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INFLUENCE OF SELF-DIRECTED LEARNING USING SMART DEVICES ON LEARNING PERFORMANCE: BASED ON MOTIVATION THEORY

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Abstract. *The development of new information communication technologies enables learners to learn more efficiently, effectively, comfortably, and flexibly. Education using smart devices, as a concept that describes learning in digital age, has gained increased attention. The purpose of this study is to examine how self-directed learning affects the behavior of individual in terms of learning motivations (perceived usefulness and perceived enjoyment). Also, we try to examine how much learning motivations influence learning performance through learning satisfaction. This study found that self-directed learning and learning motivations were positively related to learning performance through learning satisfaction.*
Keywords: Self-directed learning, Learning motivation, Learning satisfaction, Learning performance

1. **Introduction.** Recently, the Fourth Industrial Revolution has not only changed the future society but also has a big ripple effect on the universities. The development of information communication technology (ICT) has developed a digitized user environment for learning. In addition, there has been an increase to carry their own individual smart devices (e.g., smartphone, laptops, tablet personal computers, and e-book readers) that contain excellent computing performance [1].

Educational environments have shifted from traditional teacher-oriented learning to individual-oriented self-directed learning (SDL), reflecting the constructivism paradigm, which requires new learning methods such as smart-learning [2]. The role of future professor is not to teach knowledge but to advise and guide students why they should learn.

Recently, learning using smart devices is gaining in popularity as educators do not realize any more that learning must take place in the traditional educational setting. And learning using smart devices has had a great effect on improving learning motivation and performance. It can promote innovative teaching, self-directed learning, and cooperative learning. Learning motivation is one of the factors that can influence the learner's self-directed learning and can be the driving force for self-directed learning activities [3]. Therefore, smart devices have great potential of facilitating more innovative educational methods.

Despite the benefits of learning using smart devices, few studies have analyzed the structural relationship between self-directed learning, learning motivation, and learning performances. The purpose of this study is to identify the casual relationship among self-directed learning, learning motivation, learning satisfaction, and learning performance in smart devices education environment.

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2. **Literature Review and Hypothesis Development.** Smart education has gained significant attention in recent years. Smart learning environment is to provide self-direct learning and self-motivated which learners can attend courses at their own pace and are able to access the personalized learning content according to their personal difference [3,4]. Zhu et al. [3] claimed that a four-tier framework of smart educations and ten key features of smart learning environments are proposed for fostering smart learners who need master knowledge and skill of the new learning.

Self-directed learning research is still quite important [2,5], and some other academic disciplines have recently begun to integrate this area of study such as marketing, finance, human resource, and information systems. The role of motivation in the learning process and outcomes has also recently been extended to the smart learning context [5].

Prior studies have widely used motivation theory to explain an individual's behavior in accepting information technology [6] and smart learning education [2,5]. Motivation has been linked with the satisfaction and final grades of students and other learning outcomes when combined with learner self-discipline. Liu and Chu [7] and Jung [2] suggested that learning motivation in any learning setting stimulates learner's passion for learning, providing them with opportunities to master learning materials.

Jung [2] proposed that ubiquitous characteristics as well as learner characteristics had significant effects on satisfaction with u-learning and that this satisfaction had a positive effect on expectation. Joo et al. [8] also suggested to identify the casual relationship among self-regulated learning, perceived usefulness, perceived ease of use, satisfaction, academic achievement, and persistence in cyber university education. Koivisto and Hamari [9] suggested that gamification refers to designing information systems to afford similar experiences and motivations as games do, and consequently, attempting to affect user behavior. The self-directed aspects of learning (the choice of what, when, and how long to study) which social media and other technologies provide have significant consequences in the effectiveness of the user's learning efforts [10].

There are many variables that have been theoretically and empirically related to learning; in this study, we focus specifically on self-directed learning and learning motivation using smart devices. This study expects that self-directed learning and learning motivation (perceived usefulness and perceived enjoyment) to learn will be positively related to learning satisfaction and learning performance. Our research model is shown in Figure 1.

