Teachers as (re-)designers of an ICT-rich learning environment for early literacy
Paper presented at the annual ECER meeting September 13-16, 2011, Berlin

Amina Cviko, Susan McKenney & Joke Voogt
University of Twente, the Netherlands
a.cviko@utwente.nl

Abstract
Teachers often struggle to implement ICT-integrated curricula in kindergartens. Since teacher participation in ICT rich curriculum development potentially benefits curriculum implementation, this study investigates two forms of teacher involvement in curriculum. A case study method is used to study 4 teachers as redesigners and 3 teachers as co-designers of a ICT rich curriculum. Interviews are used to study teacher perceptions about their role and about the curriculum. To study the (re)-design process accounts were made during team meetings. Observations were made of the actual implementation of (re)-designed curricula. Pre-and post test on emergent literacy was used to examine pupil learning outcomes. In both teams teachers engaged in exchange of perspectives, contributed equally to decision making and have reached a team outcome. Teachers in both teams perceived themselves as co-owner, had positive perceptions about quality and practicality of the (re)-designed and curriculum. Doubts about teachers responsibility taking the role of redesigner have been reported in the resdesigner team. Findings indicate that the extent of integration of on-and off computer activities was higher in the class of teacher as designer compared to redesigner classes, as well as pupil learning outcomes. Tentatively it can be concluded that the role of teacher as designer does impact more positively effective curriculum implementation, than the role of redesigner.

Introduction

Teacher involvement in the development of classroom curricula, often fosters a sense of ownership, which increases the chances of actual curriculum use (Fullan, 2003). When teachers are supported during the design of innovative curricula, they can learn more about the innovation (Crow & Pounder, 2000), which also increases the chances of the implementation being successful. This is partly because teachers are then better informed, and able to visualize how curriculum enactment could look. Being able to 'see' a curriculum in action is an important factor considered by teachers as they weigh off the amount of effort they invest and the potential benefits of the innovative curriculum (cf. Doyle & Ponder, 1978).

Designing requires precious teacher time and effort, but also has the potential to improve the implementation of an innovative curriculum. There are various ways to involve teachers in design and to support that involvement. This study is concerned with exploring what forms of involvement are feasible, and still yield the benefits of ownership, and understanding a new curriculum? Do teachers have to create materials from scratch to experience these benefits? This study seeks to understand two forms of teacher involvement in curriculum development: (1) collaborative teacher curriculum *redesign* and (2) collaborative teacher curriculum *co-design* and their impact on teachers curriculum perceptions, curriculum implementation and on pupil learning. The following section describes the conjectured relationship between teacher involvement, curriculum implementation and pupil learning which underpins this study.

Teacher involvement in curriculum (re-)design

The relationship between teacher involvement in curriculum development, curriculum implementation and pupil learning is complex. This interaction is mediated by a host of different factors, including characteristics of individual teachers, school cultures and

curriculum policies. Rather than striving toward a comprehensive picture of how all factors interact, this discussion centers on particularly powerful factors related to teacher involvement in curriculum development and how they influence curriculum implementation which then influences pupil learning. Figure 1 shows assumptions underlying this study about how these factors interplay. The remainder of this section describes the theoretical underpinnings or relationships shown in the model.

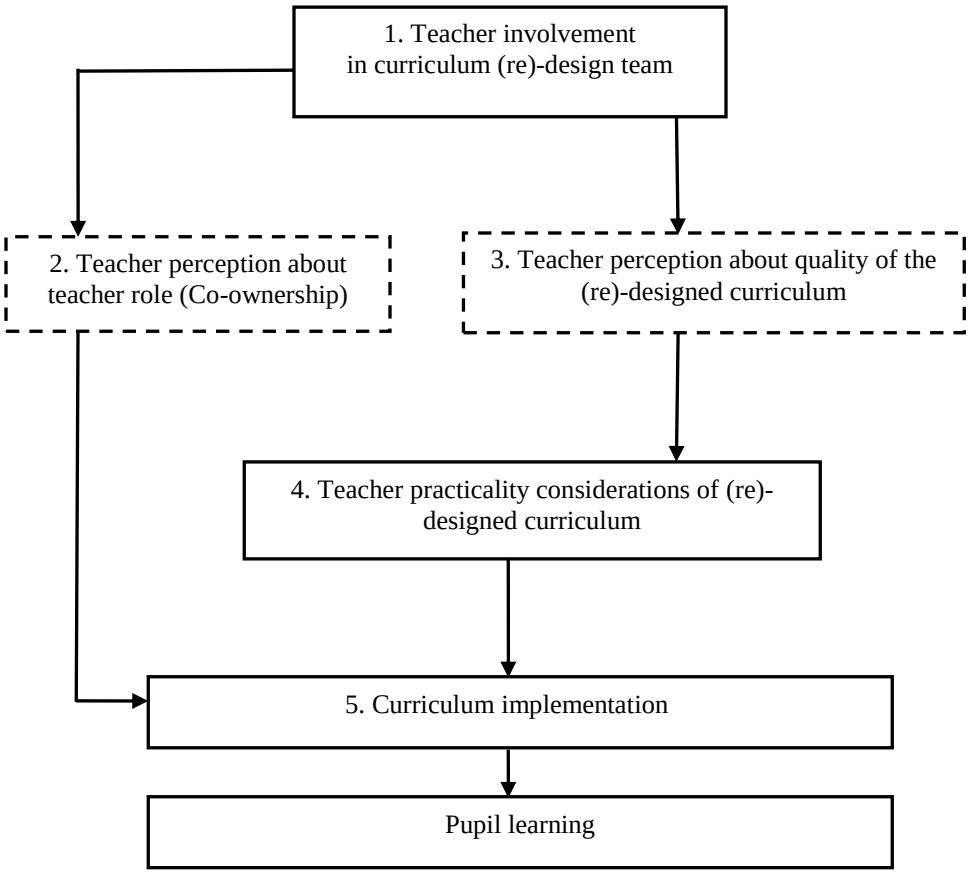

Figure 1 Components related to curriculum implementation and pupils learning

Teacher involvement in (re-)design

Teacher involvement in collaborative work on (re)-design of their curriculum is shown to contribute to teacher understanding of what it means to teach with technology (Koehler & Mishra, 2005; Reiser, Spillane, Steinmuller, Sorsa, Carney & Kyza, 2000). According to Keengwe and Onchwari (2009) teacher collaborative curriculum development should feature hands-on opportunities and actual integrated lessons. Collaboration around technology practices may make pedagogical beliefs more explicit and give teachers the opportunity to experience how classroom practices may transform due to integration of technology (Ertmer, 2005). Thus, teacher curriculum development such as hands on

opportunities for co-designing curriculum materials or redesign of actual technology integrated lessons can contribute to positive teacher perceptions about the curriculum (Abrami, Poulsen & Chambers, 2004), shape teacher attitude towards their role as (re)-designer (Becker & Riel, 2000) and actual technology integrated classroom practice and pupil learning (McGill-Franzen, Allington, Yokoi & Brooks, 1999, Parette, Quesenberry & Blum, 2009). However, current literature does not completely explain how teacher participation in a curriculum (re)-design team relates to curriculum implementation.
Several factors can be identified to describe a (re)-design team process, which influence team outcome and curriculum implementation, for example teacher perceptions of redesigned curriculum, perceptions about co-ownership and practicality considerations (components 2, 3, and 4).

