Internet self-efficacy and preferences toward constructivist Internet-based learning environments: A study of pre-school teachers in Taiwan

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ABSTRACT
This study was conducted to explore the relationship between Internet self-efficacy and preferences toward constructivist Internet-based learning environments. The sample included 365 college students in Taiwan who majored in early childhood care and pre-school education. Some of them were preservice pre-school teachers (n=185), and the rest of them were in-service pre-school teachers who pursued a degree for childhood care (n=180). Through analyzing student questionnaire responses, the findings revealed that general Internet self-efficacy might foster the preferences of constructivist Internet-based learning environments. In other words, when widely implementing constructivist Internet-based learning environments, a prerequisite may be the condition that the learners should have adequate general Internet self-efficacy. By using structural equation model (SEM), this study further investigated the causal relations among the variables considered in this study. The SEM analysis showed that students with higher general Internet self-efficacy clearly showed more preferences toward Internet learning environments where they can use with ease, explore real-life problems, display multiple sources of information, conduct open-ended inquiry learning activities, and elaborate the nature of knowledge. However, students with higher communicative Internet self-efficacy tended to display relatively lesser preferences for inquiry learning on the Internet.

Keywords
Internet self-efficacy; preferences toward constructivist Internet-based learning environments; pre-school teachers

Introduction
The concept of “self-efficacy” refers to an individual learner’s beliefs, expectations and perceived confidence in his/her capability to perform a task (Bandura, 1993, 1996). These beliefs pertain to optimistic attitudes about being able to cope with a variety of challenging situations or tasks (Schwarzer, Mueller, & Greenglass, 1999). Self-efficacy affects students’ choices of processing learning activities, how much effort they will devote, and how long they will sustain effort in dealing with difficult situations (Bong & Clark, 1999; Klassen, 2002). Research has revealed that students’ self-efficacy toward computers is related to their usages and performance in computer-assisted learning environments (Hill, Smith, & Mann, 1987; Kinzie, Delcourt, & Powers, 1994; Johnson, 2005; Olivier & Shapiro, 1993). Currently, students may have growing opportunities to learn by utilizing the Internet in Web-based instruction; therefore, their self-efficacy regarding the Internet (called Internet self-efficacy in this study), which may have considerable impacts on their views, usages and learning outcomes in Internet-based instruction, should become an important research topic for educators (Hill & Hannafin, 1997; Joo, Bong & Choi, 2000; Tsai & Tsai, 2003; Yi & Hwang, 2003). For example, the study by Joo, Bong and Choi (2000) has revealed that students’ Internet self-efficacy was related to their search outcomes on the web. Tsai and Tsai (2003) have concluded that Internet self-efficacy can foster better information searching strategies and learning outcomes in Internet-based environments. Hill and Hannafin (1997) have shown a similar finding that self-efficacy influences the strategies utilized in web-based learning.

Moreover, for successfully implementing Internet-based learning environments, educators, first, should study more about students’ or teachers’ preferences toward these environments (Lee & Tsai, 2005; Tsai, 2005). Researchers have pointed out that an appropriate use of Internet-based instruction concurs with the constructivist pedagogy (e.g., Passerini & Granger, 2000; Relan, & Gillani, 1997). Constructivists have asserted that learning is actively constructed by individual learner and the construction process is highly influenced by the learner’s prior knowledge, student negotiation and the cognitive apprenticeships provided by instructors or advanced peers (Brooks & Brooks,
Educators also believe that appropriate usage of Internet learning environments, such as a variety of online sources, different formats of information, online communication tools, can not only facilitate the construction process but also enhance student critical thinking and epistemological awareness (Chou & Tsai, 2002; Tsai, 2001b, 2004). Thus, constructivist Internet-based learning environments highlight the importance of prior knowledge, student negotiation, multiple sources, student-centered inquiry and proper cognitive apprenticeships (Tsai, 2001a), and obviously the environments should be ease of use to motivate engagement. In addition, constructivist Internet-based instruction also fosters critical judgment and promotes epistemological development for students. A better understanding about students’ preferences toward constructivist Internet-based learning environments is quite essential for the practice of Internet-based instruction. Certainly, these preferences have been shaped by numerous factors. As discussed previously (e.g., Joo, Bong & Choi, 2000; Tsai & Tsai, 2003), Internet self-efficacy may guide students’ views, strategies, and outcomes in Internet-based instruction; consequently, this study suggests that there are some relationships between student Internet self-efficacy and preferences toward constructivist Internet-based learning environments. If more knowledge about the relationships can be acquired, researchers can know more about how to effectively design better Internet-based learning environments and how to help students in these environments.

