PICTOPAL

TEACHER AS REDESIGNER OF A TECHNOLOGY INTEGRATED CURRICULUM FOR EMERGENT LITERACY

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ABSTRACT

This study sought to examine the role of the teacher as redesigner of a technology integrated curriculum PictoPal. A case study involving four kindergarten teachers was used. Observations of the team meetings were undertaken along with interviews to examine teacher redesign in a team and teacher perceptions on their role as redesigner of the curriculum. The results suggest that teacher appreciate their role as redesigner as a learning experience, but question the practicality of the role for their teacher-work. Also teacher enactment of the redesigned curriculum was observed in four classes (N=96). In two classes teachers were involved in the redesign, in the other two classes teachers only implemented the redesigned curriculum. A nonequivalent control quasi experimental design was used to investigate pupils learning outcomes. Findings on teacher curriculum enactment suggest that there can be a threshold for the optimal integration of PictoPal-activities, as high integration score does not relate to the highest learning outcomes. Pupils in the experimental group outperformed pupils in the control group on early literacy.

1. INTRODUCTION

The focus in technology integration in teachers' classroom practice needs to shift from perceiving teachers as merely receivers of technology tools to perceiving a teacher as active participants in the redesign of curriculum to integrate technology (e.g. Keengwe & Onchwari, 2009; Parette, Quesenberry & Blum, 2009). To overcome hindrances in technology integration it is argued that teachers have to take an active role, preferably with colleagues and (technology) support staff (Keengwe & Onchwari, 2009). Teacher participation in defining good teaching with technology can be fruitful for teacher ownership (Ertmer & Ottenbreit-Leftwich, 2009). Teachers need to understand why technology is important for student learning, how to use teaching strategies and apply technology which can contribute to success of technology implementation in classrooms (Parette et al. 2009). Teachers need to make their perceptions about teaching with technology explicit, consider perspectives of their colleagues and create together understanding of how to teach effectively with technology as a meaningful pedagogical tool (Ertmer & Ottenbreit-Leftwich, 2009, Tillema & van der Westhuizen, 2006).

Thus, it is expected that an active teacher role in curriculum redesign featuring technology can bring about merits for sustainable technology integration in the classroom. Through teacher participation in curriculum redesign teachers can get informed about and understand the curriculum they redesign. Also, through their participation in curriculum redesign teachers can experience ownership about the curriculum they redesign. However, an active role in curriculum redesign to integrate technology expects that teachers invest efforts and time and wish to be involved in curriculum redesign.
In this study we examine what happens when teachers redesign a technology integrated curriculum and how teachers perceive their role as redesigner. Also this study examines what happens when teachers implement the curriculum in their classrooms. This study provides insights into the teacher role as a redesigner of a technology-integrated curriculum

Teacher role as curriculum redesigner, a factor affecting curriculum implementation

Teachers can have a varying degree of involvement in curriculum with accordingly varying responsibilities and input. In the role of curriculum redesigner, a teacher devotes a larger proportion of time and has different tasks in the development of a curriculum than in the role of implementer (Carl, 2009). Ben-Peretz and Eilam (2010) speak about the teacher as adaptor of curriculum, and about a curriculum envelope, a term covering the special characteristics of planned curriculum and the space teachers have inside this envelope to make their own adaptations and plan their mode of implementation. Remillard (2005) makes in this respect a difference between the planned and enacted curriculum to indicate that the enacted curriculum in classroom is planned by a teacher and is a result of the interactions between teacher and curriculum. A role of a teacher as redesigner is natural as teachers adapt a curriculum taking into account the context-specific demands of their students (Remillard, 1999, 2005) or re-construct a curriculum in line with teachers own interests and knowledge base (Ben-Peretz & Eilam, 2010). Thus, teachers are 'naturally' engaged in redefining and redesigning activities of ready to implement curriculum and the role as redesigner is to some extent already present in teacher

work. When teachers redesign curriculum together with others, teachers are thought to have a say, be a partner in curriculum decision-making and take responsibility for the redesigned curriculum (Carl, 2009). Research has shown that collaborative design in teacher teams contributes to the formation of the image of the teacher as 'designer' of curriculum instead of ‘performer’ of prescribed curriculum (Deketelaere & Kelchtermans, 1996).

The relationships between teacher involvement in curriculum redesign, curriculum implementation and pupil learning are portrayed in a model shown in Figure 1. In the following paragraphs the relationships between the components in the model are interpreted by literature on teacher roles in curriculum redesign. The model is presented within the context of this study: the redesign of a technology integrated curriculum.

Involving teachers in collaborative technology integrated curriculum redesign: a team approach

Integration of computers in the classroom calls for teachers’ collaboration with other teachers and staff within and outside their school (Becker & Riel, 2000; Riel & Becker, 2008). Technology integration, that is appropriate use of technology resources to support student-centered practices, is an innovative practice for many teachers. Teachers need to understand that student-centered practices supported with appropriate technology resources can effectively impact pupil learning (Ertmer & Ottenbreit-Leftwich, 2009).

Collaboration around innovative practices, such as integrating technology in student centered settings, may make teachers’ pedagogical beliefs more explicit and give teachers the opportunity to experience how classroom practices and learning may transform due to integration of innovative learning methods (Ertmer, 2005). The dialog and collaboration between teachers in negotiating the meanings of the innovative practice and in forming beliefs about teaching and learning become important means in teachers’ uptake of technology. Becker and Riel (2000) suggest settings wherein teachers are encouraged to participate in the design of technology-enahnced learning environments for pupils as an effective way in developing teachers as designers of classroom practice. 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 changing classroom practice and enhanced the literacy development of kindergarten children. According to Keengwe and Onchwari, (2009) teacher collaborative curriculum development should feature hands-on opportunities and actual integrated lessons used by teachers in order to help teachers successfully integrate technology into their classroom. Such settings wherein teachers redesign the classroom practice in innovative ways may help teachers to get successful experiences with innovative teaching methods which in turn can boast teacher’s confidence in the implementation of innovative designs.

In this study it is assumed that a team approach to curriculum redesign (component 1) may help teachers to get an understanding about the curriculum at stake, shape their attitude towards their role in curriculum redesign, and have a positive impact on teachers’ implementation of innovative technology integrated curriculum redesign. For this study a team approach is adopted

to give shape to teacher involvement in redesign of a technology integrated curriculum and the teacher redesign team process and structure factors are examined.

A redesigned curriculum as a product of a teacher redesign team is influenced by the process and structure of teachers' team. The literature on teacher teams shows that that team structure factors as skills, homogeneity in educational philosophy, heterogeneity in teachers' expertise, focus of team members, team leadership skills, team size and time influence team productivity (Kahne & Westheimer, 2000; Crow & Pounder, 2000). In addition, process factors as the team work, intensity of cooperation, affect the team results (Koehler & Mishra, 2005; Bers & Portsmore, 2005). Finally factors such as conceptual exchange, acknowledgment of others perspectives, problem understanding and involvement (Tillema, 2006) have an impact on productivity of teams.
In this study factors influencing the outcomes of the team are included to study teacher involvement in redesign (component 1): 1. skills to redesign a technology rich curriculum; 2. teacher expertise; 3. focus of the team; 4. team leadership skills; 5. team size; 6. time spent in the team; 7. working in a team; 8. team work (activities); and 9. functioning and value of the redesign team.

