessible. These conditions need to be considered when designing teacher support for digital literacy. Woo (2016) noted that so-called "personal barriers" may hinder the professional development of teachers' digital literacy skills. These personal barriers include confidence, technological and pedagogical knowledge and an individual's motivation and additional engagement. All these terms refer largely to the concern Thijs et al. (2014) mentioned: feeling and being competent to do something. Therefore, it can be assumed that the limited time devoted to teaching digital literacy can at least in part be explained by a lack of teachers' basic need of feeling and being competent, which is likely caused by personal barriers.

This assumption is closely related to the self-efficacy theory of Bandura (1977), which concerns a person's belief in his or her capacity and ability to accomplish a challenge. This theory is comparable with the theories addressed above and reflects a self-assessment of the ability to perform a certain task and the expectancy this act will lead to a positive outcome. According to Bandura (1977) self-efficacy can be developed in four different ways, which can be taken into account when designing a form of teacher support. Mastery experiences are the most effective way of increasing the feeling of self-efficacy and implies repetition of behaviour that gave success. This can only be achieved if teachers experiment with teaching digital literacy, which means that they have to be motivated to do it themselves or by doing it with someone else who already has the experience. It is important to make use

of best practices to inspire and motivate other teachers. The second way is through vicarious experiences, which are examples of the successful experiences of others and can also increase the sense of efficacy. These experiences can be shared in different ways, for example by watching a video of a colleague or physically attending a lesson of a colleague. Third, social persuasion can increase the feeling of self-efficacy. This implies being persuaded verbally by others and being told that you possess the capability to take the challenge. This can be achieved for example by linking colleagues in experimenting with new activities and let them affirm each other's successful experiences. The final way of increasing self-efficacy is by reducing one's stress reactions, which has to do with physical and psychological aspects such as someone's feeling when performing an activity. This can affect the judgments of personal efficacy. Reducing stress reactions can be achieved when working on the other three aspects. When working on one or more of these aspects, the feeling of self-efficacy can be improved. This is important, because low self-efficacy can negatively affect a teachers' motivation and increase anxiety to try new things (Deci & Ryan, 2000). Negative self-assessments on self-efficacy can also indicate that professional development is needed to increase the basic need of feeling and being competent to perform a job-related task.

Together these theories point to several conditions for effectively supporting teachers. The first two conditions can be summarized as: guaranteeing basic needs of competence, relatedness and autonomy (Deci & Ryan, 2000) and minimizing personal barriers (Woo, 2016). This indicates that teachers need to be supported in their knowledge, skills and attitude about digital literacy, to increase their competence and relatedness. This should be done with carefully balanced autonomy of the teachers. To minimize personal barriers, the same support in knowledge, skills and attitudes is needed to help teachers feel confident and safe. Guaranteeing teachers' competence can increase their confidence and even motivation and engagement to try new things (Woo, 2016). These conditions are strongly related to the self-efficacy theory of Bandura (1977), which forms the third condition. Improving self-efficacy can be done in four practical ways. These can be used as examples in supporting teachers. All these conditions can help in establishing a clear view of the initial situation and provide explanation and better understanding of this situation. Also, checking these conditions in the current situation can shed light on what needs to be improved in future teacher support and which forms of support can be effective in the current situation. Supporting teachers in professional development can be done in multiple ways. A selection of valuable possibilities that meet these conditions is explained in the next paragraph.

2.3 Professional development in digital literacy

The conditions for professional development proposed by Deci and Ryan (2000), Woo (2016) and Bandura (1977) may be imposed on professional development of teachers in digital literacy. If these conditions are satisfied, professional development can be stimulated in multiple ways. Some potentially fruitful forms of professional development for teaching digital literacy that meet several of the addressed conditions are explained below.

Peer-teachers

Adding to the self-efficacy theory, Glazer and Hannafin (2006) noted that stimulating competency and hence professional development can be effectuated by using peer-teachers who serve as models and coaches. This was explained with the apprenticeship model which

shows how peer-teachers contribute to the development of their colleagues and how these colleagues can become future mentors to stimulate more professional development amongst teachers. Collaborative apprenticeship is designed to support teachers in implementing new teaching skills and strategies through four development phases which are visualized in Figure 2.1.

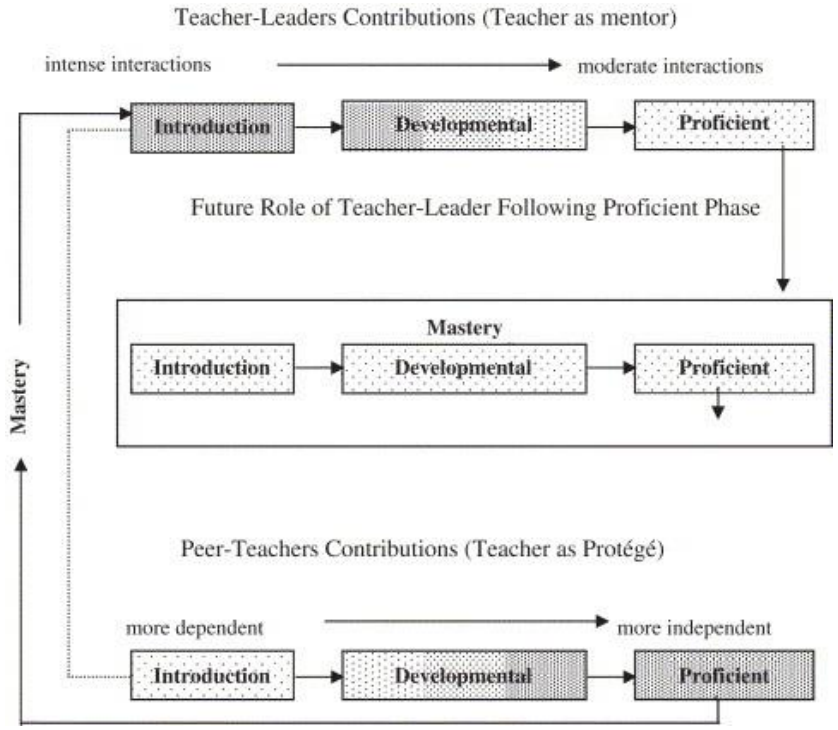

Figure 2.1 Apprenticeship model

The figure shows that this cycle starts with an introduction phase. This phase is primarily driven by a teacher-leader who is motivated and qualified to mentor peers and can share a successful experience in a meeting or workshop. This teacher-leader should be a "living example" who is willing to model successes with others (Feiman-Nemser, 2001). The main goal of the introduction phase is to motivate peer-teachers and reflect on an activity modelled by the teacher-leader. The peer-teachers analyse how this learning experience can be applied to their own classroom practices and present this modelled lesson to other teachers.

After introducing and sharing successful experiences by the teacher-leader, the teacher-leader plans informal meetings with the peer-teachers in the developmental phase. In this phase, the teachers design an activity that should eventually be used by all teachers. This phase is no longer led by a teacher-leader, who now serves as a co-teacher, encourages the peers, and monitors their progress (Swan, Holmes, Vargas, & Jennings, 2002). Peer-teachers can share ideas and support each other's learning while working on shared goals. After designing, the peer-teachers have some time to execute the designed activity and a follow-up appointment is planned. In this follow-up meeting, the peer-teachers can reflect on their experiences and discuss the designed activity in order to refine it.

The third phase is the proficient phase. In this phase, the peer-teachers continue

designing activities. The peer-teachers now have more autonomy and the teacher-leader only provides suggestions and advice. It is important that teacher keep sharing their ideas and successes and try new materials or teaching strategies. They should be less anxious to do this because repeatedly sharing successes and working on shared goals is making them more confident. The proficient phase of the apprenticeship model is comparable with the method that a Teacher Design Team (TDT) uses. According to Handelzalts (2009), a TDT is defined as ‘a group of at least two teachers, from the same or related subjects, working together on a regular basis, with the goal to (re)design and enact (a part of) their common curriculum’. TDT’s can contribute to a smooth implementation process of educational renewals. Harris (2003) stated that a TDT helps teachers to make the connection between their intention to teach and their actual teaching. According to Voogt and Agyei (2012), TDT's can stimulate teachers’ confidence in designing lessons and can even improve teaching performance.

The final phase in the apprenticeship model is the mastery phase. In this phase, the peer-teachers become the future teacher-leaders and restart the cycle based on their newly gained experiences. The peer-teachers share their successful experiences with their colleagues and support them in implementing new activities in their classroom. These teachers can be considered as the third-generation peers who will process the same phases as the previous peer-teachers who are now considered as teacher-leaders. After working with the apprenticeship model for a long period, teachers form a solid community and will be involved in a network of multiple collaborative apprenticeships. This allows teachers to keep sharing successful experiences and take responsibility for each other's overall learning and development in different ways.

When comparing the discussed conditions for professional development, using peer-teachers can be of great value, although using peer-teachers is a very structured way of support which allows less autonomy. Peer-teachers can play a major role in influencing teachers’ thinking about technology (Ertmer, 2005). Also, using peer-teachers can promote the professionalization process, because these peer-teachers have positive relationships with other teachers whereby teachers feel safer in exploring a new domain (Woo, 2016). This can help in guaranteeing teachers' relatedness and breaking personal barriers. Corresponding to the condition about guaranteeing competence, Woo (2016) stated that special roles such as mentors, coaches and peer-teachers can support the implementation of new knowledge and skills for teachers. According to Starkey (2010), these relationships can positively affect the support that teachers receive and lead to better integration of a new domain. However, teachers do need a solid basis of domain specific knowledge to participate in peer-teaching. Corresponding with improving self-efficacy, peer-teachers can give colleagues mastery experiences, vicarious experiences and social persuasion when, for example, teaching together and evaluating lessons with colleagues or sharing successful experiences. This can eventually reduce stress reactions and allow teachers to try it themselves with less guidance. These findings show that using peer-teachers meets the previously addressed conditions and can therefore play an important role in determining guidelines for effective teacher support.

Co-teaching

Another way of professionalization, which is somewhat comparable to peer-teaching, is co-teaching. This involves having a regular group teacher and a co-teacher in one classroom. The co-teacher can be considered as the professional in this particular domain (Bacharach,

Washut Heck, & Dahlberg, 2008). The professional provides the other teacher with renewed passion for teaching and professional development as an educator in this particular domain. A hands-on approach is used, in which the teachers design activities together with the co-teacher. After designing and discussing an activity, the co-teacher teaches a class together with the group teacher in which the teachers alternate between assisting and leading. According to Bacharach et al. (2008) co-teaching can support teachers in developing domain specific knowledge and didactical skills, but requires a solid base of knowledge and skills in advance, in order to be successful. It is also important to pay attention to how co-teaching should be implemented and to provide enough co-planning time for preparation of activities (Magiera, Smith, Zigmond, & Gebauer, 2005). Contrary to the apprenticeship model, co-teaching is a temporary support structure and not an ongoing cycle that strives for training new professionals to take over this process in the future. This makes co-teaching easier to implement, but less suitable for long-term use and continuous learning.

When comparing the use of co-teachers with the conditions for a successful teacher support, it can be concluded that co-teaching generally meets the same conditions as peer-teaching. Teachers design and perform activities with a professional in their own classroom, which can increase relatedness and teaching competence. Because the teacher and co-teacher alternate between assisting and leading and no strict cycle has to be followed, autonomy of the teacher is guaranteed. When comparing co-teaching with the ways of improving self-efficacy, it can be assumed that co-teaching is likely to include them. Mastery experiences could be obtained by successfully performing an activity in the classroom, vicarious experiences could be obtained when observing the co-teacher who can also verbally persuade the group teacher to increase social persuasion, and finally, stress reactions can be reduced because co-teaching is performed in a safe environment. Nevertheless, the downside of co-teaching is that its effectiveness partially depends on the domain specific knowledge of the group teacher (Bacharach et al., 2008).

Online professionalization

Online professionalization or e-learning is another promising way of professionalization. Online professionalization can take many forms, some of which may be appropriate for supporting teachers in digital literacy. In contrast with the previously addressed support forms, online professionalization focuses more on domain specific knowledge and less on competence to teach. As described before, teachers allegedly consider themselves insufficiently competent to teach digital literacy. It can be assumed that this feeling of incompetency is influenced by a lack of topical knowledge.

Online professionalization can be an effective way of improving teachers' subject-matter expertise. There are many different ways of online professionalization. A structured method of online professionalization which is rapidly rising in popularity are so-called Massive Open Online Courses (MOOCs). MOOCs can be considered as easy accessible online courses that guide a user step-by-step towards a goal. People can follow MOOCs at any time and at any place (Kizilcec, Piech, & Schneider, 2013). MOOCs are created by experts in the field and can yield more knowledge to users, whether the goal is supporting a career or exploring personal interests. MOOCs are often structured with different activities spread over multiple weeks and conclude with a peer-reviewed assignment. If online professionalization fits teachers' needs, these MOOCs can, for example, be designed for frequent issues in the actual situation of digital literacy in primary education. MOOCs hold great promise for improving the domain specific knowledge of teachers about digital literacy.

In addition to supporting teachers in expanding their domain specific knowledge, Laurillard (2016) showed that MOOCs can offer the opportunity to build an active community and let teachers learn from each other. This community can link supply and demand. If the MOOC includes and refers to the possibility for interaction with other participants, for example through a forum, teachers can support and learn from each other. This MOOC used by Laurillard (2016) also referred to off-platform tools for sharing resources and ideas, which carried great opportunities for supporting teachers in developing in digital literacy.

