Abstract: Teacher candidates should be prepared to integrate information and communication technology (ICT) into their future teaching practices. Despite the increased availability and support for ICT integration, relatively few teachers intend to integrate ICT into their teaching activities. The available research has thus far focused on isolated teacher related variables to explain the weak level of ICT integration. Also, most of this research was set up in Western settings. The present study centers on the impact of Chinese student teachers' gender, constructivist teaching beliefs, teaching self-efficacy, computer self-efficacy, and computer attitudes on their prospective ICT use. For this purpose, a survey was set up involving teacher education college students of four teacher education universities in China (N = 727). Results showed that prospective ICT integration significantly correlates with all teacher related variables. Building on a path analysis, prospective ICT integration could be directly predicted on the base of teacher thinking variables (constructivist teaching beliefs, teacher self-efficacy, computer self-efficacy and computer attitudes in education),
and indirectly by the gender of the student teachers. Implications for teacher education and further research are discussed.

Suggested Reviewers:

Opposed Reviewers:
Student teachers’ thinking processes and ICT integration: predictors of prospective teaching behaviors with educational technology

Abstract

Teacher candidates should be prepared to integrate information and communication technology (ICT) into their future teaching practices. Despite the increased availability and support for ICT integration, relatively few teachers intend to integrate ICT into their teaching activities. The available research has thus far focused on isolated teacher related variables to explain the weak level of ICT integration. Also, most of this research was set up in Western settings. The present study centers on the impact of Chinese student teachers’ gender, constructivist teaching beliefs, teaching self-efficacy, computer self-efficacy, and computer attitudes on their prospective ICT use. For this purpose, a survey was set up involving teacher education college students of four teacher education universities in China (N = 727). Results showed that prospective ICT integration significantly correlates with all teacher related variables. Building on a path analysis, prospective ICT integration could be directly predicted on the base of teacher thinking variables (constructivist teaching beliefs, teacher self-efficacy, computer self-efficacy and computer attitudes in education), and indirectly by the gender of the student teachers. Implications for teacher education and further research are discussed.

Keywords: Educational beliefs; Self-efficacy; Computer attitudes; ICT integration; Teacher education

1. Introduction and problem statement

Since the integration of educational technologies into educational settings, teacher education has faced the challenge of improving in-service teachers and preparing pre-service teachers for successful integration of educational technologies into their teaching practices. At the same time, schools have been increasing access to technology tools by acquiring hardware and software, connecting classrooms to the Internet, and providing cable and satellite capabilities (Rusten & Hudson, 2002; Zehr, 1998). But, according to Ertmer (2005), the decision regarding whether and how to use technologies for instruction rests on the shoulders of teachers. For this reason, as
Marcinkiewicz (1993) noted: ‘Full integration of computers into the educational system is a distant goal unless there is reconciliation between teachers and computers. To understand how to achieve integration, we need to study teachers and what makes them use computers’ (p. 234). Subsequently, the integration of information and communication technology (ICT) in education has become a worldwide focus in educational research (e.g., Authors, 2008a; Wang, Ertmer, & Newby, 2004). However, despite the increased availability of ICT hardware (e.g., Ertmer, 1999) and support from schools for ICT integration (e.g., Baylor & Ritchie, 2002), and strengthened consciousness of teachers on the importance integrating technology into teachings (e.g., Khine, 2001), relatively few teachers are willing to integrate ICT into their teaching activities (e.g., Becker, 2000; Authors, 2008b; Wang et al., 2004).

Two levels of barriers have been categorized for hampering teachers’ ICT implementation efforts: external (first-order) barriers and internal (second-order) barriers (Ertmer, 1999). External barriers include those that are often seen as the key obstacles, e.g., the issues of adequate access to the technologies, training, and support without which it is almost impossible to talk about technology integration. However, as Ertmer (1999) documented, even if the first-order (external) barriers were resolved, ‘teachers would not automatically use technology to achieve the kind of meaningful outcomes advocated’ (p.51). For this reason, we have to consider the second-order (internal barriers) stalling ICT integration by teachers. Internal barriers are related to a teacher’s philosophy about teaching and learning; they are veiled and deeply rooted in daily practices (Ertmer 1999, 2005). Examples of these internal barriers are teacher beliefs, teacher self-efficacy and teacher attitudes. They have been reported to be crucial to understand the frequency and success of ICT use in education (Compeau & Higgins, 1995; Compeau, Higgins, & Huff, 1999; Ertmer, 2005; Authors, 2008b). Empirical studies underpin the particular impact of educational beliefs (e.g., Higgins & Moseley, 2001), teaching efficacies (e.g., Wang et al., 2004), and computer attitudes (e.g., Author, 2001). However, little is known about direct and indirect impact of the complex interplay of teacher thinking processes on ICT integration. In addition, the
specific internal and external variables also introduce the critical issue of the role of the cultural context. Understanding how culture influences instructional behavior is a key issue in this context (Aguinis & Roth, 2003). Also Brennan, McFadden and Law (2001) emphasize that cultural differences need to be taken into account when studying instructional interventions.

