

# Exploring Practical Knowledge of Teachers as Designers of ICT rich Learning Environments for Early Literacy Development: unraveling a messy construct

Citation for published version (APA):

Boschman, F., McKenney, S., & Voogt, J. (2011). *Exploring Practical Knowledge of Teachers as Designers of ICT rich Learning Environments for Early Literacy Development: unraveling a messy construct*. Paper presented at 38e Onderwijs Research Dagen 2011, Maastricht, Netherlands.

## Document status and date:

Published: 01/06/2011

## Document Version:

Peer reviewed version

## Please check the document version of this publication:

- A submitted manuscript is the version of the article upon submission and before peer-review. There can be important differences between the submitted version and the official published version of record. People interested in the research are advised to contact the author for the final version of the publication, or visit the DOI to the publisher's website.
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Running head: Exploring teacher practical knowledge

Exploring Practical Knowledge of Teachers as Designers of ICT rich Learning Environments for  
Early Literacy Development: unraveling a messy construct

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### Abstract

The development of early literacy can be fostered through an ICT-learning environment. The effectiveness of such an environment greatly depends on teachers ability in ICT-classroom integration and his or her practical ICT knowledge. This study explores the practical ICT knowledge of kindergarten teachers within the context of early literacy. The study involved participation of 10 teachers who were interviewed and asked to draw a concept map about early literacy. The interview was semi-structured, asking teachers to express their knowledge, beliefs and practical examples within three domains; technological, pedagogical and early literacy knowledge. It was found that teachers pedagogical knowledge is aimed at a childs' wellbeing in classroom and early literacy classroom practice. This resonated in their technological knowledge, stating what is pedagogical appropriate. Their early literacy knowledge was directly linked to teaching early literacy, conceptual understanding was shallow; mostly expressed through explaining activities in their classroom. This study suggests that teachers should be adequately supported in building their early literacy knowledge base, if they are to be successful in designing and implementing an ICT rich learning environment.

## 1. Introduction

The development of early literacy has recently gained increased attention from both researchers (Missall, McConnel and Cadigan, 2006; Senechal, LeFevre, Smith & Chant, 2001) and educational organizations (e.g. National Early Literacy Panel, 2011; Expertisecentrum Nederlands, International Reading Association). Developing early literacy skills is considered beneficial for subsequent reading and academic success (IRA & NAEYC, 1998, Neuman & Roskoss, 2005). ICT (Information and Communication technology, often referred to as computers) can be effectively utilized in a learning environment that engages children in meaningful and authentic early literacy related activities (Lankshear & Knobel, 2003; Van Scoter, 2008; Parrette, Boeckman & Hourcade, 2008). However, integration of ICT into a learning environment is still a challenge to most teachers, in kindergarten as well as in other areas of education (Tondeur, Van Braak, Valcke, 2007). It seems that teachers are ill-prepared for this complex task, most teachers possess only basic ICT knowledge. Professional development that addresses teachers practical knowledge is regarded as most promising (Polly, 2011; Mishra & Koehler, 2006).

Teacher knowledge is often depicted as practical knowledge: all cognitions, beliefs included, that underlie teachers practice. Practical knowledge is personal, contextual, based on experience and reflection, mainly tacit, underlying teacher practice and is content related (Meijer, 1999; Verloop, Van Driel & Meijer, 2001). Practical knowledge underlies not only teaching but also other teaching related activities. For instance, research on teachers' decision making in enactment of curriculum material has shown that practical knowledge plays an important role (Drake & Sherin, 2006; Remillard, 2005; Nicol & Crespo, 2005). More recently practical knowledge is also shown to be linked to pedagogical design capacity, or the ability

employ various materials for effective teaching (Brown, 2009; Brown & Edelson, 2003; Davis, Beyer, Forbes & Stevens, 2011).

This study explores the practical knowledge of teachers during early stages of considering design options for an ICT rich learning environment. We view teacher engagement within innovation important, yet also acknowledge the fact that their learning needs should be addressed within this process. It therefore is imperative to explore the contents of teacher practical knowledge first. This study was conducted within the context of kindergarten education in the Netherlands. Teachers who participated in this study showed interest in expanding their knowledge within the field of early literacy and ICT; ultimately, the research team seeks to understand how to support kindergarten teachers in designing a pedagogically appropriate technology-based learning environment for early literacy. To date, we know of no such work that has focused on investigating teacher practical knowledge related to teaching early literacy in an ICT rich learning environment. This was the main goal of this study.

