ICT, Teaching and Leadership: How do Teachers Experience the Importance of ICT-Supportive School Leaders?

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English abstract

The purpose of this study was to explore the relations between teachers' experiences with ICT-supportive school leaders, perceived usefulness of computers, perceived learning outcomes for students and teachers' use of computers in their teaching. A total of 386 teachers from a nationwide sample of primary and lower secondary schools participated in the study. The correlation analysis revealed that teachers with higher levels of ICT-supportive leaders reported higher levels of perceived usefulness of computers, perceived learning outcomes for students and more frequent use of computers compared with teachers reporting lower levels of ICT-supportive leaders. Regression analysis indicated that two factors, ICT-supportive school leaders and perceived learning outcomes for students using computers, explained 25 percent of the variation in perceived usefulness of computers. Finally, these two factors, ICT-supportive school leaders and perceived learning outcomes for students using computers, explained 5 percent of the variation in how frequently teachers were using computers for reading and writing. The results indicated a need for further studies in order to examine factors that predict teachers' use of computers in their teaching.

Keywords: ICT-supportive school leaders, supportive colleagues, perceived usefulness of computers, perceived learning outcome for students, teachers' use of computers in their teaching, gender.

Introduction

During the last two decades, there has been rapid growth in the use and development of Information and Communication Technologies (ICT) (Ainley, Enger & Searle, 2008; Erstad, 2008; Law, 2009). The emergence of new technologies will very likely have a major influences on the skills required by the workforce over the next 5-10 years. This rapid growth in the use of ICT has been followed "by the recognition of the potential for such technology to transform the classroom environment" (Ainley et al, 2008, p. 76). In order to be prepared for the further emergences of technologies in society and to foster the development of what has been termed 21st century skills (Law, 2009), many countries have developed visions, plans, programs and strategies for developing their national curricula (Ainley et al, 2008; Law, 2009; Balanskat & Gertsch, 2010). The Second Information Technology in Education Studies (SITES 2006) examined how teachers were using ICT at school, including questions about policy aspects. However, the analysis of teachers answers about policy revealed that the "scope and policy concerns in the participating systems varied widely" (Law, 2009, pp. 25). Recently, Balanskat & Gertsch (2010) also found considerable variations in how different countries were defining and prioritizing the use of technology in the schools.

In the Norwegian curriculum, the ability to use information and communication technology has been considered one of five basic skills since 2006 (The Norwegian Ministry of Education and Research, 2004). The ability to use ICT is not a subject, but a skill that has been implemented in almost all subject syllabuses in the 10-year compulsory school system. The National Curriculum contains descriptions of several specific competencies at 2nd, 4th, 7th and 10th grade.

It is an ongoing initiative to implement ICT in Norwegian schools. In this context several factors are important: first, what actions do the school leaders take and how do the teachers experience this? Second, how do the teachers experience the attitudes their colleagues have towards collaboration and changes? Third, what kind of attitudes do teachers have towards the usefulness of computers in their own teaching and in students' learning? Finally, the aim of this study is to identify and examine the relationships between ICT-supportive school leaders, supportive colleagues, the perceived usefulness of computers in teaching and teachers' use of computers in their own teaching practices.

Perspectives

Leadership for ICT: ICT-supportive leaders and colleagues

Several researchers (Kozma, 2003; Dexter, 2008; Law, 2009; Tondeur, Devos, van Houtte, van Braak and Valcke, 2009) are emphasizing the importance of clear leadership in order to develop positive attitudes towards ICT among teachers, and to facilitate innovative uses of ICT in education.

Kozma (2003) states that school leadership is a crucial factor for the successful implementation of ICT in schools. Clear leadership can promote the development of digitally literate students by providing a good working environment, clear visions and a high quality infrastructure. A key point in leadership related to ICT is to help teachers engage in professional development related to the use of ICT in teaching.

One finding from the Second Information Technology in Education Studies 2006 (abbreviated SITES 2006) is that principals' leadership and further visions can influence the educational use of

ICT (Law, 2009). The school leaders are in a position where they can develop and implement plans and budgets for the school and decide what the teachers have to prioritize during the school year. However, is seems that Norwegian school leaders seldom use their authority for developing changes in school culture, for instance through professional development programs or teacher collaboration initiatives (Ottestad, 2008, 2010).

