

## Self-efficacy in Internet-based Learning Environments: A Literature Review

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### ABSTRACT

This paper reviews 46 papers from 1999 to 2009 regarding self-efficacy in Internet-based learning environments, and discusses three major categories of research: (1) learners' Internet self-efficacy, assessing learners' confidence in their skills or knowledge of operating general Internet functions or applications in Internet-based learning; (2) the interplay between learners' general academic self-efficacy and their Internet-based learning, and (3) learners' self-efficacy, particularly in terms of Internet-based learning. In general, students' self-efficacy plays a positive role in their attitude towards and their processes and outcomes derived from Internet-based learning. It was found that for the reviewed studies, a significant amount of research has adopted search tasks to predict students' learning outcomes in Internet-based settings, implying that search tasks may still be considered as the most commonly implemented Internet-based learning activities. All of the studies utilized questionnaires or surveys for assessing students' self-efficacy, and mostly selected students in higher education institutes as their samples. It was also found that relatively few empirical studies were conducted from the theoretical perspectives of the initially proposed concept of self-efficacy.

### Keywords

Internet, Self-efficacy, Internet-based learning, Internet self-efficacy

### Introduction

In recent years, the Internet-based environment has experienced prolific development. With multiple forms of representation, some research has indicated that content delivered in blended or Internet-based conditions may be more efficient than that is provided in traditional classrooms (Abdous & Yoshimura, 2010). However, when comparing the differences between distance education and classroom-based instruction, some studies have found no significant difference in effectiveness between distance education within blended or Internet-based learning settings and face-to-face (F2F) education (Bernard *et al.*, 2004; Delialioglu & Yildirim, 2008). Indeed, a variety of results have been derived from the studies relating to Internet-based learning (IBL). For instance, one of the features of IBL is that it is supposed to foster learners' active participation in the construction of knowledge (White & Frederiksen, 2005). Some studies have indicated positive effects on students' knowledge construction in IBL processes (Pena-Shaff & Nicholls, 2004), whereas some have reported that the discussions among learners are generally at low levels of knowledge construction in IBL systems (Guan, Tsai & Hwang, 2006). Hence, it may be suggested that due to the divergent components of the IBL context created by a variety of researchers, different traits may be produced.

Undoubtedly, a large amount of work has been devoted to constructing a preferable Internet-based setting to date. When compared with the traditional classroom setting, IBL provides many appealing attributes, which may consist of increasing the availability of learning experiences for learners who cannot or choose not to attend F2F offerings, assembling and disseminating instructional content more cost-efficiently, or enabling instructors to handle more students while maintaining learning outcome quality that is similar to that of comparable F2F instruction (Abdous & Yoshimura, 2010). Furthermore, learners can have access to the information without time limits or location constraints. That is, Internet-based settings may help learning be unrestricted to any specific moment or to any particular classroom. Thus, it is generally believed that IBL is likely to provide potential applications for students' learning activities. However, some research indicates that users' intention to continue in IBL may be low (Lee, 2010). In other words, occurrences of participants dropping out of IBL are not uncommon (Roca, Chiu, & Martinez, 2006). A number of possible explanations may account for learners' discontinuing IBL. For instance, more than a decade ago, Katz and Aspeden (1996) stated that uncertainty about how to get started and the perception that computers were too complicated were possible barriers. Indeed, research evidence has indicated that learners are unwilling to take part in IBL probably because they lack confidence in operating the system (Eastin & LaRose, 2000).

Based on a similar thought, some researchers have suggested that students' involvement in IBL may be associated with the perception of their own capabilities relating to specific skills and knowledge. They assert that such a concept, often referred to as *self-efficacy*, may play an important role in students' learning processes and learning outcomes in Internet-based classroom settings (Shakpa & Ferrari, 2003). In fact, recent empirical studies (e.g. Hoffman & Spatariu, 2008) have demonstrated that students with higher self-efficacy gain better performance in contrast to those with lower self-efficacy in Internet-based settings. Thus, with the significant importance of self-efficacy in IBL, the aim of this paper is to conduct a literature review examining the theory, evidence, and application of the relationship between self-efficacy and IBL. On the basis of such a concept, the review will firstly define a theoretical framework for exploring self-efficacy in the Internet-based context. Then, the evidence of self-efficacy in IBL and how it is connected to the original concept of self-efficacy will be explained. Finally, a collection of related empirical studies regarding self-efficacy in the IBL condition will be reviewed. In this review, three categories regarding the relations between self-efficacy and IBL are classified:

- 1) the *Internet Self-Efficacy* (ISE), which examines learners' confidence in their general skills or knowledge of operating Internet functions or applications in the Internet-based learning condition;
- 2) the interplay between *Academic Self-Efficacy* and *Internet-Based Learning* (ASE&IBL), which investigates the role of learners' general academic confidence played in the Internet-based learning condition;
- 3) the *Internet-Based Learning Self-Efficacy* (IBLSE), which explores learners' confidence in their participation and their expected performance, particularly in terms of the Internet-based learning.

### **Conceptualizing self-efficacy**

In general, self-efficacy refers to how confident an individual feels about handling particular tasks, challenges, and contexts (Bandura, 1997). It is widely considered to be derived from Bandura's (1986) Social Cognitive Theory (SCT). Bandura (1994) defines self-efficacy as people's beliefs "about their capabilities to produce designated levels of performance that exercise influence over events that affect their lives" (p.71). It is generally reported that individuals with higher self-efficacy perceive difficult tasks as meaningful challenges, despite the fact that others may find similar tasks discouraging. In Bandura's (1994) understanding, high self-efficacy "fosters intrinsic interest and deep engrossment in activities" (p.71); on the contrary, a lack of self-efficacy may cause people to have low aspirations, slacken their efforts, and give up easily. In addition, some researchers (e.g., Girasoli & Hannafin, 2008) have further indicated that learners' cognitive processes can be influenced by self-efficacy.

Furthermore, as proposed by Pajares and Schunk (2001), instead of being evaluated in general, research regarding self-efficacy should be assessed at a domain-specific or task-specific level because such measures may have greater validity and predictive relevance. In other words, domain-specific self-efficacy assessment, such as asking students to state their confidence in learning mathematics or writing, is more explanatory and predictive than omnibus measures and preferable for making general academic judgments (Pajares, 1996).

Levels of self-efficacy are usually considered to have strong validity for specific task domains, and most of the findings have suggested that self-efficacy is positively related to learners' performance. That is, a strong sense of self-efficacy can enrich human achievement in many ways (Karsten & Roth, 1998). For example, Caprara et al. (2008) indicated that the lower the decline in self-efficacy, the higher the grades and the greater the likelihood of remaining in high schools. Hoffman and Spatariu (2008) similarly demonstrated the positive effects of self-efficacy on problem-solving efficiency. Based on the above literature, when exploring the relationship between self-efficacy and IBL, it becomes important to interpret self-efficacy carefully from different perspectives.

### **Self-efficacy in IBL environment**

Recently, a great amount of research relating to self-efficacy has been carried out in the educational research community. Nevertheless, different researchers have observed learners' self-efficacy from a variety of perspectives. As a result, prior to describing relevant applications of self-efficacy in the IBL research, it may be helpful to identify appropriate definitions for different types of self-efficacy. In general, academic self-efficacy (ASE) pertains to a student's perception of academic learning (Girasoli & Hannafin, 2008), while computer self-efficacy (CSE) is defined as an individual's perceived confidence regarding his/her ability to use a computer (Compeau & Higgins, 1995; Murphy, Coover, & Owen, 1989). Likewise, general Internet self-efficacy describes people's perceptions about their own abilities to use the Internet (Tsai & Tsai, 2003), whereas IBL self-efficacy represents individuals'

confidence and self-belief in their ability to master an online course or online learning activity (Yukselturk & Bulut, 2007). For the purpose of this review and for the consistency of terminology, learners' general Internet self-efficacy is named as their ISE (Internet self-efficacy) in the present study.