To explore the relationships, this study gathered questionnaire responses from a group of college students with a major of early childhood care and education in Taiwan. They were either preservice or inservice pre-school teachers. Some of their background variables, such as age and Internet usage, were also included in this study for analysis. In contemporary practice, pre-school teachers are expected to use Internet for educational purposes; however, almost no research has been conducted for probing their beliefs, views as well as their usages about the Internet. Most studies about pre-school teachers focused on child-teacher interactions (e.g., Howes et al., 2000; Frisch, 2006) or their stress and efficacy in general (e.g., Nishizaka, 2002), while only a few addressed the use of technology by pre-school teachers (Higgins, 1993). Therefore, research about pre-school teachers’ views and usages regarding the Internet deserves more attention. In particular, Taiwan government has tried to implement Internet-assisted instruction for all levels of education, and much research work has been undertaken for teachers and students, but few studies were conducted particularly for pre-school teachers (E-Learning National Project, 2006). As pre-school education has become more and more important (Bailey, 2006), a better understanding about pre-school teachers’ views about Internet-related factors may help policy makers as well as related curriculum developers to improve pre-school education in Taiwan. As a result, this study chose these Taiwanese college students (i.e., preservice and inservice pre-school teachers) for further exploration.

Moreover, the use of structural equation modeling (SEM) techniques in educational research has become increasingly popular and its usefulness has been recommended by contemporary educators (e.g., Schreiber et al., 2006; McCoach, 2003). SEM is deemed as a powerful method to examine the structurally causal relationships among constructs or variables (Kelloway, 1998). SEM is appropriate for simultaneous assessment of the relationships between multiple dependent and independent latent constructs (Hair et al., 1998). And, this technique allows not only for the specifications and testing of complex path models (Kelloway, 1998), but also for more flexible assumptions (particularly allowing interpretation even in the face of multicollinearity, Kline, 1998). However, in the field of educational technology, still only a few studies used this method (e.g., Mak, 2001; Selim, 2003). This study utilizes SEM method to explore the causal relationships between student background factors (age, Internet usage), Internet self-efficacy, and preferences toward constructivist Internet-based learning environments. In sum, the research questions of this study have included:

1. What are the sampled pre-school teachers’ Internet self-efficacy, and their preferences toward constructivist Internet-based learning environments?
2. What are the correlations between the pre-school teachers’ Internet self-efficacy and their preferences toward constructivist Internet-based learning environments?
3. What are the correlations between the pre-school teachers’ age, Internet usage, Internet self-efficacy and Internet learning environment preferences?
4. What are the differences (if any) between pre-school inservice teachers and preservice teachers in terms of their Internet self-efficacy and preferences toward Internet-based learning environments?
5. By using SEM method, what are the structurally causal relationships between age, Internet usage, Internet self-efficacy and Internet learning environment preferences?
Method

Sample

The respondents of this study included 365 volunteer college students with Internet experiences. They all majored in early childhood care and pre-school education. In general, these students were relatively low-achieving students when comparing to those with other majors (such as engineering, management or elementary or secondary education). Some of them were preservice pre-school teachers (n=185), and the others were inservice pre-school teachers who were back to college to pursue an official college degree in childhood care (n=180). The sample of this study consisted of remarkably more females (including 354 females and 11 males), as most pre-school teachers are females. Their age ranged from 18 to 50, with an average of 24.7 years. All of the participating students responded to two questionnaires administered in this study. In addition, their background information (such as Internet experiences, age, teaching experiences) was gathered. The questionnaire data, after the students’ agreement, were collected in a required course by paper-and-pencil format. Before responding to the questionnaires, all of these students had experiences of using the Internet, and by consulting with some of their course instructors, it was found that the students also had opportunities of exploring different types of instructional web systems or sites in many courses. Therefore, they had adequate background to respond to the questionnaire items.