Teacher role as (re)-designer
The relationship between teacher curriculum (re)-design and successful curriculum implementation seems to be mediated by teachers' experience of taking ownership of an innovative curriculum (Kirk & Macdonald, 2001; Fullan, 2003). The experience of taking co-ownership of an innovative curriculum is considered to be fruitful for implementation, since experiences in re-shaping a curriculum gives teacher a voice in curriculum (Carl, 2005, 2009). Collaborative teacher (re)-design can help teachers experience ownership of the definition of effective teaching with technology and its implementation (Ertmer & Ottenbreit-Leftwich, 2009) and their role as (re)-designer. Becker and Riel (2000) suggest collaborative (re)-design of learning environments for pupils as an effective way in developing teachers as designers of classroom practice.

Teacher perceptions about quality of curriculum and curriculum practicality
Collaborative (re)-design can enhance teachers perceptions that they can succeed to implement an innovative curriculum in their own class (Abrami, Poulsen & Chambers, 2004). Research shows that in face of a new curriculum teachers engage in a decision making process about the curriculum in relation to its implementation. Specifically, teachers consider the quality and the practicality of a curriculum for their teaching context. As Doyle and Ponder (1977) state, a teacher considers practicality of an innovation (component 4) based on three components. First, teachers consider how well specified is an innovative curriculum. Second, teachers consider the relation between their effort they invest in the curriculum (costs) and the benefits of the curriculum for their classroom. And third, teachers consider how congruent the curriculum is with the needs of their classroom and specific students. Teacher practicality considerations determine the likelihood of actual incorporation of an innovative curriculum in classroom by teachers (Doyle & Ponder, 1977). Teacher considerations about the quality and practicality of a curriculum are shown to account for teacher use of a curriculum in classroom. Abrami, Poulsen and Chambers, (2004) found that teacher perception of the value of an innovation, expectancy of successful implementation, and perceived cost explain together for about 43% of the variance in teacher use of the curriculum, which means that curriculum implementation relates to teacher curriculum practicality and quality perceptions.

Current literature does not explain how teacher involvement in curriculum redesign (component 1) influences teacher perceptions about quality of redesigned curriculum (component 3) and teacher practicality considerations about curriculum (component 4). When involved in collaborative curriculum redesign (component 1) teachers may form their judgments about practicality of curriculum (component 4), which is how practical a curriculum is, and what consequences there are when a curriculum is implemented in a classroom considering invested efforts in redesign, on the deliberations made in a curriculum redesign team. This relationship might be mediated by teacher perceptions about quality of curriculum (component 3), which is how well a redesigned curriculum is specified and its congruence with the classroom needs on the deliberations made in a curriculum redesign team, which in turn may influence judgments about how practical a curriculum is, and what consequences there are when a curriculum is implemented in a classroom considering invested efforts in redesign (component 4). Also this relationship between component 1 and 4 might be mediated by teacher perception of their role as (re)-designer in a team which is assumed to help teacher in taking ownership of the (re)-designed curriculum.

Curriculum implementation and pupil learning

Teacher practicality considerations (component 4) relate to teacher actual curriculum implementation in classroom (component 5), (Doyle and Ponder, 1977). Teacher involvement in curriculum design allows teachers to experience co-ownership of curriculum, form their opinion about the quality of curriculum and consider its practicality, which are of importance for curriculum implementation and its sustained use. Active teacher role in curriculum decision making is related to curriculum implementation and pupil learning (Joyce, Clahoun & Hopkins, 1999; Friend & Cook, 1996). McGill-Franzen, Allington, Yokoi and Brooks (1999) found that providing teachers with the opportunity to create literacy-, language-, and print-rich classroom instruction had a positive effect on classroom practice and enhancing early literacy development in pupils. In an early childhood teacher purposive survey covering nine countries teachers reported the need for developing own technology integrated curriculum materials and activities for pupils (Kales, 2010). Moreover, those teachers involved in developing own teaching/learning materials reported that the (re-implementation) and evaluation of own ideas is a primary reason to participate in curriculum development.

Research design

This study explores the comparative effects of teacher involvement in curriculum development in two forms. Both forms involve collaborative curriculum development, where teachers work in teams to create teaching and learning materials. In this case, the materials are intended to foster the development of early literacy concepts in 4 and 5 year old children. One team of teachers re-designs existing materials, the other team creates something new. The assumption underling the research design is that actual implementation of a technology rich learning environment in kindergarten classes should be supported by teacher involvement in its development. Teacher involvement in a re-design team could help teachers experience their role as (re)-designer of classroom

practice, which is assumed to help teacher take ownership of (re)-designed curriculum. Teacher participation in a re-design team gives teacher the opportunity to consider the quality and practicality of curriculum they (re)-design. Involvement of teachers in curriculum redesign may contribute to curriculum implementation and pupil learning.

The main research question guiding this study was: *Are there similarities and differences in classroom implementation and pupil learning that can be attributed to the re-design or design forms of involvement, respectively?* This question was addressed through the following three sub-questions:

1. What do collaborative curriculum design and re-design in the teacher teams look like, respectively?
2. How do teachers integrate the teaching materials in their classrooms?
3. How do pupils learn with the (re-)designed curricula?

Both teacher teams take the PictoPal learning environment as a starting point for their (re-)design work. PictoPal is an ICT-rich learning environment with two main components: (a) on-computer activities through which pre-readers use words, sound and images to construct written texts; and (b) off-computer activities that prompt children to 'use' their printed documents for authentic purposes. For example, children create grocery lists using the computer and then 'shop' for the items on the printed list in the ´store´ corner of the kindergarten classroom. Alternatively, they prepare a weather forecast with the aid of the computer, and then 'deliver' the forecast to their class from the television corner (from inside a 'television' fashioned by the children from a large cardboard box). Figure 2 shows children, with the aid of the computer, composing a letter of invitation. Figure 3 shows children creating an envelope in which to mail the letter. For more information about the PictoPal learning environment, please refer to McKenney and Voogt (2009).