In comparison with the development of computers, Internet technology is viewed as a relatively innovative invention. Therefore, before attempting to interpret the conceivable relations between self-efficacy and IBL, it is meaningful to discuss the relevant findings concerning CSE. Marakas, Yi, and Johnson (1998) defined CSE as "an individual's perception of efficacy in performing specific computer related tasks within the general computing domain" (p. 127). Thus, CSE can be considered a domain specific measure of self-efficacy that reflects a person's belief in his/her ability to perform specific computer tasks. Consistent with the original concept of the self-efficacy theory, CSE is developed over time and is thought to have influences on the consequence of learners' interactions with computers when facing obstacles (Compeau & Higgins, 1995; Murphy, Coover, & Owen, 1989). Compared with ISE-related work, more extensive literature on CSE has been published. For instance, Moos and Azevedo (2009) conducted a comprehensive literature review on the relations between computer-based learning environments and CSE. Based on their report, a number of scholars have distinguished CSE into disparate dimensions. For example, Marakas, Yi, and Johnson (1998) and Marakas, Johnson, and Clay (2007) have divided CSE into two distinct levels: general computer self-efficacy, which assesses learners' general beliefs about their computing skills (e.g., their confidence in using software to complete a computing job), and application-specific self-efficacy, which assesses confidence in using specific applications (i.e. confidence in the ability to rename a file in specific applications such as Excel or Word).

Moos and Azevedo's (2009) work synthesized the studies including those empirically examined factors related to CSE and the relationship among CSE, learners' learning outcomes, and learning processes in the computer-based learning environment. On the basis of their findings, both behavioral and psychological factors were found to be positively related to CSE, which is related to students' learning outcomes in computer-based learning environments. Besides, it was shown that this relationship may change with students' acquisition of skills or knowledge. Finally, users' CSE might be related to their navigational paths in computerized learning environments. Different from Moos and Azevedo's review on CSE, the present research specifically focuses on those studies pertaining to the relations between self-efficacy and IBL environments.

## **Method**

### **Paper selection**

In this study, the Social Science Citation Index (SSCI) database from 1999 to 2009 was used for paper selection using the following keywords for topics: Internet AND self-efficacy; web AND self-efficacy; network AND self-efficacy; e-learning AND self-efficacy; online AND self-efficacy. The first phase of the search produced 489 articles. Studies published from 1999 to 2009 were selected because Internet technology is considered to have been widely implemented in the educational realm since 1999. To illustrate, in 1999, the UNESCO Institute on Information Technologies in Education initiated and began the project the Internet in Education (UNESCO, 2003). Moreover, IBL was defined as those learning activities taking place in an Internet-based setting. Then, the data gathering procedure was directed to the subsequent selection derived from the criteria determined by three experts in the field of educational technology. The selection criteria were comprised of three principles: (a) the major purpose of the study must include at least one component probing the role of self-efficacy in any kind of IBL condition, (b) the study design should be based on an empirical methodology, and (c) the main findings of the research must be related to learning and must elaborate the application of self-efficacy in an Internet-based setting. Abstracts were first reviewed and articles were then limited according to these principles. Then, full papers were examined for the relevancy to this review. On the basis of the previously mentioned criteria and three rounds of expert panel discussions for the validation of the selection, 46 articles remained for the current review.

### **Review framework**

Four educational researchers examined the 46 papers selected, conducted content analyses by summarizing the major findings of the studies, and after two rounds of discussions, concluded three categories for this review, which could cover almost all of the topics under investigation. The first category consisted of the studies relating to learners'

general Internet self-efficacy (ISE); the second category included the investigation exploring the interplay between learners' academic self-efficacy and the Internet-based learning (ASE&IBL). The third category contained research probing learners' IBL self-efficacy (IBLSE), that is, learners' self confidence in their participation and their expected performance in an IBL setting.

Table 1. The review framework for the research regarding self-efficacy and Internet-based learning

| <b>Category</b>   | <b>Subcategory 1<br/>Role of self-efficacy in IBL</b>  | <b>Subcategory 2<br/>Alteration of self-efficacy in IBL</b> |
|---|--|---|
| <b>ISE</b> (Internet Self-Efficacy)                                     | To investigate relations between learners' ISE and learning processes or outcomes in IBL     | To probe how learners' ISE may be altered in IBL            |
| <b>ASE&amp;IBL</b> (Academic Self-Efficacy and Internet-Based Learning) | To investigate the interplay between learners' ASE and learning processes or outcomes in IBL | To probe how learners' ASE may be altered in IBL            |
| <b>IBLSE</b> (Internet-Based Learning Self-Efficacy)                    | To investigate relations between learners' IBLSE and learning processes or outcomes in IBL   | To probe how learners' IBLSE may be altered in IBL          |

Moreover, similar to the framework applied in other reviews (e.g. Lee *et al.*, in press; Tallent-Runnels *et al.*, 2006), two subcategories were further drawn. The first subcategory comprised the studies exploring the relationship between students' self-efficacy and their learning process or learning outcomes in IBL conditions. Meanwhile, the second subcategory was made up of the research probing how students' self-efficacy might be altered among different IBL contexts. Table 1 provides an outline of the research framework of the present study.

## Review Results

### Internet Self-efficacy (ISE)

According to Table 1, studies in the ISE category were divided into two subcategories. On the one hand, the investigation between learners' ISE and their learning processes or outcomes in the IBL condition was explored. On the other hand, an amount of research was utilized to probe how learners' ISE may have altered in IBL settings. A complete list of research involving learners' ISE is summarized in Table 2.

Table 2. Summary of ISE research in alphabetic order. (\* = included in both ISE and ASE&IBL categories; exp=experimental design)

| Author                      | Purpose   | Participants                             | Method    |
|-----------------------------|---|--|-----------|
| *Brown <i>et al.</i> (2003) | Find ISE changes through GlobalEd Project   | 234 high school students in US           | survey    |
| Chiou & Wan (2007)          | To investigate changes of ISE on information searching in the Internet-based condition              | 136 college students in Taiwan           | exp       |
| Chu & Tsai (2009)           | To build a model explaining ISE's influence on adult learners' preferences for IBL                  | 541 adult learners in Taiwan             | survey    |
| Hong (2006)                 | To assess ISE's role in health-related online search  | 84 US university student                 | exp       |
| *Joo <i>et al.</i> (2000)   | To test the applicability of self-efficacy theory to the context of IBL                             | 152 junior high school students in Korea | survey    |
| Lam & Lee (2006)            | To investigate the role of ISE and outcome expectations in older adults' usage of Internet          | 1000 adults in Hong Kong                 | exp       |
| Liang & Tsai (2008)         | To explore the relations between ISE and preferences for constructivist IBL                         | 365 college students in Taiwan           | survey    |
| Lu <i>et al.</i> (2007)     | To explore ISE's effect on students' likelihood of using Internet-based systems to seek information | 229 university students in US            | survey    |
| O'Malley & Kelleher(2002)   | To examine PR students' ISE in either geographically dispersed or local teams                       | 55 university students in US             | quasi-exp |