Questionnaire exploring Internet self-efficacy

A total of 10 items were included to assess students’ Internet self-efficacy, which were adapted from the items developed by Tsai and Tsai (2003), Tsai and Lin (2004), Wu and Tsai (2006), and Peng, Tsai and Wu (2006). Internet self-efficacy indicated the self-perceived confidence and expectation of using Internet. As proposed by Tsai and Lin (2004), Wu and Tsai (2006) and Peng et al. (2006), the ten items were divided into two factors (scales), the first one addressed students’ Internet self-efficacy in general (called General Internet Self-Efficacy scale, 6 items, abbreviated as GISE), while the second one probed their efficacy for Internet-based communication or interaction (called Communicative Internet Self-Efficacy scale, 4 items, abbreviated as CISE). The following presents two sample items for the scales respectively: “I can search information on the Internet by using keywords,” and “I think I can talk to each other in online chatrooms.” Students’ Internet self-efficacy was evaluated by a five-point Likert scale from “very confident” to “very unconfident”, exactly the same as that employed by original study (i.e., Tsai & Tsai, 2003). The questionnaire items were presented in Chinese, and the items presented in this study were translated and validated by two researchers. Questionnaire responses representing their self-efficacy toward the Internet were scored as follows. A “very confident” response was assigned a score of 5 and an “unconfident” response was assigned a score of 1. The alpha reliability coefficients for these two scales were 0.86 and 0.78, and the overall alpha was 0.89. These values suggested high reliability for assessing student Internet-efficacy by using the scales.

Questionnaire for assessing preferences of constructivist Internet-based learning environments

The questionnaire for exploring student preferences toward constructivist Internet-based learning environments was modified from Constructivist Internet Learning Environment Survey, called CILES (Chuang & Tsai, 2005; Wen et al., 2004) as well as the revised version of CILES developed by Lee and Tsai (2005), Tsai (2005) and Tsai (2008). A detailed description for each CILES scale (five items for each scale), with a sample questionnaire item, is presented below.

1. Ease of use scale (EU): measuring perceptions of the extent to which students prefer that the Internet-based learning environments are easy-to-use, e.g., When navigating in the Internet-based learning environments, I prefer that they are easy to navigate.

2. Relevance scale (RE): assessing perceptions of the extent to which students prefer that the Internet-based learning environments are authentic and represent real life situations, e.g., When navigating in the Internet-based learning environments, I prefer that they present information that is relevant to me.

3. Multiple Sources (MS): exploring perceptions of the extent to which students prefer that the Internet-based learning environments contain various information sources and interpretations, e.g., When navigating in the Internet-based learning environments, I prefer that they can connect to rich relevant web resources.

4. Student Negotiation scale (SN): assessing perceptions of the extent to which students prefer to have opportunities to explain and modify their ideas to other students in the Internet-based learning environments,
e.g., In the Internet-based learning environments, I prefer that I can discuss with other students how to conduct investigations.

5. **Inquiry Learning scale (IL):** measuring perceptions of the extent to which students have the opportunities to be engaged in inquiry activity in the Internet-based learning environments, e.g., In the Internet-based learning environments, I prefer that I can find out answers to questions by investigation.

6. **Cognitive Apprenticeship scale (CA):** exploring perceptions of the extent to which students prefer to have opportunities to acquire helpful and timely guidance provided by the Internet-based learning environments, e.g., When navigating in the Internet-based learning environments, I prefer that they can provide experts’ guidance to facilitate advanced learning.

7. **Critical Judgment scale (CJ):** assessing perceptions of the extent to which students prefer to have opportunities to critically evaluate information in the Internet-based learning environments, e.g., In the Internet-based learning environments, I prefer that I can evaluate the features of various information sources.

8. **Epistemological Awareness scale (EW):** assessing perceptions of the extent to which students prefer to have opportunities to explore the value, source, merit or nature of knowledge in the Internet-based learning environments, e.g., When navigating in the Internet-based learning environments, I prefer that they can explore deeply about the nature of knowledge.

The eight scales above obviously correspond to the assertion about constructivist Internet-based learning environments discussed earlier that ease of use, prior knowledge, student negotiation, multiple interpretations, student-centered inquiry and appropriate cognitive apprenticeships should be underlined in these environments. Also, constructivist Internet-based instruction should awaken critical judgment and foster epistemological awareness for learners. It also should be noted that this study utilized “preferred” form of CILES learning environment survey, so the students were not asked to express their perceptions toward a specific Internet-based learning environment or what they actual did in a particular Internet learning environment. Rather, their preferences toward Internet-based learning environments in general were probed by the questionnaire. The use of “preferred” form in learning environment research to explore students’ views is frequent, and the students do not need to refer to specific educational context (but they need to have relevant experiences) when responding to “preferred” form survey (Fisher & Fraser, 1983; Fraser, 1994, 1998). As stated previously, all of the respondents had relevant experiences in different types of Internet-based learning environments, they could easily respond to the CILES preferred form.