According to Dexter (2008), effective ICT leadership "in a school is a significant predictor of its use by teachers and students" (Dexter, 2008, p. 543). She emphasizes that the study of leadership "goes beyond the role of head leaders" (ibid, p. 544). Instead, a team consisting of persons with different functions carries out ICT leadership. It is important to avoid solo performances, and it is necessary to ensure that leaders, coordinators, administrators, teachers and other staff are heading in the same direction. Further, Dexter points out that school ICT leadership is important for setting the direction, for helping to develop the use of ICT in teachers' educational practices and for taking steps to get the overall organization to function using ICT. It is important that both the direction and focus are realistic and in accordance with the school context.

Vanderlinde and van Braak (2010) have developed a theoretical framework emphasizing the e-capacity of a school. They describe the e-capacity of a school as "the collective competence of a school to implement ICT in a way that is a lever for instructional change" (Vanderlinde & van Braak, 2010, p. 542). The concept of e-capacity seems to contain two main dimensions. First, e-capacity is what the leaders and the staff of the school can achieve together by sharing their resources and motivation. Dexter (2008) also argues, "ICT leadership must be considered as a school-level property" (Vanderlinde, Dexter & van Braak, in press, p. 4). Second, the e-capacity concept also emphasizes that the organization is willing and able to go through changes and obtain an innovative use of ICT. Other researchers - i.e. Kozma (2003), Erstad (2008), Drent & Meelissen (2008) and Ainley et al (2008) – also underpin the importance of innovation with technology. However, according to Ainley et al (2008), the school system lacks flexibility, and therefore, the implementation of ICT is often based on using technology to maintain the traditional educational system (Erstad, 2008). Overall, one limitation in the e-capacity framework is the lack of description details, not only of the teaching conditions, but also of the process of integrating ICT in teaching.

Tondeur et al (2009) found that both the structural and cultural characteristics of a school culture are important catalysts for ICT integration in the classroom. They place supportive leadership as a characteristic of the schools culture together with innovativeness and the degree of goal orientation. They suggest that ICT support and ICT planning are two examples of structural school characteristics.

Tondeur, Coopert & Newhouse (2010) conducted a longitudinal study in seven primary schools in Australia. They found that school leadership could play an important role in the integration of ICT in schools. They emphasize the importance of 'curriculum ICT coordinators' having a responsibility for "pedagogical support for integrating ICT in the curriculum" (Tondour et al, 2010, p. 298); this targeted support is required by teachers when they are trying to adapt to and make use of computers in their own teaching practices (Drent & Meelissen, 2008; Hammond, Crosson, Frakouli, Ingram, Johnston-Wilder, Johnston-Wilder, Kingson, Pope & Wray, 2009;).

Perceived usefulness

Several researchers emphasize the importance of user attitudes in the use of computers and ICT (Larcker & Lessig, 1980; DeLone & McLean, 2003; Knezek & Christensen, 2008; Tondeur,

Hemans, van Braak & Valcke, 2008; Hammond et al, 2009; Sørebø, Halvari, Gulli & Kristiansen, 2009;); user satisfaction (i.e. perceived usefulness) can give information about the successful implementation of computer systems (DeLone & McLean, 2002; Knezek & Christensen, 2008).

The concept of perceived usefulness involves an attempt to identify whether a person is satisfied and content with how a computer system or a data solution works. The perceived usefulness concept derives from the technology acceptance model (TAM). According to Polancic, Hericko & Rozman (2010), "a key assumption of TAM is that external variables (EV) influence the decision to use particular IT only indirectly through their impact on users' beliefs" (ibid, p. 575). In TAM, perceived usefulness is an important indication of users' beliefs because perceived usefulness provides information about how successfully the users are experiencing the implementation of computers and computer systems (Teo, Lee, Chai & Wong, 2009).