Figure 2 On computer activity

Figure 3 Off computer activity

Research methods

The research questions are being answered through case studies of each team, focused on the team's design work and classroom implementation, including pupil learning. Redesign case study concerns a team of four teachers; design study a team of three

teacher; and pupils of the classes concerned. The respondents were selected on the basis of teachers experiences need for innovating their classroom curriculum for emergent literacy by participating in a re-design of a technology integrated learning environment and implementing it afterwards. In this paper, preliminary results are reported using two case studies: (1) redesigners with four teachers as redesigners and implementers of redesigned PictoPal curriculum in four classes; and (2) designers with three teachers as designers with one of them implementing the designed PictoPal curriculum in one kindergarten class.

The re-design teachers were Fiona, Diana, Mira and Iris; they had 33, 14, 3 and 2 years teaching experience respectively. The design teachers were Jenny, Wendy and Laura. The design teacher Jenny had 6 years teaching experience and, Wendy and Sandra 3 month teaching experience obtained during their internships.

Table 1 Number, gender and mean age (in months) at the start PictoPal per classroom

	n	Boys	Girls
1a, Iris	25	17	8
1b, Mira	25	15	10
2a, Clair	23	12	11
2b, Alice	23	13	10
1d Jenny	20	12	8

Data were collected using five sources: pre-intervention interviews; observation of the team design meetings; observation of classroom implementation; post-intervention interviews; and pupil pre/post-tests. Each of these is described below.

Pre-intervention interviews
The pre-intervention interviews were held with participating teachers about factors that relate to the PictoPal intervention (including education views; attitudes toward ICT; and emergent literacy).

Observation of the team design meetings
In this study, collaborative curriculum (re-)design is examined by observation of the team meetings; this observation takes the form of an open running summary.

Observation of classroom implementation
Classroom implementation is studied through structured observation using a closed checklist, which also contains open areas for comments (Verseput, 2008). Observations were focused on the extent to which teachers integrated on- and off computer activities during eight lessons. Two observers observed two lessons each to account for observer reliability. The observation data on integration was analyzed using analyses of variance

(ANOVA) as the data of the four teachers were independent and we wanted to examine the hypothesis that there was no difference in integration between four teachers.

Post-intervention interviews
Complement the classroom observations to gain more nuanced understanding of teacher decision making during (re-)design and implementation, the post-intervention interviews also probed any possible links between the design roles in each case (initial designers vs. re-designers) and how teachers perceive and enact the PictoPal curriculum innovation.

Pupil pre/post-tests
To study the impact of PictoPal implementation on pupil learning, a non equivalent group quasi experimental design was used with four classes n = 96 mean age 60.7 months (57 boys and 39 girls) learning with the redesigned PictoPal curriculum and four classes n = 65 mean age 61. 2 months (32 boys and 33 girls). Both groups used the standard language curriculum, but teachers enhanced or replaced standard activities with PictoPal activities in the experimental group. All 161 pupils were pre- and post-tested on emergent literacy using the emergent literacy test for 4-5 year olds (McKenney and Voogt, 2006). The similarity of the groups concerning language skills was determined by scores on a Dutch national language test for kindergarteners. Therefore, we analyzed the test data using analyses of covariance (ANCOVA) to test the hypothesis that there were no differences between the control and experimental groups respectively. To study the impact of PictoPal in the teacher as designer class we analyzed the pre-and post-test scores using a paired sample T-test. To investigate the impact of PictoPal in pupil learning of teachers as redesigner versus designers, pupils post test scores on emergent literacy was analyzed using an independent samples T-test.

Results

Teacher teaching/learning views, attitudes toward ICT and emergent literacy

Redesigners
The teachers involved in the redesign and implementation had a positive attitude towards technology-based innovations, expecting a successful implementation of PictoPal. The views on good teaching of young children differed somewhat between the teachers involved in the redesign and implementation. The redesigners Fiona, Iris and Mira view teaching young children as adaptive to the individual learning needs of pupils. In their view adaptive teaching means for a teacher has to know pupils, define their learning goals and offer appropriate learning objects and situations. Also, the teachers implementing the redesigned PictoPal (Alice and Clair) shared an adaptive approach view on teaching/learning of young children. One of the redesigners (Diana) emphasized in her view on teaching/learning a more developmental approach, explaining to have taken the role of a helper of pupils by bringing them in a playful and enjoyable manner one step further in their socio-emotional, cognitive and language development.

Designers

When asked about technology attitude, the teacher as designer reported that her pupils enjoy and show their enthusiasm when working on computers. In a pre intervention interview teacher as designer reported to view technology integration in her kindergarten class an important goal. She felt a need for valuable learning activities supported by computer in the kindergarten language curriculum. The teacher proposed a purchase of a Digital board for her class in her teacher team, by stipulating the connection between the introducing emergent literacy activities on PictoPal on-computer activities and the visual aid of a Digital board supporting her teaching. The teacher as designer reported that she perceived her involvement in the design and implementation of PictoPal a good start toward technology integration in her class. When asked about her view on good education of kindergarteners, the teacher explained her view as:

'*…in my view, kindergarteners should be intrinsically stimulated to understand concepts, for example they should understand that they have to put their play attributes on their place for a reason other than because their teacher want them to do so…or understand why they are not allowed to hit their peers…'.*

When asked about good teaching of kindergarteners in relation to emergent literacy and language education, the teacher gave an example of what it constitutes:

'… when pupils enroll in Grade 3 they should have gained enthusiasm for letters, concentration, and motivation in language education …'.

The teacher did not find it important to strictly follow the proposed number of letters and phonemes kindergarteners should know in kindergarten, but reported to find it important that every child develops enthusiasm to be engaged with language.

The other two teachers were positive about integration of learning activities on computer in kindergarten classes. In Wendy's view good education for young children constitutes stimulating the social – emotional development of a child as a basis for further child development, viewing a teacher not as a person providing knowledge, but also an educator tasked with child development. In relation to language and emergent literacy, she perceives language education important for developing communicating skills needed for child development. In Laura's view of good education of young children, it is important that individual pupils develop a base of early literacy skills they need to be ready for Grade 3. Laura reported that pupils should be taught in a way that suits them and meets their development by

'…teaching pupils to work independently and together, creating a good educational climate, using a wide range of methods and a wide range of learning to offer, suitable for different pupils'.

Laura had an positive attitude towards ICT: she perceives computers practical and useful tools for teaching early literacy curriculum. She felt that computers allow for faster feedback in individual and collaborative pupil learning. Also, in her view a computer

allows for a much faster and more convenient linkages of pictograms to words and sentence composition than a classroom teacher centered lesson.