2. Theoretical background

2.1. Preparing Teachers for ICT Integration

In the literature, the educational potential of ICT is stressed in a variety of ways. Godfrey (2001) and Becker (2000) stress the potential of ICT - for teachers - to design and develop rich learning environments allowing multiple perspectives on complex phenomena, flexible knowledge construction in complex learning domains, or to cater for individual differences. Other research stresses the impact of ICT, when used regularly in class, on students’ cognitive and attitudinal outcomes (Cooper & Brna, 2002; Newhouse, 1998). There is also growing evidence that teachers are more positive about the possible benefits of using ICT in subject teaching (Easdown, 2000). Despite the available evidence, the decade-old statement of Mandanach and Cline (1998) remains true that little progress has been made in the past years toward the practical, widespread implementation of ICT in classroom settings. The latter introduces key questions about teacher education and professional development. Also Albion (1996) revealed that teacher readiness is crucial to the realization of national goals about educational computer use and that the preparation of student teachers is expected to make a large difference.

For years, teacher education institutes have made efforts preparing pre-service teachers to integrate technology into their future teaching practices (Krueger, Hansen, & Smaldino, 2000). Teacher education courses have been added to enhance the ICT-capabilities of beginning teachers. Furthermore, computer availability and support for classroom use has been increased in the teacher education setting (Becker,
2000). However, research suggests that this does not translate into more or better integration of ICT in future teaching (Ertmer, 1999). For instance, Oliver (1993) found that beginning teachers who received formal training in the use of computers did not differ in their future use of computers for teaching from peers without such a training. Other factors, next to technical knowledge and skills, seem to contribute to teachers’ successful technology integration. This supported by Ertmer who already in 1999 emphasized the mediating role of internal barriers. Also Cuban (1993) already stressed at an early stage that both knowledge, beliefs, and attitudes of teachers ‘shape what they choose to do in their classrooms and explain the core of instructional practices that have endured over time.’ (p. 256).

2.2. Teacher constructivist beliefs

Calderhead (1996) introduced the concept of teacher cognition that comprises teacher knowledge, teacher thinking, as well as teacher beliefs. Teacher beliefs are therefore regarded as a type of teachers’ thought processes (Clark & Peterson, 1986). Teacher beliefs are relatively stable conceptual representations that act as a filter through which new knowledge and experiences are screened for meaning (Fang, 1996; Kagan, 1992; Nespor, 1987; Pajares, 1992). Teacher beliefs play a critical role in defining behavior and organizing knowledge and information in classroom activities (Cuban, 1993; Fang, 1996; Pajares, 1992). For instance, Pajares (1992) states that ‘educational beliefs of pre-service teachers play a pivotal role in their acquisition and interpretation of knowledge and subsequent teaching behavior’ (p. 328).

Constructivism is a philosophy that states that students construct understanding for themselves (Lowery, 1997). Constructivist views about teaching and learning have gained acceptance as a viable framework for understanding learning and developing models of effective teaching. A definition of Taylor, Fraser, and White (1994) about constructivist teaching included five components: scientific uncertainty, student negotiation, shared control, critical voice, and personal relevance. When considering the interrelationship between teacher beliefs and ICT integration, there is evidence to
suggest that, teachers’ constructivist beliefs about teaching and learning are a significant factor in determining patterns of classroom computer use. For instance, Honey and Moeller (1990) found that teachers with student-centered pedagogical beliefs were successful at integrating technology except in cases where anxiety about computers prevented them from appropriating the technology. The theoretical and actual influences of teachers’ constructivist educational beliefs on classroom activities with or without ICT integration have also been explored by a variety of researchers (Higgins & Moseley, 2001; Riel & Becker, 2000; Authors, 2008a).

2.3. Teacher self-efficacy

2.3.1. Teacher self-efficacy

Bandura defined self-efficacy as “beliefs in one’s capabilities to organize and execute the courses of action required to produce given attainments” (Bandura, 1997, p. 3). Self-efficacy beliefs were characterized as major mediators of behavior, and importantly, behavioral change. Bandura stresses that self-efficacy is strongly related to particular types of action. Therefore, in the current context we focus on teacher self-efficacy.