## 2. Theoretical framework

Practical knowledge is often studied by using Shulman's (1986;1987) framework of pedagogical content knowledge. According to Verloop, Van Driel and Meijer (2001) PCK is a specific form of teacher knowledge, it reflects their understanding of how both pedagogical knowledge and content knowledge can be intertwined. Numerous studies have elaborated on PCK. Two essential elements of PCK are (a) knowledge of teachers about specific conceptions and learning difficulties with respect to this particular content domain and (b) knowledge of teachers about representations and teaching strategies with respect to this particular content

domain (Van Driel, Verloop and De Vos, 1998). The construct of PCK is an accepted theoretical framework for understanding the domains of teacher practical knowledge. It has also been identified as part of teachers knowledge that pertains to design of curriculum material and instruction (Davis & Kracik, 2005; Remillard, 2005). Lately, technology has also been identified as another important domain in teacher practical knowledge, making it teachers practical ICT knowledge (cf. Mishra & Koehler, 2005). This study builds on theories that conceptualize the three separate knowledge domains: technological, pedagogical and content knowledge. We acknowledge the fact that teacher practical knowledge is the result of teacher abilities to intertwine these bodies of knowledge. In this exploration, it is believed that when we understanding the contents of each separate domain also includes exploration of how and where they intertwine. We also view teacher practical knowledge as depending on a delicate balance, any change in one domain affects the other domains as well. Especially the addition of the technological domain has an influence on the pedagogical and content domain that is not yet well understood. We build on knowledge that already exists in PCK related to early literacy to conceptualize the three domains that are under investigation in this exploratory study.

### 2.1 Teachers practical ICT knowledge domains.

*Content knowledge:* Early literacy as a subject matter is of specific interest lately as it is shown that effective teaching is the result of a teachers adequate knowledge on what skills are required and how these skills would be learned (Neuman & Cunningham, 2009). In the context of early literacy education it would include for instance concepts that have been identified as crucial to a child's literacy development, such as phonological awareness (the ability to identify and manipulate sounds in words) and rhyming. This research project was undertaken not only to

investigate the knowledge of teachers on integrating ICT in general. One other main focus was on exploring the knowledge that teachers held on their subject matter. Internationally, researchers have also found that there is room for improvement. For instance Cunningham, studied the skills in phonemic awareness (the ability to detect sounds in words) of teachers in first grade. They found that these skills were not adequate. However the research that furthermore investigates the knowledge base of teachers in early literacy education has been scarce, this study makes a humble attempt in adding to this research domain.

Three broad categories of knowledge within the domain of early literacy have been identified: (de)coding skills, skills in understanding and book reading and skills in functional literacy (McKenney, Bradley & Boschman, 2011). Decoding skills relate to the ability to identify the sounds that letters represent; skills in understanding involve vocabulary development and listening comprehension; and functional literacy relates to the communicative purposes of language (e.g. understanding the connections between written and spoken language, or purposes of various text types).

*Content knowledge* alone is not regarded as being effective in teaching early literacy, pedagogical skills are also vitally important. However we do believe that teachers need adequate knowledge of these concepts and the mechanism that they represent in order to understand how literacy develops and how it can be fostered. Therefore, when investigating this domain, teachers will also elude their pedagogical content knowledge, or their knowledge on how they believe this should be taught.

*Pedagogical knowledge:* Pedagogical knowledge refers to deep understanding of pedagogical principles for appropriate classroom practice in education (Mishra & Koehler, 2005). Morine-Dersheimer & Kent (1999) conceptualized pedagogical knowledge to be

influenced by personal beliefs, theoretical knowledge and personal experience within a specific context. The way a teacher thinks about teaching is strongly influenced by the context in which s/he works. In the context of early childhood education knowledge on classroom management, cognitive development of young children and developmentally related theories can be found. *Technological knowledge*. However enthusiastic educators may be, technology integration does not automatically happen by itself. Many integration problems arise when teachers face a dissonance in their pedagogical practice and the pedagogical value that are in line with using ICT. Such barriers are seen as most hindering and rather hard to overcome (Ertmer, 2005). Teachers for instance may find that computers should only be used traditionally, or computers have only a marginal place in education. These represent beliefs about appropriate pedagogical ICT practice. In early childhood education, the appropriateness of using ICT has been questioned (Cordes & Miller, 2000).