When reflecting on the prescribed conditions, online professionalization can satisfy multiple requirements of successful teacher support. Online professionalization is particularly suitable for improving a learner's knowledge. Learners are supported in expanding their domain specific knowledge and can work autonomously, at any place and any time. When improving technological and pedagogical content knowledge, for example in an easy accessible MOOC, personal barriers can also be reduced. Online professionalization can provide a solid basis of domain specific knowledge, before starting with support aimed at teaching digital literacy. When looking at ways of improving self-efficacy, online professionalization can stimulate social persuasion, for example by providing feedback on tasks or stimulating colleagues on an online platform. Also, vicarious experiences can be shared at an online platform and some practitioners feel safer in this online learning-environment (Knoch, Read, & von Randow, 2007) which can reduce stress reactions. The downside of online professionalization is that it is less suitable for use in the classroom and hence does not stimulate mastery experiences in teaching digital literacy. Therefore, online professionalization is most suitable for teachers that need to boost their domain specific knowledge before implementing it in their classroom. However, an online inspirational platform could be integrated in all stages of an implementation process.

Face-to-face training

Another way of professional development for teachers, which has been used in the past for teachers' professional development, is face-to-face training. This implies face-to-face learning from a professional who gives clarification, explanation and exercises and tries to transfer knowledge to a small group of teachers. In the past, face-to-face professionalization was often used for many innovations in education such as the use of interactive whiteboards or a digital student tracking system. This was mostly done by inviting an external professional who combined a presentation of the possibilities with some practical exercises. Comparable to online professionalization, face-to-face training also focuses mostly on improving domain specific knowledge. Traditional face-to-face training has been criticized in the past because it can lead to passive learning and does often not pay attention to critical thinking or individual differences. Face-to-face professionalization does however provide possibilities for solving complex tasks, because questions can be asked directly to the professional to get individual feedback (Johnson, Aragon, Shaik, & Palma-Rivas, 2000). However, preference for face-to-face professionalization is also highly dependent on personality factors (Knoch et al., 2007). Therefore, the effectiveness of face-to-face training depends highly on teachers' preferences.

Some important conditions for successful professional development can be satisfied in face-to-face training. Because face-to-face training has great possibilities for improving domain specific knowledge and teachers' competence, personal barriers and uncertainties about a teacher's knowledge can be minimized. Also, vicarious experiences can be used as an example in face-to-face training which can inspire or motivate teachers to improve themselves. The professional providing the training could also have a great impact on the

learners' attitude and relatedness. However, face to face training provides less possibilities for supporting teachers in practice and provides minimal autonomy because the training is often led by a professional. This indicates that face-to-face training can be effective in the initial phase of an implementation process in which teachers need to build a solid basis of domain specific knowledge and skills and solve uncertainties.

Summary

Based on the elaboration above of valuable forms of professional development, it can be stated that every form holds promise for professional development in teaching digital literacy but also has its disadvantages. Table 2.1 provides a summary of the forms of professional development in relation with the described conditions.

Table 2.1 Forms of professional development versus the conditions

		Guaranteeing basic needs					Minimize personal barriers			Stimulate self-efficacy			
Form of professional development ↓	**Conditions** →	Relatedness	Competence	Autonomy	Voluntary	Easy accessible	Confidence	Technological and pedagogical knowledge	Motivation and engagement	Mastery experiences	Vicarious experiences	Social persuasion	Reduce stress reactions
Peer-teachers		+	+	+	-	+	+	+	+	+	+	+	+
Co-teaching		+	+	+	-	+	+	+	+	+	+	+	+
Online professionalization		+	+	+	+	+	+	+	+	-	+	-	-
Face-to-face training		+	+	-	-	+	+	+	-	-	+	+	-

Using peer-teachers in the professionalization process is quite rigorous and is expected to require considerable time investment to be successful, but carries great possibilities in practicing directly on the work floor. Because professionals are used to this form of professional development and a structured cycle is used, domain specific knowledge can be obtained by the learner to a certain extent. However, peer-teaching does not imply a domain-specific training, which means teachers do need a solid basis of knowledge and skills. If educational organizations are willing to make a great investment, working with peer-teachers in the apprenticeship model could be an effective form of teacher support.

A less rigorous form of support which is also expected to be easier to implement, is using co-teachers. Co-teaching does not involve an extensive and structured cycle of continuous learning but uses a hands-on approach to quickly train teachers. Co-teaching could therefore be an effective support form to start the implementation process of digital

literacy. However, this hands-on approach also needs a solid base of domain specific knowledge of the teachers. Co-teaching is most suitable if a quick and easy solution is needed and teachers have most required knowledge and skills.

Third, online professionalization carries great possibilities when the domain specific knowledge of teachers is insufficient to start teaching, but does not provide many opportunities for training in the workplace. To link online professionalization to classroom practice, an online platform could be used to motivate and inspire teachers. This support form is non-committal and requires a curious attitude of teachers. It is most suitable if teachers need to be supported in their knowledge specific concepts and if inspiring ideas will trigger further implementation on the work floor.

The final discussed form of professional development is face-to-face training, which is also mostly geared toward transferring knowledge and solving problems. Face-to-face training is more obligatory than online professionalization, which takes away the risk of teachers not participating. Support in teaching digital literacy in the classroom is not greatly facilitated in this support form. Therefore, face-to-face training can be most effective in a preparatory phase in which teachers' knowledge and skills are the main concern.

3. Study 1: Research methodology

3.1 Research design

This exploratory study involves a needs assessment and is descriptive in nature. The study consisted roughly of two parts. The overall goal of the study was to determine evidence-informed guidelines for supporting teachers in teaching digital literacy. Before being able to define these guidelines, more insight in the current situation was needed. Therefore, the first part of the study involved a survey and focus group interviews that aimed to explore the current situation about teaching digital literacy and identify teachers' domain specific knowledge and needs for support. Based on this information, draft guidelines were formulated, which were evaluated in the study reported in chapters 6 and 7.

3.2 Respondents

In the first part of the study, all teachers employed by the school board Consent were invited to participate. This school board consists of 33 primary schools with approximately 600 teachers in total. Teachers from all grades were invited to participate because digital literacy is something that can be worked on with learners in all primary grades. Inviting all teachers also increased the chance of a high response rate. Another way to increase the response rate was involving the chairman of the school board. He contacted all teachers to emphasize the importance of the study. Teachers could participate by filling in a survey. The final number of usable respondents was 244 (*N* = 244). This was after removing partially completed responds and respondents who were no teachers. Table 3.2 presents the distribution of the respondents over different age categories. Because the youngest group included only eight teachers, it was subsumed under the 25-35-year category in some analyses.

Table 3.2 Age categories

	Frequency	Percent
< 25 years	8	3.3
25-35 years	60	24.6
36-45 years	71	29.1
46-55 years	38	15.6
56-65 years	67	27.5
Total	244	100.0

Table 3.3 shows that the respondents were equally distributed across grade levels, even though "Other" has a slight majority. This category includes people who, for example, teach multiple grades or have additional tasks besides teaching. This distribution guarantees a complete picture of the current population, because all groups include a representative number of respondents.

Table 3.3 Grade categories

	Frequency	Percent
Other	76	31.1
Group 1-2	50	20.5
Group 3-5	54	22.1
Group 6-8	64	26.2
Total	244	100.0

Of all respondents described above, the individual responses to the survey items were used to select teachers with either low or high self-assessed scores (i.e., extreme case sampling) for participation in a focus group interview. This sampling method could provide the most information in the available time. In order to be invited for one of the samples, participants needed mean scores of higher than 4.00 or lower than 2.50 in the majority of the categories of the survey (scoring is explained in the next section). After inviting teachers that meet these criteria, 11 focus groups could be formed. In total, 36 teachers participated, of which 27 women and 9 men. From these 11 groups, 5 were from the sample with high scores and 6 groups were from the sample with low scores. Every group included a minimum of three and a maximum of six teachers.

3.3 Instrumentation

Survey

An online survey aimed to measure teachers' feeling of self-efficacy about teaching digital literacy, their perceived knowledge of digital literacy, and their perceived competence in teaching digital literacy. The survey also inquired after the teachers' need for support.

The part of the survey that measures domain specific knowledge was inspired by a "21st century skills quick scan" that was used by SLO to measure the extent to which teachers pay attention to 21st century skills in their classroom (Quickscan, 2015). This quick scan was combined with the learning goals of SLO for digital literacy, which learners should master at the end of primary education. These final goals can be considered as the minimum goals that apply to teachers. Self-assessed domain-specific knowledge of every aspect of digital literacy was measured with 18 items, grouped under the categories of digital literacy which are: "ICT basic skills", "Information skills", "Media awareness" and "Computational thinking". An example of an item for the ICT basic skills category is: "I can effectively use office applications such as Word, PowerPoint, Excel and Outlook". Respondents could answer all questions on a five-point Likert scale.

The second part of the survey was adapted from the "STEBI-NL" survey of science teaching efficacy (Velthuis, 2014), which is a revised and translated version of the original self-efficacy instrument of Bandura (1977). It consists of two categories, namely the self-assessment of teaching competence and the teaching outcome expectancy. The questions from the teaching competence category about science teaching were reformulated to digital literacy teaching. A total of 12 reformulated items were created, which were validated by experts from SLO and Velthuis herself. All questions could be answered on a five-point scale ranging from "totally disagree" to "totally agree". Respondents could also choose "not applicable" if an item was irrelevant to their teaching practice. Previous research from

Velthuis (2014) has shown that adding this option reduces bias in the scores of self-efficacy. The outcome expectancy category was not used because the research from Velthuis (2014) showed that this category was unreliable. Also, teaching competence is a more important category in the current stadium where teaching digital literacy is an obstacle or even omitted. Mapping the outcome expectancy is more meaningful when large-scale implementation has already started. In relation with the teaching competence questions, four items were added that asked teachers to rate themselves in teaching every aspect of digital literacy.

In the final part of the survey, teachers could indicate their need for support. This final part of the survey consisted of four items, one for each aspect of digital literacy. The answering possibilities were inspired by previously used support forms by SLO or the school board and forms of professional development from the theoretical framework described in chapter 2. This resulted in six answering possibilities (website with sample activities, exchange ideas with colleagues and design activities together, teaching resources and methods, face-to-face training, co-teaching with professional, no support needed) to which respondents could give multiple answers. Also, respondents could add a different support form which was not in the answering possibilities. The complete survey can be found in Appendix A.

Focus group interviews

The focus groups were inspired by the structure provided by Krueger (2012), which includes clear steps for conducting a focus group interview. Based on this structure, a framework was created which can be found in Appendix B. This framework semi-structured the interviews based on the research (sub-)questions. Additional information was collected about teachers' self-assessed knowledge and skills, their pedagogical and technological knowledge (Woo, 2016) and teachers' feeling about teaching digital literacy and their relatedness (Deci & Ryan, 2000). The main goal of the focus group interview was to collect additional information about the outcomes of the survey and gain more insights in teachers' needs. Also, a brainstorm session was held to further explore possible forms of support. The brainstorming session intended to gather more specific information about the preferred support and its content. This brainstorming session also intended to determine the division between didactical and domain specific content in the teacher support.

3.4 Procedure

At the beginning of a seminar for educational ICT professionals of the cooperating school board, the study purpose and importance were explained by the researcher and the chairman of the school board. This was done to trigger the ICT professionals to spread the importance of participation amongst teachers in their schools, before possible respondents would receive the invitation from the chairman. Approximately 600 teachers from the school board received a study description with an invitation to complete the online survey within two weeks. To increase the response rate, a reminder was sent after one week. After analysing the outcomes of the survey, extreme case sampling was used to select teachers for a focus group interview in which they could share their perspective and elaborate more on the topic and their needs. To stimulate discussion, outcomes of the survey were shown to the teachers in a PowerPoint presentation. This discussion provided a starting point for a brainstorm about the preferred support. To gather more insight into the current situation,

teachers were also asked to which extent digital literacy is already addressed in their classes. After collecting additional data about teachers' self-assessed scores and discussing what is already happening in the classrooms, the focus group interviews ended with elaborating on teachers' need for support and looking at the most chosen support forms from the survey. These support forms were also visualized in the PowerPoint presentation. Teachers were asked if they would like to add a different support form for any of the categories of digital literacy, after which they were asked to prioritize these most chosen support forms to create a top three. After composing a top three, every focus group interview ended with a brainstorm session about the preferred support form to obtain more specific information about the desired support form. All interviews were audio-taped and most important information was documented in a summary of every interview separately.

4. Study 1: Results

4.1 Results from the survey

Quantitative data derived from the survey was statistically analysed in SPSS. First, scales had to be created and tested for reliability. As shown in Table 4.4, the Cronbach's alpha reliability estimates of all scales were high, meaning that the constituent items form a coherent scale. Therefore, The scales "ICT basic skills", "Media awareness", "Information skills", and "Computational thinking" for the part that measured self-assessed knowledge and skills could be retained. Also, the scale "Teaching competence" from self-efficacy could be retained. Finally, mean scores of the four questions about teaching every aspect of digital literacy separately were computed and labelled as "Teaching ICT", "Teaching media awareness", "Teaching information skills" and "Teaching computational thinking". Table 4.4 also shows that both Kolmogorov-Smirnov and Shapiro-Wilk normality were significant, which indicates that none of the scales were normally distributed. Therefore, further analysis of all aspects was conducted with non-parametric tests. Because all variables about teaching, except teaching competence, were measured by a single item, normality was not tested for these variables.

