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DETECTING THE INFLUENCE OF LEARNING COMMUNITY ON STUDENTS' SELF-DIRECTED LEARNING BY EXPERIMENTAL MODEL

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Abstract. *The Learning Community (LC) is one of affecting models for enhancing students' self-directed learning and prompting their performance. To verify the argument, this study conducted an experiment to determine the effect of learning community on students' self-directed learning and leaning performance. We selected 212 college students in the freshman economics course as our target group with controlling the possible variations during the experiment. The self-directed learning was surveyed by using a revised Learning Preference Assessment (LPA), and the treatment effects have been assessed with the difference estimation. The result reveals that well managed learning community can be used to provoke the students' attitude of self-directed learning. The designed course for economics provides an example which will enrich students' learning performance up to around 8% of their grades.*
Keywords: Learning community, Self-directed learning, Learning performance, Higher education

1. **Introduction.** In this study, we designed a Learning Community (LC) to provoke students' learning in economics and improve their attitude of self-directed learning and learning performance. Economics is an important and essential course in business schools. For most of freshmen in business school, consumer theory is relatively easier to get start and carry out into practice, but the firm theory is more difficult for them due to lack of working experiences. Therefore, the learning performance in firm theory is usually worse than that of consumer theory. Typically, it has become a new problem that most of faculty of economics should face. A major concern of those who teach economics is how to ensure that the students realize economics ideas and apply what they have learnt to the real-world. If this idea is correct, the related design could be applied to the similar academic disciplines. In this study, we addressed research context and related literature in the beginning, then the research design, testing the differences of experiment, and finally drew a conclusion.

Various related studies have examined the effects of instructional methods, for example, computer-based, game-based, or web-based on students' economics learning outcomes [1-5]. Although the traditional lecturing method enables students to systematically integrate knowledge, lecturing is a one-way teaching approach which is difficult to attract students' motivation and innovative learning [6]. In this study, we investigated the effects of the traditional lecturing and a blended learning community model on a specific business schools' freshmen. The idea of learning community was proposed by the Japanese scholar Sato Manabu, and it has been spread to primary and secondary education levels [7,8]. The advantage of learning community approach is that it can be used to cultivate spontaneous

learning, critical thinking, and sharing knowledge in peers. Based on the understanding, we hypothesized that learning community is positively related with self-directed learning and then will influence students' learning performance.

Over the past decades, Self-Directed Learning (SDL) has been one of the most active areas of inquiry within education and learning [9-11]. Concerns for self-education do not appear by itself; however, they are encouraged by the formal educational process that develops self-orientation ability of the learning activity [12]. To verify the hypotheses, we classified the target students into a treatment group (learning community + lecturing) and a control group (only traditional lecturing). The measurement of SDL is a revised Self-Directed Learning Readiness Scale (SDLRS) [13]. SDLRS is widely used in educational research, experimental research, and experimental design [14-16]. We employed a difference-in-difference method to determine the treatment effects in attitude and learning performance in economics class. Our design will provide an example to enhance college students' learning with innovative learning model in different higher education settings.

2. **Research Design.**

To understand the effect of the LC on college students, we conduct an experiment to evaluate students' learning performance. The design and methods are addressed as follows.

2.1. **Experiment design.**

The participants in this experiment are 212 college freshmen in three classes of the economics course (each class has around 70 students). To prevent variations and bias caused by the teaching style of teachers, the three classes were taught by the same professor, and the teaching schedule, content, methods, and testing were properly controlled. Three classes were randomly selected at the beginning of the semester; one class was defined as the treatment group, and the other two classes constituted the control group.

2.1.1. *Experiment period.* Two examinations were administered each semester. The experiment was arranged after the midterm exam to account for the maladjustment of incoming freshmen and to allow students half of a semester to adapt to the teaching style.

2.1.2. *Teaching schedule control.*

Before the midterm: The lecturing topics were supply, demand, elasticity, and consumer theory.

After the midterm: The topics were firm theory (including competition, monopoly, monopolistic competition, and oligopoly).

2.1.3. *Experiment design.*

Control group: The lecturing method was conducted before and after the midterm. Assignments and exercises were completed by students after classes.

Treatment group: The lecturing method was conducted before the midterm. After the midterm, the LC was implemented.

Teaching materials: The professor provided all of the teaching materials, including books, videos, and slides. Identical materials were provided to the treatment and control groups.

Classroom activities: The professor engaged in discussions with the treatment-group class. Students shared knowledge and ideas about the real market, and considered or determined real market operations.

2.1.4. *Evaluation of SDL.* The SDLRS [13] was adopted and revised. Two separate assessments were conducted before the midterm and the final examination.

2.1.5. *Learning performance.* We collected midterm and final examination grades as the assessment of learning performance.

