MONITORING ICT INTEGRATION – HOW TO INCLUDE EARLY CHILDHOOD EDUCATION

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Abstract

Simultaneously with technology investments, a call for monitoring instruments arose to gain insight into the return on investment. In Flanders, a monitoring instrument, called MICTIVO, is used to obtain information about the status of ICT integration in Flemish education. During the first edition of MICTIVO (2007-2008), actors from early childhood education indicated that a lot of questions used in the monitor were not applicable to the early childhood education context. Therefore, a new scale was developed to measure ICT use in this educational context. Exploratory factor analysis was carried out in a previous study. Confirmatory factor analysis was used on partial data from the second edition of MICTIVO. Results indicate that two types of ICT use can be distinguished: 'ICT use supporting basic skills and attitudes' and 'ICT use supporting contents and individual learning needs'. The constructed scales are valid and reliable measurement scales with good goodness of fit estimates and good levels of internal consistency. These two instruments are helpful in further research on ICT integration in early childhood education. Moreover, data confirms that the grade in which a teacher works is an important factor related to the amount of ICT use in early childhood education.

Introduction

Nowadays, ICT has found its way into the classrooms. Policy makers worldwide have invested a lot of money to introduce and integrate ICT in education, and this has happened for educational, economic as well as social reasons (Selwyn & Brown, 2000). In 2007, an ICT curriculum for compulsory education was launched by the Flemish government. This compulsory ICT curriculum is written in terms of ICT attainment targets and only applies to primary (age 6 to 12) and secondary education (age 12 to 18) (Vandenbroucke, 2007). This means that preschools (age 2.5 to 6) are not obliged to use or integrate ICT in their curriculum. The Ministry of Education considers it the responsibility of preschools themselves to choose the moment to start working with ICT with their children. Simultaneously with the implementation of these ICT attainment targets, a call for a monitoring instrument arose as government, researchers and practitioners wanted to gain insight into the return on investment and effects of ICT on teaching and learning.

The current study reports on the use of a monitoring instrument in Flanders, the Dutch-speaking part of Belgium, called MICTIVO (Monitoring ICT Integration in Flemish Education). During the first edition (2007-2008), the monitor was conceived and validated (Evers et al., 2009). ICT integration was measured through four different aspects: ICT infrastructure and ICT policy, ICT use, ICT competences, and ICT perceptions of students, teachers and school leaders. Actors from different educational levels participated in the first study. To guarantee maximum comparability, the aim of MICTIVO was to develop an instrument that can be used for all these educational levels. In Flanders, a distinction can be made between early childhood education, primary education and secondary education. Only primary and secondary education are part of the Flemish compulsory educational system. Attending early childhood education is not an obligation, but a large majority of preschoolers (93 %, Werkgroep kleuterscholen Vlaanderen, n.d.) go to school from the age of 2.5. The choice for comparability implicated a less strong focus upon unique characteristics of every educational level. This means that ICT use and competences in early childhood education were questioned in the same way as in primary education, through ICT attainment targets that only apply to compulsory education. This resulted in a sense of irrelevance amongst school leaders and teachers in early childhood education. They experienced a lot of the questions used in the MICTIVO-monitor to be not applicable to or appropriate for preschools. In other words, to get a clearer picture of ICT use in early childhood education in Flanders, it seems not sufficient to use the same attainment targets as a basis to measure ICT use in this educational context. One example: the item 'Students can use ICT

to search, process and save information' is clearly a less appropriate target for children who do not know yet how to read and write. Evers et al. (2009) conclude that if we want to integrate early childhood education in the MICTIVO-monitoring instrument, it is necessary to develop a separate instrument that pays attention to the specificity of this educational context and the possibilities of ICT within this context. During the current school year, the monitor is administered a second time. Taking into account the experiences of the previous administration of MICTIVO, the question arises how to include early childhood education in the monitoring instrument in a way that it helps to obtain valid data and information from this educational level.

ICT in Early Childhood Education

ICT can be defined as '*anything which allows us to get information, to communicate with each other, or to have an effect on the environment using electronic or digital equipment'* (Siraj-Blatchford & Siraj-Blatchford, 2003, p. 4). ICT includes much more than just computers, it also includes digital cameras, creativity and communication software and tools, the internet, telephones, interactive stories, computer games, programmable toys, electronic whiteboards, etc. (Bolstad, 2004).