Table 4.4 Normality Tests and Reliability Estimates

	Kolmogorov-Smirnov		Shapiro-Wilk		Chronbach's Alpha
	Statistic	p	Statistic	p	Statistic
ICT basic skills	.105	.000	.951	.000	.88
Media awareness	.125	.000	.918	.000	.84
Information skills	.150	.000	.924	.000	.92
Computational thinking	.071	.008	.967	.000	.91
Teaching competence	.087	.000	.968	.000	.93

Self-assessed knowledge and skills

To get answers to the first sub question, mean scores for self-assessed knowledge and skills were computed and compared with multiple ordinal values to discover possible factors that affect teachers' self-assessed knowledge and skills. From these comparisons, mean plots were created. From all mean plots, the ordinal value "age category" seemed to have the most influence on all categories of the survey. Table 4.5 shows the standard deviations and mean scores of teachers' self-assessed knowledge and skills for digital literacy of all age categories. This table shows that mean scores vary across age groups. The largest differences were found between the youngest and the oldest group. Computational Thinking had the lowest scores and the highest standard deviations. This finding was further investigated in the focus group interviews. Also, standard deviations increased with age,

indicating that there is more variety in scores in the higher age categories than in the lowest age category.

Table 4.5 Mean Scores and Standard Deviations Self-Assessed Knowledge and Skills

	25-35 [1] years		36-45 years		46-55 years		56-65 years	
	M	SD	M	SD	M	SD	M	SD
ICT basic skills	4.30	0.32	3.98	0.73	3.59	0.82	3.58	0.75
Media awareness	4.46	0.16	4.19	0.77	3.93	0.77	3.72	0.77
Information skills	4.42	0.55	4.25	0.62	3.87	0.84	3.72	.77
Computational thinking	3.43	0.74	2.83	1.01	2.36	1.08	2.11	0.95

1 This category includes the eight teachers who were younger than 25 years

A non-parametric Spearman's rho test showed significant negative correlations between age categories and ICT basic skills (ρ = -.44), Media awareness (ρ = -.41), Information skills (ρ = -.40) and Computational thinking (ρ = -.50), which indicates that younger teachers had higher scores, and hence, were more positive about their knowledge and skills than older teachers.

To further analyse the significance of these relationships between age groups, a multiple comparisons Games-Howell test showed significant differences between multiple age groups for all aspects of digital literacy. Although the significance of the differences between age categories slightly differed for the four aspects of digital literacy, highest significant mean differences were found between the 25-35-year group and the two oldest age groups. These results are shown in Table 4.6 below. This means that the mean scores of teachers up to 35 years old are significantly higher than the mean scores of teachers from 46 up to 65 years old in all aspects of digital literacy. The group of teachers with an age between 36 and 45 was located in between the extremes. This group had significantly different scores with the younger group and the oldest group, which indicates that scores of teachers in this group are comparable to average. From these findings between age groups, the extreme clusters (up to 35 years and 46 to 65 years) were created for choosing respondents for the focus group interviews. As mentioned, the 36-45 years category was considered as the average group and was therefore not used in the extreme case sampling.

Table 4.6 Mean differences between groups and significance

	Age category (I)	Age category (J)	Difference (I-J)	p
ICT basic skills	25-35 [1] years	36-45 years	0.35*	.007
		46-55 years	0.73*	.000
		56-65 years	0.74*	.000
Media awareness	25-35 [1] years	36-45 years	0.30*	.027
		46-55 years	0.57*	.001
		56-65 years	0.79*	.000
Information skills	25-35 [1] years	36-45 years	0.19*	.210
		46-55 years	0.57*	.002
		56-65 years	0.79*	.000
Computational thinking	25-35 [1] years	36-45 years	0.60*	.001
		46-55 years	1.07*	.000
		56-65 years	1.32*	.000

1 This category includes the eight teachers who were younger than 25 years

Teaching digital literacy

Teachers' feeling about teaching digital literacy was also investigated along with their self-assessed scores about teaching every aspect of digital literacy, using a similar procedure. For teaching digital literacy, age also seemed to be an important factor. Table 4.7 shows the standard deviations and mean scores of the questions that asked teachers to rate their capability to effectively teach this category of digital literacy. The table also provides the standard deviations and mean scores of "Teaching Competence", which indicates teachers' overall feeling about teaching digital literacy and is part of the previously discussed self-efficacy. Teaching computational thinking had rather low scores. Teaching ICT, teaching media awareness and teaching information skills had higher scores. Teaching competence scores were lower than the scores on the three more positively assessed aspects, which could be influenced by teaching computational thinking. This was further investigated in the focus group interviews. Mean scores again decreased with age whereas the standard deviations often increased, indicating that there is more variety in the responses of older teachers.

Table 4.7 Mean Scores and Standard Deviations Teaching Digital Literacy

	25-35 [1] years		36-45 years		46-55 years		56-65 years	
	M	SD	M	SD	M	SD	M	SD
Teaching ICT	3.92	0.85	3.61	0.98	3.03	1.15	2.91	1.11
Teaching Media Awareness	4.00	0.78	3.75	0.97	3.08	1.19	2.99	1.17
Teaching Information skills	4.05	0.75	3.85	0.87	3.13	1.17	2.87	1.15
Teaching CT	2.57	0.98	2.11	1.13	1.68	1.07	1.54	0.84
Teaching Competence	3.78	0.85	2.83	1.31	2.59	1.38	2.29	1.37

1 This category includes the eight teachers who were younger than 25 years

To test whether these relationships with age were significant, a Spearman's rho test was performed. This test showed that teaching (ρ = -.42), teaching Information Skills (ρ = -.40), teaching Media Awareness (ρ = -.35), teaching Computational Thinking (ρ = -.42) and teaching competences of digital literacy in general (ρ = -.40) had a significant negative relationship with age. This indicates that teachers in higher age categories have more difficulties with teaching any aspect of digital literacy than teachers in younger age categories.

In further analysis of these relationships, a Games-Howell test showed significant differences between multiple age groups which are comparable to the significant differences in self-assessed knowledge and skills. These results are shown in Table 4.8. Again, the youngest group had the highest significant differences in mean scores with the two oldest groups on all aspects of teaching digital literacy and is therefore considered as the most competent group. The other two mentioned groups can be considered as the less competent group when it comes to teaching digital literacy. The group of 36-45 year again had much smaller differences, indicating that for teaching digital literacy this group can be also considered as the average group. These results strengthen the created clusters of up to 35 years and 45 to 65 years.

Table 4.8 Mean differences between groups and significance

	Age category (I)	Age category (J)	Difference (I-J)	p
Teaching ICT	25-35 [1] years	36-45 years	0.32	.170
		46-55 years	0.90*	.000
		56-65 years	1.02*	.000
Teaching media awareness	25-35 [1] years	36-45 years	0.22	.441
		46-55 years	0.89*	.001
		56-65 years	0.99*	.000

Teaching information skills	25-35 [1] years	36-45 years	0.14	.744
		46-55 years	0.85*	.001
		56-65 years	0.72*	.000
Teaching CT	25-35 [1] years	36-45 years	0.48*	.041
		46-55 years	0.90*	.000
		56-65 years	1.05*	.000
Teaching competence	25-35 [1] years	36-45 years	0.86*	.000
		46-55 years	1.11*	.000
		56-65 years	1.41*	.000

1 This category includes the eight teachers who were younger than 25 years

Teachers' needs

To collect answers to the fourth sub question, the preferred support forms were analysed. Table 4.9 shows the support forms for every aspect of digital literacy with the ranked percentages of respondents who chose this support form. Respondents could select multiple answers. The preferred support was the same for ICT basic skills, information skills and media awareness. For computational thinking, the preferred support was different. Also, there was a more equal distribution of the preferred support and the number of respondents indicating that they don't need support was much smaller for computational thinking. In the "other" category, no frequently mentioned support forms were discovered. These results will be further analysed in the focus group interviews to discover possible different preferences in the extreme samples and to brainstorm about the most preferred support.

Table 4.9 Percentages preferred support forms

	ICT basis skills	Information skills	Media awareness	Computational thinking
Website with sample activities	39.6%	36.3%	35.1%	29.4%
Exchange ideas with colleagues and design activities together	31.0%	32.2%	33.4%	27.8%
Teaching resources and methods	25.3%	26.1%	24.1%	24.9%
Face-to-face training	20.4%	20.0%	18.4%	37.1%
Online training	21.6%	18.0%	16.3%	26.5%
Co-teaching with professional	17.1%	17.1%	15.9%	23.3%
No support needed	20.8%	18.0%	20.8%	10.6%

4.2 Results of the focus group interviews

Results of the focus group interviews were analysed to collect additional answers to all sub questions and also to get a first idea of the design guidelines for the teacher support. Analysis of the survey showed that young teachers had higher self-assessed scores on knowledge and skills, and teaching digital literacy when compared to the two oldest groups. These age categories were used as a basis for extreme case sampling for the interviews. As described in the respondents section, participants with an age below 35 and mean scores higher than 4.00 in the majority of categories in the survey, and participants with an age above 46 and mean scores below 2.50 in the majority of categories were included in the extreme case samples.

Quantitative data derived from the focus groups was analysed using a deductive approach. All information that fitted within the framework was summarized and grouped under the different questions in the framework. This was done for every focus-group interview separately. Because teachers in the extreme samples were already selected based on their comparable scores, all summaries were analysed for more similarities in these samples. This also stimulated creating a clear image of both groups. The results of these

samples will be presented separately, starting with the extremely positive sample. For both groups, important additions to the results of the survey concerning self-assessed knowledge and skills will be presented, followed by elaboration about their feeling about teaching digital literacy, a description of what is already happening in primary education, and elaboration on teachers' need for support and suitable support forms.

Focus group interviews with teachers with high scores

The group of teachers with a maximum age of 35 indicated that they grew up with digital literacy and, therefore, reflected positively on their own knowledge and skills. However, several teachers in this sample indicated that they do not consider themselves competent in computational thinking. The explanation was that the upswing of computational thinking has happened in the last few years so that it was not part of their education or their personal life and also hardly present in primary education. It was often described by participants as an additional aspect with a higher difficulty, most suitable for learners that need additional challenge. Participants mentioned that "thinking like a computer can only be accomplished when someone possesses the basic skills". However, these teachers indicated that they are curious about computational thinking and are motivated to improve their knowledge and skills.

When talking about teaching digital literacy, this group was somewhat less positive. Most respondents indicated that, apart from computational thinking, they consider themselves competent to teach digital literacy but do not know how to do this. Teachers indicated that it is unclear how these activities should be structured, what the learning goals of different aspects of digital literacy are or how they can integrate digital literacy in their weekly schedule. They also mentioned that they do not know how to accomplish continuous learning throughout all grades in primary education and often end up with activities that have no alignment with activities in other grades. This group of teachers often experimented with teaching digital literacy, even though there was no alignment with other grades or the learning goals were not clear. Activities that were mentioned by most teachers were either projects that lasted for several weeks before completely disappearing or activities that were performed with only a small group of learners. Also, almost every mentioned example was only performed with learners in the higher grades. For example, many schools ran a project called "Media Masters" which focused on using the internet and social media safely. After one activity for five days, this project completely vanished on many schools. Also, only grade 7 and 8 were involved in this project. This example symbolizes many of the activities that were mentioned by the teachers. However, in two interviews teachers gave examples of activities that started in grade 4 and ended in grade 8 with increased difficulty. Both examples were about teaching ICT basic skills such as using Word and PowerPoint.

When asking the teachers to prioritize the different support forms from the survey, an online platform with sample activities and time to exchange and design activities with colleagues were the most preferred support forms. Because this group had difficulty establishing learning trajectories across all elementary grades, they preferred to have all inspirational information in one place and structured by the different learning goals for all grades. As mentioned, most preferred information are sample activities. Teachers indicated that they want videos of these activities and best-practices. Videos should contain all different phases of the activity and a short explanation and evaluation of the teacher performing the activity. This explanation should also include information about how the teacher integrates digital literacy in a weekly schedule. Multiple teachers indicated that they

also want to be able to contribute to this online platform by sharing their experiences with teachers. For computational thinking, some teachers indicated that they would like a practice-oriented training, besides an inspirational online platform. For this practical training, most teachers preferred multiple sessions of face-to-face training on site from a professional. Teachers are curious about how to integrate computational thinking in their classroom, but also want to improve their own knowledge and skills. For the other aspects of digital literacy, teachers indicated that they do not need support for improving their own knowledge and skills. The teachers also indicated that they need more learning materials and hardware to teach digital literacy more often. Also, teachers indicate that they have a need for an ICT coordinator who is available for troubleshooting but also supports in projects regarding digital literacy. Most schools already have a designated ICT coordinator, but time is often spent on other tasks. Finally, several teachers indicated that they need help in creating a schoolwide plan for digital literacy, in which they can include clear agreements about how digital literacy is present in their school.