Collaborative curriculum development

Process

Redesigners

The main process characteristic in the redesign team is the tentative approach of its four members, all contributing equally to the decisions about the goal, content, form, and approach to the new redesign task. Teachers established together a goal to redesign PictoPal by expressing their perception of the importance of emergent literacy activities supported by computers within the language curriculum they already use. Teachers discussed the planning of, and the support during the implementation. Also main redesign principles and the technological affordances and obstacles of the technology rich learning environment in relation to perception of kindergarteners were discussed. An example of the discussed items was dealing with (in)correctness of the sentences as composed by pupils. The issue discussed by teachers showed that teachers had related technological affordances and obstacles, the importance of pupil own choices to create own text and the implementation of computer integrated activities in classroom. The support provided by one researcher focused on the redesign objective, expert information on principles of the technology rich environment for emergent literacy and questions asked by teachers. One team member steered the discussion of the redesign content toward a common goal of the redesign. The contributing members showed confidence and enthusiasm during redesign, mainly when they expressed how their redesign ideas, written down on a paper-drafted version, could look like when implemented. The hands on computer opportunities, the teacher manuals, own curriculum materials and access to the Internet seemed to be motivating for the team members. All members expressed appreciation for having visual support to explore directly the curriculum material and propose adaptations linked to curriculum materials they use. Teaming up in two teams with each two teachers and dividing redesign tasks made the team work efficient as the team size allowed teachers to focus on application of the proposed redesign ideas. The redesign process and the revised PictoPal were evaluated in the team with all members. The time spent in a team was in total eight hours. Teachers expressed that they worked intensively to reach their goal and that they enjoyed the work as they were satisfied with the team outcome.

Designers

Three teachers, with one of them teaching a kindergarten class and two of them having an on-the-job-training supervised by the kindergarten teacher, were involved in the design process of PictoPal. The three design sessions, in total 9 hours designing, started off with one researcher explaining the design objective, showing a demo version of PictoPal and asking teachers to bring in their ideas about a design of a new curriculum module PictoPal and its implementation. The kindergarten teacher introduced a set of principles to be incorporated in the new module. She questioned the quality of the Dutch-voice output in PictoPal. After discussing the technological obstacle, a new plan was set out for

new content and implementation, based on the used language curriculum. A new theme, vocabulary, sentence structure, wished voice intonation and understandability of a text were clearly defined by the kindergarten teachers. Throughout the design process, the importance of the newly defined features and options were discussed by the team members. During the design process the kindergarten teacher expressed frequently a clear understanding of her idea about the design in relation to the main underlying goal of PictoPal, relating the on-computer activities to possible classroom application options. The internship-teachers wrote down the design proposals and contributed to writing a new teacher manual of a new PictoPal.

Teacher perceptions about their role

Redesigners

Teachers defined a role of a redesigner as adapting curriculum to the annual composition and special needs of pupils. In teacher perception, the role of redesigner remains new, because teachers were for the first time involved in redesign of a technology integrated curriculum. Teachers reported to feel responsible for the quality of the content, vocabulary, and the degree of lingual difficulty suitable for kindergarteners. One of the teachers (Mira) reported questioning herself during the redesign as to why she took on the responsibility. She explained that the she dealt with doubts about her role:

'*I have nothing against team work, on the contrary. I am for redesigning our kindergarten curriculum, because it is fun and fruitful for learning, but I was not sure about the purpose of redesign… was the purpose to help curriculum makers adapt curriculum*?'

Redesigning a technology integrated curriculum was not a regular practice of teachers. Commitment and co-ownership were strongly connected to taking responsibility for technology integrated curriculum redesign. All teachers perceived the team product as co-owned product, because the responsibility for product redesign was by teachers. Mira reported to feel co-owner of the redesigned curriculum and to wish to be acknowledged as curriculum co-author. Teachers reported that through their role as redesigner they could understand better how curricula (and underlying goals) are planned which they perceived as an enrichment of their own skills.

Designers

The teacher as designer and implementer of the designed curriculum describes her role as activating and quickly responding to situations. In her view, she is able to adapt to situation such as design and she feels confident about reaching an outcome. When asked about her co-ownership experiences towards the designed curriculum, the teacher as designer emphasized her own input in the preparation of implementation of the designed curriculum. According to her, she adapted the designed PictoPal when preparing PictoPal activities, in order to be able to implement it as she saw fit. She felt co-owner of the design, because she gave an unique input. In her view teachers as designers differ in their design ideas. When taking the role of designer, she explained to expect an attitude

reflected in an active participation in joint thinking about and understanding of design. She felt that all members should have such attitude when taking the role of teacher as designer.

Teacher perceptions about product quality

Redesigners
Teachers reported satisfaction and confidence with the curriculum materials produced by the team. Teachers viewed the redesigned curriculum as good. Also they reported to feel confident about implementation of the redesigned curriculum.

Designers
The teacher as designer felt somewhat confident about the design team outcome. She reported to have had to adapt the introducing activities and off-computer activities during organization of the learning environment.

Teacher perceptions about practicality

Redesigners
Teachers were enabled to put their time and efforts in redesign as pupils were taught by other teachers during the redesign sessions. There was sufficient time planned for redesigning. Teachers recognized their efforts by explaining that they were intensively involved in redesign. The efforts put into collaborative curriculum redesign were in balance with the expected pay offs in their classrooms.

Designers
The teacher as designer perceived the invested efforts in the design in accordance with her perceived expectation of the investment. She acknowledges the input and efforts of other team members: she felt supported by researchers and the internship-teachers during design and implementation, yet emphasized the importance of equally shared commitment of all members toward the design(outcome). In her view, without support, designing a curriculum modules individually would cost time, and would be impractical.

Teacher perceptions about PictoPal
Although both redesigners and designers reported positive expectations toward implementation of the (re)-designed activities, when asked about implementation in a post intervention interview, only the designer was enthusiastic about her active role in implementing PictoPal during next school year without support of reserarchers and intership teachers. She proposed arranging parents to engage in guidance of pupils during pupil computer use. Redesigners were concerned about the integration of PictoPal into the overall language curriculum. They mentioned the wide range of language teaching and learning activities they already use, and propose a focus shift in their language curriculum to make PictoPal a substantial part of curriculum in all kindergarten classes. Next to it, redesigners are skeptical about successfulness of PictoPal implementation

when pupil guidance during on-computer activities is absent. Also redesigners propose to consider the amount and form of pupil support and guidance by taking into account the development of pupil autonomy, an very important teaching aspect of teachers as redesigners.