Consistent with the general definition, Tschannen-Moran and Woolfolk Hoy (2001) define teacher self-efficacy is ‘a teacher’s judgment of his or her capabilities to bring about desired outcomes of student engagement and learning, even among those students who may be difficult or unmotivated’ (p. 783). Teacher efficacy is related to teacher classroom behaviors. Teacher self-efficacy has been identified as a crucial variable that accounts for individual differences in teaching effectiveness. Teachers with a strong sense of self-efficacy are open to new ideas and more willing to experiment with new strategies, seek improved teaching methods, and experiment with instructional materials (Allinder, 1994; Guskey, 1988). Teacher self-efficacy has also been found to be correlated to ICT integration in classroom (Albion, 1996; Compeau et al., 1999; Hasan, 2003; Potosky, 2002).

2.3.2. Teacher efficacy about using computers
Self-efficacy regarding computers refers to a person’s perceptions of and capabilities to apply ICT (Compeau & Higgins, 1995). The authors state that computer self-efficacy is positively correlated with an individual’s willingness to choose and participate in computer-related activities, expectations of success in such activities, and persistence or effective coping behaviors when faced with computer-related difficulties. Teachers with higher levels of self-efficacy about computers used computers more often and experienced less computer-related anxiety. On the other hand, teachers with lower levels of self-efficacy about computers become more frustrated and more anxious, and hesitate to use computers when they encounter obstacles. Ropp (1999) uses the term ‘computer self-efficacy’ to claim that while many teachers have positive attitudes to the use of educational technologies, they do not necessarily believe in their own abilities to use technology in a classroom. Compeau et al. (1999) conducted a longitudinal study to test the influence of computer self-efficacy beliefs, outcome expectations and anxiety on computer use. Their research results point out that computer self-efficacy beliefs have a significant positive influence on computer use.

2.4. Computer attitudes

According to Ajzen and Fishbein (1977), attitudes refer to the ability to predict a person’s behavior toward certain targets. Ajzen (1988) described attitude as a predisposition to respond favorably or unfavorably to an object, person, or event. The strong relationship of computer related attitudes and computer use in education has been emphasized in many studies (e.g., Author, 2001). Attitudes toward computers influence teachers’ acceptance of the usefulness of technology, and also influence whether teachers integrate ICT into their classroom (Akbaa & Kurubacak, 1998; Clark, 2001). According to Myers and Halpin (2002), a major reason for studying teachers’ attitudes is that it is a major predictor of future classroom computer use. Huang and Liaw (2005) also state that among the factors that affect the successful use of computers in the classroom, teachers’ attitudes towards computers play a key role. Research of Authors (2004) also supported that class use of computers
was strongly affected by attitudes toward computers in education. Khine (2001) studied 184 pre-service teachers and found a significant relationship between computer attitudes and its use in the institution.

Taking the importance of attitudes toward computer into consideration, it is also important to understand what influences pre-service teachers’ attitudes towards computers (Fisher, 2000). These attitudes are related to other internal and external variables.

2.5. Gender and ICT

The literature on educational computing abounds with conflicting findings on the gender issue (Teo, 2008). Since the introduction of computers, ICT related activities have been viewed as a ‘male domain’ (Brosnan & Davidson, 1996; Panteli, Stack, & Ramsay, 1999). There is a significant body of evidence which supports the notion that gender plays a role in influencing behaviours of computer integration. For instance, more than twenty years ago, Loyd and Gressard (1986) found male teachers to be more confident and less anxious toward computers compared to their female counterparts. A study of Blackmore, Stanley, Coles, Hodgkinson, Taylor and Vaughan (1992) found similar findings-- males appear to be more positive in their attitudes toward computers than females. As predicted, a study Liao (1998) in Chinese Taiwan showed that male teachers scored significantly higher than females. Significant differences between males and females were observed for technical ICT capabilities, and situational and longitudinal sustainability (Markauskaite, 2006). However, as long the social and economic development, the role of ICT in education changed radically. Technologies are becoming an indispensable aspect of learning, work and everyday life. A number of researchers argued that computing should no longer be regarded as a male domain (King, Bond, & Blandford, 2002; North & Noyes, 2002).