Focus group interviews with teachers with low scores

The group of teachers with low scores indicated that they did not grow up with digital literacy, which is the main reason of their low self-assessed scores. Additional explanations were that implementation processes of ICT tools in education went too fast, there is not enough support in using ICT, and software updates sometimes change the layout rigorously. Courses for improving the skills and knowledge about ICT have been facilitated by the school board in the past. These courses mostly aimed at effectively using Word or Excel. However, teachers indicated that the long-term impact of these courses is low because the content was very general and not focused on the use in the classroom. Therefore, many learned skills have been lost. Also, many teachers indicated that the amount of material such as computers, tablets or interactive whiteboards is insufficient or often has disruptions. Every school has an ICT coordinator who should be available at least one day a week to solve ICT related problems. Even though most school do have an ICT-coordinator, the exempted time is often devoted to other tasks such as teaching a class of pupils. Therefore, many hardware and software issues remain unsolved for a long period of time which negatively affects the implementation process of digital literacy. Together with the low amount of knowledge and skills, this causes many uncertainties. Teachers mentioned that Computational Thinking is the aspect in which they feel the least competent. Most given explanations refered to a lack of ICT basic skills and not being able to use digital devices effectively. According to the teachers, possessing the ICT basic skills is a precondition for Computational Thinking.

Teaching digital literacy is not common for this group of teachers. Most teachers indicated that they do not consider themselves competent to do so because they do not possess the required subject matter expertise. Also, many teachers stated that they are not familiar with activities within the subject of digital literacy. Some teachers had the experience of teaching digital literacy with a professional. These teachers participated in a project in which a professional brought learning materials to the schools and supported the teachers in designing activities with these materials. These teachers indicated that it was a positive learning experience, although the activities stopped after the project ended.

When looking at the most chosen support forms from the survey, teachers indicated that they prefer substantive support in all aspects of digital literacy. However, many teachers stated that this support should be different from ICT courses in the past. Future training should be practice-oriented and combine subject matter expertise with practical examples

which can be immediately implemented in the classrooms. Even though face-to-face training was not most preferred support form when looking at the outcomes of the survey, teachers in this sample indicated that they prefer face-to-face support in mastering the required skills. Specifically, these teachers mentioned that they prefer a short introduction, after which they can work with the computer while a trainer is available for support. Besides face-to-face training, teachers also indicated that they want to be motivated and inspired to teach digital literacy. Best practices can play an important role for these teachers. Teachers indicated that they lost the overview of inspiring examples because information is spread across the internet. The perfect solution should be an organized and structured website which shows sample activities for all different primary grades. In this way, teachers believe they can work on continuous learning and organize goal-oriented activities. Teachers prefer worked-examples or lesson hand-outs along with inspiring videos. These videos should provide a clear insight in all phases of the activity and how this activity can be organized in the classroom. Two teachers had an additional idea to this online platform with videos and sample activities, which was the ability to share your own experiences. These teachers were part of an online group of teachers who all teach the first or second grade. In this group, experiences and ideas are often shared.

5. First version design guidelines

Effective teacher support should meet the previously described conditions for professional development and satisfy teachers' needs. Effective forms of teacher support should also be adapted to the current situation of digital literacy in primary education. The most frequently mentioned needs for support and practical ideas were combined with findings from the survey and important findings from literature to create a first version of the design guidelines. Effective teacher support can be established in roughly three phases. Design guidelines for all phases and their justification are presented below. Finally, a recommendation for schools is provided about what should be organized before starting with any form of professional development. These draft guidelines will be evaluated in part two of the study.

5.1 Support phase 1 – required knowledge and skills

- Provide practice-oriented training in two different groups
    - Practice-oriented face-to-face training for teachers who don't possess the required knowledge and skills in ICT basic skills, information skills and media awareness
    - Practice-oriented face-to-face training in computational thinking for teachers who possess the required knowledge and skills of the other digital literacy aspects

In preparation of large-scale implementation of digital literacy, some teachers need to be supported in improving their own ICT basic skills, information skills and media awareness skills. These face-to-face trainings are intended to support teachers with low domain specific knowledge and skills and should focus mainly on improving domain specific knowledge and skills which are needed to start teaching digital literacy, and start designing classroom activities in the second support phase. To match teachers' needs, these trainings should be practice-oriented, meaning that the training should focus on activities that are regularly performed by teachers and should present information which can be immediately implemented in the classrooms. These trainings could therefore also focus on the learning goals for pupils (Strijker, 2017) and take the most performed procedures by teachers as a starting point. Training could be held for example on using Microsoft Office applications in the classroom.

For computational thinking, this face-to-face training could be effective for all teachers who possess the required skills in other aspects of digital literacy, because both extreme groups indicated that they need support in the domain specific content. Training could be held for example on computer programming with Scratch, which is an often-used programming application in primary education. These trainings should also be practice-oriented and aim for presenting knowledge and skills which are needed to design and perform a lesson in computational thinking.

In addition, practical ideas about the content or organization of the support can be provided. For example, in face-to-face training, professionals can perform multiple sessions at schools for which teachers of all schools from the schoolboard can subscribe. The professional can present domain specific knowledge and exercises to the teachers. To attract the right audience, clear goals of the training should be described in advance.

Because many teachers indicated that they see computational thinking as an additional aspect of digital literacy, training in computational thinking should be organized only for teachers who already possess the ICT basic skills.

5.2 Support phase 2 – designing activities

- Include teachers in the design of activities by facilitating Teacher Design Teams (TDTs)
- Stimulate the development of didactical knowledge and skills in teaching digital literacy by designing and performing activities
- Facilitate teachers who can serve as a mentor
- Organize a seminar as a moment of exchanging ideas after setting up the TDT's

Many teachers indicated that they want to exchange ideas and design activities with colleagues. Therefore, the second phase of support focuses more on designing activities for digital literacy and tries to enact changes at classroom level. Teachers from different schools can be invited to join a TDT for the grade that they teach. In this way, teachers can all work on the same learning goals in a session while designing activities to implement in their own classroom. These TDTs should be led by a mentor, who can be considered as a professional or more proficient teacher. Since every school already designated an ICT coordinator who can be considered an expert, this coordinator could serve as a mentor in the design teams.

As additional ideas, the TDT sessions can be structured according to the four aspects of digital literacy and their corresponding learning goals. In this session a mentor, who can be a more proficient teacher or professional, guides a small group of teachers in designing activities together. These mentors need to be facilitated in time to perform their tasks and should also be instructed in how to lead a TDT. Because teachers indicated that they want to be inspired, every session could start by showing videos of best-practices. After showing best-practice examples, the mentor supports the small group of teachers in designing an activity for their grade. The mentor can support content-specific issues as well as didactic or organizational issues. After designing, the activity can be evaluated with the mentor and final adjustments can be made. The design session closes with setting a deadline and agreeing on a new date for the next design session. In the meantime, teachers are expected to perform the created activity in their classroom. In the next design session, the performed activities are being evaluated with the mentor. To enhance the outcomes, activities could be recorded on video. This also allows targeted evaluation in the small group of teachers. Teachers are asked to give positive feedback and appoint strengths. Learning outcomes from the evaluation of the activities can be noted and used for designing the next activity. This way of designing and evaluating in a small team can be repeated multiple times until teachers feel confident enough to continue on their own. The mentor can stimulate the teachers to persist working in this method and can keep in touch with the team in a less intensive way. To stimulate exchanging between different teams of teachers a seminar can be organized, for example by the schoolboard. At this seminar, teams can be asked to present their created activities and share their experiences. This may yield new insights and inspiration on which the teams can continue in the future.

5.3 Support phase 3 – online platform

- Create an online platform
- Collect and create videos of best-practices to inspire, motivate and provide examples
- Collect and create sample activities which can be used by others
- Stimulate continuous learning by providing a clear structure
- Support teachers in how to implement digital literacy in their weekly schedules
- Support schools in creating a clear vision and plan

To provide input for the sessions with the face-to-face training and TDT's, but also to stimulate teachers to try new activities in the long term, an online inspirational platform should be created. The first aspect of this platform focuses on providing sample activities for teachers. Many teachers indicated that they do not know what activities to perform for digital literacy or how to work on the learning goals. Another frequently mentioned problem was that teachers do not know how to stimulate continuous learning through all grades of primary education. Therefore, the structure of the online platform forms an important aspect of its effectiveness. The platform should clearly structure the sample activities according to the learning goals for digital literacy. By using this structure, teachers can easily find activities for a specific aspect of digital literacy for their grade. Consistent with the outcomes of the focus group interviews, the activities should be presented in the form of a lesson description and complemented by a video of a best-practice. This video should show parts of all phases of the activity to provide teachers a good impression of the activity. Also, the video should include an explanation of the teacher performing the activity. This explanation should be focused on the preparation of the activity, as well as possible difficulties when performing the activity. Also, teachers want to know how they can integrate these activities in their weekly schedule. This could also be explained in several introduction videos from different schools who integrated digital literacy in different ways. In addition to these explanations of teachers, the platform should also provide tools and assistance for creating a clear vision and "ICT-plan". Because teachers indicated that they often do not know what activities other colleagues perform, this assistance should pay attention to analysing the current situation and start writing a clear school-wide plan.

Additional to the guidelines for creating this online platform, input for the platform could also be gathered from the TDTs. If the TDTs design, perform and evaluate activities, these activities could serve as sample activities for other teachers.

Sharing experiences

- Facilitate online sharing of activities and experiences
- Stimulate teachers in providing positive feedback

Many teachers in the focus group interviews indicated that they are curious about the possibilities that digital literacy holds. So far, experiences are not often shared between schools and sometimes not even between teachers who work at the same school. Therefore, a second purpose of the online platform is to facilitate the possibility to share experiences and ideas with colleagues. This could be a forum on which teachers can share experiences, sample activities or opinions about activities created by others. This can inspire and motivate teachers to try new things. Also, the possibility of sharing successful experiences with other

teachers could be motivating for initiators who are trying to implement more digital literacy in the classroom. The platform could be designed as a forum or even as a community comparable to social-media communities on which teachers can share their experiences or activities. By doing this, more sample activities can be collected.

In addition to these guidelines, most important functions that could be facilitated are sharing pictures and videos of a lessons, sharing descriptions of sample activities and providing feedback on shared content. These functions can stimulate an interactive online environment in which teachers can share their experiences and thoughts. Again, this platform could be structured by the different phases of primary education and the four aspects of digital literacy. To guarantee the quality of the shared content, all material should be reviewed to determine if the quality is high enough to share it with others.

5.4 Recommendation for schools and schoolboard

- Facilitate meetings for digital literacy to identify problems or to share experiences
- Guarantee the facilities for ICT-coordinators
- Facilitate schools with more learning materials

Many teachers indicated that they often do not know what activities other colleagues perform. Also, in the focus group interviews several teachers indicated having trouble with either hardware or software, which hindered them in experimenting with digital literacy. Therefore, it is recommended to organise meetings about digital literacy. These meetings should focus on, for example, working with the interactive whiteboard or using the software in the arithmetic lessons. All problems can be listed after which the school can try to solve them together. Problems which cannot be solved at the school, are worth to sign up for one of the face-to-face trainings. Another approach for the school-wide meetings could be sharing experiences between different schools, which was also an often-mentioned need of teachers. Supply and demand can be linked and schools can function as "buddies" who help each other in solving specific problems.

Another often mentioned issue was the need for a qualified ICT-coordinator in the school. A driving force is needed to successfully implement digital literacy in the classrooms, and to maximize the effect of further professional development as described above. This means that the schoolboard should guarantee the facilitation of an ICT-coordinator and monitor this. These ICT-coordinators should also be facilitated in continuous learning to maintain their level of expertise.

Finally, many teachers indicated that they need learning materials or methods to teach digital literacy. This problem can be partially solved with the sample activities at the online platform. However, the need for more electronic devices is high. If digital literacy is considered as a key focus in the future, schools need to be facilitated with more material

6. Study 2: Research methodology

6.1 Research design

Part two of the study aimed to evaluate the initial version of the design guidelines from part one and determine the final guidelines for effectively supporting teachers in teaching digital literacy. Therefore, the draft guidelines were discussed with all stakeholders, consisting of teachers, employees of the client and members from the ICT-management group of the schoolboard. Most usable feedback that matched findings from theory and outcomes of the previous parts of the study were processed into the final version of the design guidelines.

6.2 Respondents

In this part of the study, a triangulation of respondents was used to evaluate the design guidelines. Because the initial version of the design guidelines was largely based on the indicated needs from the focus group interviews, this group of teachers was asked to also participate in evaluating the guidelines. To increase the response rate, all 36 teachers from the 11 focus group interviews were already invited at the end of the first focus-group interview session. In total 27 of the invited teachers participated in the second part of the study, of which 15 were from the sample of teachers with low scores and 12 from the sample with high scores. Women were again in the majority with (78%). With these 27 teachers, 9 groups were created. Two schools from the first part of the study could not participate in the second interview. Because teachers were classified by their scores in the first part of the study, the focus groups in part two of the study also had the same grouping with teachers with high scores or teachers with low scores on digital literacy. From these 9 groups, 5 consisted of teachers with higher scores and 4 with lower scores.

The second group of respondents consisted of six employees from the client who are involved in the digital literacy project. These employees had expertise in digital literacy and supporting schools. All respondents were between 43 and 64 years of age and had a master degree, mostly in education. Their working experience at SLO ranged from 7 to 27 years. This second group of respondents was also important to ensure that the client's expectations are satisfied.

The third group of respondents included six members of the ICT-management group of the schoolboard. Three of them work as a teacher, one is principal of a primary school, one is an ICT coordinator and one is the chairman of the schoolboard. The age ranges from 24 to 54 years. By using this triangulation of respondents, higher validity and usability of the guidelines can be ensured and guidelines are harmonized with most important stakeholders.