## 2.2 Teachers knowledge representations

This study explores the contents of teachers practical ICT knowledge by investigating the three separate domains. To study the contents of each of the three domains we address to Shulman's assertion for investigating these domains. "A conceptual analysis of knowledge for teachers would necessarily be based on a framework for classifying both the domains and categories of teacher knowledge, on the one hand, and the forms for representing that knowledge on the other." (Shulman, 1986). Shulman proposes that practical knowledge in each of the domains is represented as a *propositional knowledge, case knowledge and strategic knowledge*. Propositions are prescribing in nature ("When a child does A, a teacher should..." or "Do not do A.."), cases are vivid descriptions of events and strategic knowledge is the result of a person



negotiating conflict between propositions or cases. This last type of knowledge is accountable for the variations in outcome of innovations that teachers have faced. If a teacher decides to neglect and stick to his old ways of teaching, such knowledge is seen as strategic. Due to the complex nature of strategic knowledge and the difficulties in obtaining such knowledge (teachers can be reluctant to express opposing views), we focus on representations of propositions and cases. This has consequences in exploring knowledge of teachers within each of the three domains. Mainly in which form they represent this knowledge, either by stating propositions or rules of thumb that they use, or by expounding on practical examples or a combination of these three.

The exploration seeks to build our understanding of teacher practical knowledge from the ‘ground-up’ or as Verloop, Van Driel and Meijer (2001) remind us: “... it seems advisable to use predetermined categories as little as possible in research on teacher knowledge. Instead, researchers should try to develop such categories in interaction with teachers.” In this study it is believed that when we have teachers ‘fill’ the domains with their practical knowledge, we as a researcher can be able to communicate what and how these domains could be enhanced and ‘filled more’. In this study, the three broad domains of knowledge have been identified: early literacy (education), pedagogical practices in early childhood and technological appropriate practices in early childhood education. In these three domains, we seek to understand teacher practical knowledge as represented in the form of propositions cases. The research question in this explorative study was:

- What are, in terms of propositional and case-knowledge, the contents of the technological, pedagogical and early literacy knowledge domains of teachers as designers of ICT-rich learning environments for early literacy?

### 3. Method

#### 3.1 Participants and setup

10 teachers voluntarily participated in this study. Of those, 7 were regular teachers, 2 teachers with extended early literacy knowledge and 1 retired teacher who is still active as a teacher-trainer with expertise in ICT and early literacy. Years of experience ranged from 3 to 28 years ( $M = 24,33$ ). All participants were female, ages ranged from 26 to 61 ( $M = 50,33$ ).

#### 3.2 Instrument

Methodological triangulation (Miles & Huberman, 1994) was reached through 2 sources of data: semi-structured interview and the production of concept maps about early literacy. The theoretical framework identified three domains: technological, pedagogical and early literacy knowledge. Within each of these domains, teacher knowledge was sought through representations as either propositions or cases. This was translated into the semi-structured interview protocol. We chose three types of question, one was addressing their self-perceived level of expertise within the domain the second one directly addressed their beliefs / attitude towards this domain and the third question regarded case knowledge.

*Table 1. Interview questions*

	<b>Technological domain</b>	<b>Pedagogical domain</b>	<b>Early literacy domain</b>
<b>Self-perceived level of competence (proposition)</b>	<ul style="list-style-type: none"> <li>How well do you think your abilities are to use ICT?</li> </ul>	<ul style="list-style-type: none"> <li>How well do you think your teaching abilities are?</li> </ul>	<ul style="list-style-type: none"> <li>How well do you think your abilities in this domain are?</li> </ul>
<b>Knowledge and beliefs</b>	<ul style="list-style-type: none"> <li>What is your opinion</li> </ul>	<ul style="list-style-type: none"> <li>What is your opinion</li> </ul>	<ul style="list-style-type: none"> <li>What is your opinion</li> </ul>

<b>(proposition)</b>	about ICT and early childhood education?	about early childhood education?	about early literacy?
<b>Practical examples (case)</b>	<ul style="list-style-type: none"> <li>• How do you use ICT?</li> </ul>	<ul style="list-style-type: none"> <li>• Can you explain about your own pedagogical practices</li> </ul>	<ul style="list-style-type: none"> <li>• Can you explain your practices in early childhood education?</li> </ul>

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### 3.3 Procedures

The semi-structured interviews were held at the schools where participants worked. All of these interviews were videotaped. Prior the interview, all teachers signed letters of informed consent. The interview lasted approximately 1 hour. In another session, teachers were asked to draw concept maps about the topic ‘early literacy’. All teachers were presented with an example concept map about a different topic before drawing their own. Furthermore there were no restrictions, they could use any material. All teachers preferred paper and pencil.

