The e-capacity of primary schools: Development of a conceptual model and scale construction from a school improvement perspective

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ABSTRACT

In the search for factors affecting the use of ICT in educational settings, several authors have presented holistic conceptual frameworks. In this study, we argue that while these models are valuable sources for conducting qualitative research, they are less useful for quantitative research since few measurement scales have been created. We present an empirically tested conceptual framework to further examine the complex process of integrating ICT for instructional purposes. This model has been developed from a school improvement perspective and considers the e-capacity of a school as an overarching concept. E-capacity refers to the schools' ability to create and optimise sustainable school level and teacher level conditions to bring about effective ICT change. The conditions identified are based on a literature review in the change and school improvement literature and the ICT integration literature. All conditions have been translated into reliable measurement scales. Questionnaire data were collected from a representative teacher sample ($N = 471$) in 62 primary school in Belgium (Flanders). Exploratory and confirmatory factor analyses were conducted indicating good goodness of fit estimates and good internal consistency.

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1. Introduction

One of the central activities in Information and Communications Technology (ICT) research is the investigation of conditions that support the integration of ICT into schools (Hew & Brush, 2007). While research has traditionally focused on individual teacher characteristics or conditions at the teacher level, such as individual computer attitudes or gender differences, we believe that this ignores the social context in which teachers behave. In a recent review study, Hew and Brush (2007) show that the majority of ICT integration research primarily focuses on the role of teacher level variables, and that few studies examine important school level variables that may affect the integration of ICT. In line with this view, Hermans, Tondeur, van Braak, and Valcke (2008) argue that future research should focus on specific school conditions and school culture variables that may explain the use of ICT in classrooms. Other authors argue that ICT integration should be considered as a special case of educational innovation, and that research on ICT integration should build on theories and insights from the educational change and school improvement literature (e.g. Tearle, 2004; Watson, 2006). Furthermore, Somekh (2007) argues that we should adopt strategies about successful management of change to enable the use of ICT to support effective teaching and learning. We believe that research on ICT integration should increase its focus on both the role of characteristics of the school organisation or school level conditions, and on ICT integration as a case of educational innovation. The first research focus implies that ICT researchers should pay more attention to the role of school organisational features, the second research challenge means we endorse ICT can have a positive impact on student learning, like recently provided by rigorous research evidence (e.g. BECTA, 2007).

Moreover, ICT itself is constantly and rapidly evolving. Hardware and software are changing very quickly and schools are also confronted with new technological developments, such as web 2.0. In certain countries national governments have even administered formal and compulsory ICT curricula. These curricula have a clear pedagogical foundation and tend to focus more on the use of ICT as a tool for teaching and learning than the development of technical skills. Vanderlinde, van Braak, and Hermans (2009) argue that such ICT curricula cause a shift in the policy actions of ICT support (i.e., from a technical rationale with the main focus on funding and resources to a pedagogical rationale stressing student competencies). This is particularly the case in Flanders, the Dutch-speaking part of Belgium, where the Flemish

Government formulated cross-curricular ICT attainment targets for compulsory education in September 2007. In so doing the Flemish Government clearly outlines its view of how ICT should be integrated into schools and expects them to put this formal ICT curriculum into practice (see Vanderlinde et al., 2009).

In this study, we present a conceptual framework that we developed from a school improvement perspective. This framework was designed to help identify and measure the factors influencing both ICT integration and the implementation of ICT curricula. School improvement is regarded as a strategy for educational change that aims to enhance student outcomes and strengthen the schools' capacity for managing change (Hopkins, 2001). The following key assumptions of the school improvement approach have been outlined by Harris (2002): (a) schools have the capacity to improve themselves, (b) school improvement involves cultural change, (c) there are school level and classroom level conditions for change, and (d) school improvement is concerned with building greater capacity for change.