Teacher integration of classroom materials

Redesigners

An ANOVA with integration of on- and off computer activities as a dependent variable and classroom with 4 levels as independent variable showed a difference for level F (3, 28) = 3. 281, p = .04, $\eta 2$ = 0.26. Table 1 shows integration means for the four teachers as redesigners. A post-hoc test showed that teacher of classroom 1b (Mira) integrated on- and off computer activities at a significantly higher level than did the teacher of classroom 2a (Clair) and the teacher of classroom 2b (Alice) p = .02. This means that the mean integration score of Mira was significantly higher than the score of Clair and Alice, and that 26% of variance in the integration scores can be explained by Mira's teaching integrated activities of PictoPal. The effect can be regarded as a large effect (cf. Cohen , 1988, p. 283).

Table 2 Redesigner integration means and standard deviations

	Redesigner Iris (1a) *M (SD)*	Redesigner Mira (1b) *M (SD)*	Redesigner Clair (2a) *M (SD)*	Redesigner Alice (2b) *M (SD)*
Integration of on- and off computer activities (n = 8)	6.69 (1,44)	7.63 (2.03)*	4.69 (3.01)	5.00 (1.93)

* indicates significance at $p < .05$

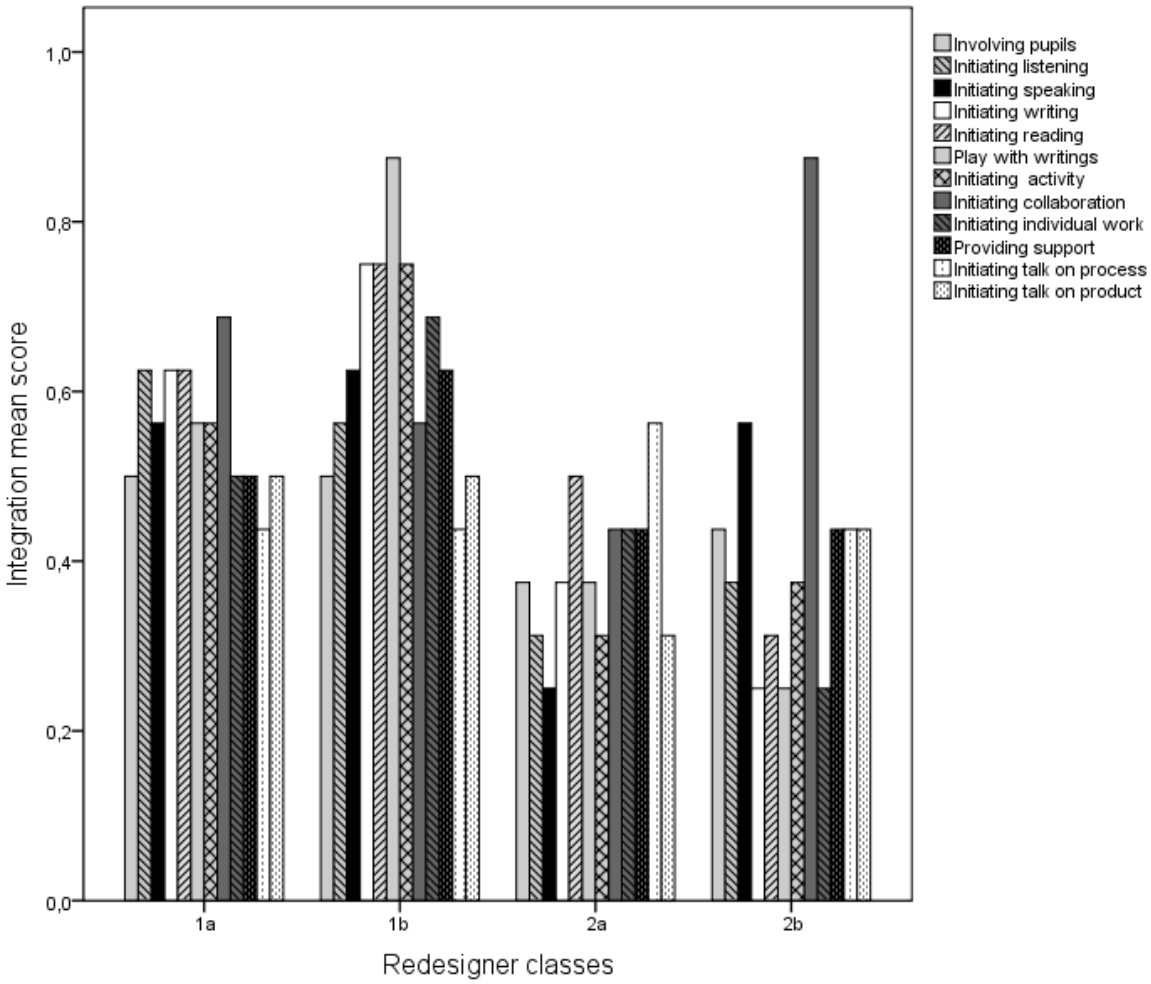

Figure 3 Distribution of observation data on the items of the integration of the on- and off-computer activities in the *redesigner* class

Figure 3 shows the distribution of the scores on the integration items per redesigner class. Specifically, the integration item scores differed between teachers. From the observation data it appears that different kindergarten teachers who redesigned same curriculum emphasize more or less different pedagogical aspects when implementing the pupil integrated computer activities. For example, pupil role play with writings was observed much more in the class of Mira than in other classes. Apparently teachers Alice, Mira and Iris encouraged pupil collaboration on applications of written product created on computer more than Clair. Clair, on the other hand, had supported pupils activity much more than her colleagues.

Designers

Figure 4 shows the observation data on the integration items in the designer class. The teacher Jenny scored highest on involving pupils in activity, as she ensured that at different times of a day there was the possibility for every child to perform the activity. This is also reflected in her high score on the item 'Initiating activity'. Specifically, Jenny put more emphasis during implementation of off computer activities on encouraging

pupils to listen, 'read' and play out their activity related role. Also the teacher initiated somewhat more collaboration between pupils than performing an activity autonomously.