|                                |   |                                    |            |
|--------------------------------|---|------------------------------------|------------|
| Peng <i>et al.</i> (2006)      | To explore ISE & perceptions of Internet  | 1417, university, Taiwan           | survey     |
| Schmidt & Ford (2003)          | To evaluate the impact of meta-cognition activities on ISE in IBL                             | 79 undergraduates in US            | exp        |
| *Thompson <i>et al.</i> (2002) | To examine the relationship between learners' self-efficacy and their search task performance | 90 undergraduates in US            | exp        |
| Torkzadeh & Van Dyke (2001)    | To develop an appropriate ISE instrument  | 277 undergraduates in US           | survey     |
| Torkzadeh & Van Dyke (2002)    | To examine the relationship among users' training, attitude, and ISE                          | 189 university students in US      | survey     |
| Torkzadeh <i>et al.</i> (2006) | To develop and examine a contingency model of ISE   | 347 university students in US      | survey     |
| Tsai & Tsai (2003)             | To examine ISE's effect on information search strategies for IBL science learning             | 8 university freshmen in Taiwan    | case study |
| Wu <i>et al.</i> (2006)        | To investigate the relationship between students' attitude and their ISE                      | 1313 university students in Taiwan | survey     |
| Yang <i>et al.</i> (2007)      | Explore how ISE mediates IAN & IBL intention  | 368, university, Taiwan            | survey     |
| Yi & Hwang (2003)              | To predict the use of IBL by incorporating ISE  | 109, university, US                | survey     |

#### *Relations between ISE and learning processes/outcomes*

It was found that some studies had been conducted to assess learners' basic perceptions of ISE in IBL prior to the investigation of the relationship between learners' ISE and their learning processes or outcomes in the IBL condition. For instance, Torkzadeh and van Dyke (2001), Wu and Tsai (2006), and Peng, Tsai, and Wu (2006) developed a number of questionnaires in order to assess learners' basic perceptions of ISE. Torkzadeh and van Dyke (2001) used 277 responses from university students to develop and validate a 17-item ISE scale. Statistical analysis supported a three-factor model, including *surfing/browsing*, *encryption/decryption*, and *system manipulation*. According to their report, the first factor assessed learners' confidence in surfing, browsing or finding information in an IBL setting; the second factor assessed learners' confidence in decrypting or encrypting messages in an Internet-based setting; the third factor assessed learners' confidence in operating an IBL system. Evidence of reliability and construct validity were indicated in their study.

Similarly, to find out learners' fundamental perceptions of ISE, Tsai and his colleagues (Peng, Tsai, & Wu, 2006; Wu & Tsai, 2006) divided ISE into two types: *general Internet self-efficacy* and *communicative Internet self-efficacy*. General self-efficacy addresses students' Internet self-efficacy for basic functions or purposes (e.g. *I can search for information on the Internet by using keywords*), whereas communicative self-efficacy probes their efficacy for Internet-based communication or interaction (e.g. *I think I can talk to others in online chat rooms*). With a sample of 1,313 university students in Taiwan, Wu and Tsai (2006) found that students' Internet attitudes are highly correlated with not only general ISE but also with communicative ISE. It was suggested that students' Internet attitudes could be viewed as one of the important indicators for predicting ISE. In a similar way, Peng, Tsai, and Wu (2006) investigated 1,417 Taiwanese university students and proposed that students perceiving the Internet as a leisure tool (e.g. as a tour or a toy) showed higher communicative ISE than those using the Internet simply as functional technology.

In addition to probing learners' basic perceptions of ISE, Tsai and his research team also attempted to identify the conceivable relationship between learners' ISE and their learning processes or learning outcomes (Chu & Tsai, 2009; Liang & Tsai, 2008; Tsai & Tsai, 2003). For example, to examine the role of students' ISE in their information searching strategies in an IBL setting, Tsai and Tsai (2003) conducted 8 in-depth case studies and concluded that high ISE students had better information searching strategies and learned better than those with low ISE in the Internet-based condition. Moreover, in an attempt to explore the relationship between learners' ISE and their preferences for IBL, Liang and Tsai (2008) surveyed 365 Taiwanese college students and revealed that students with higher ISE (e.g. "I can search for information on the Internet by using keywords.") showed greater preferences for IBL which they could use with ease; however, students with higher communicative ISE (e.g. "I think I can talk to others in online chat rooms.") tended to display relatively weaker preferences for inquiry learning in IBL.

Recently, to establish a theoretical model to explain factors that might influence adult learners' preferences for constructivist IBL settings, Chu and Tsai (2009) gathered data from 541 participants enrolled in adult education institutes for structural equation modeling (SEM) analyses. The results revealed that ISE plays a mediating role in the relationships between Internet usage and the participants' preference for IBL, and indicates that with augmented time spent on Internet practice, adult learners' ISE, strengthening their preferences for IBL, may be increased.

Besides exploring how ISE might be associated with learner's learning processes, a certain amount of research has investigated the relationship between ISE and the subsequent use of Internet-based systems. For instance, Yi and Hwang (2003) extended the technology acceptance model by incorporating ISE to predict the use of the Blackboard system by surveying 109 university students, and concluded that ISE positively influences the decision to use Internet-based technology and subsequent actual use. Contradictory to Yi and Hwang's positive results, in an attempt to explore factors influencing students' likelihood of using the Internet to seek information, Lu *et al.* (2007) found that respondents' ISE had no significant association with their intentions to seek information on the Internet after surveying 229 international students. Similarly, with a sample of 368 undergraduates, Yang *et al.* (2007) found that the anxiety of Internet use negatively influenced ISE, whereas ISE did not significantly affect the intention to use Internet sites. Lam and Lee (2006) inquired into the role of ISE and outcome expectations in learners' usage of the Internet by a longitudinal study among 1,000 seniors in Hong Kong. Their findings generally validated the effects of ISE and outcome expectations on the Internet usage intention.

Finally, Hong (2006) explored the effects of ISE and search task specificity on the outcomes and task perseverance of finding online health-related sites that contained attributes of website accountability. In the study, 84 US university students conducted two search tasks (general and specific) that varied in the degree of task difficulty. The results showed that high ISE participants located sites higher in website accountability in the general search task than their low ISE counterparts. Besides, the participants with high ISE demonstrated more task perseverance than those with low ISE.

#### *Alteration of ISE*

A number of studies were found to utilize experimental designs and to examine how learners' ISE might be changed through an intervention or training. Take Schmidt and Ford's (2003) study for example, 42 undergraduate students received a brief introduction to metacognitive practices, in which trainees were informed to more frequently and accurately reflect on what they were learning through the program before creating Web pages, while 37 participants in the control condition began the Web-page creation training immediately. Consistent with their expectations, learners reporting greater levels of metacognitive activity during training had higher levels of ISE when compared with their counterparts.

Similarly, O'Malley and Kelleher (2002) required 55 university students majoring in public relations to develop a statement and measured their ISE before, immediately after, and 7 weeks after working in either geographically dispersed (Kansas and Hawaii) or local (Kansas only) teams. In the experimental section, two participants from Kansas State and two from Hawaii were randomly assigned to each group. The participants in the control section were also randomly assigned, but they were not assigned to collaborate with students from Hawaii. The results revealed that learners' ISE increased over time regardless of the experimental conditions.

