CONTENT

Editorial
Glenn Hultman, Ragnhild Löfgren & Jan Schoultz Subject Didactics in Practice: Hidden in the Process. A Study of Teaching Logics and Classroom Cultures

Ylva Backman, Eva Alerby, Ulrika Bergmark, Åsa Gardelli, Krister Hertting, Catrine Kostenius & Kerstin Öhrling Improving the School Environment from a Student Perspective: Tensions and opportunities

Marta Mendonça, Oleg Popov, Gun-Marie Frånberg & Eugénia Cossa Introducing a Student-centred Learning Approach in Current Curriculum Reform in Mozambican Higher Education

Vali Mehdinezhad Faculty Members’ Understanding of Teaching Efficacy Criteria

Constance Oterkiil & Sigrun K. Ertesvåg Schools’ Readiness and Capacity to Improve Matter

Catarina Player-Koro Factors Influencing Teachers’ Use of ICT in Education
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Factors Influencing Teachers’ Use of ICT in Education

Catarina Player-Koro*

Abstract
This study investigates teachers’ attitudes to and beliefs about using ICT in education and proposes a model of how different variables are related to teachers’ use of ICT in classrooms. The model suggests that positive attitudes related specifically to ICT as a useful tool for teaching and learning and a strong sense of self-efficacy in using computers in education seem to influence the use of ICT the most. It is also suggested that positive attitudes to ICT generally do not seem to contribute very much to teachers’ use of ICT in classrooms. This is a surprising finding. The distinction between the importance of specific and general attitudes to ICT use and the emphasis on self-efficacy contributes to contemporary research. Self-efficacy and attitudes are suggested to be mutually related to ICT use.

Keywords: ICT use, teachers, teacher education, educational technology

Introduction
In both Nordic countries and many other countries education has been selected by political powers as a means of bridging the gap between technology and society and for introducing new technology into society. Education is often viewed as a way to move nations into the information age. It is also frequently contended that there is a need to transform education to meet the new challenges facing society.

Digital technology is often presented as the driving force of the transformation of education and carries positive overtones that information and communication technology (ICT) will contribute to this transformation “for the better” (Fisher, 2006; Nivala, 2009; Ottestad, 2010). Along with the rapid development of ICT, this has led to computers becoming part of daily life and has pushed ICT and computers into classrooms at all educational levels during the last three decades.

The motives and arguments in favour of implementing ICT come from many directions; both advocates inside schools and, more often, from the outside on the part of developers of software and hardware, and government (Cuban, 1986, 2002; Selwyn & Fitz, 2001). Over the past 30 years there has been an ongoing push in Sweden led by the Ministry of Education and the National Board of Education with the intention to integrate computers and ICT in schools (Jedeskog, 2005). However, despite the positive results obtained in small-scale, often experimental, studies and the considerable

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effort and resources put into educational computing by many governments, there is still a lack of evidence that ICT has actually enhanced educational standards (Nivala, 2009; Ottestad, 2010; Teknikdelegationen, 2010) and the process of integration has often been described as slow.

Many reasons for this lethargy have been reported, ranging from technical factors such as a lack of technology and software in schools and the limited expertise of teachers regarding ICT use to other factors such as teachers’ beliefs and knowledge about how to integrate ICT into teaching (Hsu & Sharma, 2008; Jedeskog, 2005, Nivala, 2009; Pelgrum, 2001; Peralda & Costa, 2007; Teo, Chai, Hung and Lee, 2008). Some writers have described these results in terms of waves where different technologies with intervals of three to four years have promised to deliver a revolution in teaching, learning and education but that, after a period of time, have sadly resulted in disappointment and little substantial educational change (Cuban, 1986, 2002; Gouseti, 2010; Rushby, 2005). It could be argued that the history of digital technologies in formal education has tended to promise a great deal but delivered far less.

The gap between the optimistic rhetoric surrounding ICT use in education and the current level of ICT integration into educational settings has inspired researchers to focus on teachers and the difficulties they encounter integrating ICT tools into their classroom practices (Drent & Melissen, 2008; Hsu et al., 2008; Pelgrum, 2001; Teknikdelegationen, 2010). Identifying factors explaining ICT use is seen as a way of answering the question why some teachers embrace the use of technology with students in classrooms and others do not. These factors are often technology-related teacher characteristics where, for example, teachers’ attitudes and self-efficacy are in focus (Herman, Tondeur, van Braak, and Valcke; 2008; Peralda et al., 2007; Teo et al., 2008).

