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Curricula and the use of ICT in education: Two worlds apart?

Jo Tondeur, Johan van Braak and Martin Valcke

Jo Tondeur is currently preparing his PhD on the development of a multilevel model for the integration of ICT (information and communication technology) in education. Johan van Braak is a professor at the Department of Education at Ghent University. His research interests are in the field of ICT and education. Martin Valcke is a professor and head of the Department of Education at Ghent University. His work focuses mainly on the innovation of higher education and the use of ICT. Address for correspondence: Department of Education, Ghent University, H. Dunantlaan 2, B9000, Belgium. Email: Jo.Tondeur@Ugent.be

Abstract
In many countries, information and communication technology (ICT) has a clear impact on the development of educational curricula. In Flanders, the education government has identified and defined a framework of ICT competencies for expected outcomes, related to knowledge, skills and attitudes that pupils are expected to achieve at the end of primary school. However, it has never been examined whether teachers are using ICT in accordance with the competencies proposed by the Flemish government. In order to answer this question, a survey was conducted among 570 respondents in a stratified sample of 53 primary schools. Results show that teachers mainly focus on the development of technical ICT skills, whereas the ICT curriculum centres on the integrated use of ICT within the learning and teaching process. This indicates the existence of a gap between the proposed and the implemented curriculum for ICT. The paper concludes with the potential value of a school-based ICT curriculum that 'translates' the national ICT-related curriculum into an ICT plan as part of the overall school policy.

Introduction

Information and communication technology (ICT) plays an important role in society when we take into account the social, cultural and economic role of computers and the Internet. Considering that all youngsters move through compulsory education, school is the appropriate place to develop crucial ICT competencies. In order to cope with the demands of the knowledge society, a concrete list of ICT competencies has been put forward by the national educational authorities of Flanders (the Dutch-speaking region of Belgium). In contrast to countries such as the United Kingdom (Qualification and

Curriculum Authority/Department for Education and Employment, 1999) and Canada (Alberta Learning, 2000), where ICT competencies have been included in the formal national curriculum, the ICT competencies have not yet been formally integrated into the Flemish national curriculum. They are merely presented as guidelines for schools to direct their educational innovation process while adopting the use of ICT (Ministry of the Flemish Community. Department of Education, 2004).

The absence of a formal and established ICT curriculum leads to an ambiguous situation, because there is nevertheless an observable policy towards the adoption of ICT in schools. This policy fosters the integration of ICT in teaching and learning processes, but builds on the professional attitude and willingness of the individual teacher and school principal. The current situation of informal policy expectations cannot guarantee that all pupils will achieve, to a comparable extent, the ICT competencies set forward.

The present study investigates how and to what extent schools in general and teachers in particular already implement the new expectations arising from the national authorities. In particular, it examines which ICT competencies teachers actually adopt (actual use) and which competencies they intend to adopt in the future (preferred use).

Background

International developments in educational ICT curricula

National ICT policies have reached an established position in both developed and developing countries. A study funded by the Australian Department of Education, Science and Training revealed that most national ICT policies focus on the educational sector (Kearns & Grant, 2002). Education is put forward as the central actor to pursue and attain the objectives of the ICT policy; other sectors are expected to benefit indirectly from this approach. Educational ICT policies have been designed in a variety of ways, depending on the dominant rationales that drive curriculum development. As early as 15 years ago, Hawkridge (1990) discerned four different rationales that drive policies related to the integration of ICT and the use of computers in education:

- an economic rationale: the development of ICT skills is necessary to meet the need for a skilled work force, as learning is related to future jobs and careers;
- a social rationale: this builds on the belief that all pupils should know about and be familiar with computers in order to become responsible and well-informed citizens;
- an educational rationale: ICT is seen as a supportive tool to improve teaching and learning;
- a catalytic rationale: ICT is expected to accelerate educational innovations.