Torkzadeh and his team members conducted several experimental studies to probe how ISE might be elevated or related to learners' Internet attitudes. Torkzadeh and van Dyke (2002) as well as Torkzadeh, Chang, and Demirhan (2006) reported the effects of training on learners' ISE and their computer user attitudes. With a 17-item ISE scale developed and validated in 2001, Torkzadeh and van Dyke (2002) reported on the effects of training on students' ISE and their computer user attitudes by utilizing questionnaires with a sample of 189 university students. Training was considered an important way of improving computer-related self-efficacy (Compeau & Higgins, 1995; Marakas, Yi, & Johnson, 1998). Therefore, the study collected questionnaire responses at both the beginning and end of an introductory computer training course. The content of the training program was not clearly reported in Torkzadeh and van Dyke's (2002) study, but they suggested that the training significantly improved the students' ISE. Besides, respondents with a favorable attitude toward computers were found to have higher ISE scores than those with an unfavorable attitude; and male respondents consistently reported higher than females for ISE on both the pre- and post-training scores.

Torkzadeh, Chang, and Demirhan (2006) developed and examined a contingency model of learners' CSE and ISE. With measures of user attitude, computer anxiety, computer self-efficacy, and Internet self-efficacy, the authors analyzed the survey responses of 347 university students from multiple sections of a training course like information technology infrastructure and decision support systems.. The result suggested that the training programs significantly improved learners' CSE and their ISE. Besides, respondents with favorable attitudes toward computers improved their ISE significantly more than those with unfavorable attitudes. Respondents with low computer anxiety improved both their CSE and ISE significantly more than those with high computer anxiety; however, the interaction effect between attitude and anxiety was only significant for the CSE scores but not for the ISE scores.

Finally, Chiou and Wan (2007) investigated the change of ISE on information searching in an Internet-based condition. The students receiving low-difficulty manipulation (i.e., allowing a longer search period) obtained a higher level of ISE, whereas those receiving high-difficulty manipulation (i.e., allowing a shorter search period) possessed a lower level of ISE. The results indicated that the enhancement effect of positive task experience (such as low-difficulty tasks) on self-efficacy was more pronounced for individuals with lower levels of ISE on information searching in Internet-based settings, whereas the deteriorating effect of negative experience was more prominent for individuals with higher levels of ISE on information searching in the Internet-based condition.

### *Summary of ISE research*

In conclusion, research found in the ISE category mainly focused on developing and validating methods of assessing learners' ISE and exploring its relationship with those factors likely to play a role in students' learning processes or outcomes in the IBL condition. To name a few, the relations among students' ISE and their attitudes, strategies, and preferences were examined.

Besides, some researchers also paid attention to gender-related issues while making efforts to link ISE with the abovementioned constructs. It is generally believed that computer-related tasks are more advantageous for males than females (Li & Kirkup, 2007). Although some studies (e.g. Wu & Tsai, 2006; Torkzadeh & van Dyke, 2002) have actually found that male students reveal better ISE than their female counterparts, a report of 234 high school participants conducted by Brown et al. (2003) suggested that either boys' or girls' ISE regarding a specific simulation ILE named GlobalEd Project had revealed similar patterns.

Interestingly, when taking measures to explore learners' levels of ISE, a majority of the studies (e.g. Joo, Bong, & Choi, 2000; Thompson, Meriac, & Cope, 2002; Tsai & Tsai, 2003) adopted the behavior or the performance of search tasks as students' learning outcomes. To illustrate, Thompson, Meriac, and Cope (2002) found positive correlation between ISE and the number of correct search results produced. Joo, Bong, and Choi (2000) stated that students' scores on the Internet-based search tests were significantly and positively predicted by their ISE. Hence, it may be suggested that search tasks is regarded as the most commonly implemented IBL activities at the present stage.

### **Interplay between academic self-efficacy and Internet-based learning (ASE&IBL)**

According to Bandura (1997), ASE is defined as students' expectations of how successful they will be in the classroom. There is no doubt that issues relating to ASE have been extensively researched (Pajares, 1996; Schunk & Pajares, 2002); however, most of the investigations are not related to the learning occurring in Internet-based contexts. Therefore, in the present review, the ASE&IBL category was specifically drawn to discuss the interplay between learners' ASE and IBL settings.

At first, it was found that a variety of methods and objectives characterized the research comprising the ASE&IBL category. To name a few, ASE was disclosed to be associated with goal orientation (Sins *et al.*, 2008), self-regulated learning (Crippen & Earl, 2007; Yukselturk & Bulut, 2007; Joo *et al.*, 2000), and motivational beliefs (Yukselturk & Bulut, 2007; Tai, 2006) in IBL settings. Moreover, it was found that, on the one hand, most of the non-experimental studies have investigated the relationship between learners' ASE and their motivational constructs influencing pupils' IBL processes or outcomes. On the other hand, the experimental research was inclined to the comparisons among diverse types of learning environments. More specifically, to probe potential variations, some were conducted

within a variety of forms of the IBL setting, but some were implemented within both Internet-based and traditional F2F learning conditions. It was proposed that different extents of students' ASE may have been derived from the differences in these learning environments. The studies involving ASE&IBL issues are summarized in Table 3.

Table 3. Summary of ASE&IBL research in alphabetic order. (\* = included in both ISE and ASE&IBL categories; exp=experimental design)

| Author                           | Purpose   | Participants                                       | Method              |
|----------------------------------|---|--|---------------------|
| *Brown <i>et al.</i> (2003)      | To find ISE changes through GlobalEd Project  | 234 high school students in US                     | survey              |
| Crippen & Earl (2007)            | To create an Internet-based program which improves user performance and supports well-structured problem solving    | 66 university students in US                       | quasi-exp           |
| Farel <i>et al.</i> (2001)       | To show IBL effect on professional development and practice   | 28 staffs in US                                    | exp                 |
| Francescato <i>et al.</i> (2006) | To compare learners' ASE between collaborative F2F and IBL groups   | 50 university students in Italy                    | exp                 |
| Francescato <i>et al.</i> (2007) | To compare learners' self-efficacy in developing professional skills in collaborative F2F and IBL courses           | 166 university students in Italy                   | survey<br>interview |
| *Joo <i>et al.</i> (2000)        | To test the applicability of self-efficacy theory to contexts of IBL  | 152 junior high school students in Korea           | survey              |
| Kitsantas & Chow (2007)          | To examine how ASE varied across four different instructional environments  | 472 college students in US                         | quasi-exp           |
| Meyer <i>et al.</i> (2002)       | To assess the impact of using the Internet-based setting where elders provided tutoring for students                | 12 adults (62-80 yrs old) and 60 5th-graders in US | exp                 |
| Sins <i>et al.</i> (2008)        | To test relations among learners' AS, goal orientation, cognitive processing, and achievement in collaborative IBL  | 60 pre-university science majors in Holland        | survey              |
| Tai (2006)                       | To test how the effect of training framing from supervisors on trainees' AS may influence the overall effectiveness | 126 employees in Taiwan                            | exp                 |
| *Thompson <i>et al.</i> (2002)   | To examine the relationship between learners' self-efficacy and their search task performance                       | 90 undergraduate students in US                    | exp                 |
| Waldman (2003)                   | To examine the role AS played in students' use of the library's electronic resources                                | 340 university students in US                      | survey              |
| Yukselturk & Bulut (2007)        | To examine relationship among learner selected variables, AS, self-regulated learning, and their success in IBL     | 80 online students in Turkey                       | survey<br>interview |

#### *Relations between ASE and IBL processes/outcomes*

As stated, a number of studies (i.e. Sins *et al.*, 2008; Waldman, 2003; Yukselturk & Bulut, 2007) have explored how ASE, coupled with other motivational constructs, plays a role in students' successful IBL. That is, they have sought to find out how ASE may be associated with students' IBL processes or IBL outcomes.

Sins *et al.* (2008) tested 60 11<sup>th</sup>-grade students' conceptual model of the relationship between students' achievement goal orientation and their ASE with respect to a modeling task in an Internet-based setting, where learners could collaborate online by means of a synchronous chat on inquiry assignments for science courses. The study found that learners' mastery-approach goal orientation and their ASE were both positively related to their achievement in the modeling task and their use of deep cognitive processes.