In this study, each scale included five items, presented in a five-point Likert mode, ranging from the categories of “strongly agree” to “strongly disagree”, exactly the same way used by Chuang and Tsai (2005), Lee and Tsai (2005) and Tsai (2008). Consequently, a total of 40 items were included. The questionnaire items were presented in Chinese for data collection. The reliability for each scale was high (alpha ranging from 0.84 to 0.93, with overall alpha of 0.97), suggesting that CILES had sufficient reliability to assess students’ preferences toward Internet learning environments. Students showing stronger preferences for a particular feature of the constructivist Internet-based learning environments could have higher average scores on a particular scale. In addition to the questionnaires above, this study also surveyed the respondents’ age and Internet usage (on-line hours per week).

Both of the questionnaires in this study utilized a five-point Likert scale for exploring students’ views. Jenkins and Taber (1977), and Lissitz and Green (1975) have recommended that the use of five response categories is sufficient, and Tang et al., (1999) also found that there is little added benefit associated with more than six-point Likert scale. This may be due to the fact that with too many categories, the respondents may have great difficulties to distinguish the differences among response categories. Also, researchers recommended the use of odd rather than even number of response categories to help the respondents to legitimately adopt a neutral position (Cox, 1980). In addition, the response categories which are clearly labeled (such as “strongly agree” or “very confident”) can yield better reliability than those only with the end points labeled (Weng, 2004). Based on the literatures above, this study used 1-5 Likert scale with labeled response categories to probe the students’ Internet self-efficacy and their preferences toward constructivist Internet-based learning environments.

**Data analysis**

Student descriptive data on each scale of the questionnaires were reported. As each scale of the questionnaire included about five items, the total score range for each individual could be 5 to 25 (or by item mean, it could be 1, 1.2, 1.4, 1.6…4.8, 5). Therefore, we viewed the score in each scale as a continuous variable for further analysis.
Although the response categories in Likert scales have a rank order which may be conceptualized as ordinal-level measurement, it has become common practice to assume that Likert-type categories constitute interval-level measurement as well as the intervals between values are equal (Jamieson, 2004). On the issue of the usage of Likert-type rating scales, two contradictory positions have been proposed by researchers. Some researchers have argued that the use of Likert scales may produce errors in interpreting data and the relations inferred from data, while others have proposed that the threat is probably not as serious as it has brought to be and the results we get from using summated scales and assuming equal intervals are quite satisfactory (e.g., Kerlinger & Lee, 2000). For pragmatic considerations, we adopted the latter perspective.

After calculating the score of each scale (or questionnaire item mean for each scale), Pearson correlations between two scales of Internet self-efficacy and each scale of CILES were analyzed. Similarly, Pearson’s correlation analyses were undertaken to explore how age and Internet usage might be related to Internet self-efficacy and Internet learning environment preferences. The differences between pre-school inservice teachers and preservice teachers in terms of their responses on each scale of Internet self-efficacy and preferences toward Internet-based learning environments were examined by a series of t-tests. Finally, by utilizing SEM techniques, the causal relationships between age, Internet usage, Internet self-efficacy and Internet learning environment preferences were evaluated. According to Tanaka (1987), the sample size of 365, is quite sufficient for the SEM analyses in this study.

## Results and Discussion

### Descriptive data

Table 1 presents descriptive data for students’ responses on Internet self-efficacy and CILES. These students, on average, expressed better general Internet self-efficacy than communicative Internet self-efficacy (mean score 3.41 versus 3.16). Moreover, they displayed relatively stronger preferences for all aspects of constructivist Internet-based learning environments (all larger than 3.85 in 1-5 Likert scale). They showed particular attentions to the relevance and multiple sources as provided by the Internet-based learning environments (4.21 and 4.22 respectively).