Current curriculum developments mainly reflect an economic and social rationale. National policies identify ICT literacy as a set of competencies needed to participate in society (OECD/CERI, 2001). The eEurope 2002 objectives of the Lisbon Summit stipulate that all school-leavers must be digitally literate in order to be prepared for a knowledge-based economy (Commission of the European Communities, 2000). National documents such as the *School Education Action plan for the Information Economy*

(EdNA School Advisory Group, 2001) and the *National Educational Technology Plan* (US Department of Education, 2004) take a similar approach. In the light of the socio-economic rationale, many countries have introduced ICT as a separate school subject in order to teach pupils a number of technical ICT skills (Plomp, Anderson, Law & Quale, 2003).

National ICT curricula and frameworks, eg, the Qualification and Curriculum Authority/Department for Education and Employment (1999) and Alberta Learning (2000) stress the educational rationale. This approach builds on the assumption that the use of ICT is beneficial for student learning. ICT literacy is—according to this rationale—a secondary effect of a content-related ICT use. The educational use of ICT should be embedded within subject-oriented competencies. Hawkridge (1990) also stresses the educational innovation potential of ICT use (catalytic rationale). ICT use helps to pursue higher-order thinking and problem-solving skills. It is believed that learning to solve problems, developing research skills and studying problems of personal interest are the key to a successful education (Zuga, 1993). Other benefits derived from ICT usage are that it fosters collaborative learning and flexible learning opportunities—independent from time and place—and that it offers opportunities arising from cross-cultural use (van Braak, 2001).

Though the distinction between of the four rationales discussed above is important, the OECD/CERI (2001) reports that there is a growing convergence between the economic, social and educational rationale. On the one hand, current policies convey the idea that ICT supports societal developments. On the other hand, policies state that ICT-based educational practices have to take a pedagogical position as a point of departure (Bryderup & Kowalski, 2002). A particular challenge for educational authorities resides in the need to address the economic, social, educational and catalytic rationales for the inclusion of ICT in education.

ICT curriculum in the Flemish context

Educational policies in Flanders are characterised by a high level of local school autonomy. Schools are autonomous and are accountable for organising the teaching and learning processes. They are also responsible for setting up their quality control policies in order to prove that they meet the attainment targets (standards) put forward by the government. These attainment targets are minimum objectives and should be achieved by the majority of the pupils at the end of primary education. In primary schools, a distinction is made between subject-specific and cross-curricular attainment targets. The latter refer to more generic goals such as social skills and metacognition. A first list of attainment targets was conceived during the mid-1990s. A screening of these attainment targets revealed that ICT competencies were not included in an explicit way in the formal curriculum. But some attainment targets can clearly be related to ICT use:

- Pupils must be able to use information resources in a systematic way.
- Pupils must be able to recognise examples of information processing technologies.
- Pupils must be able to consult information resources.

To respond adequately to the expectations of the knowledge society (economical and social rationale), the government has proposed a non-compulsory set of ICT attainment targets, formulated as ICT competencies (Ministry of the Flemish Community, Department of Education, 2004). This new set of targets is graphically presented in Figure 1.