Similarly, in an attempt to find out what might influence students' IBL of programming, Yukselturk and Bulut (2007) analyzed and examined the relationship among 80 online learners' selected variables (i.e. gender, age,



educational level, locus of control, and learning style), motivational beliefs (i.e. intrinsic goal orientation, extrinsic goal orientation, control beliefs, task values, self-efficacy, and test anxiety), self-regulated learning components, and their success in an Internet-based setting. The study result showed that although learners' ASE and their intrinsic goal orientation beliefs were correlated with their IBL success, they did not enter the final prediction model in the regression analyses. This finding was somewhat contradictory to Pintrich and de Groot's (1990) research outcomes, in which respondents' ASE and their intrinsic motivation significantly affected their achievement.

In a similar way, to encourage students to use library facilities and electronic resources, Waldman (2003) conducted a study to understand what factors may have promoted students to seek out information in a library setting. Previous research showed that students' ASE might be related to their academic achievement outcomes (Bandura, 1997; Pajares, 1996). Therefore, Waldman (2003) analyzed 340 university freshmen's responses concerning their library/computer usage and their ASE. The research finding showed that the students who expressed interest in learning about the library's electronic resources were more likely to have higher ASE for completing the learning task. Moreover, students with higher ASE for completing the task tended to use the library more often. The study outcome was consistent with other research on self-efficacy (e.g. Ren, 2000), suggesting that self-efficacious students have a tendency to be more active in academic work and to use resources available to them.

Finally, Thompson, Meriac, and Cope (2002) examined the relationship between learners' self-efficacy (including both general ISE and ASE) and their search task performance in the IBL condition. A total of 90 participants were required to search the Internet and to list the names of the industrial-organizational psychologists they found. The findings indicated that the improvement in both ISE and ASE could lead to higher online performance.

#### *Alteration of ASE by IBL*

Whereas the research discussed above mainly deals with how ASE may influence or be related to students' learning processes and outcomes in an Internet-based setting, the following studies observe how ASE may be altered in different Internet-related learning conditions. It was found that some studies measured the learners' ASE within IBL conditions only (e.g. Crippen & Earl, 2007; Meyer et al., 2002), while others intended to compare learners' differences of ASE between traditional F2F classroom settings and Internet-based situations (e.g. Francescato et al., 2006, 2007; Kitsantas & Chow, 2007).

Crippen and Earl (2007), Meyer et al. (2002), and Tai (2006) have evaluated participants' ASE among Internet-based conditions only. Crippen and Earl (2007) described a quasi-experimental study, wherein expert modeling was believed to improve ASE, and worked examples served as expert models in their study. A total of 66 students were randomly assigned to one of three conditions: a worked example group, a worked example/self-explanation group, and the control group. In the end, the combination of worked example with self-explanation prompt was reported to improve students' performance, problem solving skills, and ASE in terms of whether personal goals were achieved.

Meyer et al. (2002) assessed the impact of using a structured strategy as a base for an intergenerational Internet tutoring program, in which 12 older adults provided tutoring for 5th-grade students to learn the strategy through an instructional Internet-based system. The structured strategy was considered to allow readers to build mental representations similar to the text's hierarchical organization of important ideas. Sixty students were randomly assigned to one of three groups: (a) a tutoring group, in which the students worked on the Internet-based system using the structured strategy with a tutor; (b) a group in which the students worked independently on the same Internet-based instruction without a tutor; and (c) a control group, in which the students did not receive instruction in the structured strategy. The results showed that both tutors and children in the structured strategy group with tutors increased their ASE.

Likewise, to examine the effects of training framing from supervisors on trainees' ASE and training motivation in IBL, Tai (2006) surveyed 126 employees entering a training program introducing computer software operation and design, and further tested how these variables may have influenced the overall training effectiveness. The 126 employees were asked to complete a series of questionnaires at the beginning, the midpoint, and the end of the course. The results indicated that supervisors training framing could be used to predict trainees' ASE, which subsequently affected their reactions, learning, and motivation.

As mentioned earlier, other researchers have intended to identify the differences in learners' ASE between traditional F2F classrooms and IBL settings. The exploration of such differences may illustrate the role or the effects of IBL on students' ASE. For example, Francescato *et al* (2006, 2007) compared learners' self-efficacy between traditional F2F and IBL conditions within a computer-supported collaborative learning (CSCL) setting in particular. Francescato *et al.* (2006) implemented a pilot study, in which 50 psychology major students were required to learn the same material in the F2F and Internet-based classroom settings. The results indicated that participants in both groups achieved similar growth in their levels of ASE, social self-efficacy, and self efficacy for problem solving. Collecting data from a different sample, Francescato *et al.* (2007) conducted the other study with 166 students in similar experimental conditions. Different from the previous study, the results of the second research found statistically significant increases only in learners' social self-efficacy and self-efficacy for problem solving for both groups, but not in their ASE. On the basis of their study outcomes, no significant increase in learners' ASE for both F2F and Internet-based CSCL conditions was found; thus, it may be suggested that the Internet-based CSCL environment could be regarded as efficient as traditional F2F classroom settings in increasing learners' social self-efficacy and self-efficacy for problem solving, but the effects on ASE may vary across the two studies.

Kitsantas and Chow (2007) examined how college students' help-seeking behavior varied across three different instructional learning environments. A total of 472 students enrolled in distance, distributed, and traditional classes were queried about their help-seeking preferences, help-seeking tendencies, personal threat in seeking help, and ASE. The research findings showed that, regardless of the class in which they were enrolled, the students' academic achievement was positively associated with their ASE. These results were consistent with previous research findings, in which ASE was positively inter-correlated and predicted achievement, and students with higher ASE for successful problem solving displayed greater performance monitoring and persisted longer than those with lower ASE (Pintrich & de Groot, 1990).

Finally, in an attempt to examine the changes in self-efficacy through Internet-based courses, one study concerning medical professional training was reported. Farel, Umble, and Polhamus (2001) discussed the effect of an analytical skills training course on medical professional development and practice. Through a one-year Internet-based program, the study found that 28 participants' ASE increased significantly, suggesting that the Internet-based analytical and technical training initiatives could offer a promising means for reaching public health professionals, and provide an alternative opportunity for off-site workshops. With the IBL, in-service professional practitioners could acquire easier access to and adoption of training to meet their needs, which may have led to greater motivation as well as increased ASE.

### *Summary of ASE&IBL research*

Because students' perceptions of ASE are considered to be important in their use of self-regulated strategies (Zimmerman & Martinez-Pons, 1990), an amount of research (e.g. Crippen & Earl, 2007; Yukselturk & Bulut, 2007; Joo, Bong, & Choi, 2000) has probed the potential interplay between learners' ASE and their self-regulated learning activities in Internet-based settings. Furthermore, a number of studies (e.g. Joo, Bong, & Choi, 2000; Brown, et al., 2003; Thompson, Meriac, & Cope, 2002) were found to query not only learners' ASE but also their ISE. For instance, Joo, Bong, and Choi (2000) tested the applicability of self-efficacy theory to the contexts of a specific Internet-based condition, in which learners had to conduct several search tasks. They found that learners' perceptions of ASE could predict their performance measured by written tests, whereas their perceptions of ISE were significant in predicting their search test performance. These results give evidence to support that learners' ASE is more associated with achievement measured by a conventional assessment mode, while learners' ISE is related to their performance in operating Internet-related functions. Similarly, Brown et al. (2003) discussed gender issues in terms of learners' ASE and ISE. They found no difference between the two genders and concluded that both boys and girls revealed similar patterns of responses for both kinds of self-efficacy. Finally, Thompson, Meriac, and Cope (2002) examined learners' ASE and ISE in the IBL condition and suggested that improvement in both self-efficacies could lead to higher online performance. This conclusion was consistent with Bandura's (1986) assertion, indicating a reciprocal interaction between learners' self-efficacy and their performance. Therefore, when Girasoli and Hannafin (2008) reviewed the potential importance of designing scaffolds in the Internet-based condition, they suggested that both students' ASE and their general ISE should be taken into consideration and intentionally promoted.