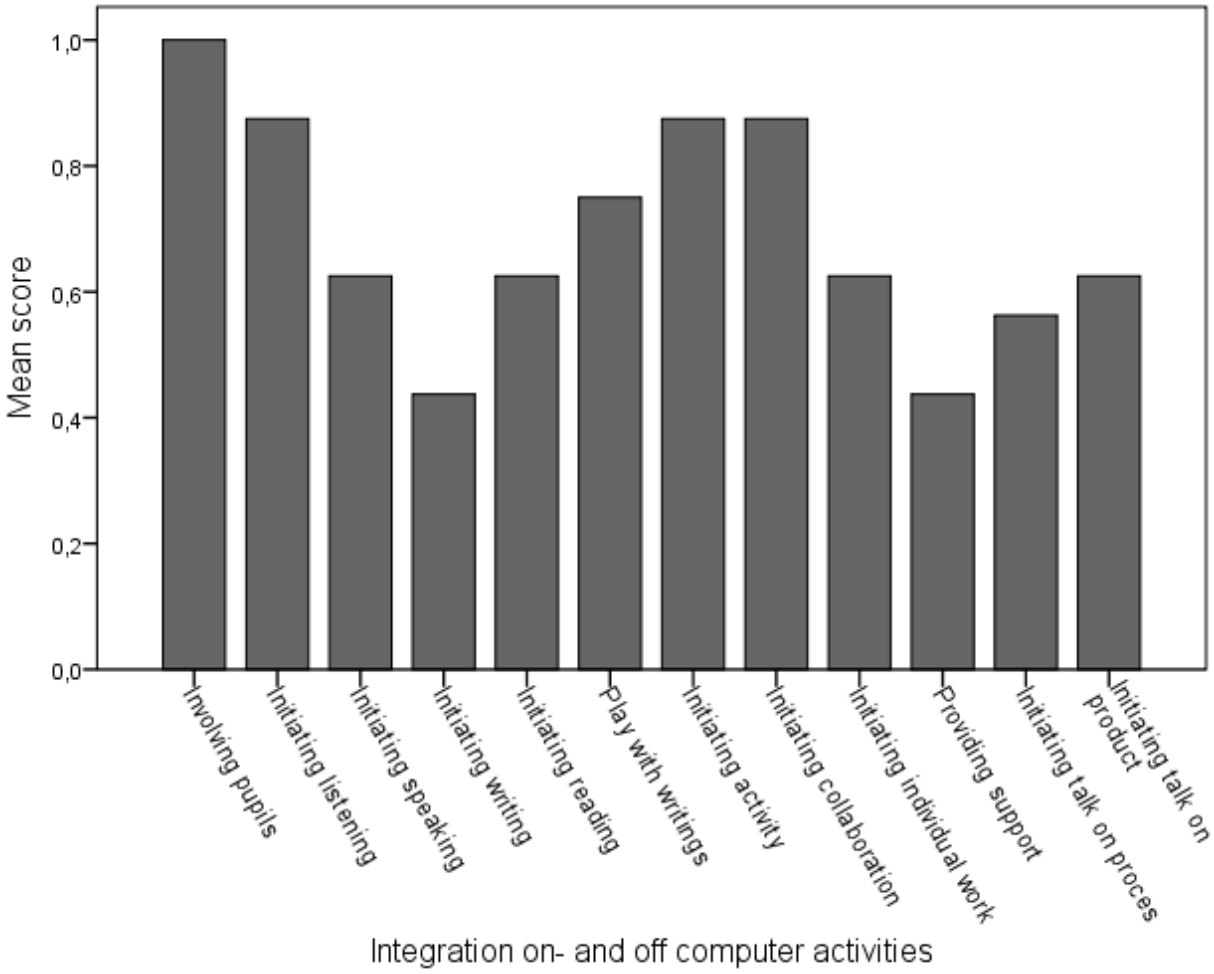

Figure 4 Distribution of observation data on the items of the integration of the on- and off-computer activities in the *designer* class

Designers versus redesigners

Table 2 shows the means of integration in redesigner and designer groups. Overall, a T-test with the integration of the on- and off computer activities as dependent variable and designer versus redesigner group as independent variable showed a significant difference for level. The integration mean score in the designer class (M = 8.31, SD = 1.75) was significantly higher from those of the redesigner classes (M = 6.00 SD = 2.41).

Table 2 Redesigner and designer integration means and standard deviations

	Redesigner classes (n = 32) M (SD)	Designer class (n = 8) M (SD)
Integration of on- and off computer activities	6.00 (2.41)	8.31 (1.75)*

* indicates significance at $p < .05$

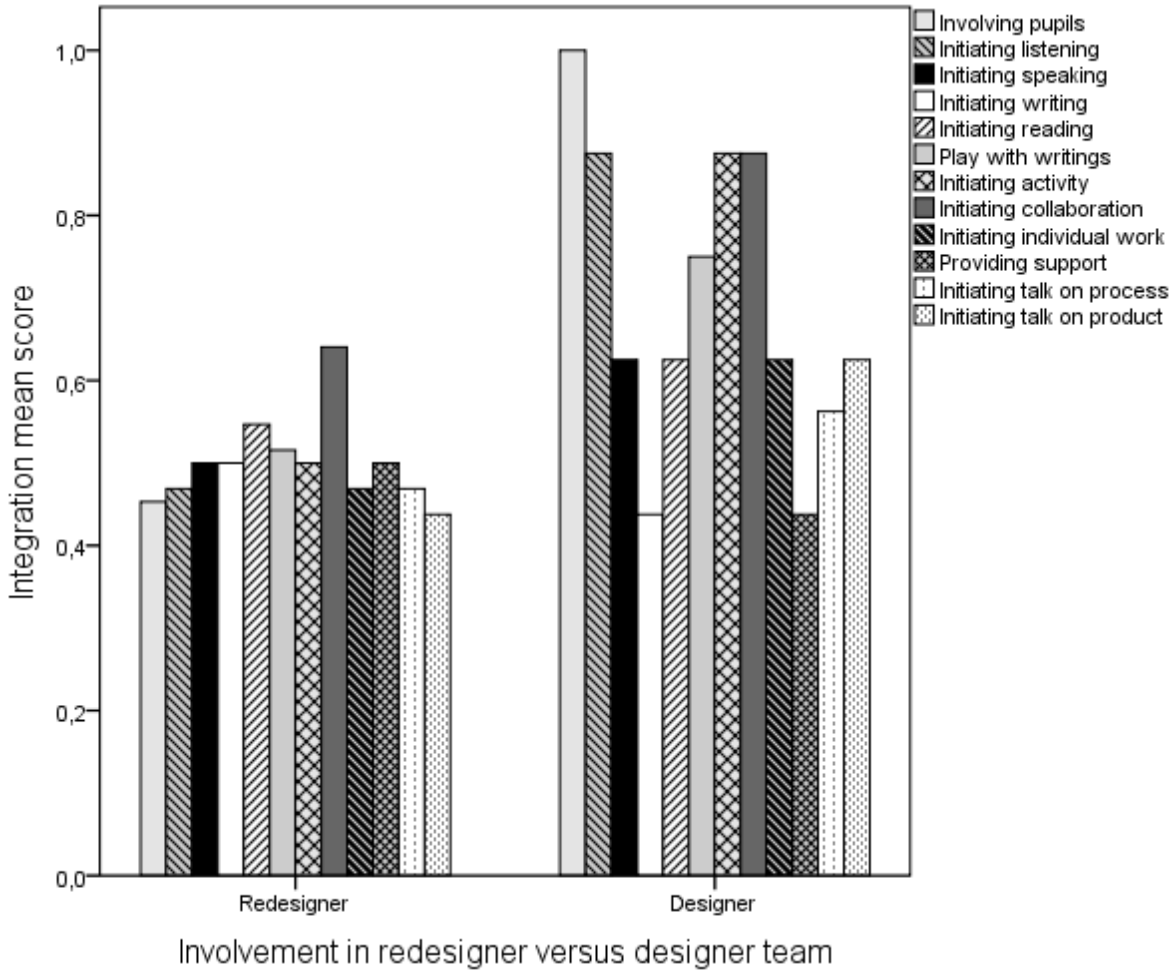

Figure 5 Distribution of observation data on the items of the integration of the on- and off-computer activities in the *designer* class

