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Teachers as co-designers of technology-rich learning activities for early literacy

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Amina Cviko research interest concerns the role of teachers in the implementation of technology-rich curricula for emergent literacy.

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Teachers as co-designers of technology-rich learning activities for early literacy

Although kindergarten teachers often struggle with implementing technology, they are rarely involved in co-designing technology-rich learning activities. This study involved teachers in the co-design of technology-rich learning activities and sought to explore implementation and pupil learning outcomes. A case-study method was used to investigate: the co-design experiences of seven teachers; implementation in three kindergarten classes; and pupil learning outcomes. Interviews were used to study teacher perceptions about pedagogy, technology, early literacy, co-designer role, practicality and co-ownership. Process notes were made during design team meetings. Observations were made of implementation, and pupil learning was pre- and post-tested in non-equivalent control quasi experimental design (N = 111). Findings indicate that teacher perceptions about pedagogy affect their co-design involvement. The extent of integration of on- and off-computer activities was similar between teachers. Significant pupil learning gains were found, thus indicating that the co-designed activities had positive effects on pupil learning outcomes.

Keywords: teachers; co-designers; technology integration; early literacy

Introduction

Early literacy is an important domain of the development of young children, because they need literacy skills to participate in their educational careers and society. Early literacy refers to development of oral language (speaking, listening), written language (reading and writing, often in combination with pictures and scribbling), and conceptual skills (Cooper, 1993). The potential of technology applications to support early literacy development in children aged 4-6 has been demonstrated through prior research (De Jong & Bus, 2003). Technology-integrated activities in early literacy development can prepare children for using technology

as a communication tool, for instance by writing with technology (Merchant, 2007). Experts agree that kindergarten teachers should address early literacy in developmentally appropriate ways, integrating technology to support the meaningful learning (International Reading Association, 2009). Development of early literacy can be supported through technology-integrated curriculum activities, yet the overall influence of technology on children's literacy development is determined by the kindergarten teacher (Labbo & Reinking, 2003). Often kindergarten teachers struggle to implement technology in developmentally appropriate ways (Parette, Quesenberry, & Blum, 2010). To successfully implement ICT-rich activities, kindergarten teachers need to understand how to use teaching strategies with technology, why technology is important to young children and also show ability to use the technology and apply it in the classroom (Parette et al., 2010). An active role of kindergarten teachers in the design of technology-integrated activities in the domain of early literacy may facilitate implementation of technology and thereby stimulate early literacy development. Involvement in development of classroom curricula gives teachers a voice in curriculum decision-making (Carl, 2009) and can enhance teacher understanding of the learning environment being created (Cochran-Smith & Lytle, 1999).

Teachers' perceptions about pedagogy, technology and curriculum content could influence co-design of curriculum activities. Also, teachers' perceptions about their role seem related to teachers' involvement in curriculum design. Involvement in development of classroom curricula could foster a sense of ownership (Fullan, 2003) and teachers' perceptions about curriculum practicality, which in turn could influence implementation. Toward understanding how implementation can be facilitated, the present study involves kindergarten teachers in the co-design and implementation of curricular activities. The study set out to examine: how teachers co-design technology-rich activities; view technology, pedagogy and early literacy; how teachers perceive the co-designer role; co-ownership; and

curriculum practicality. Further, the present study examines implementation and pupil learning outcomes. The main focus of the study was on the role of teachers as co-designers of technology-integrated curriculum activities. First, the literature is reviewed to indicate factors influencing teachers' curriculum design and implementation. Thereafter, findings are presented and implications discussed.

Factors related to teacher role 'co-designer'

Teacher involvement in the design of curriculum activities could positively influence implementation, because they can discover the classroom relevance and create opportunities for success (Kenny & McDaniel, 2011). Niess (2005) assumed that integration of knowledge about subject matter, technology, and teaching and learning supports teaching subject matter with technology. Teachers involved in co-designing technology-rich activities report learning about: technology itself; teaching with technology; and curriculum content (Polly, 2011).

Teachers' perceptions about pedagogy, technology and education have been found to be important determinants of successful implementation (Tondeur, Valcke, & van Braak, 2008). Since creating technology-rich activities engages teachers in technology, pedagogy and content, teacher's perceptions about pedagogy, technology and content of may influence how teachers co-design technology-rich curriculum activities.