| Table 1: Descriptive data for respondents’ Internet self-efficacy and scores on CILES |
|-------------------------------------------------|------|-----|
| CILES scale                                      | Mean | S.D.|
| General Internet Self-Efficacy scale (GISE)     | 3.41 | 0.53|
| Communicative Internet Self-Efficacy scale (CISE)| 3.16 | 0.63|
| Ease of use scale (EU)                           | 3.97 | 0.69|
| Relevance scale (RE)                            | 4.21 | 0.64|
| Multiple Sources (MS)                           | 4.22 | 0.60|
| Student Negotiation scale (SN)                  | 3.96 | 0.66|
| Inquiry Learning scale (IL)                     | 4.15 | 0.63|
| Cognitive Apprenticeship scale (CA)             | 4.07 | 0.65|
| Critical Judgment scale (CJ)                    | 3.85 | 0.67|
| Epistemological Awareness scale (EW)            | 4.06 | 0.65|

### The correlation between Internet self-efficacy and preferences toward constructivist Internet-based learning environments

Table 2 shows the (Pearson) correlation analysis between student Internet self-efficacy and their responses on CILES. It was found that students’ general Internet self-efficacy and their scores on each scale of CILES were all significantly positively correlated. That is, students with higher general self-efficacy tended to demonstrate stronger preferences for all aspects of constructivist Internet-based learning environments. The generally high Internet self-efficacy may foster the preferences of constructivist Internet-based learning environments. In other words, when widely implementing constructivist Internet-based learning environments, the prerequisite may be the condition that the learners should have adequate general Internet self-efficacy. However, students’ communicative Internet self-efficacy was significantly related to their responses only on selected CILES scales, such as "ease of use," "relevance," "multiple sources," and "epistemological awareness," and the correlation coefficients were low (less than r = 0.16). The communicative Internet self-efficacy, when comparing to general Internet self-efficacy, seemed
not to play a very important role on students’ preferences toward constructivist Internet-based learning environments. On the other hand, the students with better general self-efficacy tended to prefer more constructivist Internet-based learning environments.

Table 2: The correlation between Internet self-efficacy and responses on CILES

<table>
<thead>
<tr>
<th></th>
<th>EU</th>
<th>RE</th>
<th>MS</th>
<th>SN</th>
<th>IL</th>
<th>CA</th>
<th>CJ</th>
<th>EW</th>
</tr>
</thead>
<tbody>
<tr>
<td>GISE</td>
<td>0.30***</td>
<td>0.31***</td>
<td>0.36***</td>
<td>0.19***</td>
<td>0.30***</td>
<td>0.27***</td>
<td>0.14***</td>
<td>0.31***</td>
</tr>
<tr>
<td>CISE</td>
<td>0.16**</td>
<td>0.13*</td>
<td>0.15**</td>
<td>0.09</td>
<td>0.10</td>
<td>0.07</td>
<td>0.04</td>
<td>0.12*</td>
</tr>
</tbody>
</table>

***p<0.001, **p<0.01, *p<0.05

Table 3 further presents the data about how student Internet usage (on-line hours per week) and age may be related to their Internet self-efficacy and their Internet learning environment preferences. First, student Internet usage was positively related to their Internet self-efficacy (both general and communicative), but Internet usage was not significantly correlated with preferences toward Internet-based learning environments, except that there was a significant but low correlation between Internet usage and preferences of “multiple sources” (r = 0.11, p<.05). The more Internet usage may help student foster better Internet self-efficacy, but not develop stronger preferences toward constructivist Internet learning environments. Table 3 also reveals that elder students tended to have significantly lower communicative Internet self-efficacy (r = -0.18, p<0.01). However, these students (i.e., elder students) tended to exhibit stronger preferences toward many aspects of constructivist Internet-based learning environments. That is, the students with more developmental maturation seemed to place higher standards on Internet-based learning environments.

Table 3: The correlation between Internet usage, age and responses on Internet self-efficacy and CILES

<table>
<thead>
<tr>
<th></th>
<th>GISE</th>
<th>CISE</th>
<th>EU</th>
<th>RE</th>
<th>MS</th>
<th>SN</th>
<th>IL</th>
<th>CA</th>
<th>CJ</th>
<th>EW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internet usage</td>
<td>0.20***</td>
<td>0.21***</td>
<td>0.03</td>
<td>0.05</td>
<td>0.11*</td>
<td>0.02</td>
<td>0.09</td>
<td>0.00</td>
<td>0.00</td>
<td>0.05</td>
</tr>
<tr>
<td>Age</td>
<td>-0.03</td>
<td>-0.18***</td>
<td>0.17**</td>
<td>0.14**</td>
<td>0.06</td>
<td>0.14**</td>
<td>0.07</td>
<td>0.21***</td>
<td>0.12*</td>
<td>0.18***</td>
</tr>
</tbody>
</table>