The present study centres on these characteristics but tries to distance itself from viewing teachers as the main hindrance in implementing ICT in schools. Even if the rhetoric, deployment and use of ICT in educational settings remains problematic, there are teachers who do use ICT as a teaching and learning tool in their daily work with students in the classroom. The present investigation is interested in factors that can help explain why some teachers have elected to make use of ICT in education when the majority have not (Teknikdelegationen, 2010). The analysis is based on the following question: Which factors influence teachers’ use of ICT in education?

**Theoretical framework**

Research in the field of teachers’ use of technology in the classroom identifies a complex pattern of interrelated factors that are assumed to be determinants of the successful implementation of ICT in education. Taken together, research broadly speaking classifies factors that facilitate (or act as barriers to) the use of ICT in schools by teachers as either arising from the external environment or the personal characteristics of teachers—including the beliefs, values and attitudes that are felt likely to influence them.
In research where the personal characteristics of individual teachers are focused on, two theories from social psychological research are regarded as particularly relevant. One of these is Bandura’s (1989, 1997, 2002) theory about self-efficacy and the other is attitude-behaviour relations’ theory (Doll & Ajzen, 1992; Fazio & Williams, 1986; Glasman & Albarracín, 2006). These two theories will be presented next in relation to prior studies investigating the influence of attitude and self-efficacy on teachers’ ICT use in classroom practice.

**Self-efficacy**

According to Bandura (1989, 1997, 2002), people regulate their behaviour on the basis of belief systems, particularly beliefs of personal efficacy (the power to produce desired outcomes and forestall undesired ones) and self-efficacy (the belief in one’s own ability to execute a certain course of behaviour successfully). Both of these efficacy forms are considered to be situation- or task-specific key factors in how people construct and live their lives.

Self-efficacy theory has been used in research concerned with individuals’ intentions to use information technology. In this research, an individual’s perception of their ability to competently use computers is defined as computer self-efficacy, which is concerned with the judgement of what can be done in the future. It refers to judgements of ability to apply skills to broader tasks, such as promoting education. Thus, computer self-efficacy does not refer to component skills such as using a specific software feature or booting up a computer, but to judgements of the ability to apply one’s skills when using technology for broader tasks (Compeau & Higgins, 1995).

A greater sense of computer self-efficacy has been shown to influence individuals’ choice regarding computer usage and adoption in general. In the case of teachers, research has suggested that a strong sense of computer self-efficacy among teachers affects both how often and the way ICT is used in everyday instructional practice (Compeau et al., 1995; Chang & Tung, 2008; Papastergiou, 2010).

**The attitude-behaviour relation**

There are two lines of understanding in respect of attitude-behaviour relations and what makes attitude predict behaviour (Zimbardo, Ebbesen & Mashlach, 1977). One line, *attitude accessibility*, suggests that attitudes influence behaviour when actors activate them from memory and that these attitudes are more likely to guide behaviour when they are easy to retrieve. The other line of research (called *attitude stability* research) departs from the belief that attitudes influence behaviour when they are so stable that actors can reconstruct them almost without thinking.

Conditions that strengthen the attitude-behaviour relation in both approaches are direct experience, motivation to think about an object or issue, relevant and one-sided information, believing that one’s attitudes are correct, and easily recollected attitudes. Other conditions that influence attitude-behaviour relations are if
attitudes are general or specific regarding a particular behaviour. Specific attitudes to a particular behaviour improve attitude-behaviour relations because the attitude responds closely to the predicted behaviour. On the other hand, when the attitude is general and the behaviour specific there is no close correspondence between attitude and behaviour (Doll et al., 1992; Fazio et al., 1986; Glasman et al., 2006).

Research in the area of teachers’ use of ICT in education sees attitudes as having either a direct or indirect influence on a teachers’ use of technology in classrooms. The direct influence of attitudes can be categorised into two groups: attitudes to technology (Delcourt et al., 1993; Russel, 1995) and attitudes to ICT use in education (Al-Zaidiyeen, Mei and Fook., 2010; Albrini, 2006; Dogan; 2010; Herman et al., 2008; Pelgrum 1993). One example where attitudes have an indirect influence on ICT use in education is given in the Cox, Preston and Cox, (1999) study where attitudes seemed to influence teachers’ motivations to use ICT. Teachers’ motivation is, according to Cox et al. (1999), a factor with a direct influence. Another example is attitudes as a factor that will promote innovative use of ICT (Drent et al., 2007).