2.6. Towards an integrated theoretical perspective

Figure 1 represents in a graphical way the integration of the theoretical and empirical base into one model. A number of additional arrows have been added that are
There is clear evidence that gender is related to self-report on computer attitudes (Wu & Mogan, 1989), computer self-efficacy (Potosky, 2002), and the adoption of constructivist beliefs of teachers (e.g., Beck, Czerniak, & Lumpe, 2000; Cornelius-White, 2007). For instance, Beck et al. (2000) found a significant relationship between teachers’ gender and their constructivist beliefs in favor of female teachers. It is argued that student teachers’ constructivist beliefs and pedagogical philosophy influence their teaching efficacy (Sung, 2007) and self-efficacy on computers (Potosky, 2002). In the literature, different authors point at the impact of constructivist beliefs on educational computer attitudes (Ertmer, 2005; Chai, Hong, & Teo, 2008). Ertmer (2005) has documented that teachers adopting strong constructivist educational beliefs are more likely to use ICT in their classroom practice. However, as mentioned by Chai et al. (2008), how pedagogical beliefs are related to the teachers’ attitudes toward computers is a less researched area. Therefore, the relationship between constructivist beliefs and teachers’ attitudes toward computers needs to be examined. Furthermore, teachers’ teaching efficacy also are related to their attitudes toward efficacy on computers (Olivier & Shapiro, 1993; Wang et al., 2004).

3. Purpose of the study

Most previous studies have centered on the influence of one or two internal/external teacher thoughts. Therefore, little is known about direct and indirect impact of the variables and processes discussed above, when we focus on their complex interplay to explain classroom ICT integration. Earlier studies tend to ignore the systemic nature
of ICT integration. Cuban (1993) suggests that the knowledge, beliefs, and attitudes of teachers ‘shape what they choose to do in their classrooms and explain the core of instructional practices that have endured over time’ (p. 256). The main objective of the present study is as a consequence to examine the effect of student teachers’ gender and their thinking processes (constructivist teaching beliefs, teacher self-efficacy, computer self-efficacy, attitudes toward computers in education) on prospective ICT integration in education. This guiding research question can be stated as follows: To what extent do student teachers’ thinking processes (constructivist teaching beliefs, teaching efficacy, computer self-efficacy, attitudes toward computer in education) and/or gender influence their interests to integrate ICT into future teaching practices?

4. Method

In view of the purpose of the study, a survey instrument was designed to gather information from student teachers about the large set of variables. Next to general background questions, five existing scales were adapted as subsection of the research instrument.

4.1. Sample Characteristics

Participants were 727 university students (93.5% were female) majoring in primary education from 4 teacher education universities in three Chinese cities (Beijing, Changsha, and Hangzhou). Most of the respondents were juniors (246, 34%). 128 (18%) of respondents were freshmen. A further 154 (21%) were sophomores and the remainder 199 (27%) were senior students. 123 (17%) of them were majoring in Chinese, 80 (11%) in mathematics, 55 (8%) in English, 100 (14%) in science, 51 (7%) in educational technology, 33 (3%) in arts and 286 (40%) in ‘other’ (187 of them responded ‘primary education’ or elementary education). Most (351, 48%) of the respondents had 1-5 years of personal computer experience. 326 (45%) of them had more than 6 years of computer experience. 50 (7%) of the respondents reported that
they had less than 1 year of computer experiences.

4.2. Instruments

Five existing scales were utilized in our study. The recommended translation procedure ‘back-translation’ (Brislin, 1970) was applied to the development of the instrument. The instruments were translated from English into Chinese; a different translator translated that version back into English, and then an English speaker compared the original instruments with the back-translation. For illustrative purposes, the items of the five scales are shown in the Appendices.

Constructivist teaching beliefs

Student teachers’ constructivist teaching beliefs were measured through the ‘constructivist teaching beliefs’ (CTB) scale of Woolley, Benjamin and Woolley (2004). The participants were asked to rate their level of agreement with a specific statement (from 1- strongly disagree to 5- strongly agree). Internal consistency was measured with Cronbach’s alpha ($\alpha = 0.81$).

Teacher self-efficacy

Student teachers’ teaching self-efficacy was determined on the base of the ‘Ohio State teacher efficacy scale’ (OSTES short version; Tschannen-Moran & Woolfolk Hoy, 2001). The OSTES contains 12 items. The OSTES is a 5-point Likert scale (from 1- strongly disagree to 5- strongly agree). For student teachers, only one construct was suggested by the authors, since ‘subscale scores may have little meaning for prospective teachers who have yet to assume real teaching responsibilities’ (Tschannen-Moran & Woolfolk Hoy, 2001). Principal-axis factoring revealed one factor, using the response of the student teachers. The reliability of $\alpha = 0.84$ was acceptable compared to the original instrument ($\alpha = 0.90$).

Computer self-efficacy

The Computer Self-efficacy Scale (CSE, 14 items) was utilized to explore student teachers’ self-efficacy about computers. It was derived from The Microcomputer
Utilization in Teaching Efficacy Beliefs Instrument (MUTEBI) (Enochs, Riggs, & Ellis, 1993). Two items from CSE were suggested to be removed on the base of an exploratory factor analysis, due to low structure coefficients loading below .30. We utilized a 5-point Likert scale format (1 for strongly disagree, 5 for strongly agree). Negatively worded items were scored in the opposite direction with strongly agree receiving 1. Cronbach’s alpha was calculated to determine internal consistency ($\alpha = .90$).