***p<0.001, **p<0.01, *p<0.05

The comparison between preservice teachers and in-services teachers

The sample in this study included college students, but some of them were preservice pre-school teachers, and the others were in-service pre-school teachers who pursued a degree for childhood care. It is potentially interesting to compare the responses between these two groups of students. The comparisons are presented in Table 4. The results indicated that there were no statistically significant differences between preservice and in-service teachers in terms of their Internet self-efficacy and preferences toward Internet-based learning environments.

Table 4: The differences between preservice and in-service teachers on Internet-self-efficacy and CILES

<table>
<thead>
<tr>
<th></th>
<th>Preservice</th>
<th>Inservice</th>
<th>t</th>
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<tbody>
<tr>
<td></td>
<td>mean</td>
<td>S.D.</td>
<td>mean</td>
</tr>
<tr>
<td>GISE</td>
<td>3.43</td>
<td>0.49</td>
<td>3.40</td>
</tr>
<tr>
<td>CISE</td>
<td>3.21</td>
<td>0.58</td>
<td>3.11</td>
</tr>
<tr>
<td>EU</td>
<td>3.93</td>
<td>0.69</td>
<td>4.02</td>
</tr>
<tr>
<td>RE</td>
<td>4.19</td>
<td>0.62</td>
<td>4.23</td>
</tr>
<tr>
<td>MS</td>
<td>4.23</td>
<td>0.56</td>
<td>4.22</td>
</tr>
<tr>
<td>SN</td>
<td>3.94</td>
<td>0.65</td>
<td>3.98</td>
</tr>
<tr>
<td>IL</td>
<td>4.16</td>
<td>0.61</td>
<td>4.14</td>
</tr>
<tr>
<td>CA</td>
<td>4.01</td>
<td>0.61</td>
<td>4.13</td>
</tr>
<tr>
<td>CJ</td>
<td>3.84</td>
<td>0.64</td>
<td>3.87</td>
</tr>
<tr>
<td>EW</td>
<td>4.01</td>
<td>0.65</td>
<td>4.13</td>
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</tbody>
</table>
Structural model: the causal relation between age, Internet usage, Internet self-efficacy and preferences toward Internet-based learning environments

Through the structural equation modeling (SEM) analysis with Linear Structure RELationships (LISREL), the causal relationships for the variables considered in this study were explored. The student age, Internet usage and Internet self-efficacy were deemed as the predictor (exogenous) variables, while the preferences toward constructivist Internet-based learning environments were viewed as outcome (endogenous) variables. The structural model is presented in Figure 1. Only the relationships of gamma coefficients with significance of t-value are shown in the Figure. As suggested by previous research (e.g., Selim, 2003; Seyal, Rahman, & Rahim, 2002; Wen et al., 2004), the fit measures of the structural model in the present study indicated a satisfactory fit (Chi-square = 180.94; Goodness-of-Fit Index (GFI) = 0.92, recommended value ≥ 0.90; Normed Fit Index (NFI) = 0.94, recommended value ≥ 0.90; Comparative Fit Index (CFI) = 0.94, recommended value ≥ 0.90). Please note that the coefficient among the variables in Figure 1 is the standardized structural coefficient, rather than Pearson correlation coefficient. If the structurally causal relationship between two variables is significant, the interpretation of the coefficient is similar to regression analysis: if a standardized structural coefficient is 0.02, then the outcome variable will increase by 0.02 standard units for each unit increase in the predictor variable. Although some standardized structural coefficients in Figure 1 are relatively small, the causal relationships among these variables are still significant.