### Internet-based learning self-efficacy (IBLSE)

The category of IBLSE is made up of the research which examines learners' confidence in their participation and their expected consequent performance particularly derived from IBL activities. A number of features were found among the studies.

First of all, rather than developing a full instrument particularly evaluating learners' IBLSE, most researchers only included a factor with a limited number of questions in their surveys. Several reasons may account for a lack of relevant research. First, a large number of participants are required for the development of surveys, and it may somehow be difficult for researchers to have access to a large group of individuals possessing complete IBL experiences. IBLSE-related instruments can be context dependent and susceptible to a specific kind of IBL programs. Thus, it becomes difficult for other researchers to validate a questionnaire previously utilized in other research with different types of IBL activities. Thus, IBLSE-related instrument or factor may only play a minor role in many of the studies (e.g. Chang & Tung, 2008; Liaw, 2008; Tsai, 2009).

Besides, compared with the research concerning ISE or ASE&IBL, studies relating to IBLSE seem to be widely applied to certain established models. A certain amount of research was found to comply with the Technology Acceptance Model (TAM) and its associated implementation regarding the IBLSE construct.

Finally, very little research aimed to investigate the changes of learners' IBLSE. Instead of implementing experimental designs, a large amount of research has merely presented relational/co-relational data within this category (e.g. Artino, 2008; Johnson, Hornik, & Salas, 2008; Wang & Newlin, 2002). A limited number of experimental studies may suggest that, rather than observing the possible differences among diverse learning conditions, IBLSE-related research seems to have explored the interplay between learners' self-efficacy in terms of IBL and their academic outcomes in such learning activities, or their satisfaction with Internet-based programs. A complete list of studies involving IBLSE issues is provided in Table 4.

Table 4. Summary of IBLSE research in alphabetic order. (exp=experimental design)

| Author                       | Purpose  | Participants                              | Method    |
|------------------------------|--|---|-----------|
| Artino (2008)                | To investigate the relations between learners' IBLSE and their satisfaction                | 646 undergraduates in US                  | survey    |
| Bates & Khasawneh (2007)     | To propose a mediated model where a set of antecedent variables influenced students' IBLSE | 288 university students in US             | survey    |
| Bolman <i>et al.</i> (2007)  | To investigate the usability of the IBL system   | 808 unders, friends & families in Holland | exp       |
| Chang & Tung (2008)          | To add IBLSE as one of the factors to propose a new hybrid TAM.                            | 212 undergraduates in Taiwan              | survey    |
| Choi <i>et al.</i> (2007)    | To suggest an IBL success model based on flow theory                                       | 223 vocational school students in Korea   | quasi-exp |
| Johnson <i>et al.</i> (2008) | To develop a model by adding social presence to learners' IBLSE.                           | 345 university students in US             | survey    |
| Lee (2006)                   | To investigate factors affecting the adoption of the IBL through TAM                       | 1085 university students in Taiwan        | survey    |
| Lee & Lee (2008)             | Suggest a research model based on relations of IBLSE and IBL system perception             | 225 unders in Korea                       | survey    |
| Liaw <i>et al.</i> (2007).   | To explore instructors' and learners' attitudes toward IBL                                 | 30 instructors & 168 unders in Taiwan     | survey    |
| Liaw (2008)                  | To examine relations among learner satisfaction, IBLSE, and IBL effectiveness              | 424 university students in Taiwan         | survey    |
| Moneta <i>et al.</i> (2007)  | To evaluate students' affective learning in IBL  | 414 undergraduates in Hong Kong           | quasi-exp |
| Ong & Lai (2006).            | To explore gender differences among dominants affecting IBL acceptance                     | 156 employees in Taiwan                   | survey    |
| Park (2009)                  | To investigate students' adoption of IBL via SEM technique with LISREL program             | 628 university students in Korea          | survey    |

|                      |   |                                   |           |
|----------------------|---|-----------------------------------|-----------|
| Tsai (2009)          | To examine differences between conceptions of learning and of IBL | 83 college students in Taiwan     | interview |
| Tung & Chang (2008a) | To study nursing students' behavioral intentions to use IBL       | 267 university students in Taiwan | survey    |
| Tung & Chang (2008b) | To propose a new hybrid technology acceptance model (TAM)         | 228 university students in Taiwan | survey    |
| Wang & Newlin (2002) | To investigate if students' IBLSE would predict their performance | 122 college students in US        | quasi-exp |

#### *Relations between IBLSE and IBL processes/outcomes*

As stated, most of the findings revealed in the IBLSE-related studies pertain to certain established models. Consequently, IBLSE is frequently utilized as a predicting factor which may influence or be related to students' learning processes or outcomes. Moreover, it was also noted that a majority of the research pays attention to the application of the Technology Acceptance Model (TAM). For example, Park (2009) surveyed 628 university students' adoption of IBL using the structural equation modeling technique. A general structural model including IBLSE was developed, and IBLSE was found to be the most important construct for the participants' intention to use e-learning. Similarly, Lee (2006) probed the factors affecting the adoption of an IBL system by surveying 1,085 Taiwanese university students online. The research evidence was found to lend support to the original TAM findings, in which students' IBLSE was demonstrated to significantly relate to their perceived ease of use. Hence, it was considered important to develop an easy-to-use system and to increase participants' IBLSE.

In a similar way, on the basis of questionnaire responses collected from 67 female and 89 male employees in six international companies based in Taiwan, Ong and Lai (2006) explored gender differences in perceptions and relationships among factors affecting the acceptance of IBL. The research findings showed that although females' rating of IBLSE was lower than males', females' perception of IBLSE played a more important determinant role in affecting their behavioral intention to take part in IBL. It was hence suggested that gender issues should be taken into consideration when developing relevant theories.

Furthermore, in a series of studies probing learners' intention to engage in IBL, Chang and Tung (2008) and Tung and Chang (2008a, 2008b) proposed new hybrid models in which TAM was combined with the innovation diffusion theory. According to their research results, IBLSE was one of the critical factors which may have an impact upon students' behavioral intentions. At first, Chang and Tung (2008) combined the innovation diffusion theory and TAM, and added two research variables comprising of perceived system quality and IBLSE to study students' behavioral intentions to use an IBL course. With an analysis of questionnaire responses from 212 undergraduate students who were using online learning course websites in Taiwan, the study found that IBLSE had a positive effect on students' behavioral intention to use the online learning course websites.

Similarly, derived from the questionnaire responses from 267 nursing students of six universities in Taiwan, Tung and Chang (2008a) reported that IBLSE had a positive effect on learners' behavioral intention to use the Internet-based nursing program. Finally, Tung and Chang (2008b) added four variables, including computer anxiety, IBLSE, perceived financial cost, and perceived information quality. Based on 228 questionnaires collected from nursing students who had taken Internet-based courses in Taiwan, they found the more confident students were in their ability to use IBL (i.e., higher IBLSE), the more likely they were to take part in Internet-based courses.

