

How Self-Efficacy Affects Students' Performance and Pace in Self-Directed Learning with ICT

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Abstract: Due to the fact that not only most Self-Directed Learning (SDL) studies remains discussed at the undergraduate or adult level, but also ICT in education has been positively proved as a compelling factor for the children, a SDL with ICT scenario is described in this paper. In SDL, with or without the assistance or guidance from the classroom teacher, students learn by their own during the learning activity, in which the students will identify their needs, set their goals, take learning missions, and reflect their learning outcome by reviewing their finished learning missions and performance. However, although students' self-efficacy affects how the students own the perception on self-management or goal accomplishments (Ormrod, 2006), limited discussion is found for exploring self-efficacy in SDL with ICT. Therefore, in this study, students are pre-categorized into high and low self-efficacy groups for exploring the effect of self-efficacy for SDL with ICT. As a result, the result shows that students' self-efficacy might not be a crucial factor that affect students' performance or pace, with only a slightly higher gain score on performance is found in this study.

Keywords: Self-directed learning, SDL, self-efficacy, ICT

1. Introduction

Self-Directed Learning (SDL) is believed as an essential andragogy in promoting students' individualization (Knowles, 1975). However, the original design of SDL lies within adults or adolescents (Gibbons, 2003; Knowles, Holton, Swanson, 2012), and consequently limited discussions were found at the elementary level. The reasons to the phenomenon, on the one hand, might be due to the children's maturity or cognitive engagement problems (Guthrie, 2004; Pressley, 2006; Taylor, Pearson, Peterson, & Rodriguez, 2003). On the other hand, the rationale for most of the public elementary curriculum restricts the flexibility for individual students' development, even though every student holds different capability in learning. Nevertheless, with regards to the aforementioned problems, compare to children in decades before, most of the children nowadays, could be more independent from the parents or teachers, and they could be more capable to learn individually (Glaubman, Glaubman, & Ofir, 1997; Philips & Stipek, 1993). Therefore, an increasing number of researchers pay attention to the development of SDL at the elementary level (Teo, Tan, Lee, Chai, Koh, Chen et al., 2010), but only a few studies discussed the ICT adoption in public schools with SDL. Followed by the master plan from the government, Teo et al. explored the possibilities of SDL with technology readiness in terms of learning goals, resource allocation, planning, monitoring, and reassessment of learning strategies.

Moreover, most studies have empirically proved the positive effects for students' cognition or affection by using ICT in education. In other words, ICT shows potential in public classrooms for education. Therefore, it could be concluded that the computer technology not only allowed students to be more engaged, but also led to a significant improvement on learning performance. In addition, since students' self-efficacy affects how the students manage to finish the learning goals for the learning activity (Kim, 2009), the effect for the self-efficacy in SDL should be considered. Hence, with regards to the importance of SDL and the positive effect of ICT, this study designs a SDL scenario that based on

the rationale by various researchers related to SDL, and provides a preliminary analysis for the effect of different levels of self-efficacy that related to students' performance and pace.

2. Related Work

2.1 The research related to Self-Directed Learning

Self-Directed Learning (SDL) helps promote students individuality in learning and illustrate how the students' intention and action for learning individually (Tough, 1971; Knowles, 1975; Knowles, Holton & Swanson, 2012). The original idea for SDL could be traced to Tough's study, which was called "self-planned learning". In Tough's study, he found that most students or learners frequently applied the 3Ws (what, where, and when) in learning. The 3Ws could be considered as guidance for designing the SDL scenario, where students should be able to determine what to learn, where to start, and when to finish the leaning activity. Besides, researchers like Tough and Knowles both shared the similar concept in SDL, but Knowles had later popularized the term "Self-Directed Learning" and offered many learning resources for students and teachers to apply SDL in classrooms. For example, Knowles and his colleagues believed that, in SDL, students are responsible for their decisions in the learning activity, while students would set and develop their personal goals, revise and reflect their own pace or learning experience. In addition, Knowles (1975) also proposed six steps for the implementation of SDL in classrooms:

- Setting the classroom environment
- Learning needs
- Learning goals
- Identifying learning resources
- Applying suitable learning strategies
- Evaluating the learning outcome

The six steps presented above played an essential role for the adoption of SDL in the classrooms, because the steps emphasized on the transformation of the classroom learning from teacher-centered to student-centered, and focused on not only the knowledge acquisition, but also the personal reflection for the learning outcome. Therefore, followed by the SDL concept by Tough or Knowles, a researcher such as Gibbons (1994, 2002) provided specific criteria for SDL in practice. More specifically, to facilitate SDL in classrooms, from Gibbons' two studies, he suggested various criteria from two perspectives that are related to the development of the SDL framework, in which adolescents learned under the guidance by the school teachers. (See Table 1).

Table 1: Gibbons' two studies for facilitating SDL in classrooms.

Teacher's perspectives (Gibbons, 1994)	Students' perspectives (Gibbons, 2003)
● To let the students acquire knowledge from the school teacher ● To let the students learn how to teach oneself ● To let the students learn how to direct their learning individually	● To develop students' skill ● To achieve best performance with additional challenges ● To be self-managed ● To be self-motivated and be able to assess the learning outcome on their own

From the two perspectives mentioned in Table 1, the study by Gibbons (1994) emphasized on how to let the students acquire certain skills from the teacher, while his later study (Gibbons, 2003) highlighted the students' personal development, such as self-management or self-assessment. This could be referred that the weight for the feasibility of SDL in classrooms might be transformed from teachers' perspectives to the students', but we believed that there existed certain reasons that both the teacher and students' perspectives should be taken into consideration. For that reason, the design of this study would enhance the students' individuality and teacher's management for students' learning experience.

Accordingly, based on the idea of SDL by various researchers, a few studies discussed their application for SDL with ICT. For example, Robertson (2011) applied a blog-based system for students to learn in a self-directed way. In addition, followed by the master plan for education in the country, Teo et al. (2010) developed a questionnaire for SDL with ICT readiness by two pilot studies. Tan, Divaharan, Tan, & Cheah (2011) viewed SDL as a natural learning process, in which students' ownership, teachers' monitoring and management for students' learning were discussed at the elementary level, and they provided practical examples or experience for overcoming the adoption on SDL with ICT in education. Consequently, using the applications in SDL with ICT as references, the design of this study would be further discussed in Section 3.

2.2 Self-efficacy and SDL

Since students have to set their goals and strive for self-directness in SDL, students' self-efficacy, which indicates students' personal perception to success (Coutinho & Neuman, 2008), was believed as a positive relation with SDL (Kim, 2009). For the studies related to self-efficacy, most of the studies were derived from Bandura's Social Learning Theory (Bandura, 1997), in which self-efficacy refers to one's belief and capabilities for the learning outcome. Also, many researchers examined the difference for self-efficacy between high and low achievement students (Shell, Bruning, & Colvin, 1995; Stephenson, Poissant, & Dade, 1999; Stipek, 2002). In their studies, the researchers concluded that different levels of self-efficacy would result in a difference on performance expectations, because students with high self-efficacy would set a higher goal, task persistence, apply effective learning strategies, and time management than the students with low self-efficacy.

Besides, as the emergence of ICT in education show positive outcome for effective learning, studies discussed the self-efficacy with ICT. For example, Teo (2009) examined the technology acceptance by the pre-service teachers on self-efficacy, while the self-efficacy was believed to have a direct effect related to the ICT readiness, which might affect the learning outcome for the learning activity. The other study, Liaw (2008) also provided evidence that the self-efficacy is also a critical element that affects students' usage with ICT. Therefore, it is important to examine students' self-efficacy in SDL. With regards to the discussion above, this study will explore the effect of different levels of self-efficacy, in terms of students' pace and performance.