Plowman and Stephen (2005, 2006) indicate that there are cultural differences between learning in the preschool sector and learning in primary schools. The curriculum is less prescriptive (e.g. in Flanders early childhood education works with 'development goals' instead of attainment targets), and there are different norms of professional practice. There is more emphasis on learning through play and less reference to formal and adult-directed teaching. In this way, integrating ICT into early childhood education can mean something completely different from integrating ICT into primary or secondary education. While in primary education, a distinction can be made between the use of ICT as an information tool, as a learning tool and for learning basic computer skills (Tondeur, van Braak, & Valcke, 2007; Vanderlinde & van Braak, 2010), it is not clear how ICT use in early childhood education can be typified. This means that pre-service primary teachers in Flanders can be prepared to help children reach the attainment targets, while there is no such framework for preschool teachers. Different authors point to different possibilities of ICT for young children (e.g. Bolstad, 2004; Kalas, 2010), such as the use of ICT in socio-dramatic role-play, to support language development and mathematical thinking, to support children with special learning needs or from culturally diverse backgrounds, to stimulate social interaction, and to motivate children. This illustrates that ICT offers multiple possibilities and can be embedded in early childhood in many divergent ways. Further, Kerckaert et al. (2013) indicate that the grade in which a preschool teacher works is strongly related to the amount of ICT use in the classroom. This can be connected to the concept of 'developmental appropriateness' (Siraj-Blatchford & Siraj-Blatchford, 2000; Bolstad, 2004; Kalas, 2010). According to this concept, a teacher has to judge what experiences with ICT are appropriate for a certain age and a certain child. To put differently, teachers in the study of Kerckaert et al. (2013) consider the introduction of ICT to be less appropriate for the youngest children. It is interesting to explore whether these findings are consistent with results of the second administration of MICTIVO (MICTIVO 2).

In this contribution, we will first further develop an instrument to obtain valid data and information considering ICT use in early childhood education. Second, we will explore data from MICTIVO 2 to examine whether previous findings regarding the importance of grade can be confirmed.

Methodology

Data Analysis

In a separate study, we aimed to develop a new scale to measure ICT use in early childhood education (Kerckaert et al., 2013). Results of the exploratory factor analysis can be found in Kerckaert et al. (2013). Currently this new scale is being used in the second administration of MICTIVO. We will use partial data from this project to conduct confirmatory factor analysis through AMOS 21.0 and examine the stability of the exploratory factor structure. For the CFA several fit indices are calculated to provide information about the goodness of fit: a non-significant Chi Square, with χ^2/df smaller than 5, RMSEA ranging between .05 and .08, and GFI, AGFI, and CFI above .90 indicate a fair fit (Byrne, 2001). The influence of the grade in which a teacher works, will be investigated through ANOVA's in SPSS 20.0.

Participants

305 preschool teachers of 87 schools filled out the survey, as participants of the second edition of MICTIVO. 96.7 % of the sample is female. They have an average of 16.6 years of experience in education, ranging from 0 to 39 years (SD = 9.43). Of the participants, 97% are teachers in regular early childhood education. 3% are teachers in special needs education. Of the teachers in regular education, 24.1% teach in a first grade (age 3 to 4), 23.1% in a second grade (age 4 to 5), and 23.1% in a third grade (age 5 to 6). The other participants teach in a class for children aged two-and-a-half to three years (13.8%) or have a class consisting of children of different ages (15%).

Results

Scale Construction

As mentioned, in a separate study, a new scale was developed to explore ICT use in early childhood education (Kerckaert et al., 2013). Participants were asked to judge how often they use a certain kind of ICT on a Likert-scale with values 0 (never), 1 (every trimester), 2 (monthly), 3 (weekly), 4 (daily). A solution consisting of two factors was obtained: '*ICT use supporting basic ICT skills and attitudes*' (n items = 5) and '*ICT use supporting contents and individual learning needs'* (n items = 6). All items of these scales are presented in Appendix A.