2.2. **Evaluation of SDL.** The revised SDLRS was used to measure the different dimensions of SDL. The SDLRS has been widely used in experiments or quasi-experiments to collect the SDL related information [13]. The questionnaire was classified into four dimensions, namely learning interest, activeness, independence, and creativeness. The criteria of KMO (.896), the Chi-squares of the Bartlett-ball test (1565.374), and Cronbach's alpha (0.655, 0.691, 0.762, and 0.670) have reached acceptable levels respectively. Table 1 shows the results of the factor analysis for SDLRS.

Table 1. Factor analysis of SDLRS

Dimensions	**Questions**	**Factor loading**	**Cronbach's α**
Interest	Q1	0.752	0.655
	Q2	0.670	
Activeness	Q3	0.620	0.691
	Q4	0.601	
	Q9	0.792	
	Q10	0.822	
	Q11	0.554	
Independence	Q5	0.693	0.762
	Q6	0.701	
	Q7	0.789	
	Q8	0.610	
	Q15	0.589	
Creativeness	Q13	0.615	0.670
	Q14	0.654	
	Q16	0.761	
	Q17	0.813	

KMO = 0.896; Bartlett $\chi^2 = 1565.374$, p-value = 0.0000

3. **Testing by Differences.** Following the classroom experiment, the SDL assessment and examination scores were collected in pre-test and post-test. The ratio of male to female students is approximately 2:3 among 212 samples. The number of female students exceeded that of male students, because all participants in the three classes were business school students, and a business school typically enrolls more female students than male students in Taiwan. The pre-test grades for treatment and control group are similar, so do the four dimensions of SDL. This is consistent to the randomness of grouping that treatment group and control group are not different in learning performance and attitudes before the experiment. However, approximately 40 post-test participants (18%) were lost because of the investigation being conducted from Christmas to New Year in 2015, in which absences were higher during that period. One of the classes was selected previously to treat as the LC teaching model, and the lecture model was exercised in the other classes. The treatment group constituted approximately one-third of the total participants.

To investigate the changes in SDL and learning performance before and after implementing the LC approach, we tested the differences by calculating means of the variables. In Table 2, the pre-test results indicate that the creative learning of males was significantly better than that of females, regardless of whether comparisons were conducted between or within the groups. Males and females in the treatment group exhibited no difference in grades, whereas females in the control group received higher grades than males did. The activeness, independent, and creative learning of females significantly improved after the LC was implemented. Although the differences within groups were no significant, the

differences between groups were highly significant, indicating that the learning of females in the treatment group significantly improved after the LC was implemented.

TABLE 2. The gender difference for SDL and learning performance

			Mean		t-test	F-test
Type of testing	Variables	Experiment	Male (SD)	Female (SD)	$H_0 : D = 0$ (p-value)	$H_0 : D_{treatment} = D_{control}$ (p-value)
Pre-test:	Interest	Treatment	3.636 (0.128)	3.519 (0.085)	0.754 (0.453)	0.65 (0.521)
		Control	3.629 (0.089)	3.527 (0.081)	0.849 (0.397)	
	Activeness	Treatment	3.855 (0.105)	3.842 (0.074)	0.098 (0.922)	0.72 (0.487)
		Control	3.936 (0.075)	3.800 (0.075)	1.288 (0.200)	
	Independence	Treatment	3.500 (0.123)	3.235 (0.090)	1.663 (0.101)	1.87 (0.157)
		Control	3.370 (0.090)	3.232 (0.069)	1.221 (0.224)	
	Creativeness	Treatment	2.891 (0.093)	2.592 (0.069)	2.450*** (0.018)	10.98*** (0.000)
		Control	2.895 (0.073)	2.505 (0.067)	3.958*** (0.000)	
	Grades	Treatment	73.455 (2.627)	70.076 (2.080)	0.926 (0.358)	4.63** (0.011)
		Control	65.212 (2.139)	75.946 (1.373)	−4.314*** (0.000)	
Post-test:	Interest	Treatment	3.718 (0.152)	3.796 (0.102)	−0.414 (0.681)	0.28 (0.753)
		Control	3.896 (0.092)	3.795 (0.100)	0.746 (0.458)	
	Activeness	Treatment	4.545 (0.119)	4.563 (0.078)	−0.129 (0.898)	16.22**** (0.000)
		Control	4.053 (0.084)	3.993 (0.091)	0.485 (0.629)	
	Independence	Treatment	3.771 (0.104)	3.807 (0.091)	−0.227 (0.821)	4.28** (0.015)
		Control	3.540 (0.089)	3.475 (0.093)	0.502 (0.617)	
	Creativeness	Treatment	3.303 (0.090)	3.224 (0.058)	0.732 (0.467)	17.86*** (0.000)
		Control	2.989 (0.073)	2.700 (0.074)	2.781*** (0.006)	
	Grades	Treatment	76.221 (3.588)	74.352 (2.878)	0.266 (0.634)	16.63*** (0.000)
		Control	59.212 (3.282)	66.376 (3.600)	4.779*** (0.017)	

D = Male − Female; ***p < .01; **p < .05; *p < .1.