### 3.4 Analysis

The recorded interviews (N=10) were transcribed. Following Polkinghorne (2005) we selected larger coherent pieces of discussion on one single topic, usually prompted by interview questions. These pieces were then studied, and all relevant propositions, or cases were identified. Propositions were found when teachers expressed their understanding of a topic; and cases were examples, rich in detail. This procedure was done for each item in each single participants’ interview. This resulted in a list of summaries, divided in cases (n=34) and propositions (n=146). The next step in analysis was labeling the summaries, making categories of summaries. During the interviews it became clear that all teachers felt comfortable in expressing their level of competence, followed by explaining what topics they believed were relevant. We then further zoomed in by asking for their opinions, beliefs and invited teachers to express those as candid as possible, stating that there was no wrong answer.

Table 2. Summary of categories within each domain for each case

	Technological domain	Pedagogical domain	Early literacy domain
<b>Self-perceived level of competence (proposition)</b>	Adequate (n=9),	Adequate (n=10)	Adequate (n=10), yet 3 teachers stated:... room for improvement.
<b>Knowledge and beliefs (proposition)</b>	n = 55	n = 50	n = 61
<b>Practical examples (case)</b>	n = 10	n = 10	n=14

Simple descriptive data were extracted from the concept maps to gain an impression of the depth and breadth of participant conceptualizations. This involved tallying all concepts and links, and calculating mean and SD. More extended, qualitative analysis was conducted with the actual content. First each concept was coded in terms of its relation to the three strands of early literacy described previously: (de)coding; (listening) comprehension; and functional literacy. Next, patterns in the map elements were identified.

## 4. Results

### 4.1 Technological knowledge domain

#### *Appropriateness of computers in early childhood*

Teachers responded positively to computers and appropriateness in early childhood education. Most teachers state that computers are part of children's everyday life, yet children should be able to work on them individually. The fact that computers are default in any standard household was also seen as being positive. A number of teachers expressed the opinion that computers therefore should also be placed in classrooms, as it would resemble the home-learning

environment. One teacher expressed: *“It is really feasible, software that is written for kindergarteners is really fun.”* Another teacher stated: *“It is there, and you had better make good use of it.”*

### *How teachers integrate computers*

Within this domain a most of the summaries surrounded the theme ICT integration, expressing how teachers used the computer in their classroom, ratio proposition-participant 9:6. Computers were mainly seen as part of an array of material to be used in the early childhood classroom. Most teachers expressed that they mainly used computers for individual practice, either children who needed extra attention or for smarter children. Propositional knowledge was expressed as a belief; “... computers are extra.” “...computers are just another way of”. This was also reflected in their case knowledge, all of which were individual types of computer use: programs such as BAS and Treasure Chest. Interesting was that teachers who had access to a digital whiteboard also used digital storybooks and on occasion some movie’s. Only four teachers had access to a digital whiteboard at that time. Most teachers felt comfortable in using the computers in their classroom, most expressed interest in learning more “tips and tricks” on how to integrate computers, mostly pertaining to classroom management. Barriers to these teachers were mainly concerned with technical issues, speakers not working, inappropriate hardware or software that did not work. These teachers all felt that when the software was installed they could work with it. This shows that most teachers feel comfortable in using computers in a way that they feel is appropriate.

### *Pedagogies in early childhood ICT use*

Another pattern that emerged was the topic of what was appropriate ICT use in early childhood education. This was mainly surrounding a developmental approach to using ICT. One of the teachers expressed the reason a 10 minute time limit: “These eyes are still developing, and have not adjusted to staring at a computer screen for too long.” Another teacher stated that computers require children to know how to communicate with a computer and that this is difficult for children and that therefore to learn they need human communication.