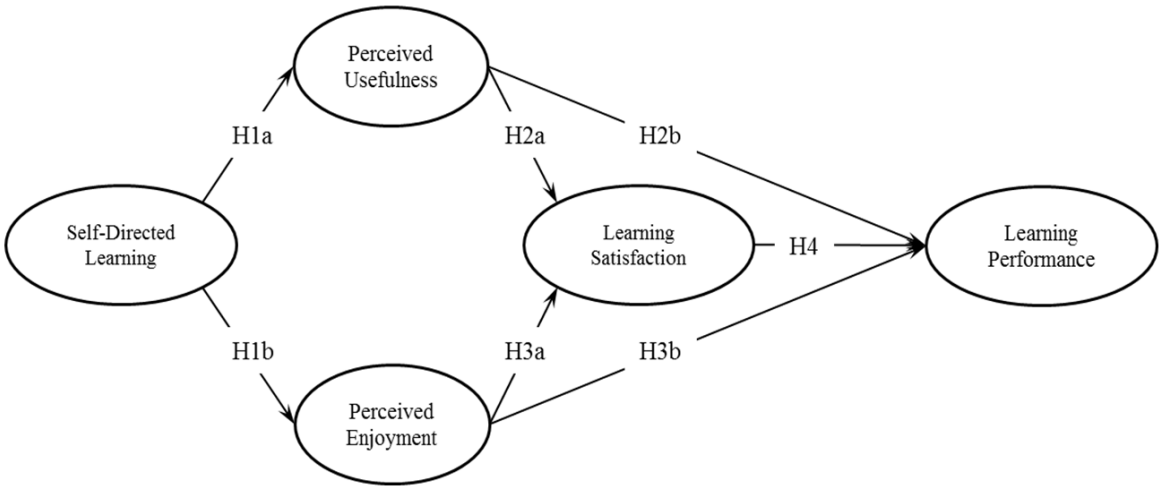

FIGURE 1. Research model

H1a: Self-directed learning (SDL) will be positively related to perceived usefulness.
H1b: Self-directed learning (SDL) will be positively related to perceived enjoyment.
H2a: Perceived usefulness in SDL will be positively related to learning satisfaction.

H2b: Perceived usefulness in SDL will be positively related to learning performance.
H3a: Perceived enjoyment in SDL will be positively related to learning satisfaction.
H3b: Perceived enjoyment in SDL will be positively related to learning performance.
H4: Learning satisfaction in SDL will be positively related to learning performance.

3. **Research Methodology.**

3.1. **Sampling and data collection.** The sample was selected from individuals who had usage experience of smart devices learning in South Korea. A total of 372 responses were collected through online and offline surveys. Among these, 8 were discarded because of missing or inappropriate data. As a result, a total of 364 responses were used to test the proposed research model.

Table 1. Demographic characteristics

Respondent profiles ($N = 364$)	Item	Frequency	Percentage (%)
Gender	Male	186	51.1
	Female	178	48.9
Age	10-19	35	9.6
	20-29	204	56.0
	30-39	67	18.5
	40+	58	15.9
Used brand	Samsung	167	45.9
	LG	51	14.0
	Apple	113	31.0
	Others	33	9.1

3.2. **Measurement model.** In this research, structural equation modelling (SEM) was used to evaluate a proposed model. For the analysis of the data, we assessed a partial least square (PLS) approach using SmartPLS2.0 software. Before testing the structural model, the reliability and validity of the measurement model were assessed through item reliability, internal consistency, and discriminant validity.

The cross loadings presented in Table 2 suggest that all the items load significantly on their posited constructs, ranging from 0.687 to 0.882. Reliability was examined by using the indicator loadings and the composite reliability (CR). Indicator loadings and CR values for most items are greater than 0.8. Three measures of reliability for internal consistency were used: Cronbach's, composite reliability and average variance extracted. For Cronbach's, a minimum value of 0.7 is considered as a cut off value for existing scales. Also, the average variance extracted (AVE) overall values were all above the 0.6 suggested for each construct.

3.3. **Structural model.** Results of the analysis for the structural model are presented in Table 3. Hypotheses 1a and 1b predicted that self-directed learning would be positively related to (a) perceived usefulness ($b = 0.339$) and (b) perceived enjoyment ($b = 0.162$) to motivation to learn.

Hypothesis 2a, which predicted that perceived usefulness ($b = 0.193$) would be positively related to learning satisfaction, was accepted. Hypothesis 2b predicted that perceived usefulness ($b = 0.169$) would be positively related to learning performance. Hypothesis 3a, which predicted that perceived enjoyment ($b = 0.518$) would be positively related to learning satisfaction, was accepted. Hypothesis 3b predicted that perceived enjoyment