4. **Estimating the Difference-in-Difference Model.** To estimate the relative effects of the LC approach on the treatment and control groups, we used the difference-in-difference model (DDM) to conduct regression analysis. The identification of difference-in-difference estimation for the relative effects of the treatment and control groups is constructed according to dummies of time (pre and post) and groups (treatment and control). The net effects of the LC on the treatment and control groups can be expressed as:

$$\Delta^{\mathrm{LC}} + \left(S^{\mathrm{after}} - S^{\mathrm{before}}\right)_{\mathrm{treatment}} - \left(S^{\mathrm{after}} - S^{\mathrm{before}}\right)_{\mathrm{control}} \tag{1}$$

in which 'treatment' represents the treatment group, 'control' is the control group, 'after' represents the post-test, and 'before' is the pre-test. The first parenthesis on the right side of the formula is the within-group differences for the treatment group, and the second parenthesis is the within-group differences for the control group. Subtracting the two parentheses yields the difference between groups and the net effect of implementing the LC (Δ^{LC}). This effect is the emerging effect of the LC on SDL in the treatment group compared with the control group. The regression equation of the difference-in-difference estimation is expressed as follows:

$$S_i = \beta_0 + \beta_1 \mathrm{Treatment}_i + \beta_2 \mathrm{After}_i + \beta_3(\mathrm{Treatment}_i \times \mathrm{After}_i) + \beta X + \varepsilon_i \tag{2}$$

in which $i = 1, 2, \ldots, n$. After substituting the two dummy variables into Equation (2), and then Equation (1), the result of Δ^{LC} is

$$\Delta^{\mathrm{LC}} = [(\beta_0 + \beta_1 + \beta_2 + \beta_3) - (\beta_0 + \beta_2)] - [(\beta_0 + \beta_1) - \beta_0] = \beta_3 \tag{3}$$

The interaction term, '$\mathrm{Treatment}_i \times \mathrm{After}_i$' is the most critical variable in the equation, and its coefficient β_3 represents Δ^{LC}. In addition, the variable 'X' in Equation (2) represents gender, location, communication approach, parents' education, job, and parenting attitude. Table 3 shows the difference-in-difference results and a comparison of these results with the means. The results demonstrate a few differences with the mean's estimation because the socioeconomic backgrounds of individuals and families are controlled in the regression model. We found that active learning was significantly improved by 0.56 for the treatment group relative to the control group, and creativeness was also increased by 0.14 for the treatment group relative to the control group. In addition, after the LC was implemented, the learning performance of the treatment group was approximately 8 points (7.97) higher than that of the control group.

Table 4 shows the effects of learning performance in regression model determined by using the tests of SDL. The result reveals that before the LC was implemented students

Table 3. The results of difference-in-difference model

Types of testing	Variables	$\mathrm{D}_{\mathrm{treatment}}$	$\mathrm{D}_{\mathrm{control}}$	Δ^{LC}
By mean	Interest	0.21	0.26	−0.05
	Activeness	0.71	0.16	0.55
	Independence	0.49	0.21	0.28
	Creativeness	0.57	0.15	0.42
	Grades	4.55	−6.69	11.24
By regression	Interest	0.21^{***}	0.33	−0.12
	Activeness	0.55	−0.01	0.56^{**}
	Independence	0.05	0.04	0.01
	Creativeness	0.17	0.03	0.14^{*}
	Grades	6.73^{*}	−1.24	7.97^{*}

$^{***}p < .01$; $^{**}p < .05$; $^{*}p < .1$

TABLE 4. The predicted effects of learning performance[a]

	Mid-term exam	**Final exam**
$\widehat{Interest}$	9.062^{***}	9.307^{***}
	(2.803)	(1.908)
$\widehat{Activeness}$	3.196	6.743^{**}
	(3.859)	(3.296)
$\widehat{Independence}$	13.353^{**}	-0.674
	(6.129)	(5.742)
$\widehat{Creativeness}$	-6.641	3.650
	(5.660)	(5.331)
R^2	0.947	0.954
Obs.	211	174

[a]Standard error in parentheses; $^{***}p < .01$; $^{**}p < .05$; $^{*}p < .1$.

obtain superior grades as they have high interest and independent attitudes in the economics course. The coefficients are 9.06 in interest and 13.35 in independence. This is consistent with our knowledge, because the traditional lecture education emphasizes students' independent study and independent work. However, after the LC approach was implemented, the final exam results indicate that independent study is no longer a valid variable for effective learning; both interest and active learning have become the most crucial factors for better learning performance. The estimated coefficients are 9.30 and 6.74 in regression model. This is consistent with the schema of collaborative learning in LC approach.

5. **Conclusions.** After we controlled for all possible variations, the experimental results indicate that students exhibited a stronger propensity for SDL after the LC was implemented than they did before. The LC approach will increase students' interest and active attitudes in collaborative discussions and brainstorming in an economics course. This approach differs from the traditional lecturing approach, which emphasizes students' independent study and independent work. Our experiments and estimations can serve as a reference for related institutions to apply LC to promoting learning effect in similar courses. For future prospect, the related studies may design flipped courses on web with the idea of learning community to enhance students' learning motivation and effect.

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