In a recent study of technology acceptance among 389 subjects, Polancic et al (2010) found that perceived usefulness has a positive impact on the productivity and quality of work with technology. The study showed that people provide crucial information when asked about how they perceive the impact or usefulness of a certain technology.

Teo et al (2009) examined TAM among 495 pre-service teachers from Singapore and Malaysia. They found that perceived usefulness had a significant, positive impact on attitudes toward computer use. Further, teachers' attitudes toward computer use had a significant, positive impact on teachers' intentions to use computers.

Sørebø et al (2009) conducted a survey on attitudes towards, beliefs about, and the use of a Learning Management System. The sample consisted of 124 teachers from 12 Norwegian university colleges. One conclusion from their analysis was that perceived usefulness has a positive prediction of satisfaction and intention to continue using computers.

Hermans, Tondeur, van Braak & Valcke (2008) studied a sample of 525 teachers from 68 Flemish primary schools. They examined the teachers' educational beliefs – student-centred vs. teacher-centred – and the teachers' use of computers. The results indicated that the more traditional view with a teacher-centred approach had a negative influence on class use of computers, whereas, the more student-centred approach had a positive influence on class use of computers.

It seems that the concept of perceived usefulness provides important information about 1) how users perceive technology, and 2) how users will continue to use technology.

Use of computers at school

According to current empirical findings, teachers' educational beliefs influence how they integrate ICT in teaching practice (Sørebø et al, 2009; Tondeur, Herans, van Braak & Valcke, 2008). Teachers with "a profile that represents both strong constructivist and strong traditionalist beliefs are more likely to adopt educational computer use" (Tondeur et al, 2008, p. 2551). Overall, Sørebø et al (2009) emphasized the importance of perceived usefulness of technology as an independent variable on further use of technology.

Yuen, Law, Lee and Lee (2011) analyzed the results of the SITES 2006 study. When analyzing the use of ICT, they found that Norwegian teachers report that they are moderate users of ICT compared

with other countries. Further, the international TALIS study (Vibe, Aamodt & Carlsten, 2009) showed that Norwegian teachers report less competence development compared with teachers from other countries. Additionally, and perhaps more importantly, Norwegian teachers want more competence development in the pedagogical use of ICT in teaching.

However, Ainley et al (2008) stated, "There is currently little understanding of the way in which ICT is used in schools and classrooms around the world" (ibid, p. 76). They claim that it is not clear when and how ICT is used in subject teaching, and therefore, that more research is required to identify how teachers use ICT at school.

Gender and ICT

There are a number of studies on gender differences among young people and schoolchildren in the use of ICT. The OECD Programme for International Student Assessment (PISA) 2006 study of 15-year old students revealed that boys were more active users of ICT than girls were (Centre for Educational Research and Innovation & Organisation of Economic Co-operation and Development, 2010). However, these findings were nuanced when taking a closer look at different user profiles within the Norwegian sample (Tømte & Hatlevik, 2011).

Hermans et al (2008) conducted a study on Flemish teachers, and they found that male teachers reported more frequent use of computers in the classroom than did female teachers. However, when Shapka & Ferrari (2003) examined the computer attitudes and outcomes from computer tasks, they did not find any gender differences. Antoniettei & Giorgetti (2006) conducted a survey to identify teachers' beliefs about learning from multimedia. They did not find any gender differences in teachers' beliefs. Further, in 2010, Sang, Valcke, van Braak & Tondeur conducted a study focused on ICT integration among 727 Chinese student teachers. Their analysis revealed that gender did have a direct effect on teachers' integration of ICT in their teaching activities. Recently, Rahimi & Yadollahi (2011) conducted a study on 254 Iranian EFL (English as a foreign language) teachers. They discovered no gender differences in computer anxiety or in the experiences of teaching. Finally, Sørebø et al (2009) did not find any gender differences in teachers' use of a LMS in their study of 430 university college teachers.

Nevertheless, beyond the mixed results of the studies mentioned, there seems to be limited research on gender issues in teachers' use of ICT. Teachers are role models, and both girls and boys benefit from having competent and motivated role models when computers are integrated in the classroom (Muller, Wood, Willoughby, Ross & Specht, 2008). Therefore, it is important to have a gender perspective on teachers' experiences with ICT-supportive leaders and colleagues, their beliefs about computers and their use of computers.