Joyce, Clahoun and Hopkins (1999) argue that involving everybody of the staff into teams who study the curriculum and innovations together and strive for good implementation, relates to high implementation in the classroom and great probability to pay off in student learning. Also Friend and Cook (1996) argue that an active teacher role in curriculum decision making seems related to the success of implementation of an innovative curriculum. Thus, teacher involvement in redesign (component 1) is related to its implementation (component 5). However, the relationship between teacher curriculum redesign and successful curriculum implementation seems to be linked by teachers' experience of ownership of an innovative curriculum (component 2). Through involvement in curriculum development teachers may experience ownership of the developed curriculum (Kirk & Macdonald, 2001; Carl, 2009). Fullan (2003) asserts that involving teachers in innovative efforts and creating opportunities for their contribution to the innovation creates greater teachers' ownership and commitment (component 2) towards the innovative curriculum, both essential for fundamental change in education. Reversely, limiting the teacher role in curriculum development as implementer of a curriculum, developed by curriculum specialists is detrimental to the teacher experience of taking ownership of a curriculum (Carl, 2005; 2009). Thus, teacher role as curriculum redesigner (component 1) relates to the success of curriculum implementation (component 5) and the relationship can be mediated by teacher ownership and commitment (component 2) towards the redesigned curriculum which teachers may experience as a result of being involved collaborative curriculum redesign.

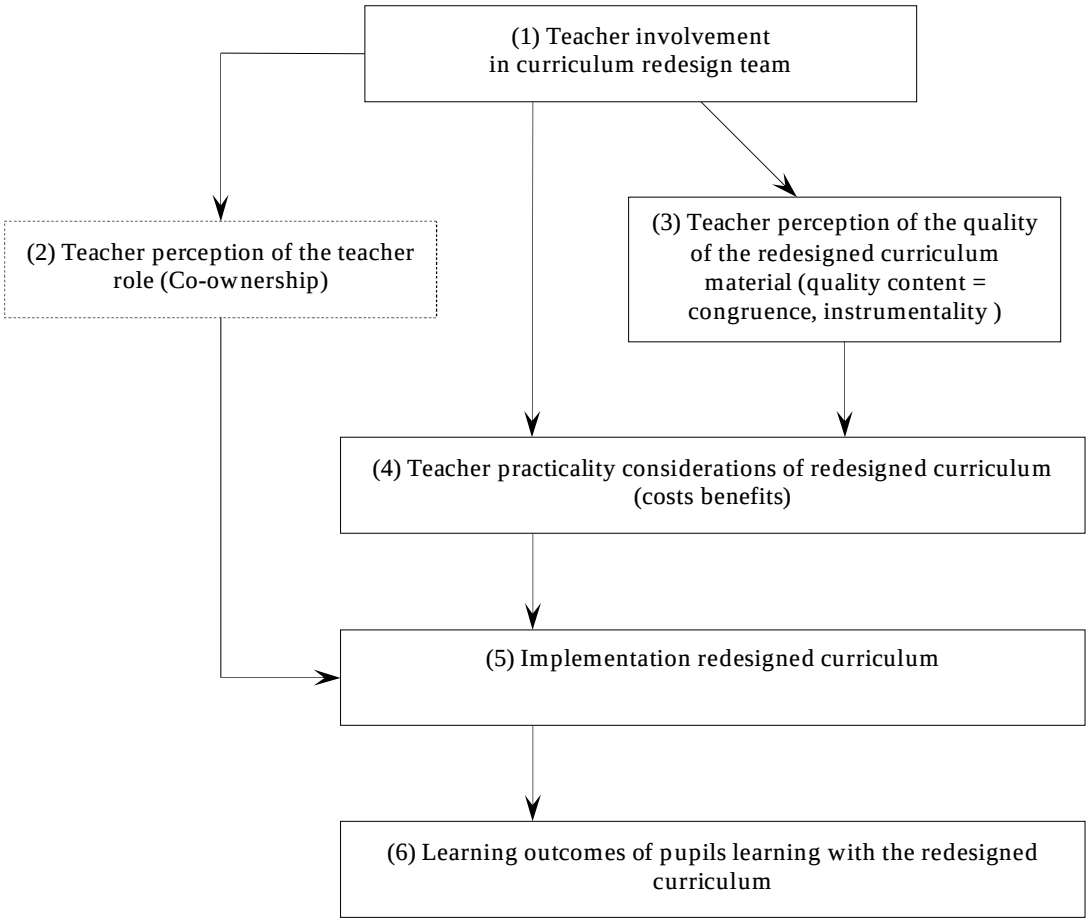

Figure 1 A path describing the components of (mediating) influence on implementation and pupil learning

As Doyle and Ponder (1977) state, a teacher has considerations about the practicality of an innovation on three aspects of the innovation. Firstly, teachers consider how instrumental the innovative materials are. Secondly, teachers consider the relation between the effort they invest in the curriculum and the benefits of the curriculum for their classroom. And thirdly, teachers consider how congruent the curriculum is with the needs of their classroom, their students and their own pedagogical routines. Thus, teacher involvement in curriculum redesign (1) can influence teacher perceptions on curriculum quality (component 3), that is how well the redesigned curriculum is specified and its congruence with classroom and student needs and teacher routines. Teacher perception of a curriculum quality on its turn affects teacher's considerations about the invested efforts in the redesign and the benefits of the redesign for classroom practice. Specifically, for the teacher role as redesigner the considerations about the practicality are of interest as teachers when involved in curriculum redesign team (component 1) will engage in 'considerations of the costs of their efforts to participate as redesigner in a team to redesign a curriculum and the benefits their classrooms have from teacher involvement in redesign' (component 4). In addition teacher practicality considerations about costs-benefits of the redesigned curriculum (component 4) are thought to have influence on teacher implementation of the curriculum (component 5).

Purpose of the study and the research questions

This study is part of an ongoing study examining the role of teachers in a technology-rich early literacy curriculum. The previous study examined the role of the teacher as implementer of a 'received' curriculum, with minimal involvement in the redesign of the curriculum (Cviko, McKenney, & Voogt, submitted). The purpose of this study is to involve kindergarten teachers in the redesign of a technology integrated curriculum for emergent literacy in order to understand the role of teachers as redesigner and implementer of a technology integrated curriculum.

The study focuses on the factors affecting collaborative curriculum design and factors affecting curriculum implementation and learning outcomes. The central question guiding this study is:

"When teachers are involved in redesigning a technology integrated curriculum, what does that imply for curriculum enactment and learning outcomes?"