In Figure 5 the items scores are shown of the redesigner and designer classes. Specifically, initiation of activity and involving pupils in activities are much more observed in the designer class. In the designer class teacher encouraged pupils listening during the off computer activity much more, compared to the redesigners. Writing was observed to be equally underemphasized during the off computer activity in both designer

and redesigner classes. This could be due to teacher perception of on computer activity as mainly encouraging pupil writing process. In the designer class the teacher was observed to stimulate collaboration and play and her pupils accordingly were observed to share, communicate about and use their computer generated products in their role play somewhat more, than was observed during interactions in the redesigner classes.

Pupil learning

Table 3 shows the number of pupils, the mean score and the standard deviation of the emergent literacy posttest of the redesigner and designer experimental groups and a control group. An ANCOVA with post-test scores on emergent literacy as a dependent variable and level (redesigners experimental group and control group) as independent variable, with the pretest scores on the emergent literacy test as a covariate showed a significant difference for level F (1, 138) = 6,951, p = .01, $\eta 2$ = .05. An ANCOVA with the post-test scores on emergent literacy as a dependent variable and level as independent variable, with national language test scores as a covariate showed similar effects F (1, 144) = 5,132, p = .03, $\eta 2$ = .03. The redesigners experimental group scored higher on a posttest when corrected for the national language test scores M = 14, 26, SD = 3, 23 than the control group M = 13, 24, SD = 3, 28. This means that the redesigners experimental group had a significantly higher score on the test compared to the control group. The effect of PictoPal can be regarded as small, as 3 % of the variance in test scores can be explained by PictoPal.

Table 3 Number of pupils, means and standard deviations of experimental groups and a control group

	Pupils (*n*)	Pre-test mean (*SD*)	Post-test mean (*SD*)	*Cohens d*
Redesigners Experimental group	87	11,78 (4,12)	14, 24 (3,58)	.75
Designers Experimental group	20	13,85 (2,87)	16,20 (2,33)	.83
Control group	49	11,44 (3,54)	13, 24 (3,28)	.53

Redesigners

Table 3 shows pre- and post test scores means for the experimental groups. We performed a paired samples T-test to test the hypothesis that there were no significant differences between the means of the pre-and post test scores of pupils learning with the teacher redesigned PictoPal. The T-test showed a significant difference between the means of the two variables: pre-test scores (M = 11.57, SD = 4,32) and post-test scores (M = 14,24, SD = 3,58), t (86) = - 6,989, p = .00. The implemented curriculum had a large positive effect on pupils learning performance *Cohens d* = .75.

Designers

We performed a paired samples T-test to test the hypothesis that there were no significant differences between the means of the pre-and post test scores of pupils learning with the designed PictoPal by their teachers. The T-test showed a significant difference between the means of the two variables: pre-test scores (M = 13.85, SD = 2,87) and post-test scores (M = 16,20, SD = 2,33), t (19) = - 3,685, p = .02. The implemented curriculum had a large positive effect on pupils learning performance *Cohens d* = .83.

To test the hypothesis that the pupils learning with different curriculum materials did not differ on their post-test scores, an independent samples T test was performed with post test scores as dependent variable, and level (redesigner, designer) as independent variable. A significant difference was found for level, t = -3, 314, p = .00, with higher pupil learning mean in the designer class (M = 16,20, SD = 2,33) compared to redesigner classes (M = 14, 07, SD = 3,63). This finding indicates that pupil learning with designed curriculum outperformed pupils learning with redesigned curriculum on a emergent literacy post test.

Discussion and conclusion

The main research question guiding this study was, "*Are there similarities and differences in classroom implementation and pupil learning that can be attributed to the re-design or design forms of involvement, respectively?"*

The process of redesigning and designing is very similar qua support provided. In both teams members were offered similar support and facilitation. The approach to redesign and design did not differ, as teachers in both teams defined common goal, linking curriculum used in kindergarten and pupil needs/class composition to the curriculum materials to be (re)-designed. In both teams, one teacher took a more leadership role, steering the ideas, proposals and decision making in the direction suitable for the kindergarten curriculum. Especially in the design team, the teachers who implemented the designed curriculum took the responsibility for the design content and structure, as she were aware of her task to implement the design in her class. Compared to designers, teachers as redesigners were equally committed to the redesign and implementation. In the designer group the teacher who implemented the designed PictoPal activities felt that other team members not involved in implementation did not feel responsible and committed as she was during design.

The role of (re)-designer was appreciated by teachers of both teams. The teacher as designer felt most confident about her role defining as active, result/performance oriented and committed compared to both the members of own design team and the members of the redesign team. Yet, findings on teacher role show that a teacher as redesigner can

view redesigning as not a task and responsibility of a kindergarten teacher. When comparing the findings on the teacher roles, it can be concluded that teachers as redesigners might feel unsecure about their involvement and their role in redesign. Based on this finding, an implication for teacher involvement in curriculum redesign is to inform teachers prior and or during the redesign process on the underlying assumption of the redesigner role, that teacher involvement and responsibility for the redesign can be fruitful for curriculum implementation in terms of understanding better why and how to use ICT-integrated curriculum for young children (Blum, 2009). Also, the intership-teachers involved in design should be informed on the benefits of their involvement for their future teaching practice with technology supported curriculum materials. Immersion in (re)-designing only can create concerns about the role of re-(designer) and impact teacher enthusiasm and commitment toward (re)design work. Both redesigners and designers did not differ in their perceptions about co-ownership of the team product. The findings show that although teachers were satisfied with the redesign product quality and practicality, based on their experiences during implementation of PictoPal, redesigners proposed new adaptations for PictoPal in order to fit their kindergarten language curriculum and teaching goals.