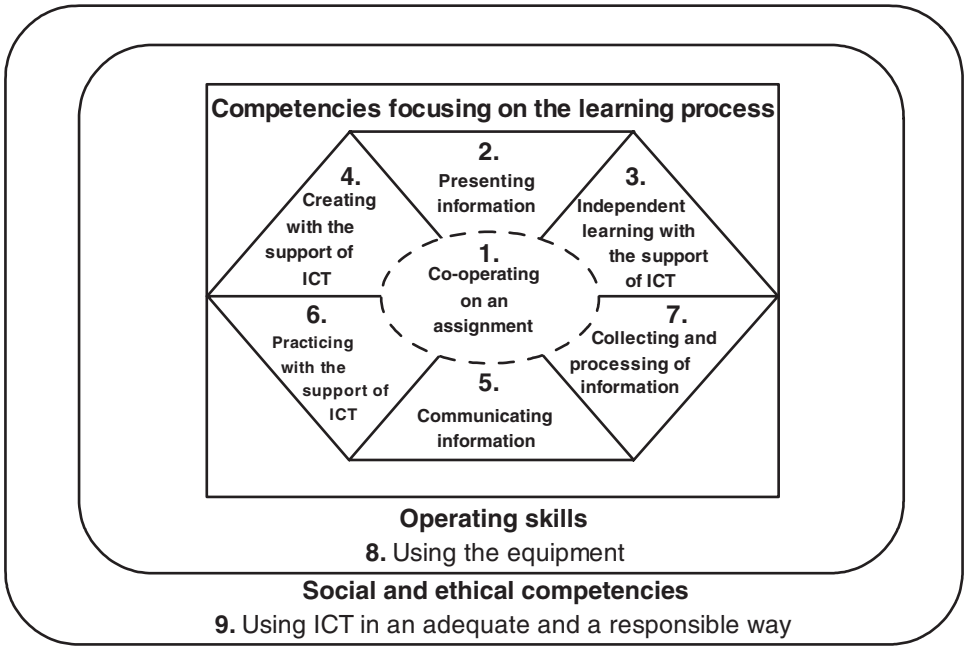

Figure 1: Framework for information and communication technology (ICT) competencies in Flemish primary education (Ministry of the Flemish Community, Department of Education, 2004)

The Ministry of the Flemish Community, Department of Education (2004) does not suggest defining a new school subject in the primary school. Since their relevance for all subject areas, ICT competencies can be labelled as cross-curricular attainment targets. The central ICT competencies are expected to influence the learning process (educational rationale). The ICT competencies empower pupils to use ICT in a functional way. For this reason, a list of sub-competencies is identified and classified in such a way that they fit into the learning process: planning, implementing, monitoring and evaluating. Next to learning related competencies, two additional clusters of competencies are identified. A first additional cluster includes technical competencies, such as being able to use the computer, peripheral equipment, the technical system and the software. A last cluster of ICT competencies comprises the social and ethical dimension of ICT use and refers to the development of attitudes to use ICT in a responsible and safe way.

Besides the importance of competencies to direct or support teaching and learning, the Flemish government also emphasises the importance of ICT as catalyst to innovate teaching and learning approaches (catalytic rationale): 'ICT can boost the creation of

an optimal teaching/learning environment. This learning organisation will evolve in the course of time from schools into open learning centres and multimedia learning environments. ICT must be viewed as a means that supports teaching aspects such as extension of the special needs provision, participation, internationalisation, lifelong learning and intercultural education' (Ministry of the Flemish Community, Department of Education, 2002, p. 16).

The ICT policies of the Flemish government illustrate the search for a more holistic approach to respond to the rationales for introducing ICT in education. Achieving the goals of the educational and catalytic rationale will, according to the Ministry of the Flemish Community, Department of Education (2004), automatically lead to the accomplishment of the goals of the economical and social rationale. The concern of governments to build frameworks and strategies to promote the educational use of ICT has been widely noted (Kearns & Grant, 2002). The essence is learning with ICT, not the use of ICT.

The question is to what degree teachers integrate ICT in their teaching and learning the way the national authorities have proposed. International research reveals that, despite the definition of national ICT-related curricula, significant differences can be observed in the way ICT is currently implemented between and within schools (eg, Goodison, 2002; Kirschner & Selinger, 2003; Loveless & Dore, 2002). The requirement that ICT should be developed across curriculum areas (educational and catalytic rationale) is not mirrored in the actual use of ICT. A recent study (Hennessy & Deaney, 2004) reports that teachers are gradually starting to integrate ICT into their teaching strategies.

This brings us to the central objective of the present study. To what extent are the current perspectives and instructional practices of Flemish primary school teachers in accordance with the new ICT framework that reflects the ICT competencies?

Research design

Research questions

Since the framework was published in February 2004 and the survey was completed in May 2004, teachers had insufficient time to adapt the ICT competencies into their practice to observe significant changes in schools. The main objective of this study was therefore not to examine any implementation effects, but to investigate whether the current perspectives and practices in the primary schools were in line with the new ICT framework.

The research findings are presented according to the following questions:

- Does actual classroom ICT use mirror the ICT competencies as defined by the Flemish Department of Education?
- To what extent do teachers pay attention to technical ICT skills?
- To what extent do teachers pay attention to ICT competencies supporting the learning process?