Involvement in design could encompass teachers' participation in decision-making and formulating goals (Penuel, Roschelle, & Shechtman, 2007) and 'hands on' opportunity for early childhood teachers for exploring the new curricular activities (Keengwe & Ochwari, 2009) and creating new materials to fit one's own context. Design team products can be influenced by team functioning (Tillema & van der Westerhuizen, 2006), team activities and -leadership, team members' design skills, team size and the time spent in a team (Crow & Pounder, 2000). Teachers' co-design could influence teachers' role perceptions. Teachers are likely to engage in roles that go beyond specified role requirements, when they perceive team

ability as high (Somech & Drach-Zahavy, 2000). A broader role repertoire allows team members to adapt their role to changing situations (Mumford, van Iddekinge, Morgeson, & Campion, 2008). Reversely, teachers' role perceptions could influence teachers' co-design. One's knowledge of the nature of a role and the situation when a particular team role should be adopted is related to a team member performance (Mumford et al., 2008).

Through involvement in curriculum development, teachers may take ownership of the resulting products (Kirk & McDonald, 2001). Teachers' co-ownership of new curricular activities can be defined in terms of commitment, understanding the new curriculum and being skilled at it on the part of teachers (Fullan, 2003). Teachers' purposeful collaboration can enable teachers to know what other teachers do and foster transparency of practice and responsibility, which can foster teachers' ownership of educational practice (Fullan, 2011).

Also, teachers' co-design could influence teachers' perceptions about curriculum practicality. The practicality of an innovation wields powerful influence on curriculum implementation (Doyle & Ponder, 1978). In their view, practicality concerns: how well a curriculum is specified; the ratio of effort required to potential benefits; and how congruent the curriculum is with the needs of the classroom. How practical teachers perceive a curriculum for their practice and pupils (and thereby successful implementation) determines if they implement the curriculum at all (Abrami, Poulsen, & Chambers, 2004). McGrail (2005) found that teachers accepted technological change as long as they were convinced that they will see gains for students and teaching. Perceptions about value of an innovation, successful implementation, and costs explain about 43 % of the variance in curriculum use (Abrami et al., 2004).

Curriculum implementation can be described in terms of the quantity of the activities offered to pupils and in terms of quality - the manner in which pre-kindergarten teachers implement activities (Landry, Swank, Anthony, & Assel, 2011). In a study of Lowther, Strahl,

Ross, and Inan (2012) teachers involved in implementation of technology integration and in a training program focused on effective technology use, showed confidence that they knew how to meaningfully integrate technology use into lessons. Also, in a study of Landry et al. (2011), pre-kindergarten teachers involved in professional development activities showed great gains in use of early literacy teaching practices and classroom organisation.

Pupil learning outcomes are commonly used as indicators of the attained curriculum. In a study of Lowther et al. (2012), no significant differences were found in achievement between students whose teachers were involved in a technology use program and implementation of technology integration and controls, students whose teachers were not involved. Landry et al. (2011) found pre-kindergarten teachers' involvement in a program including professional development activities and curriculum implementation to result in greater children's development language and early literacy skills.

The purpose of the study and research questions

Teacher involvement in the co-design of the curriculum to be implemented is assumed in this study to potentially contribute to teacher use of the new curriculum. The purpose of the co-design was to provide kindergarten teachers with an opportunity to create their own classroom intervention. This study aims to understand how the co-designer role contributes to technology integration in kindergarten classes, and how that influences learning.

The main research question was: When teachers are involved in co-designing technology-integrated activates for early literacy, what does that imply for curriculum implementation and pupil learning outcomes?

This question was addressed through the following sub-questions:

(1) What are teachers' views about pedagogy, technology and early literacy?

(2) What are teachers' perceptions about their co-design team?

(3) What are teachers' perceptions about their role as co-designer?

(4) What are teachers' perceptions about co-ownership of technology-integrated activities?

(5) What are teachers' perceptions about practicality of technology-integrated activities?

(6) How do teachers implement the technology-integrated activities?

(7) What are the pupil early learning outcomes?