Positive attitudes to ICTs and/or their use in education are often proposed to be enabling factors and negative attitudes are disabling factors (Kiridis et al., 2006; Drent et al., 2008; Pelgrum, 1993). However, positive attitudes to ICT use can be more or less specific to ICT in school, ranging from a general positive attitude to ICT in education to a more specific attitude to using ICT in daily work with students in classrooms. This distinction seems to be lacking in studies linking attitudes to computer use in teaching. Further, according to some studies experience of ICT use seems to be a link between the two theories presented above in that both self-efficacy and attitudes to ICT use are positively related to experience. In this sense, it is argued that familiarity with technology use makes people regard ICT use more positively, which also results in a greater feeling of self-efficacy (Papasterigiou, 2010).

**Technology integration**

Attitudes also have a strong influence on the ways people interact as members of organisations and groups. Rogers’ (1995) theory of Diffusion of Innovations fits this notion. It considers that people who adopt and choose to use new innovations such as technology are those who have positive attitudes to them and it has been applied in a variety of disciplines, including education, to explain if and how an innovation is diffused to members of a social system. If ICT is viewed as a workplace innovation, then the diffusion of the innovation framework seems to be relevant for explaining the process that makes teachers accept and use ICT in their classrooms in support of their classroom teaching (Chang et al., 2008; Herman et al., 2008).
Factors Influencing Teachers' Use of ICT in Education

Research methodology

Modelling process

In order to obtain a broad picture of the nature and scope of teachers’ use of ICT a survey study was undertaken. The main strength of survey research is the possibility to gather information from a larger sample of people, which is generally seen as a good method to employ if the aim of the study is to acquire information about people’s attitudes, beliefs and behaviour (Mitchell & Jolley, 1996). The research instrument was a questionnaire that was distributed to Swedish compulsory schoolteachers.

The modelling process (Figure 1) is based on empirical data and a theoretical model (Figure 2) that is constructed on the basis of the two theoretical aspects from social psychology: self-efficacy and attitude behaviour relations. The theoretical model serves as a bridge between the abstractions from theory and the development of the structural model (Figure 3). Different methods of structural equation modelling (SEM) were used in the modelling process in order to explore how some variables help explain teachers’ use of ICT in education.

![Figure 1. The modelling process](image)

Sampling method

The target population in the present research was teachers in the Swedish nine-year compulsory school in the province of Västra Götaland located in the south-west of Sweden. It is the fifth largest province in Sweden and was chosen mainly for practical reasons, but also because the province contains demographic variations typical of the country as a whole.

The selection of teachers was conducted using cluster sampling. A list from the SCB (Statistics Sweden) register of Swedish schools was used to identify the population. A random sample of 14 schools was selected from the list. Teachers working at the selected 14 schools were the participants in the investigation. Headmasters of the selected schools were contacted in order to acquire lists of the teachers working
in their schools, but this was impossible due to teachers’ rights to their privacy. The headmasters provided an approximate number of teachers working at each school. Based on that information, the number of teachers was estimated at 360. Two hundred and ten questionnaires were returned so the study results are based on 210 teachers \((n=210)\), (169 women and 41 men). These distributions approximate the overall distributions of female to male teachers in the province and in Sweden generally.

**Instrument**

The questionnaire contained 27 questions in three sections. Both fixed alternative and open-ended questions were used. The first section covered standard questions such as age, gender, educational level and access to ICT at home and school. The second section consisted of fixed alternative questions regarding teachers’ private use of ICT outside their profession; their perceived self-efficacy in using ICT and if, how and how often ICT is used for private purposes. In the last section, fixed-alternative questions about teachers’ use of ICT in classroom practice were formulated as were questions about their self-efficacy in using ICT in classroom practice and how and how often they make use of this technology there. Finally, questions about teachers’ attitudes to ICT use in education were asked. These questions were fixed interval items where the respondents were asked to agree or disagree with a series of statements. A four-point numerical scale was used, ranging from 1 = *strongly disagree* to 4 = *strongly agree*. Cronbach’s alpha for this scale was .762, which is highly acceptable.