**Computer attitudes**

The 8-item Attitudes toward Computers in Education Scale (ACE), designed and by Author (2001) was used in the present study. The ACE measures teachers’ attitudes toward the effects of computer adoption in the classroom. The scale uses 5-point Likert scale format (1 for strongly disagree, 5 for strongly agree). The internal consistency was good ($\alpha = .81$).

**Prospective computer use**

Teacher education programs in China require student teachers to be involved in teaching practices for 6-8 weeks during their 4-year academic career (Chen, 2004). Since this offers limited opportunities for student teachers to actually experience classroom computer use, we decided to examine student teachers’ reported prospected educational computer use as a dependent measure. The Prospective Computer Use Scale (PCU) was used that was derived from the ‘Computer Use Scale’ of Authors (2004). The Likert items of ‘computer use frequency’ were changed into ‘computer interest’ (1 = not at all interested, 2 = some interest, 3 = interested, 4 = very interested). Exploratory factor analysis suggested one factor by accounting for 40.2% of the shared variance among the items. Cronbach’s alpha reflected a good level of internal consistency ($\alpha = .87$).

**4.3. Data analysis**

Next to descriptive data analysis, correlation analysis procedures were adopted to study association between the different research variables. Path modeling was applied
to model the complex relationship between gender factor and teaching thinking factors upon prospective computer use variable, using AMOS 7.0 (Arbuckle, 2006).

5. Results

5.1. Correlation analysis

A first impression of the nature of the relationships between the research variables can be derived from the results of the bivariate correlation analysis (Table 1). For the purpose of this study, the correlations with prospective computer use are of primary interest. The results suggest high interrelationship among computer use variable and the set of teacher thinking variables. Furthermore, teacher thinking variables seem to be significantly to one another. For instance, constructivist teaching is significantly related to all other variables. Teaching efficacy is also related to all the other variables, except for gender.

Enter Table 1 about here

5.2. Path modelling

In order to test the model, integrating the complex relationships between gender variable, teaching thinking variables, and prospective computer use variable, path analysis was applied. Figure 2 shows the resulting path coefficients of the proposed research model. The figure includes both direct and indirect effects on prospective computer use (path coefficient or $\beta$). Each variable of teaching thinking has direct effect on prospective computer use: constructivist teaching beliefs ($\beta = .23$), teaching efficacy ($\beta = .07$), attitudes toward computer in education ($\beta = .36$), computer self-efficacy ($\beta = .23$). Furthermore, gender has an indirect effect on prospective computer use, by affecting directly on constructivist teaching beliefs ($\beta = .12$).
Table 2 summarizes the fit indices when testing the proposed research model. All values satisfied the recommended level of acceptable fit. The total explained variance in prospective computer use amounts to 35% \( (r^2 = .35) \).

6. Discussion and conclusion

6.1. Teacher thinking processes and prospective ICT integration

Our study produced empirical evidence to argue that student teachers who were exposed holding more constructivist teaching beliefs, strong teaching efficacy and computer self-efficacy, more favorable attitudes toward computer in education, would be more interested to integrate computers into their future teaching practice. Among the variables about student teacher thinking process, attitudes toward computer use in education seem to be the strongest predictors of prospective computer use. This finding is in accordance with previous studies with in-service teachers (e.g., Wu & Morgan, 1989; Authors, 2004) and with pre-service teachers (e.g., Khine, 2001; Lin, 2008).

Constructivist teaching beliefs of student teachers strongly influence their prospective computer use directly and indirectly (mediated by teaching efficacy, computer self-efficacy and attitudes toward computer in education), indicating that student teachers with higher constructivist teaching beliefs are more inclined to integrate technologies into their future teaching. This finding is in line with previous studies that state constructivist beliefs consistently predict student teachers’ computer-related
behaviors (e.g., Becker & Ravitz, 1999).

As mentioned earlier, teaching self-efficacy is related to teacher behavior in the classroom. Teachers’ self-efficacy has repeatedly been reported to be a major variable to understand the frequency and success of computer use in education (Albion, 1999; Oliver & Shapiro, 1993). The former is strongly supported by our study. Teacher self-efficacy predicts - directly - student teachers’ prospective computer use in education, and indirectly via its impact on the mediating variables attitudes towards computers in education and computer self-efficacy. Computer self-efficacy is also a strong predictor of student teachers’ prospective computer use. This finding is in line with other studies that emphasize the importance of computer self-efficacy on teachers’ computer-related behaviors (e.g., Compeau et al., 1999). This implies that the more confident student teachers are about their capacity to teach or/and to use computers in education, the more likely they are to be interested in teaching with computers. This is consistent with the basic hypothesis of Bandura (1977): people high on both outcome expectancy and self-efficacy would act in an assured, decided manner.