*“In their development, young children need person-to-person contact, such can never be provided by computers. Their motor-skills are not that developed that they can operate a computer, like I have a question and this is what I will do to ask the computer this question.”*

The ICT and early literacy expert had an opposing belief about computers in early childhood education.

*“Computers have unending patience, and if designed well they will always let the child do the right thing. So they are not presented with the feeling of failure. That is important that children have the feeling that they don’t fail. This is one of the advantages of well-designed computer programs.”*

This is evidence that most teachers’ ICT-use was driven by beliefs that would fall in the pedagogical domain; in what is developmentally appropriate and what is ‘good’ classroom use. Their beliefs within these propositions are expressed clearly, but vary across teachers. For

instance when addressing learning strategies linked to ICT. The teacher who stated that children could not communicate with computers also stated that children in kindergarten ages should learn by playing with concrete materials. Computers were merely extra. Another teacher, one from the same team but who graduated 3 years ago, stated that when she had a digital whiteboard, she could use it to aid children in developing a transition from concrete to more abstract thinking. In her opinion, computers had an advantage over using concrete material there. This difference could be accounted for by years of ICT experience. Where the first teacher had less experience. Most teachers addressed to the ICT questions through their pedagogical beliefs. None of the regular teachers linked ICT to early literacy beliefs, in contrast to the more language experienced teacher:

*“If you for instance have computer program that focuses on auditive synthesis but does not use letters, you know this cannot be done separately, I will not use the program. It is not appropriate to do so.”*

Most teachers when linking ICT and early literacy only expressed what programs or applications they used: digital storybooks, software specifically designed for early childhood and on occasion a word processor. None of the teachers regarded computers from a early literacy appropriateness standpoint.

#### 4.2 Pedagogical knowledge domain

##### *The importance of a child's wellbeing in kindergarten.*

All teachers expressed confidence in their own ability to teach in early childhood education, judging this as adequate or good. Striking was also that in their expression, they clearly expressed their beliefs and convictions. Using words as: *“What is really important..”*, *“What I think is most important..”* and *“...in my opinion this is essential.”* The importance of the development of children's social emotional growth was considered essential by teachers. If a child feels self-efficacious, knows classroom structure, it will enhance further learning. Teachers will develop this by adapting their level of verbal communication *“Adjust to their level, don't use the word 'not' just tell them what you want.”* But also by closely observing a child's behavior, in group and in individual setting. One teacher stated: *“Look closely, know where children are, what do you think that children think, why does a child react the way it reacts.”* And furthermore she states: *“... you will always find entrance cognitively.”* This expresses the feeling that was shared by a number of teachers, that a child's well being is their first concern and that when this is ensured a child will be able to learn. Following this, teachers stated that observation is best done when children are seated in small groups. This links developmental value directly to classroom practice that is most salient in early childhood education. Many teachers expressed the advantages of small-groups, they could observe every child, interaction between children and teachers was higher and time-to respond to questions was decreased. Furthermore, it promoted childrens' peer-to-peer interaction. Children were believed to learn from each other and help each other.



*“...sometimes a child asks: “Can I help him, he does not understand that well.”  
 Than I respond: “Of course you can help!” Nothing is more wonderful than that... with  
 us this can be done easily, not in higher grades. But with us... That’s how they learn and  
 a child is happy that something worked out and that’s how they learn all sorts of things.  
 That’s how it works.”*

Observation skills were mentioned by all teachers as most important when working in early childhood education. These skills were needed to assess children’s responses to each other, how children played, their general emotional well-being and to their specific learning needs.

### 4.3 (Pedagogical) Content knowledge domain

#### 4.3.1 Semi-structured interview

##### *Teaching early literacy*

Teachers were confident in their ability to teach early literacy. In this study the particular focus was on early literacy subject matter knowledge. The first thing that appeared out of the data was that when discussing early literacy, they quickly addressed to their use of teaching strategies. This would be categorized as knowledge within the pedagogical content domain, or teaching early literacy. No accounts were recorded in which teachers showed in-depth early literacy subject matter knowledge. Striking was also that the propositions that teachers made about early literacy, did not express their beliefs, they mostly summed up their strategies and some case examples of skills. These strategies were: early literacy teaching through play and motivate children by making them curious about literacy. Both were related to each other, when

for instance literacy was introduced to children by a form of play, this would fuel their curiosity. *“Children, when made curious, make their own discoveries about literacy, isn’t that beautiful?”*