Likewise, deriving from the notion of TAM, a three-tiered Technology Use Model (3-TUM) was developed by Liaw, Huang, and Chen (2007) and Liaw (2008) to investigate how individuals' IBLSE influences their satisfaction and behavioral intention regarding IBL programs. In their studies, 3-TUM was defined as integrated multidisciplinary perspectives comprising motivation, social cognitive theory, theory of planned behavior, and TAM. In Liaw, Huang, and Chen's (2007) study, a total of 30 instructors were asked to answer a series of questionnaires. The result indicated that instructors' behavioral intention to use the IBL program was positively influenced by their perceived IBLSE. Similarly, derived from 424 university students' survey responses, Liaw (2008) stated that users' perceived IBLSE played a positive role in determining students' satisfaction with and behavioral intention to use Internet-based systems.

Though Lee and Lee (2008) did not directly refer their study to the notion of TAM, they proposed a research model adopting IBLSE as a moderating variable to investigate learners' perceptions of the quality of an IBL system. Their study result indicated that higher IBLSE group was more sensitive to the effectiveness and usefulness of the system and was aware of the contextual information quality (e.g. the variety of the lectures) than those with lower IBLSE. On the contrary, the lower IBLSE group was found to be more sensitive to the effect of the ease-of-use of the system and paid more attention to the representational information quality (e.g. the consistency of the lectures). This outcome may suggest that learners with different IBLSE have diverse opinions about IBL activities.

While some studies have specialized in issues concerning TAM, others are concerned with the relationship between learners' perceived IBLSE and their satisfaction with IBL settings. As an instance, Artino (2008) surveyed 646 undergraduates and concluded that learners' IBLSE and their perception of the learning environment were significantly positive predictors of their satisfaction. Likewise, Johnson, Hornik, and Salas (2008) developed a model of e-learning effectiveness, which added social presence to other frequently studied variables, such as users' IBLSE, perceived usefulness, course interaction, and effectiveness. With an examination of survey responses from 345 individuals, they found that learners with higher IBLSE were more satisfied with the course than those with lower IBLSE.

Still others demonstrated the relationship between students' IBLSE and their learning outcomes in the IBL condition. For instance, to examine students' personal choices when taking Internet-based courses, Wang and Newlin (2002) investigated 122 college students and tested whether learners' IBLSE would predict their performance in the Internet-based sections of the class. The results showed that students' perceived IBLSE were predictive of their final exam scores. Moreover, students showing curiosity about the Internet-based program revealed higher IBLSE and had better class performance than those taking part in the course solely due to availability.

Similarly, Bolman *et al.* (2007) investigated the usability of a navigation support tool, which guided learners by generating advice on the next best step to take in a self-directed Internet-based course. Although they found that the navigation tool had not increased learners' IBLSE, it was indicated that learners with high IBLSE had completed more modules, adhered more often to the advice given, and were convinced that the navigation tool helped them plan the course. Therefore, it was suggested to incorporate IBLSE enhancing strategies in the navigational support of IBL activities.

#### *Alteration of IBLSE*

Among the reviewed papers, little research directly examined how IBLSE might be altered by certain types of IBL. Rather, these studies utilized "indirect" methods of investigation to reveal some potential avenues of fostering IBLSE. For instance, Bates and Khasawneh (2007) considered that evaluating the mediating role of IBLSE could provide a better understanding of the functional properties or potential enhancement of IBLSE and further clarify what factors might account for the differences among individuals in their participation in IBL activities. Accordingly, they proposed a mediated model to seek and to identify a number of theoretically based factors, which were believed to contribute to the development of IBLSE. On the basis of 288 university students' survey responses and self-reports, the research results revealed a partially mediated model, in which the block of antecedents (i.e. students' previous success with the IBL, instructor feedback, anxiety, pre-course training, and the perceived nature of IBL ability) had a direct effect on the dependent variables (i.e. students' outcome expectations, mastery perceptions, and the hours spent per week using the IBL technology to complete assignments for university courses) as well as an indirect effect through their influence on IBLSE. The finding was considered consistent with Bandura's (1982) premise that one of the strongest sources of self-efficacy beliefs is an individual's direct experience with the same or a similar phenomenon. It was proposed that instructional strategies, providing positive learning experiences with the IBL, may play a vital role in enhancing learners' IBLSE, fostering positive expectations, and encouraging their use of the technology.

With a sample of 223 learners taking part in an Internet-based program, Choi, Kim, and Kim (2007) confirmed that flow experience and attitude towards IBL had significant impacts on learners' IBLSE. Therefore, to enhance the effectiveness of IBL, it may not be sufficient to focus solely on learners' preferences; instead, to increase students' experience involvement, or intrinsic interest may be some possible ways to enhance learners' preferences, which may consequently contribute to students' IBLSE.

Besides, in an attempt to investigate students' conceptions of learning in the F2F condition, conceptions of IBL, and the differences between these conceptions, Tsai (2009) analyzed 83 Taiwanese college students' interview transcripts. The findings derived several categories of conceptions of F2F traditional-type learning and IBL, and it was suggested that the conceptions of IBL were often more sophisticated than those of F2F learning. In addition, learners' questionnaire responses revealed that the sophistication of the conceptions of IBL was associated with better searching strategies as well as higher IBLSE. These findings highlighted the need for fostering students' conceptions of learning by Internet-based environment, as they may enhance more sophisticated learning strategies and IBLSE.

Finally, different from previous research designs, one study was found to compare students' learning outcomes within a variety of classroom settings. Moneta and Kekkonen-Moneta (2007) assessed 414 students on not only affective learning (including intrinsic engagement, extrinsic engagement, and negative affect) but also IBLSE in an introductory computing course, which was taught once in a lecture format and twice in a rich interactive multimedia online format. IBLSE was assessed by a questionnaire item. The research results found that the IBL modules fostered more intrinsic engagement and higher IBLSE.

### *Summary of IBLSE research*

In conclusion, while looking into the research relating to learners' IBLSE, probing their confidence in the participation and expected performance in the Internet-based activities, a great number of studies (e.g. Chang & Tung, 2008; Liaw, Huang, & Chen, 2007) were found to deal with the extended development of established models. For example, the notion of TAM is extensively applied in the relevant research. Moreover, some studies (e.g. Artino, 2008; Johnson, Hornik, & Salas, 2008) have discussed the relation between users' IBLSE and their satisfaction with IBL, whereas others (e.g. Bates & Khasawneh, 2007; Choi, Kim, & Kim, 2007; Tsai, 2009) were found to perceive IBLSE as a predictor or a mediator of students' learning outcomes in an Internet-based setting.

Indeed, by assessing students' IBLSE, researchers may have acquired indications about their expected outcomes derived from IBL activities. In fact, this finding may have also resulted from the fundamental feature of IBLSE, in which IBLSE was utilized to evaluate learners' perceptions of their learning in an Internet-based setting. Therefore, it may have been somehow unavoidable to associate IBLSE with the students' evaluation of their satisfaction or performance with regards to IBL.

Compared with the research found in the ISE and ASE&IBL categories, it was noted that relatively few studies (Moneta & Kekkonen-Moneta, 2007) had been conducted to compare learners' IBLSE among different learning environments. However, it was found that providing positive learning experiences with IBL activities (Bates & Khasawneh, 2007; Choi, Kim, & Kim, 2007) or the sophistication of the conceptions of IBL (Tsai, 2009) may have played an important role in enhancing learners' IBLSE.