Research questions

There are some scientists who study perceived usefulness of computers, and there are other researchers who are concerned with ICT leadership. In this paper we want to link how teachers perceive the school leadership and their colleagues with how they perceive the usefulness of computers in teaching and how often they use computers.

First, are there any gender differences in teachers' experiences of ICT-supportive leaders, supportive colleagues, perceived usefulness of computers and the use of computers in teaching?

Second, are there correlations between experiences of ICT-supportive leaders, supportive colleagues, teachers' perceived usefulness of computers and teachers' use of computers at school?

Third, what are the factors explaining variation in teachers' perceived usefulness of computers in teaching?

Finally, what are the factors explaining variation in how frequently teachers use computers when writing or reading at school?

Overall, the aim of this paper is to examine and answer the following four critical research questions, based on a review of previous studies and the importance of understanding perceived usefulness, correlations, user patterns and other factors that may explain variation in teachers' ICT experiences.

Method

Procedures and Participants

This is a cross-sectional study. Sample preparation consisted of three steps. First, the primary and lower secondary schools were randomly selected based on official information about the schools in Norway. Second, the schools were stratified according to region and the number of students in each school. Third, the school leaders were asked to select from 1 – 2 teacher participants from their schools.

The total sample consisted of 386 teachers from primary and lower secondary school (156 males and 230 females). The teachers came from more than 220 schools, and the response rate was approximately 48% at the school level.

The school leaders received information about how to select teachers from their schools, and how to give teachers access to a web-based questionnaire.

Measures

The current study developed the questionnaire based on previous studies (Educational Testing Service, 2001; Dexter, 2008; Centre for Educational Research and Innovation & Organisation of Economic Co-operation and Development, 2010; Polancic et al, 2010) in order to gather information to answer the research questions.

Under the headline "Do you agree or disagree with the following statements about how you experience the support of school leaders", the teachers were presented with four statements. For example "I get to use subject-specific digital learning resources in education" and "I get support to understand how the use of ICT improves my teaching"; the responses could range from 1 = *strongly disagree* to 4 = *strongly agree*. Internal consistency analysis revealed good consistency (Cronbach's alpha = 0.77) for the factor labelled ICT-supportive school leader.

Four items were used to identify teachers' experiences of working with supportive colleagues. The teachers were asked if they agreed or disagreed with statements such as "the teachers are willing to try out new ideas for practice" and "teachers are organized so that we work well" using the same

response range. Internal consistency analysis revealed good consistency for collaboration (Cronbach's alpha = 0.78) for the factor labelled supportive colleagues.

The variable 'perceived usefulness of computers in the classroom' included four items, such as "I use ICT to make students more interested in the subject" and "It is easier to activate students when I use ICT in teaching" with responses using the rating scale described above. Internal consistency analysis revealed very good consistency for the factor 'perceived usefulness of computers in the classroom' (Cronbach's alpha = 0.80).

The teachers were asked about how they perceived the outcomes for students using computers for reading and writing (Herman et al, 2008). The following two items were used: "The use of computer makes the students get more practice in written presentation" and "Using the computer helps the students to read better" (1 = *strongly disagree* and 4 = *strongly agree*). A level of Cronbach's alpha = 0.70 indicated an acceptable level of internal consistency.

Further, the teachers answered questions about their use of computers at school on the following four themes: hours of computer use for teaching, using computers to give feedback to students, frequency of computer use for reading or writing, and the use of computers in group work, etc.

Teachers agreed or disagreed with three statements describing computer use for feedback: "I use the computer to give students feedback on drafts", "I use the computer to give students feedback on assignments" and "I use the computer to give feedback to students about how they can improve the task". A Cronbach's alpha = 0.89 indicated a very high level of internal consistency for the factor labelled feedback with computer.

Teachers agreed or disagreed with two statements about how often they used a computer in reading or writing in the classroom: "I use the computer in connection with writing" and "I read texts on the computer". A Cronbach's alpha = 0.90 indicated a very high level of internal consistency for the factor labelled computers in reading or writing.