- To what extent do teachers pay attention to the development of social and ethical competencies?
- To what extent do teachers intend to pay attention to the ICT competencies in the future?

Research sample

A stratified sample of 60 schools was drawn from schools in Eastern Flanders, one of the five Flemish provinces. Stratification variables were based on the educational networks the schools belong to and the degree of urbanisation (rural/urban). One teacher of each grade level was asked to fill out a questionnaire, resulting in data from at least six teachers per school. The data were collected in May 2004. Fifty-three out of sixty school principals agreed to cooperate in the study, representing a high response at school level. Because of our interest in understanding how the ICT competencies have been introduced at school level, the school principals were interviewed (using a semi-structured interview protocol) in October 2004. The final teacher sample consisted of 570 teachers, of which 75.6% were female. The age ranged from 22 to 61 years, with an average age of 38 years.

Research instrument

The questionnaire presented to the teachers focused on the central research variables and information about background variables at teacher and school level. A reliability analysis helped to examine the internal consistency of the instrument in view of determining the attention paid to pursuing the three particular types of ICT competencies. The results are presented in Table 1.

Table 1: Reliability coefficients and descriptive statistics for the attention levels paid to pursuing the three types of information and communication technology (ICT) competencies

	α	*M*	*SD*
Technical ICT skills	0.91	67.8	26.6
ICT competencies focusing on the learning process	0.85	59.0	23.0
Social and ethical ICT competencies	0.91	59.1	26.7

Control of the psychometric quality of the research instrument reveals a high level of internal consistency ($\alpha > 0.70$). To facilitate data analysis, sum scores were calculated for the three types of competencies (minimum 0–maximum 100).

Results

ICT profile

All teachers in the sample reported to be to some extent familiar with ICT. The average computer experience was 9.04 years. Only 2.6% of the sample reported they never used a computer, neither for supportive tasks, class use nor for leisure purposes. Table 2 summarises descriptive data about the teacher sample.

Table 2: Descriptive statistics for the information and communication technology profile of the teacher sample

	M	*SD*
Computer experience in years	9.04	4.14
Computer use for professional support (hours a week)	4.35	3.86
Computer use for class use (hours a week)	2.28	2.81
Computer use for leisure activities (hours a week)	2.42	3.88

On average, teachers reported to use the computer 9.05 hours a week, mostly for professional support and, to a lesser extent, for class use or leisure activities (see Table 2). Only 12.3% reported that computers were never used in the classroom. Most of the teachers use the computer between 1 to 2 hours a week (62.3%) and 25.4% integrate computer use into their class activities for 3 hours or more. It can be concluded that computers have found their way into classrooms, but the average time spent on computers in classrooms remains rather limited.

More than half of the teachers (56.2%) have followed at least one computer training course during the last 5 years. The average number of training courses followed during these 5 years was 1.05 ($SD = 1.49$). Up to 54.8% reported that ICT training has contributed 'to a lesser extent' to the integration of ICT in the classroom. Only 6.3% reported a strong effect of ICT teacher training.

Principals' response to the new framework for ICT competencies

Most principals (89.1%) indicated that they are aware of the existence of the new list of ICT competencies promoted by the Ministry of the Flemish Community. But only a minority of the schools (17.6%) planned concrete actions to integrate the ICT competency framework into the classroom curriculum. During the interviews the non-compulsory character of the ICT competencies was stressed as the main reason of non-implementation. The list of concrete school based strategies that have been adopted by principals in view of implementation of the competencies comprised the following actions: presentation of the ICT competencies to the school team, incorporation of the ICT competencies into a school based ICT plan and the development of ICT related activities based on the list of ICT competencies.

ICT competencies in primary education

A comprehensive picture of the actual level of attention paid to pursuing the three types of ICT competencies is shown in Figure 2.

From this figure it is clear that technical ICT skills receive the highest priority in primary education ($M = 0.97$; $SD = 0.49$). Social and ethical ICT competencies ($M = 0.68$; $SD = 0.41$) and ICT competencies related to the learning process ($M = 0.68$; $SD = 0.41$) mirror significantly lower priority levels.