The respondents also had the opportunity to add responses in their own words in a number of open-ended questions after each of the sequences in the questionnaire. The reason for this was to ensure that no relevant response was missed.

**Procedure**

The questionnaires described above were delivered as self-administrated questionnaires. Aware of the limitations with this method such as a low return rate and the risk of the respondent misunderstanding the questions (Mitchell et al., 1996), a contact person was selected at each school to help with the distribution and to explain the intention of the questions if needed. Personal contacts were established with the contact persons before the questionnaires were sent out and continued until the questionnaires had been sent back. The contacts were mainly teachers working with ICT innovation in the schools.

In total, 360 questionnaires were distributed and 210 were returned. Based on those figures, the return rate was 58 percent. This is quite good for questionnaires administered to teachers in Sweden nowadays. However, the actual return rate may be better than it seems as some loss in the return rate can be explained by the fact that the number of teachers was based on estimations by the head teachers at each school, not the actual figures. Contact persons reported reasons like burden of work and too many papers to fill in as explanations for not answering the questionnaire. Other explanations could be that some teachers were on the sick list, part-time workers
or on parental leave. Questionnaires were received from every school in the sample and the return rate did not vary significantly among the schools.

**Data analysis**

The analysis was conducted in three steps. First, a *stepwise multiple regression analysis* was used in order to investigate the most appropriate pattern of predictive variables. In stepwise regression analysis poor predictors are eliminated on a stepwise basis and best predictors are selected on the basis of statistical criteria.

The criterion variable was identified from a fixed alternative question about teachers’ uses of ICT in classroom practice and was labelled: *teacher’s use of ICT in education*. This question consisted of 20 different activities where the teachers were requested to mark which activities they are carrying out with their students.

The value of the criterion variable was computed from the fixed alternative question about how teachers’ make use of ICT in classroom practice. Each activity marked in the questionnaire was summarised. Teachers who marked the greatest number of activities also generated the highest score on the criterion variable. Teachers also had the option to add activities to the list. A significant relation emerged, suggesting that a feeling of self-efficacy in using computers in education and having positive attitudes to ICT use were the variables that best predicted teachers’ use of ICT in education.

*Factor analysis* was used in the second step of the analysis as a means to further explore the structure of the teachers’ attitudes to ICT use in education.

The aim of the third step was to understand and explain how teacher behaviour can be predicted by belief systems. In this sense, the results of the regression analysis and the factor analysis were used to modify a theoretical model that had been generated based on the two theoretical aspects from social psychology, self-efficacy and attitude behaviour relations mentioned earlier (Figure 1). The model expressed expected patterns of relationships between manifest and latent variables and was tested and further modified for best fit against the empirical data using Amos 7.0. Amos 7.0 is a form of computer software that is designed and used for building and analysing structural equation models.
Results
A theoretical model (Figure 2) was formulated based on theories about self-efficacy and attitude-behaviour relations.

![Figure 2. The theoretical model](image)

Factors 1–3 in the above model represent teachers’ attitudes to using ICT in education and each factor can be thought of as representing different dimensions of these attitudes, which can also be held on a general or specific level regarding a specific behaviour.

Stepwise multiple regression analysis was performed using teachers’ use of ICT in education as a dependent (criterion) variable. Using the stepwise method, a significant model emerged: $F(2, 197) = 30.67, p < 0.001$. This model explained 30.24% of the variance. Adjusted $R^2$, which takes into account the number of predictor variables in the model and the number of participants that the model is based on, was calculated, $R^2 = .317$.

The predictor variable with the largest correlation with the criterion variable was attitudes to using ICT in education. This variable explained 21.9% ($p < 0.001$) of the variance. The second variable, selected based on the highest partial correlation, was self-efficacy in using computers in educational practice. Together with attitudes to using ICT in education, these two variables explained a further 10.5% ($p < 0.01$) of the variance.

The absolute values of the standardised estimate ($b$) of these factors, when all are included, are from largest to smallest: attitudes to using ICT in education $b = 0.37, p < 0.01$ and self-efficacy in using computers in education $b = 0.34, p < 0.01$. Variables that did not pass the entry requirement and were therefore excluded from the equation were teachers’ use of ICT for private purposes, self-efficacy in using computers for private purposes, age and, perhaps somewhat surprisingly given previous research results, formal education in ICT.