A single item asked for how many hours teachers in general used computers in their teaching in an average week. This question was not defined towards any software, activities or subjects.

Another single item asked, was how often the teachers allowed students to use a computer in group work, projects or discontinuous work.

Additionally, the teachers were asked about their gender.

Data Analysis

All statistical analyses of means, measured by independent t-tests, internal consistencies, measured with Cronbach's alpha, bivariate correlations, measured by Pearson's r, and regression analyses were conducted using the Statistical Package for the Social Sciences (SPSS) version 18.

Results

Measurement Model Results

The first research question was about gender differences. Table 1 shows means and standard deviations for total, males and females on the factors and single items in the study. Independent t-tests of means were run to examine any gender differences in the experiences of ICT-supportive leaders, experiences of supportive colleagues, perceived usefulness of computers and the use of computers in teaching (research question 1).

Table 1: Information about means and standard deviations for the factors and items in the study.			
	Total	Male	Female
ICT-supportive leaders	3.24 (0.61)	3.26 (0.61)	3.23 (0.61)
Supportive colleagues	3.00 (0.57)	2.97 (0.54)	3.02 (0.59)
Perceived usefulness	3.28 (0.55)	3.24 (0.55)	3.31 (0.55)
Perceived learning outcome for students	2.87 (0.71)	2.90 (0.69)	2.86 (0.72)
Use of computers in reading or writing	2.26 (1.01)	2.29 (1.02)	2.25 (1.00)
Feedback with computer	2.38 (1.07)	2.48 (1.09)	2.31 (1.05)
Time spent at the computer	1.51 (0.90)	1.59 (0.97)	1.46 (0.85)
Computers in group work and projects	2.70 (1.31)	2.71 (1.36)	2.69 (1.29)

The analysis of the independent t-tests revealed no differences in how male and female teachers report their experience of ICT-supportive leaders, supportive colleagues or perceived usefulness of computers, nor was there differences in how frequently male and female teachers use computers in teaching (Table 1).

Table 2 shows the bivariate correlations between the factors of experiences with ICT-supportive leaders, experiences with supportive colleagues, teachers' perceived usefulness of computers and teachers' use of computers at school (research question 2). The correlations between the factors and single items are measured with Pearson' r.

Table 2: Information from bivariate correlations.								
	1	2	3	4	5	6	7	8
1. ICT-supportive leaders	1.00							
2. Supportive colleagues	.39[**]	1.00						
3. Perceived usefulness	.30[**]	.15[**]	1.00					
4. Perceived learning outcome for students	.24[**]	.14[**]	.46[**]	1.00				
5. Computers in reading or writing	.18[**]	.08	.15[**]	.19[**]	1.00			
6. Feedback with computer	.23[**]	.09	.28[**]	.25[**]	.34[**]	1.00		
7. Time spent at the computer	.24[**]	.07	.20[**]	.24[**]	.36[**]	.36[**]	1.00	
8. Computers in group work and projects	.26[**]	.09	.26[**]	.26[**]	.33[**]	.34[**]	.40[**]	1.00
Note: *p <.05, **p <.01, ***p <.01								

Analysis of the correlations show that perceived usefulness correlates significantly with both supportive leaders and supportive colleagues. The correlations seem to be stronger between supportive leaders and perceived usefulness compared with the correlation between supportive colleagues and perceived usefulness. Further, analysis of the bivariate correlations reveals that supportive leaders have a significant correlation with how often teachers use computers when reading/writing in school, how often they provide feedback with computers, their overall time with computers in teaching, and how often they use computers in group work or projects.

A stepwise regression analysis was used to identify factors explaining variation in teachers' perceived usefulness of computers in teaching (research question 3). The factors that measure perceived support and attitudes towards ICT were used as independent variables. Therefore, ICT-supportive leaders, supportive colleagues and perceived outcomes for students were the independent variables in the regression analysis. The results from the analysis are presented in Table 3.