In the second edition of MICTIVO, these scales are used to obtain valid data about ICT use in early childhood education. However, in order to make the rating scale fit within the context of the monitor, instead of asking for frequencies of use, the labels are changed to completely disagree (0), disagree (1), more or less disagree (2), more or less agree (3), agree (4), completely agree (5). The CFA confirms the two-factor structure (see Figure 1) with all items loading significantly on the two latent factors. All coefficients are between .48 and .91. The results show a good fit between the hypothesized model and the observed data (df = 40, χ^2 = 110.35, χ^2/df = 2.76). The fit indices are GFI = .94, AGFI = .89, CFI = .97, RMSEA = .08, indicating a good fit.

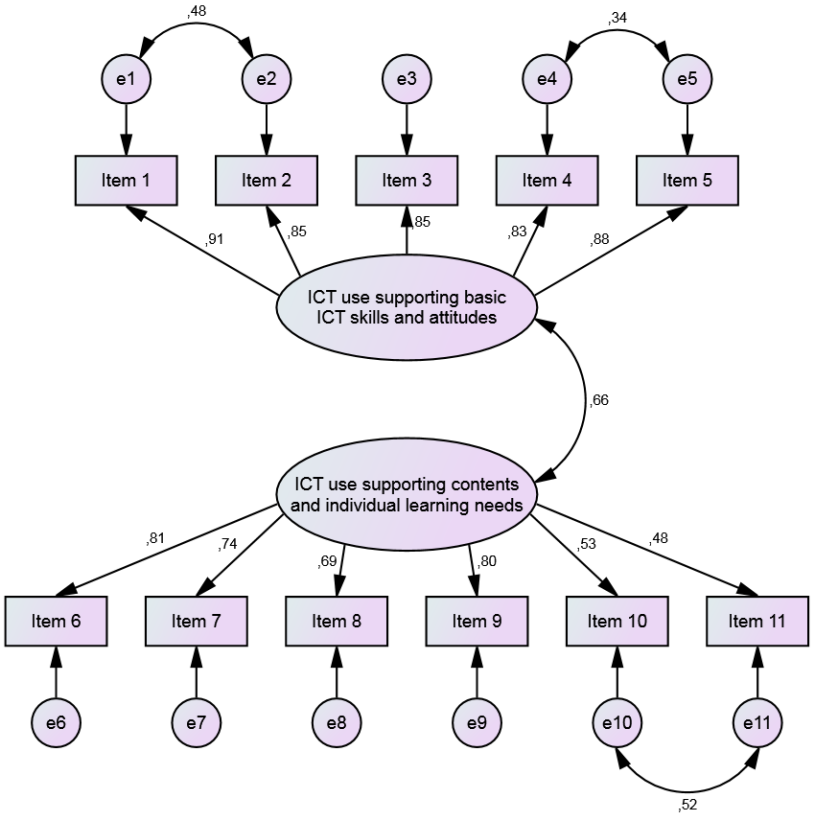

Figure 1: Confirmatory factor analysis for 'ICT use in early childhood education'

In total, three pairs of residuals (e) are allowed to correlate: e1 and e2, and e4 and e5 for '*ICT use supporting basic ICT skills and attitudes'*, and e10 and e11 for '*ICT use supporting contents and individual learning needs'*. This leads to a significant decrease in χ^2 (from 280.85 to 110.35) compared to the model without correlated residuals. The correlated residuals suggest a substantial overlap between the items. Item 4 and Item 5 (see Appendix A) can both be related to a responsible and positive attitude towards ICT. Item 10 and Item 11 both focus on supporting individual learning needs of preschoolers. Item 1 and Item 2 seem to relate to teaching ICT basic skills. This could mean that preschool teachers mainly use games to teach their pupils to work with ICT. Finally, the Cronbach's alphas are calculated to examine internal consistency of the two factors. The alphas indicate that both scales are reliable (Table 1).

Table 1 Cronbach's alphas and descriptive statistics

Scale	Alpha	M	SD
ICT use supporting basic ICT skills and attitudes	.94	70.24	24.77
ICT use supporting contents and individual learning needs	.84	57.34	22.23

First Comparisons

In Table 1, some descriptive statistics are presented. All items were summarized into sum scores ranging from a minimum score of 0 to a maximum score of 100. The average score for '*ICT use supporting basic ICT skills and attitudes'* is 70.24 (SD = 24.77). Regarding '*ICT use supporting contents and individual learning needs*', the average score is lower (M = 57.34, SD = 22.23). Preschool teachers indicate they put a stronger focus on the basic ICT skills of their pupils then on using ICT to support contents or learning needs.