To answer the research question three sub-questions are formulated:

1. Teacher curriculum redesign: How does the process of teachers collaboratively redesigning of a technology-integrated curriculum for emergent literacy look like?
2. Teacher perceptions:
   a. What are teachers' perceptions about their teacher role as redesigner?
   b. What are teachers' about the quality of the redesigned curriculum?
   c. What are teachers' perceptions of the practicality of the redesigned curriculum?
3. Teacher' curriculum enactment: How do teachers integrate the redesigned activities?
4. Pupil learning: What are pupils' learning outcomes when they learn with a technology – integrated curriculum?

Research question 1 encompasses the first component of the model: (1) Teacher involvement in curriculum redesign team. The second, third and fourth component of the model are studied through research question 2. Research questions 3 and 4 encompass, respectively the fifth and sixth component of the model.

PictoPal, a technology-integrated learning environment for emergent literacy

PictoPal is a technology integrated curriculum for emergent literacy with learning activities on the computer and in the classroom. PictoPal is based on a selection of the national attainment goals for emergent literacy: (1) functional reading and writing (writing and reading with purpose), (2) function of written language (learning that printed language is a means to communication) (3) relationship between spoken and written language and (4) language consciousness. The basis of the PictoPal curriculum is the notion that children do have an intrinsic drive to engage with the world around them (McKenney & Voogt, 2009). Therefore PictoPal consists of components representing a context children are familiar with. PictoPal invites children to engage with written and spoken language and to create own written products. The aim of PictoPal computer and classroom activities is to create a learning environment for children wherein emergent literacy knowledge and skills are encouraged. PictoPal focuses on formation of

linguistic concepts regarding the nature and function of written language by providing children with the opportunity to write own meaningful texts and use their written products in meaningful contexts (McKenney & Voogt, 2009). The focus on meaning-making and use of written products is characterized by connected computer activities and classroom activities. An example of a computer activity and classroom activity is given in Figure 2 and Figure 3.

Figure 2 On computer activity: Composing invitation letter

Figure 3 Off computer activity: Creating an envelope for the letter

Computer activities are designed using Clicker software. Clicker is a word processor with voice output. The word processor contains a grid with cells wherein parts of sentences, words and images are placed, and a writing window. Clicking on the cells allows children to put words and images in the writing window and to hear the spoken words. In addition children can print their resulting writings. In this way children create their own written texts which they can use then in classroom activities in an authentic way.

The connection of the computer activities with the classroom activities is made by teachers. Teachers create opportunities for children to use their writings (written on computer) in the classroom by introducing, organizing and arranging classroom activities (McKenney & Voogt, 2009). PictoPal emphasizes using on the computer written products in play or other authentic classroom settings. A teacher manual supports the teacher with suggestions for the classroom activities.

2. METHODOLOGY

For studying the collaborative redesign a multiple case study (Yin, 1993) (component 1, 2, 3 and 4 of the model) was conducted with four teachers as cases. For the implementation a multiple case study embedded design (Yin, 1993) (model components 5 and 6) has been carried out with four kindergarten classes as cases. Each case had two units of analysis: teachers and pupils. To study differences in learning outcomes between pupils who participated in the PictoPal curriculum (experimental condition) and those who had an alternative language program (control group a non equivalent group quasi experimental design was used.

Participants

Four kindergarten teachers (Fiona, Diana, Mira and Iris) of one campus were involved in the collaborative redesign of PictoPal curriculum. Also four teachers implemented the redesigned PictoPal in their classrooms. Two of the four teachers (Mira and Iris) were involved in redesign and implementation. Two teachers were not involved in curriculum redesign, one of them (Alice) was minimally informed through her participation during a workshop about PictoPal. The other teacher (Clair) was not involved in redesign nor attended the workshop. Table 1 shows for the teachers participating in redesign and/or implementation of PictoPal the years of experience teaching kindergarteners, teaching in kindergarten classes of the school campus the study was carried out and their total teaching experience.

In the kindergarten classrooms of the other two campuses of the school the teachers were not involved in redesign and did not implement PictoPal. These teachers used the software accompanying the kindergarten language curriculum, called 'Treasure Chest', as an alternative to the PictoPal curriculum.

Table 1 ***Teaching experience of the teachers participating in the study***

	Experience in teaching kindergarteners	Experience in teaching kindergarteners within school campus	Teaching experience within school campus
Fiona Redesigner only	33	33	33
Diana Redesigner only	12	12	14
Alice Implementer only	20	15	33
Clair Implementer only	½	½	½
Iris Redesigner &implementer	1	1	2
Mira Redesigner &implementer	0	0	3

The pupil group working with PictoPal consisted of 96 children (***n*** = 96), mean age 60.7 months (57 boys, and 39 girls). Kindergarteners of the other two campuses formed the control group, which consisted of 65 children (***n*** = 65), mean age 61. 2 months (32 boys and 33 girls).

PictoPal was implemented in two junior kindergarten classrooms (1a and 1b) and two senior kindergarten classrooms (2a and 2b). The junior kindergarten consisted of pupils aged 4-5 years and the senior kindergarten of pupils aged 5-6 years. Table 2 presents an overview of the distribution of pupils in the four classrooms.

Table 2 ***Number, gender and mean age (in months) at the start PictoPal per classroom***

	N	Boys	Girls	Mean age (in months)
Junior classroom 1a, teacher Iris	25	17	8	56. 1
Junior classroom 1b, teacher Mira	25	15	10	56. 8
Senior classroom 2a, teacher Clair	23	12	11	69. 1
Senior classroom 2b, teacher Alice	23	13	10	69. 4

Procedure

Four kindergarten teachers were invited to participate in the redesign meetings to redesign existing PictoPal module 'Spring'. The redesign meetings were held at the school where teachers were working. The four teachers that formed the redesign team designed a paper-based version of the PictoPal activities (see Figure 4 and 4.1). The paper-based version was then converted into an electronic version of PictoPal computer activities and into teacher guidelines by a research assistant and given to teachers who implemented the redesigned PictoPal curriculum during eight weeks.

Two of the teachers who were involved in the redesign of the PictoPal curriculum have implemented PictoPal in their classrooms. One teacher was not involved in the redesign of PictoPal, but did implement it in her classroom. The fourth teacher was minimally informed about the redesign through her participation in a workshop given at the start of the project PictoPal about the goals and content of PictoPal.

Instruments

Process accounts

To study teachers' involvement in the redesign team observations of the sessions of the redesign team were held resulting in descriptive notes covering the redesign process (component 1). The process accounts were used as an adjunct to an interview about the process and structure of teacher redesign to describe teacher involvement in collaborative curriculum redesign.