6.2. Gender differences of prospective ICT integration

Gender of student teachers has no direct effect on their prospective computer use. This seems to be in line with other recent studies (e.g., Hong & Koh, 2002; Wood, Viskic, & Petocz, 2003). Also in the Chinese context, the same results are found; though the direct impact on prospective ICT use was not always the focus of these studies. For instance, Shapka and Ferrari (2003) did not observe any gender differences in computer related attitudes of aspiring teachers. Yuen and Ma (2002) who studied one hundred and eighty-six pre-service teachers in Hong Kong also found no significant gender differences in undergraduate trainee teachers’ attitudes towards computers.

7. Implications, limitations, and conclusions
7.1. Implications for the innovation of teacher preparation

According to our findings, ICT integration is influenced by the complex of student teachers’ constructivist teaching beliefs, teaching self-efficacy, computer attitudes in education and their computer self-efficacy. The latter implies that teacher education should reconsider its training approaches. Teacher education should be carried out in constructivist learning environment and provide student teachers with a conducive and non-threatening environment to experience success in using the computers. This will allow them to gain competence and confidence in using computers for teaching and learning (Teo, 2008). In addition, Albion (1999) stresses the need for real life experiences in classroom settings. Wang et al. (2004) claim that this might help to attain vicarious learning experiences that help to increase student teachers’ self-efficacy for technology integration. At the same time, these real life experiences are expected to influence the interrelated set of teacher thoughts (teaching beliefs, self-efficacy, attitudes, etc.) in relation to prospective educational use of technology.

7.2. Limitations and directions for further research

It should be noted that this study has a number of limitations. The quantitative research methodology is heavily based on self-report measures. Future studies could build on classroom observation of internship activities and/or interviews with student teachers. Furthermore, longitudinal studies are recommended that might be helpful to track changes in thinking processes and related teaching practices with and without educational technologies. Since the potential of ICT can differ according to specific curriculum goals and specific knowledge domains, more attention should be paid in future studies to the nature of the curriculum taught with or without ICT.

It should also be noted that the present study focused on microlevel issues of classroom practices. Available research points at the importance of e.g., school policies and related classroom practices.

7.3. Conclusion

Our study has provided insight into the interrelated nature of student teachers’
thinking processes and gender on the potential level of ICT integration in a Chinese context. The findings suggest that successful ICT integration is clearly related to the thinking processes of classroom teachers, such as teacher beliefs, teacher efficacies, and teacher attitudes toward ICT. The results underpin the importance of an integrated and concurrent understanding of teachers’ thinking processes. The study also suggests that in order to improve the innovation of classroom activities, teachers’ thinking processes should be challenged.

APPENDICES

APPENDIX A

<table>
<thead>
<tr>
<th>Constructivist Belief Scale</th>
<th>Component</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 I make it a priority in my classroom to give students time to work together when I am not directing them</td>
<td>.713</td>
</tr>
<tr>
<td>2. I involve students in evaluating their own work and setting their own goals</td>
<td>.712</td>
</tr>
<tr>
<td>3. I make it easy for parents to contact me at school or home</td>
<td>.693</td>
</tr>
<tr>
<td>4. I invite parents to volunteer in or visit my classroom almost any time</td>
<td>.659</td>
</tr>
<tr>
<td>5. An essential part of my teacher role is supporting a student’s family when problems are interfering with a student’s learning</td>
<td>.639</td>
</tr>
<tr>
<td>6. I believe that expanding on students’ ideas is an effective way to build my curriculum</td>
<td>.588</td>
</tr>
<tr>
<td>7. I prefer to assess students informally through observations and conferences</td>
<td>.560</td>
</tr>
<tr>
<td>8. I often create thematic units based on the students’ interests and ideas</td>
<td>.560</td>
</tr>
<tr>
<td>9. I invite students to create many of my bulletin boards</td>
<td>.512</td>
</tr>
<tr>
<td>10. I prefer to cluster students’ desks or use tables so they can work together</td>
<td>.509</td>
</tr>
</tbody>
</table>