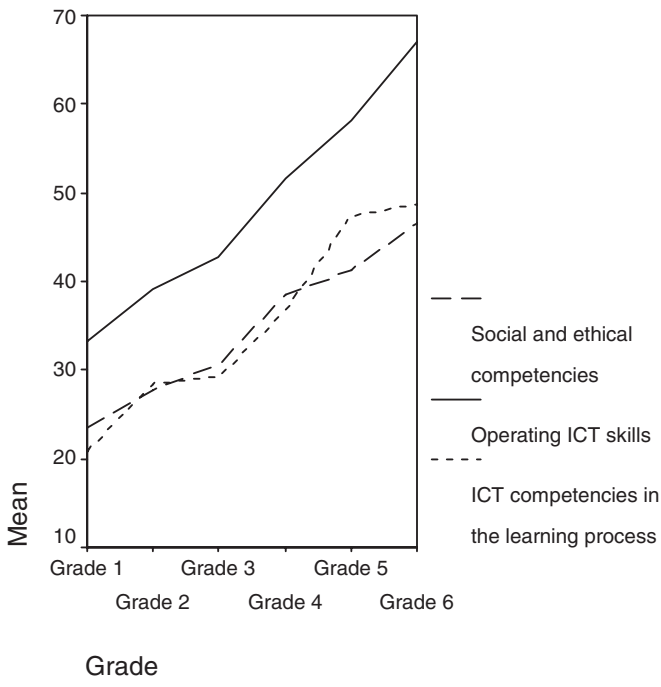

Figure 2: Frequent use of information and communication technology (ICT) competencies in Flemish primary education

Table 3 presents the degree of correlation between the three types. Significant Pearson product-moment correlation coefficients vary between $r = 0.59$ and $r = 0.71$. This suggests that the three scales share a high percentage in variance. In other words, if teachers stress a particular type of ICT competencies, they are likely to pursue the other two types. This is, in part, to be expected. For instance, pursuing ICT competencies focusing on the learning process will imply that some technical ICT skills will have to be attained.

Table 3: Pearson product-moment correlation coefficients among the three types of information and communication technology (ICT) competencies

	TS	*LC*
Technical ICT skills (TS)		
ICT competencies focusing on the learning process (LC)	0.71**	
Social and ethical ICT competencies	0.65**	0.59**

**$p < 0.001$

Technical ICT skills

Our results (Figure 3) suggest that technical ICT skills are in general stressed to 'a certain degree' ($M = 0.97$; $SD = 0.49$). Most attention is paid to the competency 'pupils are able to use the elementary features of a computer and the peripheral equipment' ($M = 1.17$; $SD = 0.58$).

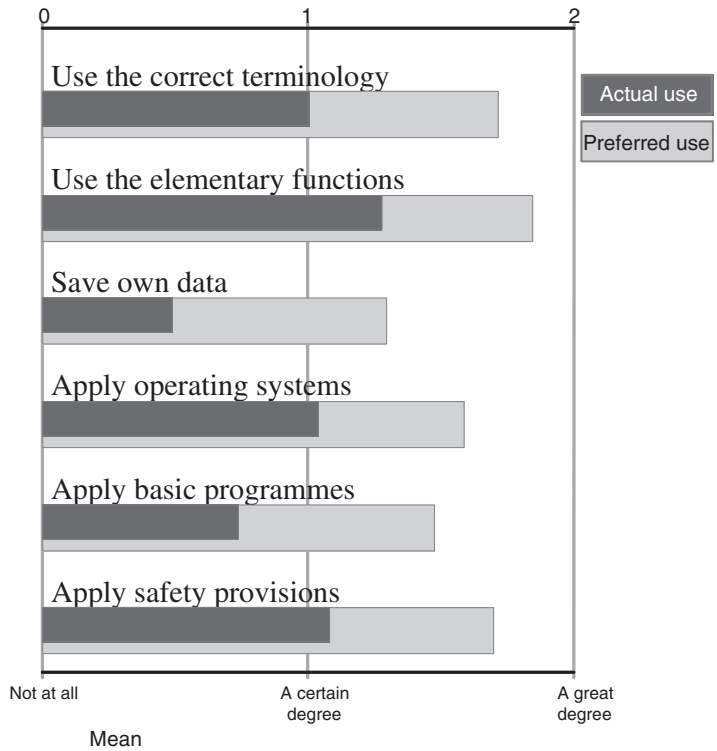

Figure 3: Frequent use of technical information and communication technology skills in Flemish primary education