Methodology

A case study, defined as an empirical inquiry for investigating phenomena in real-life contexts (Yin, 2003) was used to examine teachers co-design and the related teachers' perceptions, implementation and pupil learning outcomes. Within the case study, a non-equivalent group quasi experimental design was used to examine early literacy outcomes of pupils learning with co-designed technology-integrated activities.

Intervention

PictoPal is a technology-supported intervention for early literacy. PictoPal is based on the national attainment targets: (1) Functional reading and writing; (2) The functions of written language; (3) The relationship between spoken and written language; and (4) Linguistic awareness. PictoPal consists of on-computer activities through which pre-readers use words, sound and images to construct written texts; and off-computer activities that prompt children to 'use' their printed documents for authentic purposes (Author, 2009). Figure 1 shows an on-computer activity, in which children, compose a recipe for a vegetable soup (left) and an off-computer activity, in which children follow instructions on their printed recipe (right). In this way each on- and off-computer activity is integrated in a meaningful way.

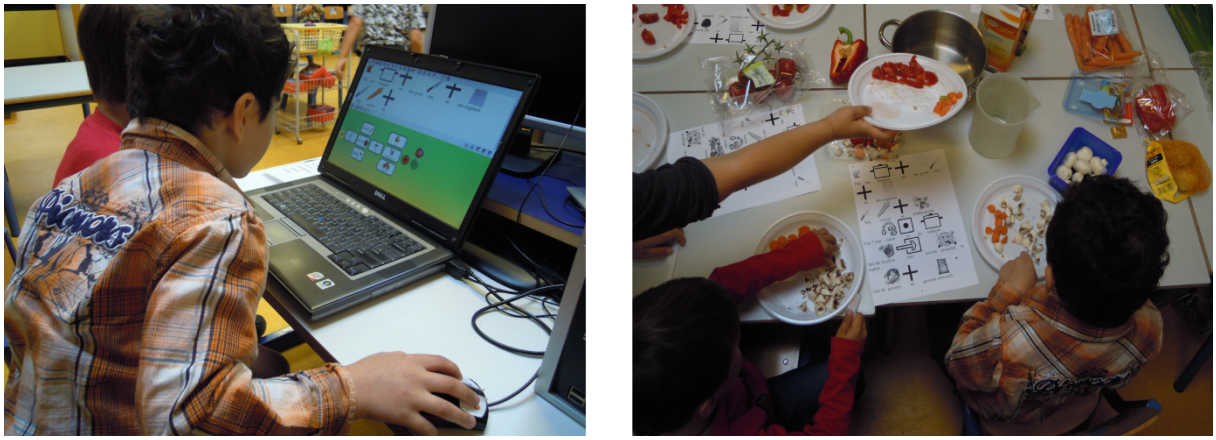

Figure 2. On computer activity: creating a recipe (left), off computer activity: using the recipe to cook (right).

Co-design task

Teacher involvement in the co-design of the curriculum to be implemented is assumed in this study to potentially contribute to teacher use of the new curriculum. The purpose of the co-design was to provide teachers with an opportunity to create their own classroom intervention. The design task required teacher input for new content of eight on- and eight off-computer activities, aligning with the existing goals and structure of PictoPal. The goal of the co-designed activities was to engage pupils in computer-assisted writing and in subsequent purposeful applications of the written products. Specifically, teachers were challenged to:

(1) Create new content (texts types, sentences, words and pictograms);

(2) Gradually increase the difficulty level of on-computer activities;

(3) Connect on-computer activities products with off-computer activities; and

(4) Ensure thematic alignment within and between activities.

Researcher(s) had a facilitative role during design. PictoPal was introduced to teachers by researcher(s) by presenting a demo version, and explaining its purpose, content, and features.

Teachers were invited to discuss their views about early literacy and technology integration, and ideas about design and implementation of a new module. Teacher' designs written on paper were converted into computer activities and teacher manuals, which teachers used to guide their own implementation.