2. The need for a new framework: e-capacity

As schools are being given greater autonomy and responsibility for their future, they must now operate as strategic organisations (van den Berg, Vandenberghe, & Sleegers, 1999). Their capacity to successfully implement educational innovations or policy initiatives (Geijsel, van den Berg, & Sleegers, 1999) has become an important issue among researchers and policy makers (see also Stoll, 1999). Geijsel, Sleegers, Stoel, and Krüger (2009) rightly note that the schools' capacity to transform a large-scale reform into an accountable learner-oriented teaching practice has become a major focus in recent research into educational change. However, it is necessary to clearly conceptualise (Stoll, 1999) and operationalise (Geijsel et al., 1999) this concept of capacity. From a school improvement perspective (Harris, 2002; Hopkins, 2001; Stoll, 1999), the schools' 'capacity' can be generally defined as the competence of a school to implement educational innovations or to bring about effective change (Geijsel et al., 1999; Malen & King Rice, 2004). A crucial matter in this context is that we assume that schools have the capacity to improve themselves while establishing school level and classroom level conditions to support and manage change (Harris, 2002; Hopkins, 2001).

In this study, the concept of capacity, as described in the school improvement literature, has been translated and contextualised for the case of ICT integration. We speak about the e-capacity of a school, defined as the collective competence of a school to implement ICT in a way that is a lever for instructional change. From this perspective, e-capacity is concerned with creating and optimising sustainable school level and teacher level conditions to foster effective change through ICT. The school and teacher level conditions identified in this study and presented in our model (see section 3) are based on both a review of the change and school improvement literature and the literature on ICT integration. As a starting point for our own conceptual model, we examined existing conceptual frameworks (Hew & Brush, 2007; Kozma, 2003; Lim, 2002; Tearle, 2004), yet as these frameworks do not include measurement scales they were thoroughly revised. Below we outline the central ideas within the frameworks studied. See Table 1 for a summary overview of the existing conceptual frameworks.

Kozma (2003) describes the conceptual framework developed by the 'International Society for Technology in Education.' This framework outlines factors that might influence the use of ICT in the classroom and its impact on educational outcomes. Kozma (2003) speaks about 'innovative pedagogical practices that use ICT' and embeds these practices in a concentric set of contextual levels which include the classroom (micro level), the school or local community (meso level), and state, national and international entities (macro level). For each level, Kozma (2003) identified actors and factors that mediate change. Factors on the micro level include the classroom organisation, teacher characteristics, teachers' experience with ICT, and student characteristics. For the meso level, Kozma (2003) identified school leaders and parents as possible actors; and the school organisation, ICT infrastructure, technical support, and local culture as possible factors. National and state policies and international trends are identified on the macro level. This framework puts emphasis on characteristics of the innovation (or innovative ICT practices), such as practicality, complexity, clarity, relevance, and need. It also takes into account existing teaching and student practices and the actual use of ICT.

Table 1
Brief summary of the existing conceptual frameworks.

Author	Theoretical underpinnings	Central concept	Influencing conditions
Kozma (2003)	Comparative education, school reform, technology and education, diffusion research, etc.	Innovative pedagogical practices that use technology	- *Innovation characteristics* (e.g. complexity, clarity) - *Micro level* (e.g. teacher background, classroom size) - *Meso level* (e.g. leadership, ICT infrastructure) - *Macro level* (e.g. policy makers, economic forces) - *Outcomes* (e.g. teacher competencies)
Tearle (2004)	- Management of change - Use of ICT in schools	Use of ICT in teaching	- *Individuals* (e.g. ICT skills, beliefs in ICT) - *The ICT implementation process* (e.g. support and training, resource provision) - *The whole school* (e.g. strong leadership)
Lim (2002)	- Sociocultural approach - Activity theory	ICT-based lessons as activity systems	- *Course of study* (e.g. curriculum, assessment) - *School* (e.g. ICT facilities) - *Education system* (e.g. recruitment and training of teachers) - *Society at large* (e.g. publishers)
Hew and Brush (2007)	Technology integration in K-12 schools	Technology integration for instructional purposes	- *Barriers:* resources, institution, subject culture, attitudes and beliefs, knowledge and skills, assessment - *Strategies:* vision building, overcoming scarcity of resources, changing attitudes, professional development, reconsidering assessment