Table 3: Unstandardized and standardized regression coefficients for stepwise regression analyses explaining variance in perceived usefulness.			
	Perceived usefulness of computers		
	β	$SE\ \beta$	$std.\ \beta$
Perceived learning outcome for students	.32	.04	.41***
ICT-supportive leaders	.20	.04	.21***
R^2			.25
Note: *p <.05, **p <.01, ***p <.01			

The regression analyses shows that two factors explain 25% of the variation in teachers' perceived usefulness of computers: perceived outcomes for students and ICT-supportive leaders.

Finally, a stepwise regression analysis was run in order to identify factors explaining variation in how frequently teachers used computers when writing or reading at school (research question 4). Again,

the factors that measure perceived support and attitudes towards ICT were used as independent variables, whereas we did not use other indicators of use in order to predict how frequently teachers use computers when writing or reading at school. ICT-supportive leaders, supportive colleagues, perceived outcomes for students, and perceived usefulness of computers were independent variables. The results from the analysis are presented in Table 4.

Table 4: Unstandardized and standardized regression coefficients for stepwise regression analyses explaining variance in how frequently teachers use computers when writing or reading at school.			
	Teachers use computers when writing or reading at school		
	β	$SE\ \beta$	$std.\ \beta$
Perceived learning outcome for students	.23	.08	.16**
ICT-supportive leaders	.23	.09	.14*
R^2			.05
Note: *p <.05, **p <.01, ***p <.01			

The results from the regression analyses show that two factors – perceived outcomes for students and supportive leaders – explain 5% of the variation in how frequently teachers use computers when writing or reading at school.

Discussion

Limitations

The limitations of this study should be taken into account when discussing the results. First, it was voluntary for the schools and teachers to participate in the study. There might be a chance of self-selection; however, analysis of the participating schools shows that the distribution matches the strata used to select the schools. Further, there is a possible bias because the school leader chooses the teachers who fill out the questionnaire. We have less control over the reviews school leaders undertake in the selection of teachers. Second, a web-based questionnaire gathered the data. This could promote schools that have successfully integrated computers at school. However, analysis of the results indicates that schools with both lower and higher frequency of computer use at school participated in the study. Third, this is a cross-sectional study. Therefore, the results from the regression analysis have to be used with caution, and it is important that the findings be supported by other theories and other research. Fourth, the sample consists of Norwegian teachers from primary and lower secondary schools, and therefore, the conclusions have to be restricted to these school types. Fifth, the questionnaire contained self-report questions. Teachers' self-reports can be overestimations or underestimations; nevertheless, several self-report studies have provided important information about students' learning and the use of computers (Pedró, 2007; Christensen & Knezek, 2008; Centre for Educational Research and Innovation & Organisation of Economic Co-operation and Development, 2010). Despite these limitations, a discussion of the results from the study provides both interesting and informative insights into current ICT use.

Study Results

The first research question gave attention to whether there were gender differences. Analysis of the results does not show any gender differences in how males and females experience ICT-supportive school leaders or supportive colleagues, and there are no gender differences in the perceived usefulness of computers, or in how teachers use computers at school. This result is in alignment with the findings from Sørebø et al (2009).

Second, an analysis of the findings reveals that teachers' experiences of ICT-supportive school leaders are significantly correlated with their experiences of ICT-supported colleagues, perceived usefulness of computers and frequency of computer use at school. These findings underpin the importance of the decisions and priorities made by the school leaders. According to Vanderline & van Braak (2010), school leaders can have an influence on the teaching and learning processes in the schools. They assume an indirect effect of leadership with ICT, because school leaders can influence the working conditions, the teachers' commitment and their motivation.

Further, supportive colleagues are significantly correlated with perceived usefulness of computers. However, the factor experience of supportive colleagues is not significantly correlated with how teachers use computers at school. One reason for this could be that teaching practice is private, and additionally, that teachers do not always have the option to lean on others for support in their teaching. At many schools, the teachers work in teams when preparing for their teaching, but they are often teaching alone or with one other colleague. Additionally, results from the TALIS study (Vibe et al, 2009) showed that Norwegian teachers have requested more training in the pedagogical use of ICT.