6.3 Instrumentation

In all groups of respondents, focus group interviews were performed. Every group of respondents was asked to reflect on the guidelines. Because most teachers are not used to read English, an annotated Dutch version of the guidelines was sent to the teachers and members of the ICT-management group of Consent as input for the interviews. For these focus group interviews, a framework was created which can be found in Appendix C. This framework was inspired by the from Krueger (2012), which was also used in the first part of the study. This framework semi-structured the interviews with evaluative questions. All

groups of respondents were asked to give their opinion about the expected effectiveness of the guidelines and evaluate the usability of these guidelines from their perspective. This triangulation of data served to increase the validity of the final guidelines. Because the initial guidelines were largely based on teacher's needs, teachers were also asked to evaluate the processing of their needs in the guidelines. Adding to this, some questions were asked that were specific for employees of SLO or members of the ICT-management group. For example, respondents of the schoolboard were asked about the organizational aspects and feasibility of the guidelines from their perspective. Employees of SLO were asked to also reflect on the relationship with theory.

6.4 Procedure

All interviews with the teachers were performed at location of the schools. Members of the ICT-management group of the schoolboard and employees of the client were invited for a focus-group interview by email. Interviews of all three groups were recorded and most important information was documented in a summary. Members of the ICT-management group of the schoolboard were invited by email for a focus group interview at location. This interview was also recorded and important feedback was summarized. The final group, which were the selected employees of the client, was asked to schedule a focus group interview after a meeting of the digital literacy project group. In these focus group interviews, the establishment of the guidelines was explained. The guidelines were evaluated by asking general questions together with questions specific for the different groups of respondents. For example, members of the ICT-management group of the school board were asked to evaluate the feasibility of the guidelines from the perspective of the schoolboard, which is a more organizational and financial perspective. This was done by presenting most important outcomes of the survey and focus-group interviews, followed by explaining the design guidelines. This was the same for employees of SLO. Besides evaluating on the practical feasibility of the guidelines, employees from SLO were also asked to evaluate the relationship between the guidelines and most important theory. Besides showing the most important outcomes of the study and explaining the guidelines, this final group also received the original literature review belonging to the advice. This was done to strengthen the relationship with theory. Most important feedback from all groups was used to improve the design guidelines in the final report.

7. Study 2: Results

This chapter presents the results of the focus group interviews that could be processed in the final version of the guidelines. These findings are summarized for every phase of support, starting with the feedback from the client's employees, followed by members from the ICT-management group, and finally the teachers. Guidelines with no comments or additions are not discussed in detail.

7.1 Feedback on the first support phase

Required knowledge and skills

- Provide practice-oriented training in two different groups
    - Practice oriented face-to-face training for teachers who don't possess the required knowledge and skills in ICT basic skills, information skills and media awareness
    - Practice oriented face-to-face training in computational thinking for teachers who possess the required knowledge and skills of the other digital literacy aspects

When looking at these guidelines, the employees of the client reacted predominantly positive. They indicated that the guidelines provided either new insights in supporting teachers, or confirmed that ways that have been tried in the past can be adapted to supporting teachers in the future. No questions were raised about the used theory for these guidelines. The employees of SLO indicated that face-to-face training was used several years ago. They found it interesting that teachers preferred this form of support in the future. To guarantee the effectiveness of any face-to-face training, it was suggested to inventory the educational infrastructure of digital literacy—that is, all forms of training or support in digital literacy. SLO wants this information to investigate which role it can play in future support and also to get clear what needs to be further developed. Also, before this first phase of face-to-face training, SLO believes that linking schools based on their needs can play an important role in solving most basic issues. This should be in a preparatory phase which can be mostly guided by schools and the schoolboard. The described draft recommendations to schools and the schoolboard can be processed in this preparatory phase.

Members of the ICT-management group of the school board also reacted very positive on the guidelines of this first phase of support. Some members mentioned that schoolwide training sessions should be performed at the school's location with the resources available. The training can thus be adapted to a specific team of teachers. The presented content in the face-to-face training should be considered as minimum required knowledge, which can be processed in the ICT policy of the schoolboard. Respondents also indicated that digital literacy should get a prominent place in the reflection reports of schools. These reports must be written annually by school directors, which is used as a basis of an evaluative conversation between school directors and management of the schoolboard. By adding digital literacy to this report and the evaluative conversation, schools are required to work consciously on annual goals for digital literacy and structural evaluation is stimulated. Guaranteeing sufficient time for an ICT coordinator should also be included in these annual reports. The minimum schoolwide goals can be determined by the ICT-management group.

The group of teachers indicated that their needs have been successfully processed in the draft guidelines. Teachers were very positive about practice-oriented face-to-face training. They indicated that they prefer clearly described goals which helps in choosing the most suitable trainings to participate in. Younger teachers were very curious about the training in computational thinking, in contrast to older teachers who were curious especially about the training in basic skills. This corresponds with the findings from the survey, in which younger teachers had higher scores in basic skills and therefore do not prefer much training in this aspect. Furthermore, the preferred training differed from person to person. Some teachers indicated that they want to be trained in most necessary software for teachers and pupils. Others stated that they would like to be trained in effectively using their interactive whiteboard or their student tracking system.

7.2 Feedback on the second support phase

Designing activities

- Include teachers in the design of activities by facilitating Teacher Design Teams (TDTs)
- Stimulate the development of didactical knowledge and skills in teaching digital literacy by designing and performing activities
- Facilitate teachers who can serve as a mentor
- Organize a seminar as a moment of exchanging ideas after setting up the TDT's

The employees of SLO had no questions about the used theory and reflected positively. One additional article by Van Bergen, Beijaard, Van Joolingen, and Stoop (2015) was provided, which presented a successful experiment of teacher design teams in primary education. This is considered as confirmatory information. When evaluating the expected effectiveness of the guidelines, employees of SLO were very positive about the teacher design teams (TDTs) and indicated that they have used TDTs in the past with great success, especially in secondary education. This suggests that TDTs can be beneficial for primary education as well. One respondent, who was part of setting up these TDTs in the past, stated that its effectiveness starts with sufficient facilitation in time of participants. The experts from SLO agreed that the existing ICT-coordinator can play an important role in these teams. They mentioned that fulfilling this role also starts with guaranteeing the time for these coordinators.

Members of the ICT-management group were positive about creating TDTs. The chairman was reluctant because it needs great time investment, although he recognized the usefulness of TDTs. Other members indicated that this investment is needed to improve teachers' digital literacy and stimulate the implementation of teaching digital literacy. After a short discussion, the chairman agreed that TDTs can be effective. The financial aspect of setting up and facilitating the TDTs remains an issue which needs to be further investigated.

All groups of teachers indicated that they are curious about the TDTs and what the outcome of the TDTs will be. Some teachers already offered to participate in a TDT, on condition that time will be provided to them and other volunteers. According to the teachers, TDTs are a promising way of designing activities and also sharing experiences with

colleagues from other schools.

7.3 Feedback on the third support phase

Create an online platform

- Create an online platform
- Collect and create videos of best-practices to inspire, motivate and provide examples
- Collect and create sample activities which can be used by others
- Stimulate continuous learning by providing a clear structure
- Support teachers in how to implement digital literacy in their weekly schedules
- Support schools in creating a clear vision and plan

Sharing experiences

- Facilitate online sharing of activities and experiences
- Stimulate teachers in providing positive feedback

Feedback about the online platform from employees of SLO was positive; they especially liked the idea of collecting sample activities on a clearly structured platform. All respondents indicated that videotaping best-practices is already done by SLO. In the future, this could be done with a more specific focus on the content that teachers want. However, they indicated that attempts of creating a platform for these best-practices stranded for financial reasons. As a less extensive alternative, one employee indicated that this platform could be included in the already existing digital portrait of digital literacy. This digital portrait is a page on which most important information about digital literacy is available for teachers, for example the draft version of the curriculum for digital literacy by Strijker (2017), which was introduced in section 2.1. Finally, sharing activities was considered as an added value. One employee questioned the feasibility of guaranteeing the quality of shared material. This is an aspect that needs careful consideration when setting up the platform.

Members of the ICT-management group indicated that they are willing to collaborate with SLO in providing input for the platform. One respondent indicated that ICT coordinators who lead a TDT can be used in creating input for the online platform. By doing this, quality of the material can be guaranteed, because the ICT coordinator has expertise in digital literacy. Stimulating teachers to provide feedback to this shared material was considered very time consuming and respondents stated that this does not contribute to a professional online platform. Two respondents further mentioned that the material should meet minimum quality standards, which could be assured by the ICT coordinators and ICT-management group. This implies ICT coordinators to be informed of these requirements.

The group of teachers reflected positively on the online platform. All teachers indicated that this is one of their largest needs, which was also shown in the results of the survey. One group consisting of six teachers indicated that there is a lot of diversity between schools, such as differences in the used devices, different didactics and different learning methods. They believed that this can negatively affect the usability of the shared material. One teacher in this group stated that this diversity is not a problem and in fact can stimulate the exchange of inspirational ideas. Finally, most teachers indicated that they are willing to share their ideas through this online platform. This was mentioned especially by younger

teachers. Older teachers indicated that they like the possibility of online sharing, but only at a later stage.

7.4 Feedback on recommendations for the schoolboard

- Facilitate meetings for digital literacy to identify problems or to share experiences
- Guarantee the facilities for ICT-coordinators
- Facilitate schools with more learning materials

The group of SLO employees thought that linking schools may be an effective way of solving problems together or to share experiences. Also, all respondents indicated that digital literacy should get a more prominent place in primary education and become part of a school's identity. This comes with guaranteeing the time for ICT coordinators and providing sufficient learning materials, which can be influenced by the schoolboard.

The ICT-management group recognized the importance of facilitating ICT coordinators and is willing to reconsider their ICT policy for the upcoming schoolyear. Also, most important conditions that need to be satisfied before starting any form of support will be reconsidered in the new policy. This also regards to guaranteeing the time of an ICT coordinator, but also to providing sufficient learning materials for schools.

The group of teachers reiterated the importance of guaranteeing sufficient time for ICT coordinators. Eight of the nine groups indicated that their ICT coordinator does not have sufficient time to solve problems, not to mention the implementation process of teaching digital literacy. Adding to this, all teachers indicated that they need more learning material to start with the implementation process. Most teachers indicated that they need electronic devices like computers, tablets or interactive whiteboards. This is a prerequisite for successful implementation of digital literacy. Finally, three groups of younger teachers indicated their preference of several study days to solve problems together. They mentioned that there are many issues at their school which could be solved together if time is available to do this. Several study days specifically for digital literacy can stimulate this. Besides solving problems, these teachers also mentioned that they would like to use these study days for creating a shared schoolwide vision on (teaching) digital literacy. This vision can be created step by step and should provide a solid base for implementation in the future.

8. Final design guidelines

Based on feedback received from three different groups, the first version of the guidelines as well as the defined phases were revised. Figure 8.2 visualizes the phases in the teacher support. The final guidelines corresponding to every phase are explained below.

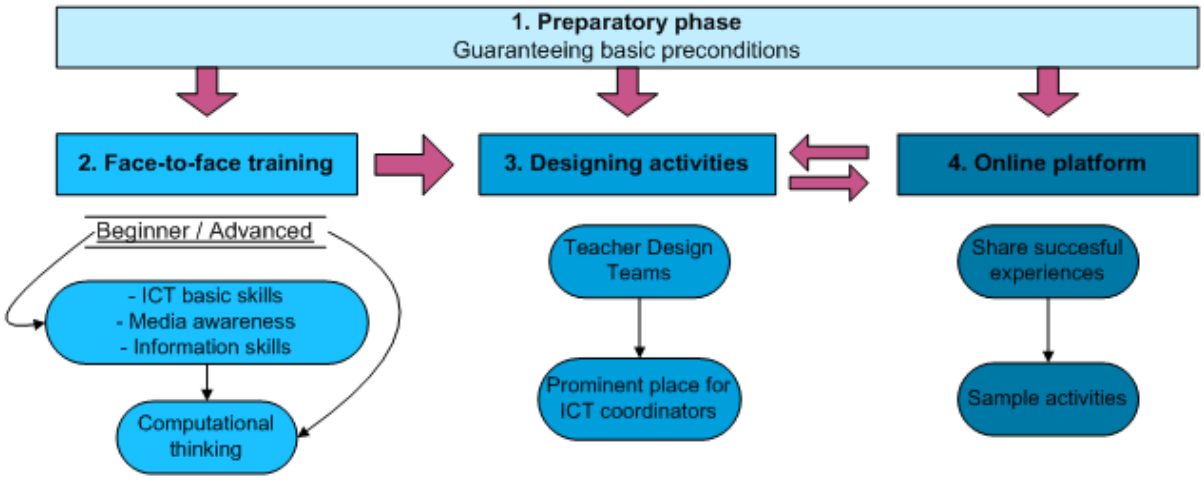

Figure 8.2 Phases of Supporting Teachers

8.1 Preparatory phase

Because the described recommendation for the schoolboard was added with several aspects by the respondents and many prerequisites were mentioned especially by teachers, these recommendations are included in a preparatory phase. The main goal of this phase is to satisfy the most important preconditions needed for any form of teacher support and to start the implementation process. In addition to the information obtained through the interviews in part two of the study, these preconditions are also derived from observed problems or frequently mentioned needs in part one. Most of these guidelines are meant for the ICT-management group of the schoolboard. The final guideline is intended for SLO, but could also be useful for the schoolboard if they wish to actively participate in designing teacher support. Design guidelines for this phase are:

- Facilitate study days for digital literacy
- Link schools based on supply and demand
- Guarantee the facilities for ICT-coordinators
- Establish meetings for ICT-coordinators
- Assign ICT-coordinators as a mentor and train them to be TDT leaders
- Facilitate schools with more learning materials
- Include digital literacy in reflection reports
- Inventory educational infrastructure for digital literacy

Study days should be structurally scheduled by the schoolboard, with the intention to stimulate solving problems that are related to digital literacy such as hardware and software issues, but also to create a schoolwide vision. To reduce the number of topics that need to be shaped into a training, schools can also be linked to support each other and solve problems together.