Traditional teacher directed group activities prevailed and these activities could be initiated throughout the entire day, mostly in moments of transition. These activities were all teacher initiated and when explaining what they did, they summed up a lot of concepts that they believe are part of early literacy development: rhyming games, ‘cut and paste’ exercises, letter-sound exercises to name a few. *“We do rhyming games, letter naming games...”* and *“... well you know such things as rhyming, book reading, reading a name, cut-and-paste.”* When compared to teachers with more expertise in early literacy, a difference in statements was recognized. These teachers not only knew various teaching strategies but also explained the rationales behind some of their strategies. This is shown in the reflection of one teacher who worked as special education as a dyslexia / early literacy specialist:

*“There are some children for whom certain phonological tasks are not appropriate for their age. You don’t have to start with that at age four. This is important to know... I know, one of the main predictors of later reading success is letter knowledge. This has a high relationship with reading education in first grade.”*

Another teacher who earned her degrees as a teacher trainer also expressed similar deep understanding of subject matter. She began explaining that all teachers should know exactly what the origins of our writing system are to better understand its’ implications in education. She taught this to all teachers: writing came into existence in the will to communicate through symbols. These symbols had meaning and could transport a message. Furthermore she addressed

the need for a more skills based instruction that used pictograms and sound-letter knowledge and even stated that in the Netherlands she found this to be lacking in general early literacy teaching strategies. It should also be stated that this teacher was the designer of a computer program that did just that, teach isolated skills in a closed environment to ensure deep letter-sound knowledge. It seemed however that this last teacher was bit of an odd one out. She had her teaching license, but earned most of her merits in teacher training and practical research on early literacy and is acknowledged for this achievement. Her opinions about early literacy are rather strong and sometimes opposed to scientific knowledge. These opinions and deep knowledge all were the result of years and years of experience as a teacher trainer, all of this knowledge was mainly practical. She explained that when working with disabled children, she constantly addressed to their learning needs and questioned herself about what would be appropriate.

Therefore we can conclude that regular teachers early literacy subject matter knowledge is basically pedagogical content knowledge and that most skills that teachers identify are explained as case examples and not as much as propositional statements that address specific early literacy topics.

### *Importance of early literacy education*

Another theme that was regularly expressed addressed the importance of early literacy education. *“If you cannot read, you are hindered in functioning in this society”*. Learning to read was also shown as one of the important skills that schools should focus on. *“Next to Arithmetic, reading is one of the most important things.”* Teachers addressed to these questions more in terms of propositions.

*Functional literacy*

Functional literacy pertains to the ability to recognize the meaning of written language. In most cases however, teachers used the concept of functional literacy to explain cases in which they engaged children into play-related activities in play corners. They saw this as one of the ways to gain children's interest in learning to read, in other words they used functional literacy to motivate children through playing with authentic self-written literacy material. Still, the skill-based traditional approach prevailed, and teachers stated this as one of the many ways that early literacy could be taught.

*Goals are important*

In the early childhood grades, it is common for teachers to use a standardized test that assesses children's knowledge and skills in early literacy. Two important instruments were mentioned, the dyslexia protocol and the Cito test. This assessment material clearly specifies what skills a child must exhibit in order to pass onto the next level of reading, functional reading. Most teachers expressed that their conceptual understanding of early literacy was through working with these tests. *"They show you what you should do."* Most concepts that were included in these tests could also be found in the conceptual knowledge of teachers. Especially the term 'cut-and-paste' was used a lot. Teachers also valued that knowing what children need in first grade (groep 3) is very important. *"I know from experience what children need to know in first grade, this is useful when teaching early literacy."* Another teacher stated that *"Whenever we don't know exactly what to do, we ask our colleagues in first grade. For instance if they know if something is out of the ordinary or maybe inappropriate."*

Early literacy subject matter knowledge was also addressed in this study by concept map analysis.

#### 4.3.2 Concept map

A large variety was shown in teachers concept maps. A total of 9 maps were analyzed (one teacher decided to discontinue participation due to personal circumstances). At first glance, the concept maps showed great diversity in shape and number of concepts. The mean number of concepts located on each individual map was 16, but the standard deviation of 7,28 shows that the variety was great. All concept maps were drawn with “early literacy” surrounded by other concepts. Concepts that were directly linked early literacy were considered first level concepts. Here too, analysis showed variety, with theme and number of level 1 concepts being 7 and the standard deviation of 2,57. In only 4 concept maps were cross-links were drawn between branches below the first level.