3. Design

The essence of SDL emphasizes on students' individualization. To this end, this study designs a SDL environment based on the design principles originally proposed by Knowles (1975). With regard to the discussion in Section 2, this study designs mechanisms for SDL used in classrooms. In figure 1, the three components: students, the teacher, and the system would be described as follows:

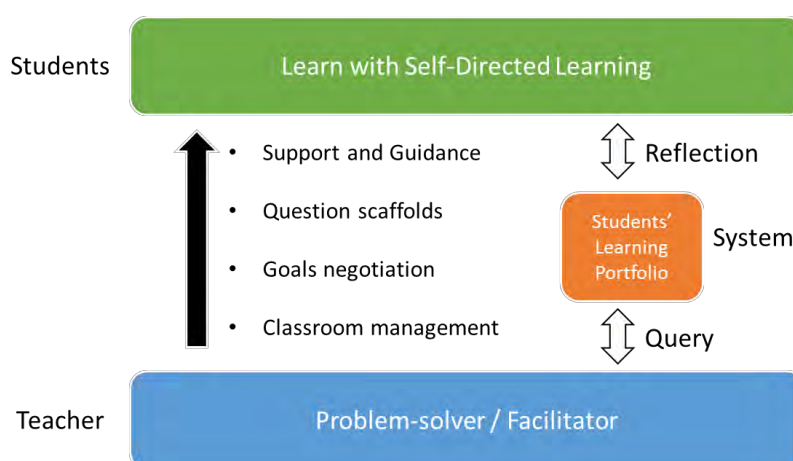


Figure 1. The design framework in this study.

3.1 Students: learn in a self-directed way

Students learn in SDL way, in which interactive learning missions (Chen, Liao, Cheng, Yeh, & Chan, 2012) would be provided as the major learning material during the learning activities. Most of the learning missions are designed based on the spiral curriculum, and these learning missions, along with some drill and practice games (Ku, Chen, Wu, Lao, & Chan, 2014), could be formulated by the concept understanding and procedural fluency (Kilpatrick, Swafford, & Findell, 2001). In the first 40-minute class of every week, students would first review their finished learning missions, then they have to decide how many learning missions and the performance should reach during the learning activity. During this learning process, students would be able to review their needs as well as reflect their learning experience, and set an appropriate goal.

3.2 Teacher: become a facilitator or a problem-solver

For the teacher, s/he is required to look into students' needs, and offer suitable directions for students to solve the problem in learning. For example, since most students could be able to work on their learning missions individually, a few students, especially low-achievers or those are easily distracted, are needed to be "coached" one-by-one. Moreover, according to the information provided by the system, the teacher would be able to support or provide guidance to the students, offer questions scaffolds that help resolve the mathematical problems, review and negotiate students' learning goal via the learning system, and maximizing the classroom management (such as offering bonus).

3.3 System: play as a learning portfolio for fulfilling the needs

The computer technology would make the SDL adoption in classrooms easier. Compares to the past, teachers or instructors were needed to review students' learning process one-by-one. This was quite time-consuming and the classroom teacher were barely to evaluate all students' learning carefully. Therefore, the design of this study takes the advantage of ICT, by offering real-time database inquiry for both students and the teachers. On the one hand, students can retrieve the status of their learning experience, which helps review and reflect their learning. On the other hand, teachers could be support by the system, in which the every students' learning status (such as accomplished learning missions, goals, and performance) can be accessed via the teachers' monitor.

4. Method

This section describes how the study is conducted. Students were randomly distributed in every class, and most of the students (> 90%) brought their parent-purchased tablet PC to the school. Every time when the mathematics class starts, students would turn on their table PCs and visit the web-based learning platform on their own. Nonetheless, due to the fact that most students own different self-efficacy in learning, it is needed to understand the different levels of self-efficacy among the students. To this end, since various studies applied the Motivated Strategies Learning Questionnaire (MSLQ, Pintrich, 1990) for understanding students' difference, this study adopted the self-efficacy for learning & performance scale in MSLQ. However, the original manuscript of MSLQ is used for adults and is in English, this study applied a localized version by Hsin, Lin, Yeh (2005), and the Cronbach alpha is 0.72.