Secondly, the role of ICT-coordinators needs to be expanded. ICT-coordinators can provide support in multiple aspects of future teacher support, which will be further explained in the other support phases. These coordinators can have great impact on the success of the implementation process of digital literacy and should therefore get a prominent place with sufficient facilitation. To stimulate the exchange of information between schools, the schoolboard must establish the multiple meetings for ICT-coordinators. These ICT coordinators also need to be assigned as mentors and trained to be leaders in the TDTs. This guideline is part of setting up the TDTs, but preparations should start early on. This guideline is further explained in section 8.3.

Besides facilitation of the coordinators, schools also need to be facilitated with sufficient materials. This implies well-functioning interactive whiteboards, sufficient number of computers or tablets, etcetera. All facilitation must be done effectively. Therefore, schools their progress needs to be monitored and included in the annual reflection reports. This allows a schoolboard to provide targeted improvement points.

Finally, as a preparation to the second phase, the educational infrastructure must be inventoried. This implies all existing professionalization forms for topics related to teaching digital literacy. This can provide insights in designing face-to-face trainings in the future, and could also prevent reinventing the wheel.

8.2 Face-to-face training

Because most feedback on the face-to-face training was positive, these guidelines remained largely the same. One guideline was added based on various preferences of the teachers. The final guidelines for the second phase of teacher support are:

- Provide practice-oriented training in two different groups
    - Practice oriented face-to-face training for teachers who don’t possess the required knowledge and skills in ICT basic skills, information skills and media awareness
    - Practice oriented face-to-face training in computational thinking for teachers who possess the required knowledge and skills of the other digital literacy aspects
- Stimulate ownership of the professionalization

The guideline regarding the subdivision in two groups has been maintained. However, because trying to solve schoolwide problems was added in a preparatory phase, it is expected that these trainings in phase two can focus on fewer topics. Training could be held at the school’s location when the training content is relevant to all teachers. For more specific training that is not relevant for all teachers, for example in ICT basic skills, sessions could be held at different locations for teachers it concerns.

The guideline about stimulating ownership was added, because the indicated subject matter preferences of teachers differed. Therefore, teachers should be free to choose the trainings corresponding with their needs. The condition that entails this, is that a carefully

considered balance between stimulating ownership by freedom of choice and guaranteeing a minimum required level of knowledge and skills must be created. In the end, all teachers must be involved in this implementation process.

8.3 Designing activities

- Include teachers in the design of activities by facilitating Teacher Design Teams (TDTs)
- Stimulate the development of didactical knowledge and skills in teaching digital literacy by designing and performing activities
- Assign ICT-coordinators as a mentor and train them to be TDT leaders
- Organize a seminar as a moment of exchanging ideas after setting up the TDT's

The guidelines regarding TDTs remained largely the same as the initial guidelines, except that ICT-coordinators are now designated to be leaders of the design teams instead of a more proficient teacher. This means that the facilitation of ICT-coordinators by the schoolboard is very important. Besides facilitation in time, these coordinators should also be trained in how to lead a TDT. As mentioned before, this training is part of setting up the TDTs, but can already be used in the preparatory phase.

8.4 Online platform

Create an online platform

- Redesign the existing digital portrait for digital literacy to meet teachers' needs
- Collect and create videos of best-practices to inspire, motivate and provide examples
- Collect and create sample activities which can be used by others
- Stimulate continuous learning through all elementary grades by providing a clear structure
- Provide information about how to implement digital literacy in schools their education program
- Support schools in creating a clear vision and plan

Sharing experiences

- Facilitate online sharing of activities and experiences
- Stimulate teachers in providing positive feedback

The final part of supporting teachers in the implementation process is still creating an online platform. Because employees of the client indicated that similar ideas failed in the past because of high costs, it is recommended to redesign the already existing digital portrait for digital literacy. These portraits should match the needs of the teachers and therefore include the previously described videos and sample activities. The portrait should use the different elementary grades and corresponding learning goals for structuring this material. The

material can be collected and designed by SLO, but can also be supplemented by schools. Sharing activities and experiences must be stimulated and teachers from the TDTs can be asked to share their material. Quality of these materials is guaranteed when the TDT are led by a professional.

Finally, the portrait should provide more general information about how to implement digital literacy in a school's education program in different phases. A frequently mentioned need that can be included in these steps, is creating a clear vision and school-wide plan about digital literacy. Therefore, examples can be provided at the online platform.

9. Discussion and conclusion

This study tried to contribute to closing the gap between the speculations about the reason that the implementation of digital literacy is lagging behind and the actual cause. Many innovations are being designed, but even though teachers are considered as the most important group to support (Voogt & Roblin, 2010) it was not clear if teachers are ready to implement these innovations. Also, there is a large difference between developments and actual changes at the classroom level (Harris, 2003).

This study also aimed to give a clear impression of teachers' perception about digital literacy, their knowledge and skills and the activities they already perform, in order to provide a solid starting point for any form of teacher support. Based on this information, guidelines for teacher support were formulated which could bridge the gap between a new future-oriented curriculum and actual implementation in the classrooms. These guidelines can be used in the design process of teacher support that eventually can assist practitioners in implementing digital literacy in their schools.

The general research question guiding this study was: *"What are evidence-informed design guidelines for supporting teachers in implementing digital literacy in the classroom?".* The sections below will discuss the interpretation of the results from theory to practice, limitations and recommendations for future research.

9.1 Interpretation of results

The results for every sub question are explained below. Sub questions for this study were:

(1) What is the initial situation of primary teachers regarding teaching digital literacy?
(2) What should be the substance of the teacher support?
(3) What are important conditions that must be satisfied to support teachers?
(4) What should be the form of this teacher support in order to stimulate professional development of teaching digital literacy?

The initial situation of teaching digital literacy

This study provided insights in, and better understanding of, the initial situation of teaching digital literacy in primary education. Thijs et al. (2014) already stated that teachers do not consider themselves competent to teach digital literacy. The results from the focus-group interviews underpinned this statement. The results from the survey further showed that self-assessed scores for teaching digital literacy were lower than scores regarding teachers' content-specific knowledge and skills. Further investigation in the focus groups indicated that teaching digital literacy happens occasionally on most schools. This is often based on initiative of a single teacher. Most teachers indicated that their lack of competence and insufficient time in their weekly schedule are the main reasons for not teaching digital literacy. In these occasional activities, teachers do not work deliberately on corresponding learning goals and most activities have no follow-up towards the next year.

Substance of the support

Thijs et al. (2014) stated that teacher's negative self-esteem of teaching digital literacy regards to both didactic and content knowledge. This statement was confirmed by the results

of the present study. Didactic knowledge and skills were the lowest, which could be influenced by low content knowledge. This means that the substance of a form of teacher support should include didactic and content-specific information. A subdivision could be made between the aspects of digital literacy, but also between age categories of teachers. Computational thinking is the aspect where the most progress can be made for both younger and older teachers. For the other aspects of digital literacy, younger teachers don't need content-specific information. Older teachers (>46 years) are the ones that must professionalize in all aspects of digital literacy on both didactic and content knowledge and skills. However, these results should be carefully considered because they could be negatively affected by a group of older teachers that had extremely low scores. The scores of these teachers may have affected the mean scores. On the other hand, didactic information is needed for all age groups and for all aspects of digital literacy, since most teachers indicated that they do not effectively teach in digital literacy. These results indicated that didactic support should consist of designing activities as well as performing and evaluating these activities.

Conditions for supporting teachers

When aiming for the professional development of teachers, multiple conditions were derived from theory. When reflecting on these conditions in view of the results of this study, it can be concluded that several preconditions for implementing digital literacy are not satisfied in the current situation. For example, Deci and Ryan (2000) stated that stimulating any kind of growth or development starts by guaranteeing the basic needs for competence, relatedness and autonomy. When looking at teacher's self-assessed scores on the survey, it can be concluded that the basic need of competence is not met for many teachers. This is an important condition which need to be satisfied before digital literacy can be implemented in primary education.

When comparing the results with the personal barriers described by Woo (2016), these low scores could point to a lack of confidence, and technological and pedagogical knowledge. However, the focus group interviews showed that teachers are motivated to start implementing digital literacy and are willing to take part in a professionalization process. This indicates that the conditions for motivation and additional engagement are more satisfied than the other described personal barriers. As described before, these conditions closely relate to the self-efficacy theory of Bandura (1977). When looking at the results of the survey and focus-group interviews, most teachers indicated that they prefer an online platform with good-practices of others. Because the need for good practices was mentioned by a majority of respondents, it can be concluded that offering vicarious experiences is the most promising way of increasing self-efficacy of teachers.

Based on the results of the focus group interviews, some additional conditions were identified. These conditions were raised by teachers and pertained mostly to the available time for ICT coordinators and the instructional materials at schools. This was not part of the focus of the research, but was considered an important prerequisite for supporting teachers.

Form of support for stimulating professional development

This study also tried to investigate teachers' preference for available support forms, which were based on the previously described conditions. Therefore, the study contributed to literature about forms of professionalization, by reflecting them on important conditions.

Based on this reflection, there can be concluded that some support forms carry more opportunities than others. Based on literature, using peer-teachers and co-teachers seemed the most promising type of support. But the teachers who participated in the survey held a somewhat different view. They strongly preferred online professionalization, and gave low priority to professionalization from a co-teacher. However, the results of the focus groups showed that teachers do not exclude these less chosen support forms altogether. In fact, it can be concluded that all support forms used in the survey carry different possibilities and can be used in different phases of this professionalization. The results showed that differences in the preferred support form is based on different needs and different self-assessed scores. For example, younger teachers with higher self-assessed scores prefer an online platform instead of face-to-face training, whereas older teachers with lower scores indicated that face-to-face training is their most preferred support form. These results can be used in designing teacher support in different phases and for different target audiences.

Guidelines for supporting teachers

The first version of the design guidelines was based on a carefully considered combination of findings from literature and results of the survey and interviews in the first part of the study. Since the goal of the second part of the study was to evaluate these guidelines to create a final version, some guidelines were adjusted or added. Some of the added guidelines were only based on frequently mentioned feedback of teachers. Examples of these guidelines are linking schools together, facilitation of learning materials and facilitating study days for digital literacy. This was done because teacher's needs played an important role. However, these guidelines are not discussed in theory and were not part of the focus of this study. Although these guidelines seamlessly match teacher's needs, the reliability and effectiveness of these guidelines should be considered before executing them.

9.2 Limitations

The research has some limitations which could have impacted the findings. These possible limitations could signal ways to improve future studies into teacher professionalization in digital literacy. One limitation is that this research was performed with teachers from one large schoolboard, who were asked to participate by their chairman. A representative sample of the invited teachers participated. However, still a large sample of non-participating teachers remained. This sample might for example include teachers who have no affinity with digital literacy or who are not willing to participate in a form of teacher support. Also, this schoolboard just started a group which is trying to improve the current situation of digital literacy in their education. Perhaps results differ for schoolboard who put less emphasis on digital literacy. For a more generalizable outcome, the research could be performed with more samples and with different schoolboards.

Another limitation is the measurability of knowledge and skills of digital literacy. The survey used a limited number of items derived from existing and reliable instruments, which painted a clear picture of teacher's knowledge and skills. However, the computed scores for all aspects of digital literacy are based on self-assessment. The actual knowledge and skills of teachers may differ from these self-assessed scores. A more complete view on teacher's knowledge and skills can be obtained differently, for example by performing assessments or observing teachers when performing tasks related to digital literacy.

A final limitation is the fact that there are great differences between schools. Some of the participating schools are far ahead of others in terms of digital literacy, because they have focused on this for a long period. These schools may have different needs than the most frequently mentioned needs which led to the described guidelines and may need different support forms or different substantive content of the support forms. This implies that the guidelines for supporting teachers can only be effective for teachers who recognize themselves in the generalized image of the current situation.

9.3 Implications for practice and future research

An implication for practice is guaranteeing the described preconditions. Facilitating study days for digital literacy, establishing meetings for ICT-coordinators and providing more learning materials involves great investment in time and money. Without guaranteeing these preconditions, some of the guidelines cannot successfully be implemented. The effectiveness of these guidelines should be examined to ensure the outcomes of large-scale implementation of these forms of teacher support.

When looking at implications for future research, a similar study can be conducted in secondary education. For continuous learning, it is important to adapt primary education to secondary education. It is important to know if there is a difference between primary education and secondary education. For example, for generalizability. If the needs of teachers correspond, parts of the teacher support could perhaps be executed for primary and secondary school teachers together.