Interview with teachers of the redesign team

Interviews were held with teachers after the collaborative redesign of the PictoPal curriculum. An interview scheme guided the interviews with the four teachers. The scheme consisted of questions regarding the collaborative redesign process (component 1), teacher perceptions about their role as

redesigner (component 2), teacher perceptions about the quality of the redesigned curriculum (component 3) and their perceptions on the practicality (component 4) of the redesigned curriculum.

Observation checklist integration computer and classroom activities

To study the implementation of the redesigned curriculum (component 5) the Integration checklist of Verseput (2008) was used. The Integration Checklist measured teachers' integration of PictoPal on- and off computer activities. The Integration Checklist containts 12 items measuring the extent of teachers' integration of on- and off-computer activities: (1) Involving pupils; (2) Initiating listening; (3) Initiating speaking; (4) Initiating writing; (5) Initiating reading; (6) Play with writings; (7) Initiating activity; (8) Initiating collaboration; (9) Initiating individual work; (10) Providing support; (11) Initiating talk on process; and (12) Initiating talk on product. An example of item 12 operationalization is: "The teacher lets pupils talk on the product of their activity".

Emergent literacy test

For a measurement of pupils' emergent literacy proficiency (component 6), the Emergent literacy test for 4-5 year olds (McKenney & Voogt, 2006) was used. The test was administered prior to the implementation of PictoPal and after a period of 8 weeks of pupils' working and learning within PictoPal. The test consists of 20 items measuring emergent literacy skills regarding functional reading and writing, linking spoken and written language, function of written language. An example item is the following task: (1) The researcher sets out color pencils, a pen, paper, scissors, a coloring page, a book, a spoon, a postcard and a grocery list; (2) the researcher presents the items to the child with an open arm gesture and says, "Can you pretend that you are writing something". The item is scored as correct if the child takes either a pencil or a pen and a sheet of paper, and does or imitates the act of writing. The items were scored on a two-point scale (1 = correct; 0 = not correct). Cronbach's alpha was 0.72 on the pre-test and 0.63 on the post-test.

The pre-test scores on the emergent literacy test correlated significantly with the pupils' scores on the national language proficiency test (***rpb*** = .64, ***p*** =. 05). The correlation between the two tests suggests that the emergent literacy test for 4-6 year olds measures linguistic skills in children. The national language proficiency test measures two aspects related to conceptual consciousness of language: passive vocabulary; and listening (Van Kuyk & Kamphuis, 2001). This test also measures some aspects of emergent literacy (meta-linguistic consciousness) which are: sound and rhyme; writing orientation; hearing the first and last word in a sentence; and synthesizing sounds. The specific aspects of emergent literacy measured by the two tests do not overlap, but both measure elements described in the national interim goals for emergent literacy.

Data analysis

For the study we adopted a qualitative comparative method involving studying cases separately along common variables followed by a cross-case analysis (Patton, 2002; Miles & Huberman, 1994). The data on teachers' perceptions was content analyzed within each case to understand the particular cases. The content analysis involved summarizing the teachers' responses into groups: a content code was attached to each teacher's response reflecting the kernel of the response. The comparison of perceptions between the cases involved scanning the perceptions for commonalities, shared perceptions, thereby avoiding forcing cases into same categories (Miles & Huberman, 1994).

The data on integration of the redesigned technology integrated activities were analyzes using ANOVA to test the hypothesis that there are no differences in extent of integration of on-and off activities between the four teachers. The teachers' perceptions were compared to the data on teachers' curriculum enactment. The data from the process accounts recorded during the teacher redesign process were content analyzed and summarized resulting in a description of the teacher approach to redesign process. The analysis of the process accounts was supplemented by teacher interview data on the collaborative redesign.

All 161 pupils were pre- and post tested on emergent literacy. The similarity of the groups concerning language skills was determined by scores on a national language test for kindergarten pupils (Cito). The data of the emergent literacy test was analyzed using ANOVA and ANCOVA.

3. TEACHER OUTCOMES

The teacher outcomes are presented per research question. First a description of the teacher curriculum redesign process (model component 1) is given, followed by teacher perceptions about their role as redesigner (component 2), the quality of the redesigned curriculum (component 3) and teacher practicality considerations (component 4). Finally the teacher' curriculum enactment (component 5) will be presented.

Teacher involvement in collaborative curriculum redesign (component 1)

Process accounts redesign process

The logbook containing accounts of the redesign process notes provided a description of the team process. Teachers worked as a team during two sessions of four hours each. The following is a description of what happened in the teacher team during the two redesign sessions.

Redesign session 1

At the start of the first session a researcher explained to the teachers that the objective of the meetings was a team work on a redesign of the curriculum for emergent literacy. The redesign 'redesigning PictoPal-curriculum 'Spring theme' in such a way that it is integrated with the existing language curriculum 'Tresure Chest'. Also teacher were informed on the time (2 sessions) planned for redesigning and time to be planned by teachers for the PictioPal implementation during the year 2010.

The explanation of the redesign meetings provoked a discussion by teachers on new design of PictoPal versus adaptation of the existing PictoPal curriculum to be redesigned by the teachers. As adaptation of PictoPal-curriculum activities became teachers' objective a discussion started on an orientation how to approach the redesign. A discussion was held on a central theme covering the activities to be redesigned and the period in the academic year for PictoPal-implementation. Teachers agreed on the idea that the redesign of PictoPal- Spring curriculum to PictoPal-Winter curriculum would suit the Treasure Chest curriculum qua theme and period as teachers considered the period January-April suitable in the planning of implementation.

The orientation on a redesign approach continued through discussing the goal of technology supported curriculum ending in concrete ideas on redesign. Teachers discussed the goals of and their experiences with technology integrated curricula for emergent literacy. A comparison was made by teachers of the goals of available technology for kindergarteners on emergent literacy and the goals of the technology integrated curriculum for emergent literacy of PictoPal. The heterogeneity of the expertise and experience among the teachers came to the foreground as teachers began to bring up ideas about the goals of emergent literacy curriculum for their kindergarteners. All teachers expressed the importance of emergent literacy in the kindergarten, but also expressed their concerns about the difficulty of the content and technical aspects of PictoPal emergent literacy activities for all kindergarteners. This aspect of difficulty was discussed by teachers and ideas were provided on how to redesign the content of PictoPal curriculum to fit their pupils. A set of common ides were formulated to gauge the redesign of the PictoPal activities:

- The redesigned PictoPal-activities have to do with the central theme, the Winter;
- The redesigned PictoPal-activities have to be connected in some way to the activities planned in the existing Treasure Chest curriculum activities for emergent literacy;
- The difficulty of the words, sentences and the presence of pictograms in relation to the words have to be connected to the world of the kindergarteners.