Figure 1: The structurally causal relationships between age, Internet usage, Internet self-efficacy and preferences toward constructivist Internet-based learning environments

According to Figure 1, student age had a positive effect on their preferences for constructivist Internet-based learning environments with ease-of-use, cognitive apprenticeship, and epistemological awareness. That is, the maturation of student age might lead them to prefer learning environments which were user friendly, provided expert guidance, and explored the nature of knowledge deeply. Student Internet usage seemed not to play an explicitly important role on
student Internet learning environment preferences, similar to the correlation analysis presented in Table 3, suggesting the more Internet usage did not directly guide them to develop stronger preferences toward constructivist Internet learning environments. More importantly, the structural model suggested that general Internet self-efficacy had positive effects on the preferences of many aspects of Internet-based learning environments, such as ease-of-use, relevance, multiple sources, inquiry learning, and epistemological awareness. Students with higher general Internet self-efficacy clearly showed stronger preferences toward Internet learning environments where they could use with ease, explore real-life problems, display multiple sources of information, conduct open-ended inquiry learning activities, and elaborate the nature of knowledge.

The SEM model also showed that student communicative Internet self-efficacy had no effects on all variables related to the Internet learning environment preferences, except the inquiry learning scale. Nevertheless, the structural relationship between communicative Internet self-efficacy and the inquiry learning preferences was negative. Students with higher communicative Internet self-efficacy tended to show relatively less preferences for inquiry learning on the Internet. It is also interesting to find that communicative Internet self-efficacy had no effect on the preferences of “student negotiation” scale, as this scale is directly related to (peer) communication in the Internet-based learning environments.

Conclusions and Implications

The sample of this study included college students who were also preservice or inservice pre-school teachers. This study asserted that to effectively implement constructivist Internet-based learning environments for pre-school education, a better understanding about pre-school teachers’ preferences toward these environments is quite essential. By gathering questionnaire responses from 365 pre-school teachers, some main findings were revealed by using SEM (structural equation model) techniques. SEM analysis with LISREL is a powerful method for elaborating the causal relationships among variables; and still not many studies in the field of educational technology have employed this method for investigation. SEM analysis in this study showed that students’ (or pre-school teachers’) age had a positive effect on their preferences toward a few aspects of Internet-based learning environments. More importantly, their general Internet self-efficacy, but probably not communicative Internet self-efficacy, affected their preferences toward many aspects of Internet-based learning environments. Higher general Internet self-efficacy has enhanced students’ preferences toward constructivist Internet-based learning environments. Therefore, to widely implement Internet-based instruction for pre-school education, these students (or pre-school teachers) should have sufficient general Internet self-efficacy.

Educators, then, need to find some ways to enhance student general Internet efficacy. Research has concluded that frequency of usage and relevant training are positively associated with Internet or computer self-efficacy (e.g., Durndell, & Haag, 2002; Salanova et al., 2000; Tsai & Tsai, 2003). The results derived from the present study also indicated that Internet usage was positively related to their Internet self-efficacy (presented in Table 3). Therefore, more appropriate experiences of using Internet may greatly enhance Internet self-efficacy. Again, it should be noted that, in this study, Internet usage did not directly affect student Internet learning environments preferences. But, it is possible that Internet usage influenced student Internet self-efficacy, which finally shaped their preferences toward some features of Internet-based instruction. In other words, the relationship between Internet usage and Internet learning preferences might be mediated by the factor of Internet self-efficacy.

Moreover, some researchers have developed training courses for promoting Internet self-efficacy. For example, Torkzadeh and Van Dyke (2002) proposed a computer training course and showed positive effects on student Internet self-efficacy. Hasan (2003) further suggested that course focusing on programming and graphics applications rather than spreadsheet and database applications was quite helpful for self-efficacy. The study by Torkzadeh and Van Dyke (2002) also elaborated some positive interplays between Internet self-efficacy and attitudes toward computers or Internet. Internet self-efficacy is also positively associated with better seeking approaches and learning outcomes derived from Internet environments (Hill & Hannafin, 1997; Joo et al., 2000). In sum, higher Internet self-efficacy may not only foster student preferences about Internet-based instruction, but also better attitudes, searching strategies and learning outcomes toward using Internet (Joo et al., 2000). Therefore, the enhancement of Internet self-efficacy is an important task for educators.
Finally, this study can be viewed as a pioneering study exploring pre-school teachers’ views about Internet-based learning environments by SEM method. As Internet-based instruction becomes more and more prevalent across all levels of education, educational researchers are encouraged to conduct more research about pre-school teachers’ views and usages regarding Internet-based instruction. As well, more research on Taiwanese students’ and teachers’ reactions of constructivist Internet learning projects should be undertaken in the future.

**Note**

A full list of questionnaire items either in English or in Chinese can be obtained by contacting the corresponding author (cctsai@mail.ntust.edu.tw).

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**Reference**