Factor analysis was undertaken in order to explore the underlying pattern of the variable attitudes to using ICT in education. The various indicators of factorability
were good and the residuals indicate the solution was a good one. Three factors, which accounted for 50% of the variance overall, were extracted with eigenvalues (the sum of the square factor loading) equal to or greater than 1.00. A commonly accepted procedure is to ignore any factors with an eigenvalue of less than 1.00 because such factors cannot be considered statistically significant. The scree plot, which is a graph of the amount of variance explained by the factors, also supported the selection of these three components.

Rotation is a mathematical method that makes it easier to identify the structure of the factors. Varimax rotation of the factors, the most common rotation option, yielded the factors given in Table 1. These factors can be thought of as representing different dimensions of teachers’ attitudes to using ICT in education. *Factor 1* represents teachers who find ICT useful for teaching and learning and these attitudes can therefore be seen as specifically relevant to ICT use in education. *Factor 2* represents teachers who find ICT useful for students’ future life. These attitudes can be thought of as more general regarding ICT use in education. *Factor 3* represents teachers who do not think ICT is necessary in education.

**Table 1.** Orthogonal factor loading matrix

| Label | Variable                                                                 | Factor 1 (F1) | Factor 2 (F2) | Factor 3 (F3) |
|-------|--------------------------------------------------------------------------|---------------|---------------|---------------|
| A1    | ICT in education has changed the way I work in the classroom:            | 0.711         | -0.162        | -0.200        |
| A2    | ICT in education facilitates student learning                            | 0.520         | 0.332         | -0.155        |
| A3    | ICT in education contributes to cooperation between me and my colleagues| 0.744         | 0.003         | 0.001         |
| A4    | ICT in education contributes in making student work more active and problem-based | 0.694         | 0.375         | -0.101        |
| A5    | ICT in education increases students’ awareness of the range of possibilities of computers and ICT | 0.489         | 0.340         | -0.07         |
| A6    | ICT in education makes teaching and learning funnier                     | 0.366         | 0.565         | -0.082        |
| A7    | ICT in education prepares students for their future career              | 0.433         | 0.500         | -0.253        |
| A8    | ICT in education is important in order to prepare students to be active members of the public | 0.116         | 0.643         | -0.221        |
| A9    | ICT in education develops teachers’ pedagogical ability                 | 0.672         | 0.385         | 0.038         |
| A10   | Teachers should have knowledge about how ICT can support learning       | -0.197        | 0.675         | 0.210         |
| A11   | ICT in education changes teachers’ role to be more an instructor than a mediator | 0.486         | 0.289         | 0.546         |
| A12   | Students should have learnt ICT even if they do not use ICT in education| -0.091        | -0.027        | 0.617         |
| A13   | ICT in education promotes subject integration                            | 0.351         | 0.580         | 0.013         |
| A14   | ICT in education takes time away from other important school activities | -0.149        | -0.166        | 0.622         |
Analysis

Research has shown that general attitudes predict behaviour poorly and that specific attitudes improve predictive accuracy as they are often more relevant and are developed from direct experience (Doll et al., 1992; Fazio et al., 1986; Glasman et al., 2006). In research about teachers’ attitudes to ICT use in education, positive attitudes have been seen as an important factor in general in order to encourage teachers to use ICT in classrooms. In the present investigation, the positive attitudes are separated. Factor 1 represents more specific positive attitudes to ICT in education, while Factor 2 represents more general positive attitudes and Factor 3 represents negative attitudes. The theoretical model (Figure 2) assumes that Factors 1–3 will have a direct effect on ICT use in education.

Self-efficacy is the belief that one has the capability to perform a particular behaviour and computer self-efficacy is an individual’s judgment of their ability to competently use computers for broader tasks, such as education (Bandura 1989, 1997, 2002; Compeau et al., 1995; Chang et al., 2008). The theoretical model (Figure 2) thus assumes that Self-efficacy in using ICT in education will have a direct effect on teachers’ use of ICT in education. It was tested and modified for best fit against the data using AMOS 7.0.

Figure 3. The structural model. Model after testing and modification against data (A1-A14 = attitudes toward ICT in education).
The structural relationships among the research variables and the standardised path coefficients are presented in Figure 3. They show that Factor 1, which represents a dimension of attitudes that ICT is useful for teaching and learning, has a positive relation to both self-efficacy in using ICT in education and to teachers’ use of ICT in education. Factor 2, which represents the attitude that ICT is useful for students’ future life, is strongly related to Factor 1 but negatively related to the variable teachers’ use of ICT in education. Factor 3 represents teachers who do not think ICT in education is necessary. It has a small influence on Factor 1 and Factor 2 and no influence on teachers’ use of ICT in education.