Participants

From four schools, five teachers and two student teachers (interns) were interested in PictoPal and co-designing activities. They worked in two teams, referred to here as the teacher-team and the intern-team. The teacher-team had four teachers, each teaching their own kindergarten class. Each teacher had approximately 20 years teaching experience. Carla (school 1) and Maria (school 2) co-designed and implemented PictoPal in their classes. After the second team meeting, Mary and Wilma (school 3) discontinued participation. The intern-team had one teacher (school 4), teaching her own class and two student teachers, who were not yet responsible for a class of their own. Teacher Jenny had 6 years of teaching experience, while interns Wendy and Laura had 6 months of teaching experience. Jenny implemented PictoPal in her class.

Pupils from three classes $n = 44$ (28 boys and 16 girls) participated in the experimental group and pupils from four classes $n = 67$ (18 boys and 49 girls) participated in the control group. The control classes were not taught at the same schools as the experimental classes. Those pupils came from another school in the same region. The experimental and control groups were comparable, because both groups used the standard language curriculum, but teachers enhanced or replaced standard activities with PictoPal-activities in the experimental group. Table 1 shows an overview of the distribution of pupils in the classrooms studied.

Table 1. Number and gender of pupils at the start of PictoPal implementation.

	n	Boys	Girls
Class 2a, Maria	8	6	2
Class 2b, Carla	16	10	6
Class 2c, Jenny	20	12	8

Instruments

Table 2 shows an overview of the instruments used in this study and provides a short description of the instruments.

Table 2. An overview of the instruments.

Instrument	Detail
Interview	An interview scheme guiding interviews was used to examine teachers' perceptions about teaching, technology, early literacy; teacher role; co-ownership and practicality. When elaboration was needed, teachers were asked to clarify their responses. An example questions is: 'What are your views on teaching young children?'
Team notes	Observations of teams of teachers co-designing the materials were made using minutes. The notes contained descriptions of team activities, team size and time spent in a team.
Integration checklist	Integration of on- and off-computer activities was observed using an checklist with 12 items (Verseput 2008). An example item is: 'The

	teacher lets pupils talk about the products of their activity.' The items were scored as 0 = absent; 0.5 = observable to some extent; 1 = observable to a great extent.
Early literacy test	An early literacy test for 4-5 year olds (Author, 2006) consisting of 20 items was used to investigate pupil learning outcomes. An example item is: (1) the researcher sets out colour pencils, a pen, paper, scissors, a colouring 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 test items were scored as 1 = correct and 0 = not correct.

Data collection

After PictoPal-implementation, teachers were interviewed about pedagogy, technology and early literacy; involvement in co-design team, the co-designer role; co-ownership and practicality of PictoPal. The data collection involved two researchers. During co-design meetings, notes were taken and later analysed to describe team activities and the time teachers spent in a team. After the second co-design meeting, two teachers were interviewed about their reasons for discontinuation. Classroom implementation was observed using an integration checklist (Verseput, 2008), focused on the extent to which teachers integrated on-and-off computer activities. During eight weeks of implementation, observations were held once a week in each class for about 20 minutes. The inter-rater reliability of two observers, who rated the integration during one activity was found to be Cohen's kappa = .63, ($p <$ 0.001), 95% CI (.20 – 1.06), indicating an acceptable agreement (DeVellis, 1991). The test for early literacy was administered before and after implementation.

Data analysis

The data from the interviews were analysed by summarizing responses. Teachers' responses regarding pedagogy, technology end early literacy were analysed by two researchers. Each step in the analysis was discussed until agreement was reached on categories. The observation data on integration was analysed using analyses of variance (ANOVA) and pupil early literacy outcomes using analysis of covariance (ANCOVA) and a paired sample T-test.

Results

Perceptions about pedagogy, technology and early literacy

Findings showed that teachers hold a developmental or an experience approach to teaching. They were positive or critical about technology and viewed early literacy teaching important. Table 3 shows an overview of the teacher's views about pedagogy, technology and early literacy.

A developmental approach can be characterized as stimulating child development by offering a tailored learning environment. For instance, teaching should occur in the 'zone of proximal development', and pupils should be intrinsically stimulated to understand concepts. Also, teachers should stimulate the social–emotional development of a child and should be taught by creating a good educational climate and using various learning methods suitable for different pupils. The experience approach features teaching based on pupil experiences which was found to represent the views of two teachers. Their perspective was that children should be stimulated to discover their own world; for instance, a teacher can offer writing activities based on children's experience and volition to engage in writing.