The third research question focused on factors that could explain variation in teachers' perceived usefulness of computers. Analysis reveals that ICT-supportive school leaders and teachers' perceived outcomes for students explain variation in teachers' perceived usefulness of computers. Perceived usefulness is about the ideas teachers have regarding computers in class and how teachers feel about computers contributing to good teaching. The results indicate that ICT-supportive leaders can predict teachers' beliefs about the benefits from computers. Tondeur et al (2010) assume that ICT leadership can predict teachers' commitment and motivation for using computers at school. Additionally, teachers who believe computers have positive outcomes for students report higher levels of perceived usefulness of computers. This indicates a more student-centred approach toward learning, because the teachers are focusing on how the use of computers can support student learning and achievement (Herman et al, 2008). Overall, when teachers believe that computers are useful for students' learning achievements (learning outcomes), it might help them to believe it is useful to implement computers in their own teaching. This finding matches reasonably well with other empirical studies elaborating on the relationship between teachers' beliefs about computers being important for students and their own use of computers (Hermans et al, 2008; Hammond et al, 2009; Tondour et al, 2009).

Fourth, ICT-supportive teachers and perceived outcomes for students can explain variation in how frequently teachers use computers in writing or reading at school. The results indicate that these two factors explain 5% of the variation, and therefore, the prediction from these two factors seems to be small. A more student-centred approach towards learning (Hermans et al, 2008) and emphasizing what Tondeur et al (2009) labelled 'cultural school characteristics' seems to have a

larger prediction of teachers' use of computers. Other researchers (Hammond et al, 2009; Tondour et al, 2010) have recently conducted research with similar findings.

ICT-supportive leaders, supportive colleagues and perceived usefulness of computers do not automatically predict teachers' use of computers. Therefore, further studies are necessary to elaborate on what stimulates the innovative use of ICT. Specifically, longitudinal studies with two or more stands are required in order to investigate the factors that have an effect on teachers' use of computers at school.

Concluding remarks

The results from this study indicate that teachers experiencing ICT-supportive school leaders are more likely to experience supportive colleagues, are more likely to believe that computers can be useful in the classroom, and are spending more time and effort on using computers as part of their classroom than are teachers who do not have ICT-supportive leaders. This is also supported by other studies and theoretical assumptions emphasizing that the leadership of a school can predict teachers' motivation, dedication and teaching practice.

However, it does not seem that experiencing supportive colleagues is correlated with more use of computers in the classroom. An assumption has been that supportive colleagues can be an indication of an ICT-supportive climate at school. However, the questions relating to support from colleagues, used in this survey, are probably too general and do not take into account colleagues' attitudes to ICT and computers in particular. Nevertheless, it seems important to conduct further studies looking into school climates and the interactions between teachers from the same school about their use of ICT.

Ainley et al (2008) explained how ICT could change the school and classroom environment. Many attempts to implement ICT in education have taken place within a traditional educational system (Erstad, 2008). There are many obstacles in the educational system when implementing ICT in teaching, mainly 1) because there is resistance toward changes within the educational system (Ainley et al, 2008) and 2) because ICT is implemented as a new concept within the traditional structure (Erstad, 2008). Therefore, it is difficult to exploit the opportunities that computers and other technology provide for making real changes in the development of how we teach and learn. According to the U.S. Department of Education (2010), the combination of technology and face-to-face teaching is most effective when technology is combined with development of the curriculum and the use the most appropriate pedagogy.

It seems important to broaden approaches when implementing ICT in education. Access, support and modelling of ICT use are important issues in order to develop good use of computers in teaching (Kozma, 2003; Dexter, 2008; Hammond et al, 2009; Vanderbrake & van Braak, 2010). However, the teachers' beliefs about the usefulness of computers in teaching are also important for effective use of computers in teaching practice (Hammond et al, 2009; Sørebø et al, 2009; Tondeur et al, 2008).

Further studies are required. A longitudinal study following teachers over time will be important in the future to identify beliefs about the value of computers, beliefs about students' learning outcomes from computers, and experiences of cultural and structural characteristics in individual schools.

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