Table 2. Measurement item and convergent validity

Construct	Item	Cross loadings	Composite reliability	Cronbach's α	AVE
Self-directed learning	SL1	0.761	0.867	0.776	0.685
	SL2	0.849			
	SL3	0.869			
Perceived usefulness	PU1	0.882	0.928	0.896	0.762
	PU2	0.857			
	PU3	0.876			
	PU4	0.876			
Perceived enjoyment	PE1	0.864	0.872	0.781	0.696
	PE2	0.870			
	PE3	0.764			
Learning satisfaction	LS1	0.806	0.888	0.831	0.664
	LS2	0.835			
	LS3	0.842			
	LS4	0.776			
Learning performance	LP1	0.776	0.866	0.794	0.620
	LP2	0.841			
	LP3	0.835			
	LP4	0.687			

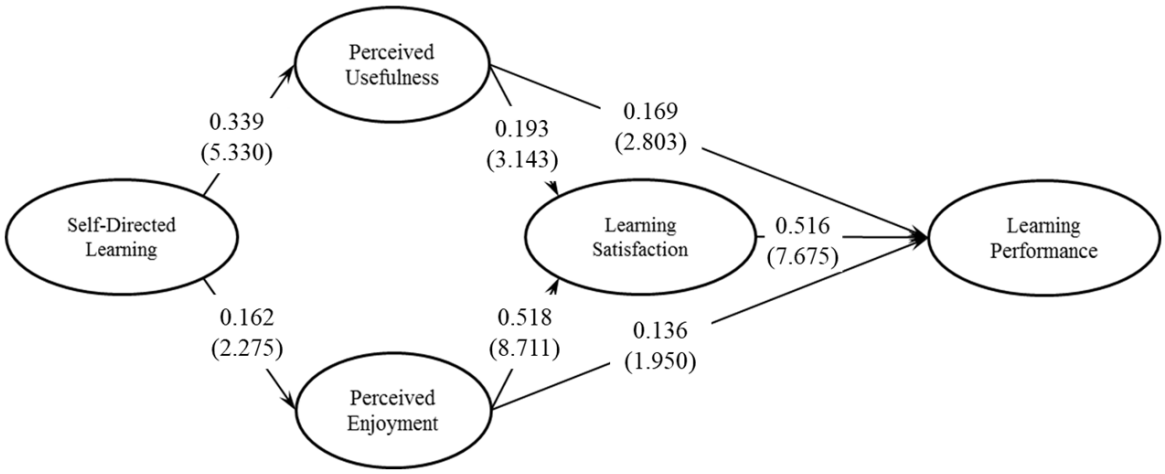

Figure 2. Results of the research model

($b = 0.136$) would be positively related to learning performance. Finally, the path coefficient from learning satisfaction to performance was 0.516 and significant at $p < 0.01$, providing support for H4.

4. **Discussion and Conclusions.** Smart learning is a new educational paradigm that makes learning possible anytime, anywhere for various educational materials, such as smart devices and intelligent technologies. Generally, smart learning environment is effective, efficient, learning motivation, and performance.

This study empirically tests the effects of self-directed learning on different dimensions of learning motivation, learning satisfaction, and learning performance. The academic implications are as follows: This study suggests a theoretical framework for explaining how self-directed learning can influence to facilitate learning motivation (perceived usefulness, perceived enjoyment), learning satisfaction, and learning performance.

Table 3. Results of hypothesis

Hypothesis	Standardized coefficient	t-value	Results
H1a Self-directed learning → Perceived usefulness	0.339	5.330 **	Accepted
H1b Self-directed learning → Perceived enjoyment	0.162	2.275 *	Accepted
H2a Perceived usefulness → Learning satisfaction	0.193	3.143 **	Accepted
H2b Perceived usefulness → Learning performance	0.169	2.803 **	Accepted
H3a Perceived enjoyment → Learning satisfaction	0.518	8.711 **	Accepted
H3b Perceived enjoyment → Learning performance	0.136	1.950 *	Accepted
H4 Learning satisfaction → Learning performance	0.516	7.675 **	Accepted

Note: * $p < 0.05$, ** $p < 0.01$.

Self-directed learning has a positive effect on perceived usefulness as learning motivation. With respect to our specific focus on self-directed learning in smart learning, learning motivation (perceived usefulness and enjoyment) has been theorized as an important element and a critical enabler. Learning satisfaction is an important determinant of their learning performance. In addition, learning motivation using smart devices can not only facilitate learners' attitudes but also determine their behaviors.

The practical implications are as follows. First, learning motivation using smart devices can not only facilitate learners' attitudes but also determine their behaviors. Second, educational environment has shifted from traditional teacher-oriented learning to individual self-directed learning which requires new learning methods. Third, university as well as college classrooms are now slowly inching towards advanced education, which rules out the most conventional method.

This study highlights the originality of smart learning, which provides educators and developers with important insights into these learner's behaviors.

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