Another implication for future research and for practice is evaluating the effectiveness of the described guidelines for supporting teachers. All guidelines are based on a carefully considered combination of insights from theory, teachers' self-assessed scores and teachers' needs. Some of the guidelines have been used in the past, albeit in different contexts. Therefore, small scale testing is needed to guarantee the effectiveness in practice of all support phases. This can be done for all support phases separately, for example by testing in a small pilot group. All phases can be tested and evaluated, after which adjustments and preparations can be made for large-scale implementation. In the preparatory phase, a small group of schools can be linked based on their supply and demand. These schools will be supported in all important prerequisites such as facilitating ICT-coordinators in time and providing learning materials. After a scheduled time, these schools can be asked how they experienced this extra support and all prerequisites can be evaluated separately to get an indication of its effectiveness. After this, the pilot group continues with face-to-face trainings based on their needs. Preferably, the content of these trainings must have interfaces with the needs of schools that are not participating in the pilot. After these trainings, teachers can again be asked about their experiences, but the trainings could also be evaluated on the presented content. Based on this evaluation, trainings could be adjusted before implementing on large scale. After the face-to-face trainings, the pilot schools can be supported in creating several TDTs led by the ICT-coordinators. In these teams, they design activities which can be performed by themselves or other colleagues. This can be done for example by focusing on one aspect of digital literacy. This allows other stakeholders to start working on the online platform for this single aspect. After some experiences with working in a TDT, the effectiveness of the teams but also the outcomes can be evaluated. Again, possible adjustments can be made before starting large-scale implementation. High quality activities which have been evaluated positively can be used as input for the online platform.

This cycle can be repeated for other aspects of digital literacy to complete the online platform.

9.4 Conclusion

The results of this study describe the current situation of digital literacy in primary education. In this current situation, teaching digital literacy is often omitted and teachers need support in expanding their knowledge and skills. A significant relation between age and mean scores about knowledge and skills of all aspects of digital literacy was found. Teachers from the age of 46 onward have significantly lower self-assessed scores than younger teachers. Computational thinking is the aspect with the lowest self-assed scores for all age categories. Self-assessed scores about teaching digital literacy were even lower than scores on content specific knowledge and skills. Most teachers indicated that an online platform and designing activities together are the most preferred support forms for all aspects of digital literacy. For computational thinking a large group of teachers also chose for face-to-face training. Additional data derived from the focus group interviews showed that older teachers prefer face-to-face training in all aspects of digital literacy, whereas younger teachers hold on to these trainings only for computational thinking. Other important insights in teachers' needs are the need for facilitation of ICT coordinators, the need of learning material and the need for study days.

Concerning the support of teachers in teaching digital literacy there can be concluded that supporting teachers can be done in different phases. The support should start with a preparatory phase which focuses on guaranteeing important prerequisites. The second phase focuses on practice oriented face-to-face training in all aspects of digital literacy. This can be done in two groups, based on teachers' initial situation. The third phase is designing activities in TDTs. The outcomes from these TDTs can provide learning material for an online platform in the fourth phase. This platform can be expanded to offer the inspiration and sample activities that teachers need.

The results of this study provide a better understanding of the current situation. Also, the defined guidelines can be used in supporting teachers in implementing digital literacy. The effectiveness of these guidelines can be evaluated in future research, for example by testing the forms of support in a pilot group.

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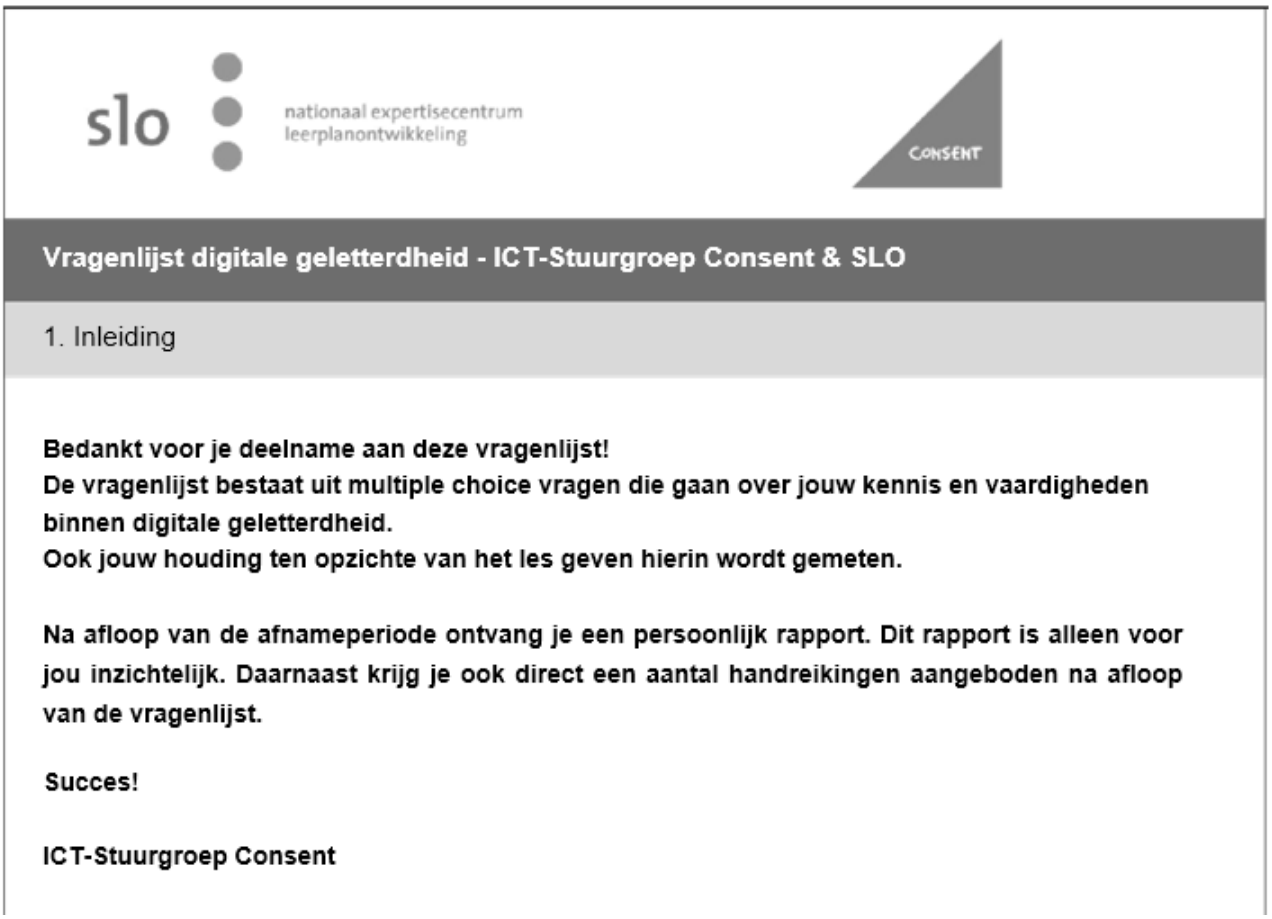
11. Appendices

Appendix A: Survey for Teachers



slo nationaal expertisecentrum leerplanontwikkeling

CONSENT

Vragenlijst digitale geletterdheid - ICT-Stuurgroep Consent & SLO

1. Inleiding

Bedankt voor je deelname aan deze vragenlijst!
De vragenlijst bestaat uit multiple choice vragen die gaan over jouw kennis en vaardigheden binnen digitale geletterdheid.
Ook jouw houding ten opzichte van het les geven hierin wordt gemeten.

Na afloop van de afnameperiode ontvang je een persoonlijk rapport. Dit rapport is alleen voor jou inzichtelijk. Daarnaast krijg je ook direct een aantal handreikingen aangeboden na afloop van de vragenlijst.

Succes!

ICT-Stuurgroep Consent

Vragenlijst digitale geletterdheid - ICT-Stuurgroep Consent & SLO

2. Start vragenlijst

* 1. E-mail adres

* 2. Leeftijdscategorie

- jonger dan 25 jaar
- 25-35 jaar
- 36-45 jaar
- 46-55 jaar
- 56-65 jaar
- ouder dan 65 jaar

* 3. Aantal jaren onderwijservaring

- minder dan 5 jaar
- 6-10 jaar
- 10-15 jaar
- 15-20 jaar
- 20-25 jaar
- meer dan 25 jaar

* 4. Ik geef op dit moment les aan

- Onderbouw PO
- Middenbouw PO
- Bovenbouw PO
- Anders, namelijk

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3. ICT basisvaardigheden

De onderstaande vragen hebben betrekking tot jouw eigen kennen en kunnen binnen de aspecten van digitale geletterdheid. Digitale geletterdheid bestaat uit: computational thinking, ICT basisvaardigheden, informatie vaardigheden en mediawijsheid.
Bij de laatste vraag van ieder aspect kun je aangeven in hoeverre je jezelf ook bekwaam schat om hier les in te kunnen geven.
Hieronder zie je een korte toelichting per aspect met daarbij een aantal stellingen. Kruis aan hoe je jouw bekwaamheid inschat, waarbij 1 niet bekwaam is en 5 zeer bekwaam.

* 5. **ICT basisvaardigheden**

-

Bij de ICT basis vaardigheden gaat het vooral om de basisbegrippen en basishandelingen. Denk hierbij aan de onderdelen en functies van een computer en het aansluiten van apparaten, maar ook aan het omgaan met bepaalde software zoals Word, PowerPoint of beeldbewerkingssoftware.

	1	2	3	4	5
Ik kan overweg met computers en/of andere digitale apparaten (zoals de bediening, aansluiting, onderdelen benoemen, controleren op updates, programma's installeren of verwijderen)	◯	◯	◯	◯	◯
Ik kan kantoortoepassingen (zoals Word, PowerPoint, Excel, Outlook) efficiënt en effectief gebruiken	◯	◯	◯	◯	◯
Ik kan openbaar toegankelijke informatie ontsluiten en delen (bijvoorbeeld een video, afbeelding of document kunnen delen via het internet)	◯	◯	◯	◯	◯
Ik kan internet toepassingen zoals de internetbrowser, e-mail en een cloud effectief en efficiënt gebruiken	◯	◯	◯	◯	◯
Ik ben op de hoogte van beveiligings- en privacy aspecten van internetgebruik	◯	◯	◯	◯	◯
Ik ben in staat om effectief les te geven in ICT basisvaardigheden	◯	◯	◯	◯	◯

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4. Mediawijsheid

* 6. Mediawijsheid

-

Mediawijsheid staat in het teken van de kennis en vaardigheden die nodig zijn om bewust te kunnen participeren in de gemedialiseerde samenleving. Hierbij kun je denken aan het bewust omgaan met sociale media, online zoeken naar een baan, maar ook het begrijpen wat de impact is van sociale media op de samenleving.

	1	2	3	4	5
Ik ben op de hoogte van de invloed die media kan hebben op de samenleving en op mijzelf	○	○	○	○	○
Ik kan (sociale)media gebruiken om informatie te maken, presenteren en delen	○	○	○	○	○
Ik kan constructief deelnemen aan sociale media zoals weblogs, twitter en facebook	○	○	○	○	○
Ik kan bewust omgaan met nieuwe media	○	○	○	○	○
Ik ben in staat om effectief les te geven in mediawijsheid	○	○	○	○	○

Vragenlijst digitale geletterdheid - ICT-Stuurgroep Consent & SLO

5. Vervolg

* 7. Informatievaardigheden

-

Bij informatie vaardigheden gaat het vooral om het zoeken en selecteren van relevante informatie en het leren beoordelen van de bruikbaarheid en betrouwbaarheid van informatie. Denk hierbij ook aan het opstellen van een goede onderzoeksvraag en het gebruiken van een effectieve zoekstrategie bij het zoeken naar informatie om je onderzoeksvraag te beantwoorden.

	1	2	3	4	5
Ik kan een onderzoeksvraag opstellen	○	○	○	○	○
Ik kan op meerdere manieren relevante informatie op internet zoeken	○	○	○	○	○
Ik kan bronnen van internet selecteren op basis van relevante en/of inhoudelijke criteria	○	○	○	○	○
Ik kan informatie verwerken in bijvoorbeeld een verslag, informatiebrief of website	○	○	○	○	○
Ik ben in staat om effectief les te geven in informatievaardigheden	○	○	○	○	○

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6. Vervolg

* 8. Computational thinking

-

Computational Thinking staat vooral in het teken van het (her)formuleren van problemen zodat deze met de computer zijn op te lossen. Hierbij kun je bijvoorbeeld denken aan het schrijven van een computer programma of het herkennen van patronen in gegevens en conclusies trekken, maar ook aan bijvoorbeeld Lego Mindstorms of het programmeren van functies in Excel.