In contrast, teachers indicate that little attention is paid to 'pupils save their own data on a computer' ($M = 0.68$; $SD = 0.73$). This corresponds with the findings mentioned below concerning learning process-related ICT competencies. Figure 2 also shows that the respondents intend to pay more attention to technical ICT skills in their future educational practices ($M = 1.17$; $SD = 0.75$).

ICT competencies focusing on supporting the learning process

As reflected in Figure 4, teachers report a rather limited level of attention to pursue learning process supporting ICT competencies ($M = 0.68$; $SD = 0.41$). Within this type of competency, teachers mostly stress that 'pupils can exercise independently with the support of ICT' ($M = 1.16$; $SD = 0.61$).

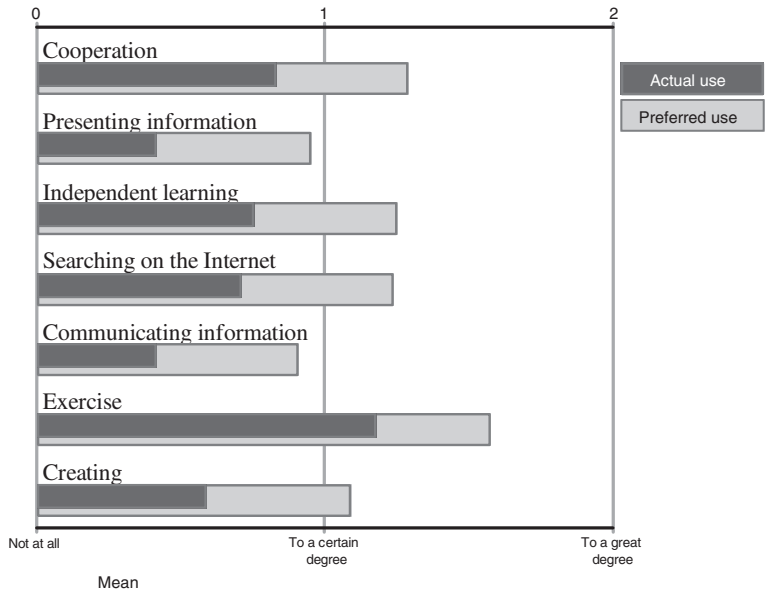

Figure 4: Frequent use of competencies focusing on the learning process in Flemish primary education

The ICT competencies 'pupils can send and receive messages with the aid of electronic communication resources' ($M = 0.40$; $SD = 0.64$) and 'pupils can represent multimedia information with the aid of ICT' ($M = 0.41$; $SD = 0.58$) are stressed to a far lesser degree in current classroom practices. Consequently, technical competencies that support this attainment target are also considered to be of less importance; eg, 'being able to save personal data on a computer'.

Social and ethical competencies

Teachers seem to recognise the importance of social and ethical ICT competencies ($M = 0.68$; $SD = 0.41$). Figure 5 illustrates some consideration for the attainment targets, such as 'pupils work in an accurate and careful manner' and 'the pupils use the computer in an ergonomical way' ($M = 1.07$; $SD = 0.55$). Other targets, however, receive low priority: 'Pupils adopt a critical approach to ICT' ($M = 0.65$; $SD = 0.59$), 'the pupils inform about harmful or discriminating contents' ($M = 0.49$; $SD = 0.67$), and 'pupils take the financial and ecological aspects of ICT resources into account' ($M = 0.46$; $SD = 0.59$).

Nevertheless, respondents intend to stress more strongly the socio-ethical ICT competencies in the future.