To assess the overall goodness-of-fit of the model described above, five common model-fit measurements were used. These are presented in Table 2. The amount of discrepancy between the model and data in the population is measured with a root mean square of approximation (RMSEA). RMSEA also takes model complexity into account. The RMSEA was .046. A value about .05 and less would indicate a close fit of the model in relation to degrees of freedom (Byrne, 2001; Gustafsson, 2006).

Table 2. Goodness-of-fit measures

| Fit Indices | $\chi^2$ | $\chi^2/df$ | GFI | AGFI | CFI | RMSEA |
|-------------|-----------|-------------|-----|------|-----|-------|
| Recommended value | - | 3 | 0.9 | 0.9 | 0.9 | 0.05-0.08 |
| Default model | 133.682 | 1.393 | 0.915 | 0.880 | 0.943 | 0.046 |

Discussion

The aim of this study was to identify common influential factors among teachers who have implemented ICT in their professional work that are assumed to have influenced their choice to do so. The research used quantitative methods for data analysis and these are research methods that have been the subject of a great deal of criticism. The function of quantitative methods to simplify data is one of many aspects that have been criticised with the argument that this leads to a simplification of social reality (Bryman, 2008). However, in this study the possibility of simplification is one of the reasons for the choice of methods. If the reduction of complexity implies a loss of information, that could be seen as a negative consequence but, on the other hand, it also implies a concentration of data on the particular aspects of data that are of interest, which could be seen as a strength and a way to make visible patterns that could otherwise be difficult to detect. It is hoped that this study can make a contribution here.

Teachers’ use of ICT is, according to the research, influenced by many interrelated factors. This study has attempted to contribute knowledge about how the two theoretical constructs from social psychology – self-efficacy and theories about how attitudes seem to predict behaviour – can be used to explain teachers’ use of technology in education.
Starting with the influence of self-efficacy theory, Banduras’ definition of self-efficacy highlights a concern with the ability to execute a specific course of action instead of whatever skills one possesses, which is also an important part of the definition of computer self-efficacy. It incorporates judgement of the ability to apply computer skills to broader tasks (Bandura 1989, 1997, 2002; Compeau et al., 1995, Papastergiou; 2010).

In this study, self-efficacy is directed to the specific course of action of using ICT in education. It does not refer to using ICT outside school or formal education in ICT. These predictors were eliminated during the stepwise regression analysis in the present study.

With the structural model (Figure 3) as a point of departure one could argue that teachers who judge themselves as having the capability to use ICT in education (Self-efficacy in using ICT in education) also use ICT in classrooms because they also believe (and have the experience) that it will benefit their pedagogical work and contribute to students’ learning (influence from Factor 1). Theories about the predictive power of attitudes on behaviour could be used to support this argument. When attitudes are specific regarding a particular behaviour and arise from experience they are also far more likely to guide behaviour. Real experience is also effective for increasing self-efficacy.

Theories about attitudes also stipulate that attitude-behaviour relations are reinforced if one perceives that one’s attitudes are correct (Doll et al., 1992; Fazio et al., 1986; Glasman et al., 2006). According to the model, teachers’ use of ICT in education is prejudiced directly and indirectly by the positive impact teachers believe ICT has on student learning processes. One could argue that this pedagogical approach is underpinned by the influence of Factor 2 (positive attitudes to ICT) because of its benefits for students’ futures.

This factor (Factor 2) represents more general positive attitudes in relation to ICT use in education. According to theories about attitude-behaviour there is no close correspondence between general attitudes and specific behaviours, and that could explain why the attitude dimension represented by Factor 2 only has a weak influence on teachers’ use of ICT in education. Finally, another argument deriving from these theories about attitudes and self-efficacy that could be used to understand this model is that these theories seem to have two factors that are strong predictors of behaviours in common; direct experience and beliefs (Bandura 1989, 1997, 2002; Doll et al., 1992; Fazio et al., 1986; Glasman et al., 2006). These relations are visible in the present theoretical model.