Figure 4 Teachers redesigning PictoPal

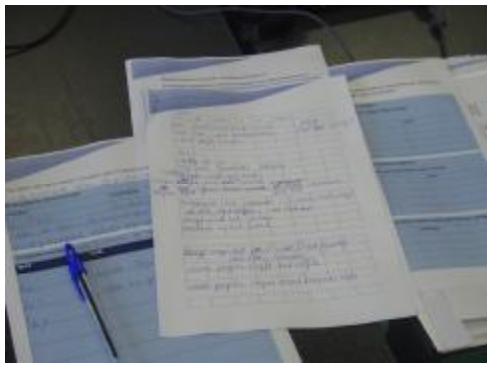

Figure 4.1 Drafts of the redesigned PictoPal curriculum

In meeting one, after teachers' agreement on the common understandings which they would account for when redesigning the PictoPal activities, teams of two teachers redesigned all eight PictoPal computer activities. Diana and Iris teamed up in a team to redesign four of PictoPal-activities and Mira and Fiona as a team the other four. As the difficulty of the activities increases from first to the eighth activity teachers choose to evenly distribute the activities per each team. Teachers explored the PictoPal computer activities by hands on computer and by making notes of initial ideas of the redesign per activity. During the team work both teams worked on their redesign but were communicating about their progress, asking each other to comment on ideas about activity content and lingual correctness.

Teachers engaged in the discussion about the initial ideas, the choice, the vocabulary, the number of words pupils are able to choose from when writing a sentence, and the length and correctness of the sentences pupils can write. Both teams were engaged intensively in redesigning classroom activities. One of the team used the Internet and the print booklets from their classrooms too gather information on kindergarteners' vocabulary and pictograms teacher use in their classroom.

The role of the researcher in the team was supporting the team process through provision of facilitating guidance in the team (providing laptops, paper lay outs for redesign and information about the design principles of PictoPal, for example the accumulating difficulty of the activities. Teachers also asked the researcher to help out with the principles guiding the redesign (the instruction for pupils within computer activities, the adequacy of pictograms representing the meaning of the words in context, the voice affordances: what can be done with audio output to facilitate feedback for pupils). The researcher observed the team and made notes of redesign session 1 and 2.

Redesign session 2

Teachers agreed upon the goal of redesigning classroom activities: The computer activities have to be profoundly connected to the classroom activities, so that pupils can meaningfully use their computer-products. The researcher provided written information on guiding principles for the pupil's writing process and on feedback about PictoPal- 'Spring'-activities (based on a language expert appraisal of the Spring activities) and discussed it with the teachers. Teachers agreed upon to include the information on the writing process into the PictoPal teacher guidance. Teachers discussed how to approach orientating pupils on writing during introduction activities in their classrooms and discussed how to deal with correctness of the sentences as composed by pupils during classroom activities. Also teachers agreed to have adult guidance by a research assistant and the researcher for their pupils during computer activities.

In the second meeting teachers considered the classroom activities and its connection to the computer activities. Teachers discussed the content of the guideline and the planning of the time for the implementation of the PictoPal activities. Teachers went thought the guideline and explored the connection between classroom activities guideline and computer activities The result of the second meeting were redesign ideas about the classroom activities to be connected with computer activities in the teacher PictoPal guideline written down as drafts.

Teachers showed enthusiasm through their statements about the implementation of the redesigned activities in the classroom and the pupils' enthusiasm of their pupils teachers expected to see in children when working with PictoPal. The result of the redesign meeting one was a paper draft with ideas for redesign of the computer activities (see Figure 4.1). Teachers were enthusiastic about the actual redesigned PictoPal and emphasized that it was now ready for implementation in kindergarten classrooms. Teachers were enthusiastic about the actual redesigned PictoPal ready for implementation.

Teacher perceptions on the team process

Role as redesigner in a team

Teachers perceived their role in the team as clearly defined partly due to explanation of the purpose and procedure of the meeting by the researcher. Teacher reported to have perceived themselves as redesigner. Only one teacher (Mira) reported to have been questioning herself during the redesign why she takes the responsibility to redesign curriculum and if it was a task of others than teachers. She explained that the she dealt with doubts about the goal of redesigner role stating it by the following …**' *I have nothing against team work on contrary I am for redesigning together kindergarten curriculum as 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 the curriculum?...'***

Working in the team

Working collaboratively on curriculum adaptations is perceived by all teachers as positive. Teachers reported that they are forming already a kindergarten team in their school and have worked already as team on curriculum decisions for their classrooms.

Team activities

Teacher perceived the team activities as intensive. According to teachers the activities call for creativity and working intensively. They explained that they had to think about the content, structure and align it with the audio and visual possibilities to make it pupil-oriented. Teachers found it important to incorporate more guidance into the computer activities, by including instruction spoken by an agent to help pupils through an activity. Teachers found that they have worked on the redesign of the activities intensively. Teachers reported to have had a common goal and confidence on the final product.

Functioning of the team

The functioning of the team was perceived by all teachers as very positive, because of the existing collaborative relationships between the teachers; the collaboration in redesigning curriculum was perceived as very intense and good. All the teachers in the team have worked together already as a team in the same school and their relationships are personal and professional of nature.

Value of the redesign team

The added value of working in the redesign team was, according to the teachers:

- A lot of ideas and proposals were exchanged in the team, teachers could recognize ideas of other teachers, which contributed to joint understanding of the elements they were taking into account during their redesign (for example: The redesigned activities are linked to the central theme, the Winter).
- Increase of understanding of the content and structure of the curriculum. Teachers reported that a team was of learning experience for the teachers as teachers jointly raised understanding about the content and structure of the redesigned curriculum.

Expertise in the team

The expertise of the teachers in the team was perceived by all teachers as sufficient for the collaboration in the redesign of the PictoPal curriculum, partly because the expertise and experience between the teachers in teaching of young children and curriculum redesign was not the same. Teachers did not feel a need for presence of a language expert during the sessions, but found paper-based feedback form a language and curriculum expert provided by the researcher sufficient to inform their redesign.

Design skills for technology rich curriculum

Teachers perceived their (re)design skills as sufficient and expressed that they do not need other competences to be able to redesign a technology-integrated curriculum. Also teachers recognized themselves as skilled to adapt their kindergarten curriculum to the pupils of their classrooms, but felt that the adaptation of the technology activities was new for them.

Leadership skills in the team

Leadership was shared during the redesign meeting according to the teachers. Teachers felt that the shared leadership was due, because of

- Equal participation by all teachers;
- Joint setting / formulation of the redesign objectives and goals;
- Early on clarification of the plan of the redesign meetings;
- No need for a presence of an expert during the meetings.

Team focus

The focus of the team was very clear during the redesign process as the teachers had clear ideas of the common goal of the meetings. Teachers felt that they were able to oversee the intermediate steps of the redesign.