*Decoding:* The majority of the concepts listed by teachers pertained to this domain. The concept with the highest frequency was ‘letters’ (n=4) or ‘letter-related’ concepts (n=20). Rhyming and related concepts took second place (n=5).

*Understanding:* Within this category, books as well as book-related activities were prevailing (n=16) mostly linked to vocabulary (n=6). Most of the concepts in this category pointed to teaching understanding, through book reading, talking, and using pictures for vocabulary development.

*Functions:* Writing and related activities (n=15) dominated this category. Most teachers (n=7) identified concepts that fall in this category.

## 5. Conclusion and discussion

This small scale qualitative study was set out to explore practical knowledge in the context of the design of an ICT-rich learning environment for early literacy. Participants in this study volunteered out of interest in early literacy and ICT. The main goal of this study was to gain insights into their propositional and / or case knowledge within three domains. These domains were: (a) technological knowledge, (b) pedagogical knowledge, (c) knowledge of (teaching ) early literacy. Their practice is influenced by their understanding within each of these three domains and the way that they weave those three bodies of knowledge together. By investigating the contents, through explicating their propositional and case-knowledge, we gained insight into the contents of each body of knowledge and how this content was intertwined across domains.

Results of the responses within the technological domain showed that teachers felt competent in using computers, they managed very well but that mainly technical problems impeded that use. Results also show that most teachers address to ICT from a pedagogical frame of mind. They expressed regarding ICT as a positive factor in young childrens' lives and that it has its' place in early childhood education.

Responses pertaining to the pedagogical knowledge domain had a strong orientation towards: (a) appropriate classroom practices in early childhood education and (b) developmentally appropriate strategies. Most emphasis was on childrens' socio-emotional development. This was the main concern of teachers. If this prerequisite was met and children felt comfortable, safe and competent, teachers believed that learning would be successful. Given

the context of this study, early childhood education, these responses are expectable. In the Netherlands early childhood education has been influenced by the works of Vygotsky, Piaget. The work and heritage of these developmental psychologists still have a profound influence on early childhood education (cf. Leseman, Rollenberg & Rispen, 2001).

The results show that within the context of early literacy, subject matter knowledge is naturally tied to *teaching* subject matter. A reason for this is the nature of the subject matter. Unlike subject matter knowledge in for instance secondary education science, this subject matter is not so much involved into teaching topics, early literacy development is basically skill focused. A skill is learned in action, in other words reading skills are not transferred as conceptual knowledge, rather they are transferred through specific exercise. Scientific knowledge for teachers on early literacy is also expressed in propositions that guide classroom practice. Conceptual understanding therefore is also on teaching early literacy, rather than on in depth knowledge about the concept itself. This is contrast to teachers with more exemplary knowledge in early literacy. They expressed deep understanding of early literacy topics by addressing some specific issues like the fact that phonological awareness is always linked to recognizing letters.

Another reason for the fact that early literacy knowledge is about teaching early literacy is the way that this knowledge itself is taught to teachers, either through their initial teacher preparation program or in in-service education. Most teachers have primarily general subject matter knowledge. Early literacy is not a specific subject that is taught in-depth in teacher training programs. Teaching early literacy has also been subject of strong debate about what is appropriate and important (see IRA & NAEYC, 1998). There is set body of (scientific) knowledge that is communicated to teachers as authoritative in Dutch pre-service programs, and

as a result teachers derive their knowledge base out of a variety of sources. It would appear as though teachers conceptual knowledge highly resembles that which is reflected in standardized curricula and testing material. However we also need more evidence of successful early literacy practices using technology. This study revealed some aspects of teacher practical knowledge relating to technology use for early literacy development. This study suggests that especially pedagogical knowledge is well developed, expressed in beliefs and showing a strong influence of developmental psychology. Socio-emotional wellbeing and play as learning feature prominently in the practical knowledge of these teachers. Teachers technological skills vary, but however their skills are, they manage to use computers in a way that they view as appropriate. They also suggested that they would welcome any form of professional development on technology integration in the classroom. In terms of content, teachers tended to be more focused on issues related to (de-) coding and less on the functions of language, although there was some attention to writing.



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