In Table 2, the mean scores for both types of ICT use of teachers of different grades can be found. ANOVA shows that, for both types of use, significant differences exist between grades (basic ICT skills and attitudes: $F(3, 245) = 16.84$, $p < .001$; contents and individual learning needs: $F(3, 245) = 14.97$, $p < .001$). Post-hoc analyses show that the differences mainly occur between third grade and the younger grades (*basic ICT skills and attitudes*, grade 0: $t(248) = -6.50$, $p < .001$; grade 1: $t(248) = -4.16$, $p < .001$; grade 2: $t(248) = -1.28$, $p = .20$; *contents and individual learning needs*, grade 0: $t(248) = -4.82$, $p < .001$; grade 1: $t(248) = -6.06$, $p < .001$; grade 2: $t(248) = -2.31$, $p = .02$). It is clear that the amount of ICT use is related to the age of the children. Teachers who work in classes with multiple ages are not included in this analysis (n = 56).

Table 2 Mean scores for both forms of ICT use in different grades

	ICT use supporting basic ICT skills and attitudes		ICT use supporting contents and individual learning needs		N
	M	SD	M	SD	
Grade 0 (age 2.5 to 3)	51.33	27.11	48.49	19.47	42
Grade 1 (age 3 to 4)	64.28	28.08	46.81	22.30	71
Grade 2 (age 4 to 5)	75.35	16.80	59.71	19.06	68
Grade 3 (age 5 to 6)	80.35	18.33	67.79	20.25	68
Total	69.51	24.83	56.35	22.08	249

Conclusion and discussion

In a previous study, we aimed to develop a valid scale to measure ICT use in early childhood education (Kerckaert et al., 2013). During the second edition of MICTIVO, a slightly adapted version of this scale is used to offer a solution for the problems that occurred during the first edition. The constructed scales are valid and reliable measurement scales with good goodness of fit estimates and good internal consistency. The developed scales can be used in further quantitative research on ICT integration in preschools. They can also be used to help teachers identify which forms of ICT use are not present in their teaching, but could be interesting to work with. Currently, teachers agree that they rather use ICT to support basic ICT skills and attitudes. ICT use supporting contents and individual learning needs occurs less, but could be considered more innovative.

Previous research has indeed shown that ICT professionalization is a crucial factor in stimulating ICT use that transcends supporting basic skills and attitudes (Kerckaert et al., 2013). Also more attention should be given to more qualitative research to be able to give more examples with every type of ICT use.

It is important to notice that item 10 and 11 have the lowest loadings on '*ICT use supporting contents and individual learning needs*'. These items focus on ICT use supporting individual learning needs. It is possible that there should be three factors: ICT use supporting 1) basic ICT skills and attitudes, 2) contents and 3) individual learning needs. This means that future research could try to expand the number of items focusing on individual learning needs. This way, a fully separate factor could be developed to assess ICT use regarding this aspect.

Finally, analysis of the MICTIVO 2 data indicates that the grade in which a teacher works is an important factor related to the amount of ICT use in early childhood education. This confirms the results of a previous study (Kerckaert et al., 2013), and stresses the importance of 'developmental appropriateness' (Siraj-Blatchford & Siraj-Blatchford, 2000).

Appendix A

Scale 'ICT use supporting basic ICT skills and attitudes'

- Item 1: In my class I teach my pupils ICT basic skills.
- Item 2: In my class preschoolers use ICT to play games.
- Item 3: I teach preschoolers to use the computer and corresponding peripherals.
- Item 4: I teach preschoolers a positive attitude towards ICT.
- Item 5: I teach my pupils to handle ICT in a safe and responsible way.

Scale 'ICT use supporting contents and individual learning needs'

- Item 6: I use ICT with preschoolers to illustrate certain subjects.
- Item 7: I use ICT during instruction.
- Item 8: My pupils discover ICT because I offer them digital stories.
- Item 9: In my class I use educational websites to deliver certain contents to my pupils.
- Item 10: I use ICT for remediating tasks for the preschoolers.
- Item 11: In my class preschoolers with learning difficulties use adapted software/websites.

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