Before the activity starts, the localized MSLQ was distributed to the students. Thirty-one effective samples were returned from two Grade 2 classes in a public school (See Table 2). As a result, to classify the effects of different levels of self-efficacy, students were categorized into two groups: high and low level of self-efficacy. Students with the above average score would be considered as high self-efficacy group, while the students with below average would be assigned to the low self-efficacy group. In addition, in order to understand the effect on self-efficacy, the performance and the pace were collected in both the pre-test and the post-test.

Table 2: Gibbons' two studies for facilitating SDL in classrooms.

Group of students	Class A	Class B	Total
HiSE group	10	6	16
LoSE group	7	8	15
Total	17	14	31

5. Results

In order to understand how students' self-efficacy affects students' performance and pace, this section describes preliminary analysis for both the pace and performance with independent t-test. To this end, a group of 31 students were divided into two groups based on the quantitative result by the MSLQ questionnaire (see Section 3), i.e. high and low self-efficacy groups (HiSE and LoSE), separately. For the students who own an above-average result, will be assigned to HiSE group (n=16), while the students who own a below-average result, will be the LoSE group (n=15). In this study, the result demonstrates that HiSE students do not have a significant difference with the LoSE students on both performance ($t = -1.105$, $p > .05$) and pace ($t = .984$, $p > .05$). It implies that the students' differences on different levels of self-efficacy would not be a factor that might affect students' learning performance and pace. The reason to this phenomenon might due to the limited flexibility for individuals in the public classrooms, and consequently no significant difference was found on students' performance and pace.

Table 3: The comparison of pace between high and low self-efficacy groups with independent t-test.

Group of students	Mean (number of missions)	SD	d.f.	t	p
HiSE	240.13	11.05	29	-1.105	.278
LoSE	245.67	9.20			

First, as stated in Table 3, the result for students' pace shows that the HiSE group has no significant difference with the LoSE group, and the HiSE group (mean: 240.13) is slightly lower than the LoSE group (mean: 245.67). This implies that HiSE students would not be beneficial by the difference on the self-efficacy with LoSE students. It might be due to the fact that some of the students in LoSE group have reached the maximum pace (eight students, the maximum pace: 256), and while most of the students in HiSE group is comparatively slower. Second, for the performance (See Table 4), no significant difference is found between the two groups of students. This implied that students with high self-efficacy would not result a difference with the low self-efficacy students. Nevertheless, we notice that an increase on the gain score for the performance of HiSE students, but a decrease for the performance of LoSE students. It could be explained that although no significant difference is found for the gain score, students with different levels of self-efficacy might lead to a slightly difference for the learning performance.

Besides, the average pace and performance in the samples for high self-efficacy have a slightly lower score than the low self-efficacy students. We believed that it might be due to the ceiling effects or some outliers existed among the students.

Table 4: The comparison of performance between high and low self-efficacy groups with independent t-test.

Group of students	Mid-term (Mean)	Final (Mean)	Gain score (Mean)	s.d.	d.f.	t	p
HiSE	86.50	87.06	0.56	4.163	29	.984	.333
LoSE	90.73	89.87	-0.81	3.907			

6. Conclusion

With regard to the emerging importance for SDL in the education, students learning capabilities on different perspectives (such as individual differences, learning habit) should be considered. Therefore, this study provides a preliminary exploration on the self-efficacy for both the performance and the pace in the SDL environment. Hence, in order to understand the effects between students with different levels of self-efficacy, this study addresses a SDL scenario into the public classrooms in Taiwan. As a result, students with different levels of self-efficacy did not show significant differences on both performance and pace. This indicates that the self-efficacy would not be an index for understanding students' difference for learning in SDL. However, this study is only a preliminary study and analyze for self-efficacy in SDL. Additional exploration should be carefully addressed. For example, the sample size of this study is too small (HiSE group = 16, LoSE group = 15), and additional samples are needed to be done. Also, Further, this study provides a preliminary evidence and analysis on self-efficacy for SDL with ICT, and could be a reference on the adoption of SDL with ICT in education.

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