Teacher perceptions on teacher role as redesigner and co-ownership (component 2), redesigned curriculum (component 3) and practicality considerations (component 4)

Teachers involved in the redesign of the technology integrated curriculum were asked to explain how they felt about their role as redesigner. All teachers expressed that the role of redesigner was new for them as they were never involved in redesign of a technology integrated curriculum. Teachers experienced taking this role as a learning experience. One teacher (Mira) reported having doubts if a kindergarten teacher should take the responsibility of redesigning the PictoPal curriculum. Teachers expressed that they feel familiar with a role of adapting curriculum materials when needed to the individual needs of the pupils by selecting for example specific print booklets or specific learning materials for specific pupils. The role redesigner of the PictoPal curriculum also implies redesigning the content and structure of the curriculum. The teachers emphasized their need for available curriculum materials which enable pupils to work autonomously or with minimal guidance. In their role as redesigner teachers reported to have taken the responsibility for the content, vocabulary, degree of lingual difficulty suitable for kindergarten classrooms. And this was felt by all teachers as an enrichment of their own skills in developing an adapted curriculum and understanding on how curriculum content is planed and its underlying goals.

Teacher perceptions on their role as redesigner and co-ownership (component 2)

All teachers perceived the productivity in their team and their commitment to redesign the PictoPal curriculum as high. Also teachers perceived their own commitment and the commitment of the other teachers as positive. All teachers perceived the team product as owned/co-owned product, because the product was created by teachers themselves. Specifically one teacher reported to feel that she co-owned a redesigned curriculum as she (and her colleagues) was the co-redesigner of the curriculum, and as such wanted to be acknowledged as co-author of the curriculum.

Commitment and co-ownership were strongly connected to teachers questioning the task and responsibility of teachers in redesigning a technology integrated curriculum. Teachers were satisfied with the opportunity to redesign a curriculum, but emphasized that the role of curriculum redesigner of a technology integrated was not a daily practice of a teacher in their school. However, teacher reported to take a role of a redesigner when the kindergarten teacher team at the start of each year adapts the kindergarten curriculum to the kindergarteners. The need for the adaptations depends on the annual composition of their classrooms and special needs of pupils in each classroom.

Teacher perceptions on product quality (3)

Teachers reported satisfaction and confidence with the curriculum materials produced by the team. According to teachers the team produced looking good curriculum material. Teacher reported to feel confident about their implementation of the redesigned curriculum.

Teacher perceptions on practicality (4)

Teachers were enabled to put their time and efforts in redesign instead of teaching as there was teacher replacement (pupils have been taught by other teachers during the redesign sessions). There was sufficient time planned for redesigning. Teachers perceived intensive involvement of them selves and all other teachers in the PictoPal-redesign. Efforts put in the team work and the curriculum redesign were perceived by all teacher in balance with the expected pay offs of the curriculum in their classrooms.

Teacher' curriculum enactment (5)

Teacher curriculum enactment is operationalized as the integration of on- and off computer activities. The results are presented for each classroom. 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, η^2 = 0.26. Table 3 summarizes the results on integration of the PictoPal activities for the four teachers. A LSD post-hoc test showed the following differences on integration between the teachers:
Teacher of classroom 1b (Mira) integrated the computer- and classroom activities at a significant higher level than did the teacher of classroom 2a (Clair) and the teacher of classroom 2b (Alice) p = .02. Although Iris scored higher on the integration of the PictoPal- activities than Alice, this difference was not significant (p = .07).

Table 3 ***Means and standard deviation of the extent of integration per classroom/teacher***

Role of the teacher in curriculum redesign	***Involved in the redesign***	***Involved in the redesign***	***Not involved in redesign***	***Not involved in redesign***
Class taught with redesigned PictoPal	Teacher class 1a Iris ***M (SD)***	Teacher class 1b Mira ***M (SD)***	Teacher class 2a Clair ***M (SD)***	Teacher class Alice 2b ***M (SD)***
Integration of computer-classroom activities (n = 8)	6.69 (1.44)	7.63 (2.03)*	4.69 (3.01)	5.00 (1.93)

Figure 5 shows how the extent of integration scores are distributed over eight activities of eight weeks. A significant proportion of variance in integration can be explained by the time of 8 weeks teacher Mira (1b), teacher Clair (2a) worked within PictoPal, respectively R^2 = .72, F (1, 6) = 15.24, p = .01; R^2 = .74, F (1, 6) = 16.60, p = .01. Although the extent of integration in class 1a (Iris) and 2b (Alice) increases over time, no significant correlation was found between the time working within PictoPal and the extent of integration. This means that the significant correlations between time

and integration in classes 1b and 2a indicate that teachers Mira (1b) and Clair (2a) were substantially improving each week in their way of offering the integrated activities, while Iris (1a) and Alice (2b) did not improve much in their extent of integrating the activities over eight weeks.

Figure 6 shows the distribution of the mean score per integration item. Compared to other classes, teacher of class 1b (Mira) scored highest on initiating speaking, writing and reading when integrating computer and classroom activities. Also Mira scored highest on play activities around the written products pupils had created on the computer. The item 'play with writings' indicates the integration of the written products in the classroom by playing it out for example in a role play. The teacher linking the writing products of pupils created on a computer with a (play) activity in the classroom is indicative for a strong integration of the activities. Pupils' individual activity with their written products was encouraged more by teacher Iris (1a) than by Mira (1b), Clair (2a) and Alice (2b). Alice (2b) encouraged strongly collaboration between pupils on activities in classroom.