Both self-efficacy and attitudes have been widely reported in research as symbiotically related to ICT and its use in classrooms. This suggests that teachers who embrace ICT in their work with students/pupils will have positive attitudes about using ICT in education and will feel self-efficacious in using ICT. This notion is strongly supported by contemporary research (see e.g. the theoretical framework section). Moreover, beliefs are also said to be central to the innovation decision-making process for ex-
plaining if and how an innovation is diffused to members of a social system. Teachers who are using ICT in their classroom practice play an important role for the diffusion of ICT in schools according to the diffusion of innovation model, which is the intention of many European countries today (European Commission, 2010; Herman et al., 2008; Rogers, 1995).

Conclusions
The present study differs from many other studies in two ways. Firstly, the multivariate methods used here brought teachers who are already using technology in their classroom practice and who have direct experience of using technology for teaching into sharp focus. Secondly, the model that emerged during the analysis suggests that the association with pedagogical work in classroom practice is important by highlighting the distinction between general and specific attitudes to ICT use in education. What is shown is that specific positive attitudes to ICT in pedagogical work with students and colleagues are the kind of attitudes that seem to facilitate teachers’ use of ICT in education, whilst general positive attitudes to ICT in education do not seem to have much of an impact. This finding differs from reported findings that an increase in ICT competence in general also leads to more positive attitudes to using ICT in classrooms (see, for example, Al-Zaidiyeen et al. (2010)).

A relevant question concerns how the findings of the present research can be harnessed. So far, the study of education and technology use has been characterised as a “fickle and faddish’ area of study, where empirical research has documented few significant changes to educational practices (Gouseti, 2010; Rushby, 2005). If teachers are included in research they are often constructed as people who experience different kinds of difficulties with the implementation of technology and as being resistant to educational change. On the other hand, teachers are also considered as important agents who significantly influence the process of ICT implementation and educational change (Teknikdelegationen, 2010). The present study tries to distance itself from this contradictory picture arising from research by starting with teachers who actually use ICT in their education and it is hoped that the investigation will thus be seen as a building block in the development of knowledge about how teachers can become competent and confident in using ICT in their pedagogical work in classroom practice.

Different ICT-related variables have been highlighted in research literature as important for promoting teachers’ use of computers and information technologies in education. The main objective of the present investigation was to explore some of those variables in order to investigate which factors seem to contribute most to explaining teachers’ use of ICT in education. The results point in the same directions as much other research. They suggest that suitable training (especially in the pedagogical aspects of ICT) is necessary and that direct experience of how to handle technology in classrooms is needed (Jung, 2005; Kiridis et al., 2006; Steketee, 2005).
**Bias and further study**

It is important to be aware of findings from research showing that teachers’ use of ICT is influenced by many interrelated factors. Factors have been classified in the research literature in different ways. In some investigations they are situated at different contextual levels, while in others it is suggested that a categorisation distinguishing factors as either arising from external environments or from personal characteristics of teachers is important. Moreover, according to the research literature it seems obvious that a dynamic process involving a complex pattern of interrelated factors stemming from different categories determines the successful implementation of ICT. To fully understand these factors at a deeper and broader level, investigations that explore how teachers’ professional reality is socially constructed, taking account of both social and structural conditions, must be employed. The present investigation can serve as a building block that makes patterns of variables visible at a general level.

However, in the present study only one set of data was used for modifying the model. This affects the level of significance of the overall “goodness-of-fit” of the model so replication of the model on a new sample is recommended. Further investigations in this area are important in order to make teachers competent in planning and managing the use of ICT in the classroom.

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Catarina Player-Koro

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CONTENT

Editorial
Glenn Hultman, Ragnhild Löfgren & Jan Schoultz Subject Didactics in Practice – Hidden in the Process. A Study of Teaching Logics and Classroom Cultures

Ylva Backman, Eva Alerby, Ulrika Bergmark, Åsa Gardelli, Krister Hertting, Catrine Kostenius & Kerstin Öhrling Improving the School Environment from a Student Perspective: Tensions and opportunities

Marta Mendonca, Oleg Popov, Gun-Marie Frånberg & Eugenia Cossa Introducing a Student-centred Learning Approach in Current Curriculum Reform in Mozambican Higher Education

Vali Mehdinezhad Faculty Members’ Understanding of Teaching Efficacy Criteria

Constance Oterkiil & Sigrun K. Ertesvåg Schools’ Readiness and Capacity to Improve Matter

Catarina Player-Koro Factors Influencing Teachers’ Use of ICT in Education