| eigenvalue | 3.83 |
| % total variance | 38.33 |
### APPENDIX B

**Teacher Self-efficacy**

<table>
<thead>
<tr>
<th>Component</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. To what extent can you use a variety of assessment strategies?</td>
<td>.680</td>
</tr>
<tr>
<td>2. How much can you do to control disruptive behavior in the classroom?</td>
<td>.637</td>
</tr>
<tr>
<td>3. How much can you do to get students to believe they can do well in schoolwork?</td>
<td>.632</td>
</tr>
<tr>
<td>4. To what extent can you provide an alternative explanation or example when students are confused?</td>
<td>.618</td>
</tr>
<tr>
<td>5. How much can you do to get children to follow classroom rules?</td>
<td>.609</td>
</tr>
<tr>
<td>6. How much can you do to help your students value learning?</td>
<td>.608</td>
</tr>
<tr>
<td>7. To what extent can you craft good questions for your students?</td>
<td>.606</td>
</tr>
<tr>
<td>8. How much can you do to calm a student who is disruptive or noisy?</td>
<td>.601</td>
</tr>
<tr>
<td>9. How much can you do to motivate students who show low interest in schoolwork?</td>
<td>.586</td>
</tr>
<tr>
<td>10. How well can you implement alternative strategies in your classroom?</td>
<td>.585</td>
</tr>
<tr>
<td>11. How well can you establish a classroom management system with each group of students?</td>
<td>.565</td>
</tr>
<tr>
<td>12. How much can you assist families in helping their children do well in school?</td>
<td>.549</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>statistic</th>
<th>value</th>
</tr>
</thead>
<tbody>
<tr>
<td>eigenvalue</td>
<td>4.43</td>
</tr>
<tr>
<td>% total variance</td>
<td>36.88</td>
</tr>
<tr>
<td>alpha</td>
<td>.71</td>
</tr>
<tr>
<td>scale mean (maximum 5)</td>
<td>3.67</td>
</tr>
<tr>
<td>SD</td>
<td>.47</td>
</tr>
</tbody>
</table>

### APPENDIX C

**Attitudes toward Computers in Education Scale**

<table>
<thead>
<tr>
<th>Component</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The computer provides opportunity for improving the learning performance</td>
<td>.717</td>
</tr>
<tr>
<td>2. The efficiency of the learning process is increased through the use of computers</td>
<td>.685</td>
</tr>
<tr>
<td>3. The computer increases the level of creativity of students</td>
<td>.656</td>
</tr>
<tr>
<td>4. The computer used as a learning tool, increases student motivation</td>
<td>.649</td>
</tr>
<tr>
<td>5. Students with learning difficulties can strongly benefit from the didactic possibilities which the use of computers entail</td>
<td>.608</td>
</tr>
<tr>
<td>6. Computer knowledge and practical experience should be more integrated in the curriculum</td>
<td>.536</td>
</tr>
<tr>
<td>7. The use of computer helps students to achieve better text writing</td>
<td>.503</td>
</tr>
</tbody>
</table>
8. Computers can help the teacher to apply differentiation among the students  .399

eigenvalue  2.90
% total variance  36.3
alpha  .81
scale mean (maximum 5)  3.92
SD  .79

### APPENDIX D

<table>
<thead>
<tr>
<th>Teacher Computer Efficacy Scale</th>
<th>Component</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 . Whenever I can, I avoid using computers in my classroom</td>
<td>.818</td>
</tr>
<tr>
<td>2 . When students have difficulty with the computer, I am usually at a loss as to how to help them</td>
<td>.761</td>
</tr>
<tr>
<td>3 . I wonder if I have the necessary skills to use the computer for instruction</td>
<td>.751</td>
</tr>
<tr>
<td>4 . I generally employ the computer in my classroom ineffectively</td>
<td>.745</td>
</tr>
<tr>
<td>5 . I am not very effective in monitoring students’ computer use in my classroom</td>
<td>.702</td>
</tr>
<tr>
<td>6 . Even when I try very hard, I do not use the computer as well as I do other instructional resources</td>
<td>.676</td>
</tr>
<tr>
<td>7 . I do not know what to do to turn students on to computers</td>
<td>.671</td>
</tr>
<tr>
<td>8 . I find it difficult to explain to students how to use the computer</td>
<td>.654</td>
</tr>
<tr>
<td>9 . Given a choice, I would not invite the principal to evaluate my computer-based instruction</td>
<td>.587</td>
</tr>
</tbody>
</table>

eigenvalue  4.54
% total variance  50.44
alpha  .90
scale mean (maximum 5)  3.49
SD  .76
## APPENDIX E