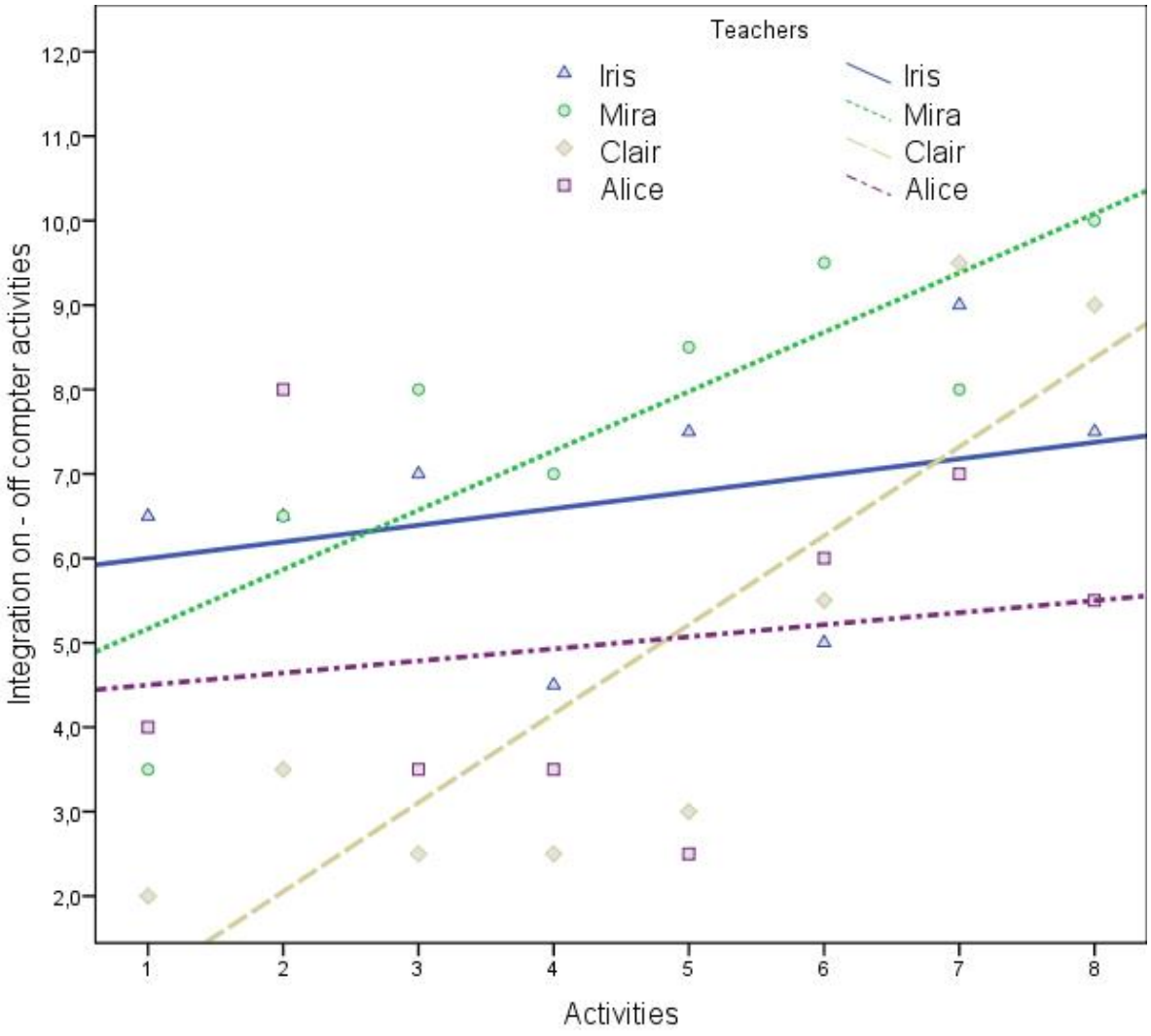

Figure 5 Distribution of observation data on the twelve items of the integration of the on- and off-computer activities over 8 weeks (for 8 activities during 8 weeks)

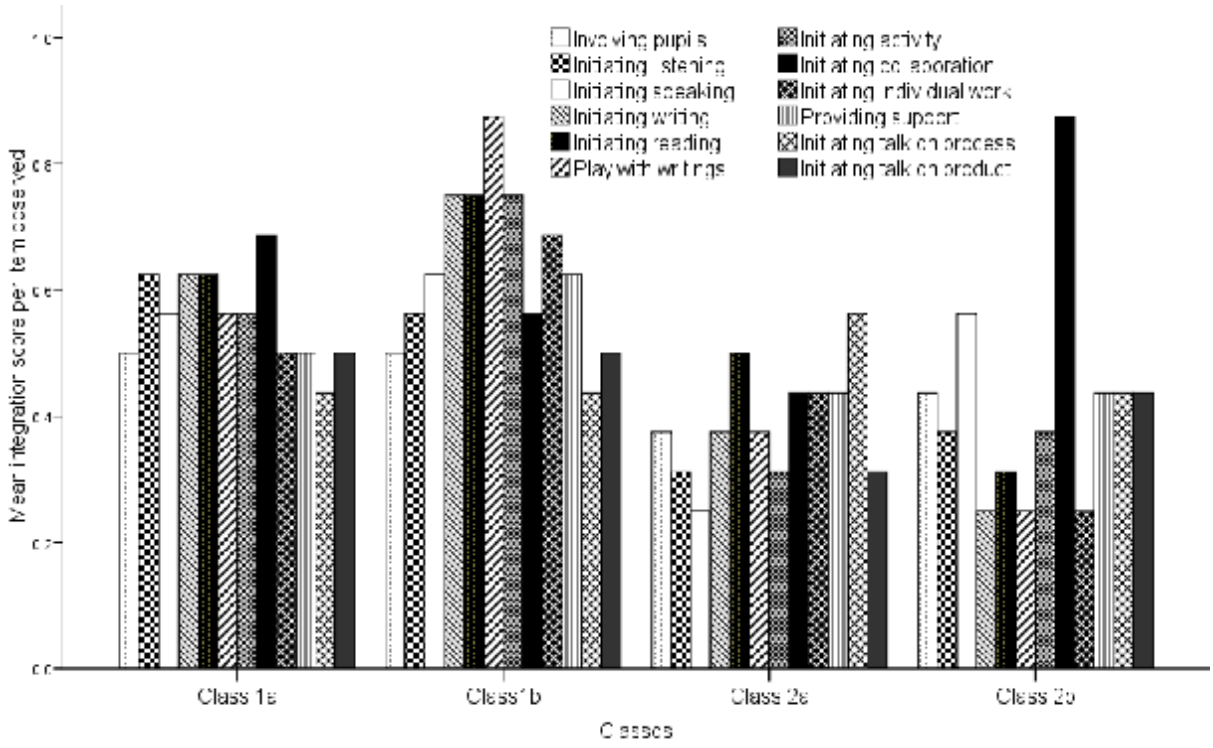

Figure 6 Distribution of the mean score on the twelve items of integration of on – and off computer activities per classroom / teacher

4. LEARNING OUTCOMES OF PUPILS LEARNING WITH THE REDESIGNED CURRICULUM

Pupil emergent literacy proficiency when learning with PictoPal

Table 4 shows the number of pupils, the mean score and the standard deviation of the emergent literacy pre- and posttest of the experimental and control group. An ANOVA was performed with the pre-test score on emergent literacy as a dependent variable and level (experimental and control group) as independent variable. There was no difference between the control and experimental group on the pre-test scores. Also, when an ANOVA was performed with the language national test scores (as a pre-test measure) as a dependent variable with level (experimental and control group) as independent variable no significant difference was found for level. An ANCOVA with post-test scores on emergent literacy as a dependent variable and level (experimental and control group) as independent variable, and the pretest scores on the emergent literacy test as a covariate showed a significant difference for level ***F*** (1, 138) = 6,951, ***p =*** . 01, η^2 =05. The experimental group ***corrected M*** = 14, 34, ***SD*** = 3, 23 scored higher than the control group ***corrected M*** = 13, 12, ***SD*** = 3, 28. 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, η^2 =03. The experimental group scored higher on a posttest when corrected for the national language test scores ***corrected M*** = 14, 26, SD = 3, 23 than the control group ***M*** = 13, 24, SD = 3, 28.