Finally, several studies were found to probe learners' IBLES in specific domains in particular. For example, Chang and Tung (2008) and Tung and Chang (2008a, 2008b) examined students' IBLES in nursing contexts, whereas others investigated their IBLES in IBL of management (Lee & Lee, 2008), psychology (Wang & Newlin, 2002) or service academy (Artino, 2008). In general, the research results have indicated a positive influences of IBLES on either learners' intention, performance, or satisfactory toward IBL.

## **Discussions and Conclusions**

### **State of self-efficacy research in IBL environments**

Because of the increasingly important role self-efficacy plays in Internet-based learning (IBL), the relationship between self-efficacy and IBL has been widely investigated in the last decade. Consequently, the present study has collected and investigated 46 research papers published from 2000 to 2009 concerning these relations for a comprehensive literature review. Research is classified into three major categories: the Internet Self-Efficacy (ISE); the interplay between Academic Self-Efficacy and Internet-Based Learning (ASE&IBL); and the Internet-Based Learning Self-Efficacy (IBLSE).

Regarding the category of ISE research, the studies generally focus on the relationship between learners' Internet self-efficacy and learning processes. The relations among students' ISE and their attitudes, strategies, and preferences have been frequently examined. It is worth noting that because of the prolific development of Internet-based instruction, which has elicited various forms of IBL activities, research concerning ISE is likely to assess students' confidence in their skills or knowledge of operating specific Internet applications (such as communication) in IBL contexts instead of evaluating learners' ISE in general.

As for research regarding ASE&IBL, it is found that students' ASE is often applied to correlate with their performance, motivation, and perceptions of the effectiveness of Internet-based systems. In general, students' ASE has had positive effects on their academic outcomes resulted from IBL.

Finally, research on learners' IBLSE, which investigates learners' confidence in their expected performance in IBL, is discovered to mainly deal with the application of established models. For instance, a great amount of research has been arranged on the notion of Technology Acceptance Model (TAM). Moreover, IBLSE was found to be perceived as a predictor of students' learning outcomes and their satisfaction with IBL activities. In general, IBLSE was shown to have impacts on learners' satisfaction with IBL.

### **Evaluation of self-efficacy research in IBL environments**

According to the original theory proposed by Bandura (1982, 1994), the source of self-efficacy is derived from multiple sources of efficacy information, including enactive mastery (e.g., past performance accomplishments resulting from previous experiences or training), verbal persuasion such as that resulting from collaboration and performance-related corrective feedback, and physiological arousal including changes in emotional states such as anxiety, fear, or positive anticipation. However, except for Francescato et al. (2006, 2007) and Johnson, Hornik, and Salas' (2008) reports concerning social persuasion, Bates and Khasawneh (2007), Yang, et al. (2008), and Chiou and Wan's (2007) investigation on mastery experiences, and Moneta and Kekkonen-Moneta's (2007) paper regarding affection arousal, relatively few empirical studies were found researching from the initially proposed concept of self-efficacy.

In addition, deriving from Moos and Azevedo's (2009) review of computer self-efficacy (CSE), three major findings were suggested: First, both learners' behavioral and psychological factors are related to CSE; secondly, CSE pertains to students' learning outcomes in computer-based learning (CBL) environments; and finally, CSE was found to be associated with users' navigational paths. In comparison with their findings, the current study found similar trends but somehow varied results in the research on self-efficacy in IBL environments. For instance, the results of research concerning the relationship between students' self-efficacy and their behavioral factors were found to be inconsistent in this current study. On one hand, some study findings revealed that ISE (Chu & Tsai, 2009; Lam & Lee, 2006; Yi & Hwang, 2003) or IBLSE (Chang & Tung, 2008; Liaw, Huang, & Chen, 2007) are related to students' subsequent use of IBL systems; on the other hand, others (Lu et al., 2007; Yang et al., 2007) stated that ISE had no significant effect on their following participation in IBL activities. This might imply there is a difference between the roles of CSE and ISE played in CBL and IBL environments respectively, indicating different natures could exist between CSE and ISE as well as between CBL and IBL.

Aside from the inconsistent findings about the relations between learners' self-efficacy and their behaviors, investigation outcomes on the relationship between students' self-efficacy and their psychological factors (such as perceived attitude, anxiety, and usefulness) seem to be consistent in this current study. Studies have, in general, indicated a positive relation between students' ISE and their attitude towards IBL (Peng, Tsai, & Wu, 2006; Torkzadeh, Chang, & Demirhan, 2006; Wu & Tsai, 2006) and a negative relation between learners' ISE and their perceived anxiety (Lam & Lee, 2006; Torkzadeh, Chang, & Demirhan, 2006; Yang et al., 2007).

Moreover, consistent with Moos and Azevedo's (2009) findings, the relationship between students' self-efficacy and their achieved outcomes in IBL was found to be positively correlated. For instance, Tsai and Tsai (2003) stated that students with higher ISE had better information search strategies and learnt better than their counterparts. Thompson, Meriac, and Cope (2002) found positive relations between students' self-efficacy (including both ISE and ASE) and the number of correct search results produced. In the ASE&IBL category, various researchers (Sins et al., 2008; Wang & Newlin, 2002; Yukselturk & Bulut, 2007) have claimed that ASE could serve as a positive predictor of

learners' final achievement in the IBL condition. Similarly, in the IBLSE category, Bolman et al. (2007) also revealed a positive relationship between learners' IBLSE and their IBL outcomes.

Furthermore, it was noted that when attempting to take measures probing learners' perceptions of self-efficacy, a significant amount of research (e.g. Chiou & Wan, 2007; Joo, Bong, & Choi, 2000; Thompson, Meriac, & Cope, 2002) has adopted *search tasks* to predict students' learning outcomes in the Internet-based setting because search tasks may still be considered as the most commonly implemented IBL activities. Nevertheless, in contrast to Moos and Azevedo's (2009) findings concerning CSE, no relevant research in this review was found on the relationship between individuals' perceived self-efficacy in the Internet-based setting and their navigational paths. More research may be needed to investigate on the relationship.

Finally, some methodological issues may be worthy of notice. First, it seems that all of the Internet-related research concerning self-efficacy is based on questionnaires or surveys for measuring self-efficacy. Researchers should find other ways of assessing students' Internet-related self-efficacy, such as interviews or observation. Most of the studies in this review employed a quantitative approach; qualitative or mixed research approaches are recommended for future research. In addition, among the 46 papers reviewed, 35 studies used university students as their samples. In other words, most of the participants invited to take part in the related studies were either undergraduates or graduate students in universities. It may be necessary to encourage learners with various kinds of demographic backgrounds to take part in the relevant research. Meanwhile, among the reviewed papers, 19 studies in America, 22 studies in Asia, and 5 studies in Europe were reported. Relevant research based on European samples is relatively rare. Finally, within all of the reviewed studies, only students' or employees' perceptions were probed; it may be interesting to investigate instructors' perceptions of Internet-related self-efficacy.

### **Future study**

Because the papers selected for the current review were limited to those included in the SSCI database, other relevant research regarding self-efficacy may still be found to outline a more comprehensive review. Future studies can explore the differences between students' perceptions about CBL and IBL as well as compare students' CSE and ISE, simultaneously, in order to further examine the relationship between CSE and ISE. Secondly, researchers can further examine the construct of three categories of self-efficacy in IBL by assessing the significance and power of using ISE, ASE and IBLSE to predict students' IBL performances or outcomes. This could help researchers and educators realize more about the relationships among the three variables and learning outcomes in IBL environments. Thirdly, future studies can examine the relationship between students' perceived self-efficacy and their learning behaviors in specific Internet-based learning context such as the online search tasks mentioned above. Finally, more qualitative methods are suggested for future Internet-related self-efficacy assessments.

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