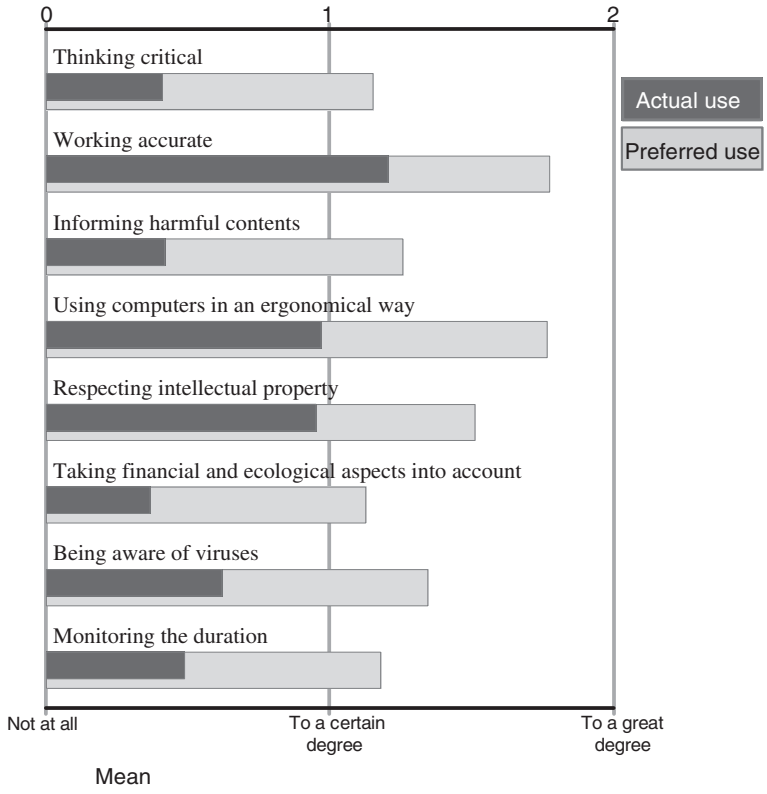

Figure 5: Frequent use of social and ethical information and communication technology competencies in Flemish primary education

Discussion

The main finding of this study is that teachers in primary education still stress to a large extent technical ICT skills. ICT competencies focusing on supporting the learning process and social and ethical components reflect lower priority levels. This means that the actual educational practice is still not in line with the ambition of the Flemish government to integrate ICT into the learning process (educational catalytic rationale). These results are largely in accordance to findings of other studies suggesting that ICT is hardly used as a tool to support the learning process. The focus in general is on skill-based ICT use (eg, Niederhauser & Stoddart, 2001; Smeets, 2005). Moreover, Smeets, (2005) found that the use of ICT merely showed characteristics to traditional approaches to learning.

The gap between the actual and the preferred class use of ICT presents both opportunities and challenges. On the one hand the educational potential of ICT seems to be

acknowledged by the teachers (preferred use); it appears that most teachers embrace the list of ICT competencies proposed by the Flemish government. On the other hand, the inconsistency between teacher intentions and current classroom practices put forward a variety of issues to be considered (actual use):

- school planning on using ICT across the curriculum;
- strategies to redirect educational practice;
- access to courseware to integrate ICT within the core curriculum;
- opportunities for professional development;

Considering the latter, findings of this study indicate that only half of the teachers have followed at least one ICT training course during the last 5 years. Moreover, for the majority of the teachers, ICT training has only contributed 'to a lesser extent' to ICT integration in the classroom. These results raise questions as to how the priorities of ICT policies can be realised. A policy-evaluation study of the ICT training approach in Flanders (Valcke, Rots, Verbeke & van Braak, 2005) suggests that flexible and school-based training, follow-up activities and ongoing support are needed to foster a more successful integration of ICT in teaching practice. Furthermore, this study challenges policy makers in the Flemish context to develop an ICT policy plan including vision building, professional development, ICT-curriculum, -planning and -evaluation to frame ICT training in a broader vision of ICT for teaching and learning.

Several studies have pointed at the critical importance of national ICT policies to promote the potential of ICT into learning processes. Tawalbeh (2001) for example, has argued that the highly centralised nature of the French and Jordanian educational system, in combination with a comprehensive ICT policy, has highly fostered the integrated use of ICT in schools. However, the question is whether a top-down implementation process alone is desirable. As argued by Goodison (2002), the definition of a national ICT curriculum on its own does not guarantee any instructional use of ICT.