Table 4 ***Number of pupils, means and standard deviations for the experimental and control group***

	Pupils (***n***)	Pre-test means (Standard deviation)	Post-test means (Standard deviation)
With PictoPal	87	11,78 (4,12)	14, 41 (3, 23)
Without PictoPal	49	11,44 (3, 54)	13, 28 (3, 01)

Pupil emergent literacy proficiency of four classes working with PictoPal

Table 5 presents the means and standard deviations on the pre- and posttest scores of the four PictoPal classes. An ANOVA was performed with pre-test scores on emergent literacy as dependent variable and level (classroom 1a, 1b, 2a, and 2b) as an independent variable. A significant difference was found for level ***F*** (3, 86) = 12. 58, ***p*** = .00, η^2 = .31. Pupils from class 2a (Clair) ***M*** = 15.81, ***SD*** = 2.32, ***n*** = 21 and pupils from class 2b (Alice) ***M*** = 14.52, ***SD*** = 4. 29, ***n*** = 21 scored higher on the pre-test than pupils from class 1a (Iris) ***M*** = 14.42, ***SD*** = 3.59, ***n*** = 24 and class 1b (Mira) ***M*** = 12.19, ***SD*** = 3.06, ***n*** = 21.

Table 5 ***Means and standard deviations on the pre-and post test of the four PictoPal classes***

Classes	Pupils (***n***)	Pre-test mean (Standard deviation)	Post-test mean (Standard deviation)
1a (Iris)	24	9,48 (2,65)	14,42 (3,59)
1b (Mira)	25	9,14 (3,69)	11,84 (3,12)
2a (Clair)	21	14,22 (3,38)	15,81(2,32)
2b (Alice)	22	13,86 (4,78)	14,55 (4,18)

To examine the effect on pupils learning outcomes per class, we performed an ANCOVA with post-test scores on the emergent literacy test and level (classes 1a, 1b, 2a, and 2b) with the pretest scores on emergent literacy test as covariate. The ANCOVA showed a significant difference on the posttest for the classes when corrected for the pretest ***F*** (3, 82) = 3. 30, ***p*** = .02, η^2 = 0.11. Pupils from class 1a (Iris) scored higher on the post test ***corrected M*** = 15.66, ***SD*** = 3.59 than the pupils of classes 1b (Mira) ***corrected M*** = 13.54, ***SD*** = 3.06 and 2b (Alice) ***corrected M*** = 13.25, SD = 4.29. No significant differences were found between classes 2a and 2b. An ANOVA 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 this difference for the four classes ***F*** (3, 87) = 4. 76, ***p*** = .01, η^2 = .14. A LSD post hoc test showed that again pupils from class 1a (Iris) ***corrected M*** = 15.81, ***SD*** = 3.06 outperformed pupils of classes 1b (Mira) ***corrected M*** = 13.76, ***SD*** = 3.06 and 2b (Alice) ***corrected M*** = 12.24, ***SD*** = 3.06. Thus, a higher learning outcome of class 1b was found compared to class 1a and class 2b.

5. CONCLUSIONS

This study sought to explore teacher involvement in a redesign team, their perception on their role as a redesigner, curriculum quality and curriculum practicality. In addition this study examined teacher enactment of the redesigned curriculum and the pupil learning outcomes.

In this study we found that teachers were rather positive about their role as a redesigner, and perceived themselves committed to the redesign of and the redesigned curriculum. Also all teachers reported to feel co-owner of the redesigned curriculum. The quality of the curriculum was perceived by the teachers as practical for their classroom practice. Yet, specifically for the role of redesigner an emerging aspect found in this study was that teachers questioned the relevance of taking the role as redesigner by a teacher. Although teachers experienced their role as a redesigner as a learning experience they questioned its relevancy for the daily teacher work. One of them questioned the role of a teacher as redesigner, as whether redesign-work is practical for teacher work and whose responsibilities it is to redesign curriculum. This teacher considers the practicality of her involvement in redesign team. The teachers view themselves rather as implementer only than as redesigner and implementer of a curriculum as their definition of the role of implementer is teaching a 'received' curriculum with making small adaptations to pupils needs, for example adding extra materials / activities. These adaptations are not the same in teachers' view as the adaptations to the eight PictoPal computer and classroom activities, guided by time, principles of difficulty, structure and specific thematic language content and technological affordances and constraints. The teachers made a clear difference between redesigning the content and structure of a curriculum (redesign) and curriculum adaptation as meant and practiced by themselves, which includes according to the teachers small adaptations of the learning materials to the needs of specific pupils. Teachers perceived their investment in the redesign and the benefits of their involvement to be in balance.

From the results on integration it can be concluded that teachers involved in curriculum redesign integrated to a greater extent the PictoPal activities than did teachers who were not involved in the curriculum redesign. Therefore it can be concluded that participation in redesigning seems to affect positively the enactment of the technology integrated curriculum. This finding supports the link found by McGill-Franzen, et al. (1999) between collaborative redesign of literacy-, language-, and print-rich classroom activities and implementation in classroom practice.

Regarding the effect of the PictoPal curriculum on pupils' outcomes it can be concluded that the redesign of the PictoPal curriculum yielded enhanced early literacy learning outcomes for pupils who used PictoPal. However, the effect was very small in terms of practical evidence. An effect of 5 % of the variance explained by learning with the redesigned curriculum is on the small side when compared to the effect of PictoPal (not redesigned by teachers) of 12% found in a previous study (Cviko, Mckenney & Voogt, submitted). The small effect of PictoPal could be because of 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. For example the degree difficulty of PictoPal was not redesigned by teachers so that the difficulty accumulates consistently through all the eight activities as was present in the existing exemplary PictoPal

curriculum activities with the theme ‘Spring’. Ben Peretz and Eilam (2010) rightly caution for this pitfall by stating that teacher adaptations to existing curriculum 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. 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.

Regarding the learning outcomes of the pupils who used PictoPal it can be concluded that one of the junior kindergarteners (class 1a) outperformed the other junior class and one of the senior classes. Although Mira (1b) integrated to a higher extent the on-and off computer activities than Iris (1a), the pupils of Iris outperformed Mira’s pupils. The integration score for class 1a (Iris) was approximately one point lower than the integration score of class 1b (Mira), yet the integration of on-and off activities was Iris’ class sufficient to optimize pupil learning resulting in better outcomes than in Mira’s class (1a). This result might imply that there is an integration level forming a threshold of sufficiency and necessity for effective and optimal pupil learning. Future research should test this assumption, as this study shows that higher extent of integration does not equal higher pupil learning performance. Also future research should explore the time pupils attend to the classroom activities and or the pupil experience of the classroom activities with their written products. Even if a teacher encourages pupils as much as possible to be active with writings during a given time, the extent of teacher initiation of activities may not be in line with pupil capacity and enthusiasm to pay attention to the offered activities. Young children’ attention span determines how much learning can occur within given time (Claessens, Duncan & Engel, 2009). And the time for PictoPal activities for example early in the morning or end of the midday can influence pupils’ enthusiasm and capacity to pay attention to learning with their written products.

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