	1	2	3	4	5
Ik kan op een systematische manier gegevens verzamelen (bijvoorbeeld via artikelen, experimenten, interviews, enquêtes of literatuurstudie)	○	○	○	○	○
Ik kan op een zodanige manier een probleem formuleren dat het mogelijk wordt om het probleem op te lossen door gebruik van een computer of ander digitaal apparaat (een groot pro	○	○	○	○	○
Ik kan gegevens analyseren (door logisch ordenen, patronen te vinden of statistische methode toepassen)	○	○	○	○	○
Ik kan een computerprogramma schrijven in code (bijvoorbeeld met behulp van Logo, Scratch, of programmeren in Excel)	○	○	○	○	○
Ik kan gegevens digitaal visualiseren (bijvoorbeeld in modellen of grafieken)	○	○	○	○	○
Ik ben in staat om effectief les te geven in computational thinking	○	○	○	○	○

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7. Bekwaamheid bij het lesgeven in digitale geletterdheid

De volgende vragen geven een beeld van aspecten waar jij jezelf positief of minder positief over inschat als het gaat om lesgeven in digitale geletterdheid. Houd bij het invullen de vier aspecten van digitale geletterdheid in gedachten (computational thinking, ICT basisvaardigheden, informatie vaardigheden en mediawijsheid)

* 9. Zelfbeoordeling competenties

	Volledig oneens	Gedeeltelijk oneens	Noch eens/noch oneens	Gedeeltelijk Eens	Helemaal eens	Niet van toepassing
Ik geef even goed les in digitale geletterdheid als in andere vakke	○	○	○	○	○	○
Ik weet hoe ik concepten van digitale geletterdheid moet aanleren	○	○	○	○	○	○
Ik kan leerlingen op zo'n manier begeleiden in opdrachten binnen digitale geletterdheid, dat zij in staat zijn om antwoorden te vinden op hun eigen vragen	○	○	○	○	○	○
Over het algemeen ben ik tevreden met de manier waarop ik lesgeef in digitale geletterdheid	○	○	○	○	○	○
Ik begrijp de inhouden van digitale geletterdheid goed genoeg om er effectief les in te kunnen geven	○	○	○	○	○	○
Ik kan leerlingen uitleggen wat de reactie van de computer is bij een opdracht in digitale geletterdheid	○	○	○	○	○	○
Ik ben over het algemeen in staat om vragen van leerlingen over digitale geletterdheid te beantwoorden	○	○	○	○	○	○
Ik heb de benodigde vakdidactische vaardigheden om les te geven in digitale geletterdheid	○	○	○	○	○	○
Als mijn directeur of een collega bij een les aanwezig is, dan vind ik het prima als dat een les in digitale geletterdheid is	○	○	○	○	○	○
Als een leerling moeite heeft met een digitale geletterdheidconcept, dan weet ik hoe ik de leerling moet helpen om het beter te begrijpen	○	○	○	○	○	○
Als ik les in digitale geletterdheid geef vind ik het fijn als leerlingen vragen stellen	○	○	○	○	○	○
Ik weet hoe ik leerlingen kan motiveren in digitale geletterdheid	○	○	○	○	○	○

Vragenlijst digitale geletterdheid - ICT-Stuurgroep Consent & SLO

8. Ondersteuningsbehoefte

Geef in onderstaande tabel aan welke vorm van ondersteuning je denkt nodig te hebben om (meer) bekwaam te worden in het lesgeven in digitale geletterdheid. Geef dit per aspect van digitale geletterdheid aan. Er is ook ruimte om je eigen oplossing aan te dragen.

Graag alleen de twee voor jou best passende ondersteuningsvormen kiezen per aspect van digitale geletterdheid.

* 10. Om (meer) bekwaam te worden in het lesgeven in**ICT basisvaardigheden** heb ik behoefte aan...

- [ ] Geen ondersteuning nodig
- [ ] Online professionaliseringsaanbod (online training)
- [ ] Methodes/leer middelen op school
- [ ] Website met lesideeën, informatie, goede voorbeelden etc.
- [ ] Co-teaching in de klas met professional
- [ ] Tijd om ideeën uit te uitwisseling en onderwijs te ontwerpen met collega's
- [ ] Face-to-face professionaliseringsaanbod (training)
- [ ] Anders, namelijk...

* 11. Om (meer) bekwaam te worden in het lesgeven in**Informatievaardigheden** heb ik behoefte aan...

- [ ] Geen ondersteuning nodig
- [ ] Online professionaliseringsaanbod (online training)
- [ ] Methodes/leer middelen op school
- [ ] Website met lesideeën, informatie, goede voorbeelden etc.
- [ ] Co-teaching in de klas met professional
- [ ] Tijd om ideeën uit te uitwisseling en onderwijs te ontwerpen met collega's
- [ ] Face-to-face professionaliseringsaanbod (training)
- [ ] Anders, namelijk...

* 12. Om (meer) bekwaam te worden in het lesgeven in**Mediawijsheid** heb ik behoefte aan...

- [ ] Geen ondersteuning nodig
- [ ] Online professionaliseringsaanbod (online training)
- [ ] Methodes/leer middelen op school
- [ ] Website met lesideeën, informatie, goede voorbeelden etc.
- [ ] Co-teaching in de klas met professional
- [ ] Tijd om ideeën uit te uitwisseling en onderwijs te ontwerpen met collega's
- [ ] Face-to-face professionaliseringsaanbod (training)
- [ ] Anders, namelijk...

* 13. Om (meer) bekwaam te worden in het lesgeven in**Computational thinking** heb ik behoefte aan...

- [ ] Geen ondersteuning nodig
- [ ] Online professionaliseringsaanbod (online
- [ ] training) Methodes/leer middelen op school
- [ ] Website met lesideeën, informatie, goede voorbeelden
- [ ] etc. Co-teaching in de klas met professional
- [ ] Tijd om ideeën uit te uitwisseling en onderwijs te ontwerpen met
- [ ] collega's Face-to-face professionaliseringsaanbod (training)
- [ ] Anders, namelijk...

Vragenlijst digitale geletterdheid - ICT-Stuurgroep Consent & SLO

9. Einde vragenlijst

Bedankt voor je deelname!
Na de afnameperiode ontvang je jouw persoonlijke rapport.

Ben je geïnteresseerd in dit onderwerp en wil je zelf vast een aantal (eerste) stappen zetten? Hier onder vind je een aantal praktische handreikingen voor in de klas en voor je eigen ontwikkeling. Bij je persoonlijke rapport ontvang je deze links nogmaals.

- **Uitwerking van digitale geletterdheid, voorbeeldmaterialen, leerlijnen en doelen: SLO Curriculum van de toekomst**
- **Direct starten met digitale geletterdheid in de klas (plugged en unplugged): CodeKinderen**
- **Informatie voor de leerkracht en activiteiten voor in de klas (plugged en unplugged): Programmeren in het basisonderwijs & Aanvullende informatie over de leerlijn**
- **Verdiepings-en uitbreidingsprogramma met veel activiteiten (unplugged) : CS unplugged**
- **9 Tips om te beginnen met programmeren: Kennisnet - 9x Zo begin je met programmeren**
- **Laat kinderen direct starten met Scratch (programmeren) of Kodu (games maken) (middenbouw-bovenbouw) ! Er staan veel Nederlandse voorbeeldlessen op YouTube Meer info over Scratch op: TU Delft & Scratchweb**
- **Laat kinderen hun eigen game maken met GameKit (middenbouw-bovenbouw)**
- **ABC van programmeren**
- **Geef een robot opdrachten met BomberBot (middenbouw)**
- **Robot programmeren met RoboMind (vanaf groep 3)**
- **Blogs en filmpjes over programmeren door de tiener Nick Jordan op Jorcademy**
- **Codeuur verzamelt lesmateriaal en stelt dit ter beschikking**
- **Aan de slag met CodeCombat (groep 8 en VO)**
- **Spelenderwijs programmeren met HopScotch**

Appendix B: Focus group interview scheme study 1

Algemene gegevens deelnemers interview	
• Datum:	
• School:	
• Namen deelnemers:	
• Leerkracht matcht met profiel:	

Inleiding interview	
Bespreekpunt	**Aan bod gekomen?**
• Toestemming vragen voor geluidsopname • Tijdsindactie geven (+/- 30 tot 45 min)	
• Herhalen doel van het onderzoek *Het in kaart brengen van de actuele situatie als het gaat om de kennis en vaardigheden van leerkrachten in digitale geletterdheid. Het gaat hierbij zowel om de inhoudelijke kennis en vaardigheden als vakdidactische kennis en vaardigheden. Daarnaast het adviseren van SLO, maar ook Consent, in het ontwikkelen van een geschikte ondersteuning voor leerkrachten.* • Vragen naar eventueel gebruik van handreikingen die zijn gegeven na afloop van de vragenlijst.	
In kaart brengen actuele situatie	
Bespreekpunt	**Aan bod gekomen?**
• Een korte samenvatting geven van de uitkomsten tot dusver *Aantal deelnemers, verdeling van leeftijd en bouw en het tonen van de opvallende resultaten per leeftijdsgroep (voor zowel de inhoudelijke vragen als de vragen over het lesgeven).*	
• Aanvullende informatie verkrijgen op de informatie die al verkregen is uit de vragenlijst - *Herken je de actuele situatie en daarbij het verschil per leeftijdsgroep? Hoe kan dit verschil volgens jullie verklaard worden?* - *Welke ervaring heb je met eerdere implementatieprocessen van bijv.*	

ICT in het onderwijs (apparaten maar ook programma's)? - *Heb je in het verleden deelgenomen aan activiteiten die als doel hadden om de EV van DL te verbeteren? Waren deze succesvol voor jou? Waarom wel/niet?* - *Waarom denk je dat CT opmerkelijk lagere scores heeft dan de andere 3 aspecten?* - *Hoe verklaar je dat "lesgeven" in alle aspecten gemiddeld een punt lager wordt beoordeeld dan de inhoudelijke delen?* - *Hoe sta jij zelf in "lesgeven in digitale geletterdheid"?* - *Wat doen jullie al aan DG op school of heb je in het verleden gedaan? Hoe ging dit? Zou je dit weer hetzelfde doen of wil je het in de toekomst anders?* *Hoe zie jij digitale geletterdheid het liefst in jouw onderwijs?*	
Ondersteuningsbehoefte	
Bespreekpunt	**Aan bod gekomen?**
• Bekijken van de meest gekozen ondersteuningsbehoeften per aspect van digitale geletterdheid - Zie jij jouw ondersteuningsbehoefte voor CT ook anders dan voor de andere 3 aspecten? - Herken jij jouw behoefte in deze lijst van meest gekozen ondersteuningsbehoeften of mis je iets? - Aan welke vorm of combinatie van vormen heb jij het meest behoefte aan? • Brainstormen over de inhoud/organisatie/randvoorwaarden van de gekozen ondersteuningsvorm. Hoe zien leerkrachten dit voor zich en hoe zou deze ondersteuning volgens hen de meeste kans van slagen hebben? - Eventueel meerdere brainstorms indien de ondersteuningsbehoefte per aspect van digitale geletterdheid verschilt.	
Afsluiting	
Bespreekpunt	**Aan bod gekomen?**
• Vragen/opmerkingen? • Uitleggen vervolgfase *Interviews worden uitgewerkt en de resultaten vormen, samen met literatuur en resultaten uit de enquête, een basis voor een advies voor de SLO. Dit advies zal tevens beschikbaar zijn voor Stichting Consent. Het advies zal toegezonden worden naar de deelnemers van de interviews.*	

• Deelnemers vragen of zij bereid zijn om een opzet met daarin de richtlijnen voor de ondersteuning te evalueren	
• Bedanken voor medewerking	

Appendix C: Focus group interview scheme study 2

Inleiding	
Bespreekpunt	**Aan bod gekomen?**
• Kort herhalen van vorige fases in het onderzoek die hebben geleid tot deze richtlijnen • Aangeven doel van dit interview en tijdsindicatie geven (max 45 min)	
Uitleggen en evalueren van de richtlijnen	
Bespreekpunt	**Aan bod gekomen?**
• Uitleggen van de richtlijnen per fase. De richtlijnen worden opgenoemd en toegelicht. deelnemers kunnen tussendoor vragen stellen. Aan alle groepen wordt hun persoonlijke mening gevraagd en inzichten wat betreft de verwachte effectiviteit van deze richtlijnen. Daarnaast worden er aan de verschillende groepen nog een aantal specifieke, aanvullende vragen gesteld. <u>Aan de leerkrachten wordt gevraagd om de volgende vragen in gedachten te houden bij het evalueren van de richtlijnen:</u> - *Is mijn persoonlijke behoefte vertaald in (één of meerdere aspecten van) het advies?* o *Zo ja, welke punten spreken mij het meest aan en welke het minst? Waarom?* - *Kan deze vorm van ondersteuning mij helpen om in de toekomst verder te komen in digitale geletterdheid?* - *Welke randvoorwaarden heb ik nodig vanuit het schoolbestuur/ vanuit de overheid om deze ondersteuning voor mijzelf te laten slagen?* - *Heb ik aanvullingen op deze adviespunten of zie ik mogelijke adviespunten aan Consent/SLO die nu niet genoemd zijn?* Aan SLO experts worden de volgende vragen gesteld. Het evalueren gebeurt verder op dezelfde manier. - *Passen de richtlijnen bij de beschreven theorieën?* - *Zijn (aspecten van) richtlijnen vergelijkbaar met ondersteuningen voor leerkrachten die SLO in het verleden heeft geprobeerd? Zo ja, hoe is die ondersteuning verlopen?* - *Welke richtlijnen zien jullie als het meest effectief? En waarom?* - *Welke richtlijnen zien jullie als het minst effectief? En waarom?* - *Heb je, naast opmerkingen, ook aanvullingen op deze richtlijnen?*	

Aan leden van de ICT regiegroep van Consent worden de volgende vragen gesteld. Het evalueren gebeurt verder op dezelfde manier. - *Kan deze vorm van ondersteuning leerkrachten helpen om in de toekomst verder te komen in digitale geletterdheid?* - *Hoe ziet het schoolbestuur de uitvoerbaarheid van de richtlijnen? Wat kunnen zij hierin betekenen en wat niet?* - *Welke richtlijnen zien jullie als het meest effectief? En waarom?* - *Welke richtlijnen zien jullie als het minst effectief? En waarom?* - *Heb je, naast opmerkingen, ook aanvullingen op deze richtlijnen?*	