### Computer Interests Scale Component

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I would use the computer as a tool to teach new subject knowledge, i.e. the pupils acquire knowledge directly from the computer</td>
<td>.756</td>
</tr>
<tr>
<td>2. I would use educational software with my pupils for learning subject knowledge through drill and practice</td>
<td>.720</td>
</tr>
<tr>
<td>3. I would use the computer to assist with differentiation or implementing individual learning plans</td>
<td>.717</td>
</tr>
<tr>
<td>4. I would encourage pupils to work collaboratively when using a computer.</td>
<td>.697</td>
</tr>
<tr>
<td>5. I would use the computer as a tool for demonstration working with presentations I have made myself (e.g., PowerPoint)</td>
<td>.688</td>
</tr>
<tr>
<td>6. I would encourage pupils in class to search for relevant information on the Internet</td>
<td>.678</td>
</tr>
<tr>
<td>7. I would use the computer as a tool for demonstration working with existing presentations, or those someone else has made for me</td>
<td>.659</td>
</tr>
<tr>
<td>8. I would ask pupils to undertake tasks or follow up classwork at home on the computer</td>
<td>.632</td>
</tr>
<tr>
<td>9. I would teach pupils to consider the implications and opportunities of computer use</td>
<td>.625</td>
</tr>
<tr>
<td>10. I would use e-mail to communicate with pupils out of school (or class time)</td>
<td>.597</td>
</tr>
</tbody>
</table>

| Eigenvalue | 4.6 |
| % Total Variance | 46.05 |
| Alpha | .87 |
| Scale Mean (Maximum 4) | 3.09 |
| SD | .53 |

### References


Authors, (2008a).


Authors, (2008b).


Authors, (2004).


Student teachers’ thinking processes and ICT integration: predictors of prospective teaching behaviors with educational technology

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Department of Educational Studies, Ghent University

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E-mail address: guoyuan.sang@ugent.be (G.Sang).

Present address: Department of Educational Studies, University of Ghent, Dunantlaan 2, 9000 Ghent, Belgium.
Dear Editor,

It is our pleasure to submit the manuscript to your journal.

The original manuscript is an empirical study in China titled “Student teachers’ thinking processes and ICT integration: predictors of prospective teaching behaviors with educational technology”. A survey was set up involving teacher education college students of four teacher education universities in China.

We claim that the manuscript has not submitted to any other journal.

We are looking forward to hearing from you.

With best regards,

Sincerely,

The authors

The information of corresponding author follows:

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E-mail address: guoyuan.sang@ugent.be (G.Sang).

Present address: Department of Educational Studies, University of Ghent, Dunantlaan 2, 9000Ghent, Belgium.
Figure 1 integrated model of the impact of gender and student teacher thinking processes on prospective classroom ICT use.
Figure 2 Path coefficients of the research model
**Table 1 Correlations coefficients for pairs of variables (N= 727)**

<table>
<thead>
<tr>
<th></th>
<th>{1}</th>
<th>{2}</th>
<th>{3}</th>
<th>{4}</th>
<th>{5}</th>
</tr>
</thead>
<tbody>
<tr>
<td>computer use</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.02</td>
</tr>
<tr>
<td>gender</td>
<td></td>
<td></td>
<td>.02</td>
<td></td>
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</tr>
<tr>
<td>constructivist teaching</td>
<td>.42**</td>
<td>.12**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teaching efficacy</td>
<td>.35**</td>
<td>-.01</td>
<td>.51**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>computer self efficacy</td>
<td>.31**</td>
<td>.02</td>
<td>.19**</td>
<td>.20**</td>
<td></td>
</tr>
<tr>
<td>computer attitudes in education</td>
<td>.46**</td>
<td>-.03</td>
<td>.35**</td>
<td>.38**</td>
<td>.02</td>
</tr>
</tbody>
</table>

**Correlation is significant at the 0.01 level (2-tailed).**

*Correlation is significant at the 0.05 level (2-tailed).

**Table 2 Summary of goodness-of-fit indices**

<table>
<thead>
<tr>
<th>Fit Index</th>
<th>Recommended Level of Fit</th>
<th>Proposed Research Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>χ2</td>
<td>n.s at p &lt; .05</td>
<td>7.389 (p = .117)</td>
</tr>
<tr>
<td>χ2 / df</td>
<td>&lt; 5</td>
<td>1.846</td>
</tr>
<tr>
<td>GFI</td>
<td>&gt; .90</td>
<td>.996</td>
</tr>
<tr>
<td>NFI</td>
<td>&gt; .90</td>
<td>.989</td>
</tr>
<tr>
<td>RMSEA</td>
<td>&lt; .05</td>
<td>.035</td>
</tr>
<tr>
<td>CFI</td>
<td>&gt; .90</td>
<td>.995</td>
</tr>
</tbody>
</table>