An interesting issue in the context of this discussion is the balance between the extrinsic and intrinsic forces that drive the integrated use of ICT by teachers. Imposing policy decisions is often less responsive to teacher perspectives and often neglects workplace constraints (Hennessy, Ruthven & Brindley, 2005). According to Olson (2000), educational policies are driven to a too large extent by a vocational orientation (economic rationale). These policies do not reflect a clear understanding of teacher and student school cultures and therefore the perceptions of ICT users and non-users. Policy developers tend to consider the impact of ICT use as a unidirectional process. They assume that teachers accept and implement curricula in a straightforward way. Educational change, however, is a far more complex process.

A decentralised approach, on the other hand, limits the role of the central government. Decentralised educational systems engender larger control by local educational authorities and schools. This implies that the Flemish Government—by means of information and awareness campaigns, in-service training, subsidising of infrastructure, etc—indirectly encourages schools to integrate ICT into education. A concrete example is

the dissemination of an information brochure in primary schools that presents good practices to pursue the new ICT competencies.

The results from this study in Flemish schools demonstrate that a national ICT curriculum, without other supportive measures, will not easily result in changes in instructional practices. Olson (2000) argues that policy decisions and change models do not attend the culture of classroom practice and the pivotal role of the teacher in effecting change. He suggests that, rather than imposing new frameworks for ICT, a dialogue should be established based on parity between teachers on the one hand and innovators, researchers and policy developers on the other hand. 'What emerges then is not an argument as to whether equipment, support or training is the more important, but a much broader debate about mindsets, assumptions, beliefs, and values of individuals and organisations' (Tearle, 2003, p. 581). Curriculum reform, based on in ICT, is therefore unlikely to succeed unless we understand teachers' personal perspectives and educational practices (Niederhauser & Stoddart, 2001).

A way forward is stressing the responsibilities of local schools to develop a school-based ICT curriculum that 'translates' the national ICT-related curriculum at school level into an ICT plan as part of the overall school policy. In a best-case scenario, an ICT plan makes ICT competencies visible for all parties involved, and stimulates the dialogue among school managers, teachers and parents about ICT use in the local curriculum (Bryderup & Kowalski, 2002). This is in line with the recommendation of Olson (2000, p. 1), who states that ICT integration depends on the understanding and the commitment of teachers: 'What they find may challenge their educational philosophy and practice in unexpected ways—some good and some not so'.

Conclusions

In this study, the link between national curricula and the use of ICT in primary education has been explored. In particular, the study has pointed to the relative importance of a national ICT curriculum in the context of a decentralised educational system. Although the results in this study cannot be generalised beyond the target population of Flemish primary schools, the present study can inspire states and regions where a similar incongruence is being observed between ICT-related national curriculum initiatives and the current level of adoption of integrated ICT use. From the research findings, it is to be concluded that the aspirations of national educational authorities in view of establishing ICT competencies does not automatically result in changes in classroom practices. Curriculum frameworks can even be in conflict with the characteristics of the local school system (eg, school policy, school culture and teacher beliefs).

Our findings also suggest that teachers have hardly been involved yet with regard to the integration of ICT competency frameworks. Analysis of the interviews with the principals indicates a lack of communication between school principals and teachers concerning the implementation of ICT in the school. The development of a school-based ICT plan that translates nationally defined ICT-competencies in terms of school-based operational objectives is presented as a more promising approach. The development of

an ICT plan gives stakeholders the opportunity to reflect on their particular educational use of ICT.

Within this dialogue, the following questions can be explored: How can the framework for ICT competencies be implemented and tested in classroom practice? What feedback can be derived from classroom practice? What type of feedback is considered critical from a classroom perspective?

In the future, in-depth studies are needed to identify in more detail how teachers respond to ICT curricula, how this is related to their education conceptions and to what extent contextual factors at school level (eg, ICT policies and school plans) can be identified as determinants of the use of ICT in the classroom. In these follow-up studies, the balance between centralised and decentralised factors should be stressed.

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