From the results on integration it can be concluded that teachers involved in curriculum design integrated to a greater extent the PictoPal activities than did teachers who were involved in the curriculum redesign. It can be concluded that participation in designing seems to affect positively the enactment of the technology integrated curriculum. This finding is supported by the finding on pupils learning. Although PictoPal had an effect on pupils learning in both groups, findings indicate that pupil learning with PictoPal designed and implemented by a teacher as designer, outperform pupils of redesigners. When compared to a control group, PictoPal was found to yield enhanced early literacy learning outcomes in pupils learning with redesigned PictoPal. However, the effect was small in terms of practical evidence. An effect of 5% of the variance explained by learning with the redesigned PictoPal is small when compared to the effect of PictoPal (not redesigned by teachers) of 12% found in a previous study (Cviko, Mckenney & Voogt, 2011). An explanation can be a decline in the quality of the redesigned PictoPal curriculum as teachers might not have included fully the structural components of the PictoPal curriculum when redesigning it. Teacher adaptations to existing curriculum can raise the problem of adherence to curricular guidelines, for example the increasing difficulty degree across the activities and the question how far teachers may go without destroying the meaning of the planned curriculum (Ben Peretz & Eilam, 2010). Thus, when involving teachers in redesign of a technology integrated curriculum, researchers should take into account that teachers do not have a clear understanding of the critical components of the curriculum.

A limitation in this study is the inclusion of one design team with one teacher as designer and implementer, with one class of 20 pupils. More data on design teams can support the preliminary results of this study. As this preliminary study is part of an ongoing study, future reports on this study will include findings based on more data on teachers as designers, their curriculum enactment and pupil learning in their classes.

A limitation in this ongoing study forms the absence of a control group for a comparison of pupils learning in designer groups. Practically this was not feasible, because no other groups of children were at kindergartens of teachers as designer to consider as control group(s).

Involving teachers in curriculum development offers an opportunity for teachers to understand better a curriculum before enacting it in their class. Both roles do have positive impact on integration of technology rich curriculum and pupil learning, but the support provided in terms of information about the benefits seems to be important for teacher in defining their role and attitude in their roles as re(designer). This study indicates tentatively that teachers curriculum implementation and pupil learning is more positively impacted by a collaborative teacher curriculum design, provided that teachers involved in curriculum design are informed participants. The findings of this study contribute to the knowledge on what constitutes effective kindergarten teacher involvement in curriculum development, which positively affects implementation of technology integrated curricula and pupils learning.

References

Abrami, P. C., Poulsen, C., & Chambers, B. (2004). Teacher motivation to implement an educational innovation: Factors differentiating users and non-users of cooperative learning. *Educational Psychology*, *24*(2), 201-216.

Becker, H. J., & Riel, M. M. (2000). *Teacher Professional Engagement and Constructivist-Compatible Computer Use.* (National Survey Rep. No. 7). Irvine, CA: Center for Research on Information Technology and Organizations, University of California.

Ben Peretz, M., & Eilam, B. (2010). Curriculum Use in the Classroom. In E. Baker, B. McGaw & P. Peterson (Eds.), *International Encyclopedia of Education* (pp. 348-358). Oxford: Elsevier.

Blum, C., Parette, H. P., & Watts, E. H. (2009). Engaging young children in an emergent literacy curriculum using of Microsoft_PowerPoint: Development, considerations, and opportunities. In A. M. Vilas, A. S. Martin, J. M. Gonza´lez, & J. A. Gonza´lez (Eds.), Research, reflections and innovations in integrating ICT in education (Vol. 1, pp. 41–45). Badajoz, Spain: Formatex.

Carl, A. (2005). The "voice of the teacher" in curriculum development: a voice crying in the wilderness? *South African Journal of Education, 5*, 223–228.

Carl, A. (2009). *Teacher Empowerment through curriculum development. Theory into practice.* Cape Town: Juta.

Cviko, A. McKenney, S. & Voogt, J. (2011) Teachers enacting a technology-rich curriculum for emergent literacy. *Educational Technology Research and Development, 1-24*. doi:10.1007/s11423-011-9208-3

Cohen, J. (1988). *Statistical power analysis for the behavior sciences.* New Jersey: Lawrence Erlbaum Associates.

Crow, G.M., & Pounder, D. G. (2000). Interdisciplinary Teacher Teams: Context, Design, and Process. *Educational Administration Quarterly, 36,* 216-254.

Doyle, W., & Ponder, G. A. (1977). The Practicality Ethic in Teacher Decision-Making. *Interchange, 8,* 1–12.

Ertmer, P. A. (2005). Teacher pedagogical beliefs: The final frontier in our quest for technology integration? *Educational Technology Research and Development, 53*, 25-39.

Ertmer, P.A., & Ottenbreit-Leftwich, A. T. (2009). Teacher technology change. How knowledge, beliefs, and culture intersect. *Journal of Research on Technology in Education.*

Fullan, M. (2003). *Change Forces with a Vengeance.* New York: RoutledgeFalmer.

Friend, M., & Cook, L. (1996). *Interactions: Collaboration Skills for School Professionals.* White Plains, NY: Longman.

Joyce, B, Calhoun, E. & Hopkins, D. (1999). *The New Structure of School Improvement: Inquiring Schools and Achieving Students.* Florence, KY: Taylor and Francis.

Kales, I. (2010). Recognizing the potential of ICT in early childhood education. Analytical survey. Moscow: UNESCO Institute for Information Technologies in Education.

Keengwe, J. & Onchwari, G. (2009). Technology and Early Childhood Education: A Technology Integration Professional Development Model for Practicing Teachers. *Early Childhood Education Journal*, 37, 209-218.

Kirk, D. & MacDonald, D. (2001). Teacher voice and ownership of curriculum change. *Journal of Curriculum Studies, 33,* 551-567.

Koehler, M.J., & Mishra, P. (2005b). What happens when Teachers Design Educational Technology? The Development of Technological Pedagogical Content Knowledge. *Journal of Educational Computing Research, 32*, 131-152.

McGill-Franzen, A., Allington, R. L., Yokoi, L., & Brooks, G. (1999). Putting books in the room seems necessary but not sufficient. *Journal of Educational Research, 93*, 67–74.

McKenney, S., & Voogt, J. (2009). Designing technology for emergent literacy: The PictoPal initiative. *Computers & Education, 52*(4), 719-729.

Parette, H. & Quesenberry, A. (2009). Missing the Boat with Technology Usage in Early Childhood Settings: A 21st Century View of Developmentally Appropriate Practice. *Early Childhood Education Journal*, 37, 147-151.

Reiser, B.J., Spillane, J.P., & Steinmuller, F., Sorsa, D., Carney, K., & Kyza, E. (2000). Investigating the Mutual Adaptation Process in Teachers' Design of Technology-Infused Curricula. In B. Fishman & S. O'Connor-Divelbiss (Eds.), *Fourth International Conference of the Learning Sciences* (pp. 342-349). Mahwah, NJ: Erlbaum.