A Study on Self-efficacy of Undergraduates in Blended Learning in Chengdu, China--The Moderating Effects of Gender, Disciplines and Social Influences

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Abstract: This study examines the factors influence learner' self-efficacy, such as perceived behavioral control and motivation, as well as moderating effects of gender, disciplines, and social influences. Blended learning reform in China was first stared in engineering majors and developed relatively mature, which became one of the models for other majors` reform. Blended learning has been a major goal of higher education curriculum reform in recent years, whereas the role students play in it is not discussed enough in China, including their subjective feelings and emotions, such as self-efficacy. Data was collected through an online questionnaire from a total of 500 undergraduates from Chengdu who have had blended learning experiences in the past year. Results indicate that both perceived behavioral control and motivation are significant predictors of self-efficacy. Gender plays a significant moderating role, while disciplines does not. When gender, disciplines, and social influence were considered together, influences from family and teachers and peers exerted different moderating effects, respectively.

1. Introduction

Following the nationwide application of online teaching in response to the COVIN-19 pandemic, China is now attempting to make blended learning the general form in higher education according to Xinhua News Agency (2022)[1]. It mentioned that by the end of February 2022, the number of online courses in China has exceeded 50,000, with nearly 800 million students taking courses and more than 300 million students studying in MOOCs. But while the rapid growth of online education resources and blended learning courses, these education reforms must be noticed that development at such an impressive speed are mainly driven by external forces, such as policy and investment support. And the subjective experience of learners, who are the subjects in education, deserves the attention and research of educators. This study investigated the key factors including perceived behavior control, motivation and self-efficacy and the effects of gender, disciplines and social influences moderating on the self-efficacy of undergraduates involved in blended learning.

In this study, blended learning is defined as a combination of traditional classroom learning and e-learning, which combine the interaction in face to face classroom and the technology advantages

of internet system (O'Byrne & Pytash, 2015)[2]. Since the emergence of blended learning, it often combined different technical media and activities to create appropriate programs for specific training audiences (Onguko et al., 2013) [3]. It was provided to be a flexible, efficient and effective approach to learning and enable learners to become the centre of the curriculum (Hameed et al., 2007) [4]. Learner-centred implies that the subjective willing and feelings of the learner deserve more attention, because it related to learner engagement closely. Many teaching strategies have been practiced and studied to enhance learners` engagement, including flipped classrooms, cooperative learning. But these strategies did not make differences for longtime (Zainuddin & Perera, 2017[5]; Saad, 2017[6]). Students` engagement and its influence factors need more exploration

A previous study compared learner`s experience between blended and traditional learning groups and found blended learning learner demonstrated more overall satisfaction, self-efficacy and degree of knowledge practice (Ho et al., 2014)[7].

Siddiqui et al. (2020) [8] studied the psychological needs of students in blended learning and found that blended learning could help enhance the learning outcomes when it provides an autonomous rather than controlled environment. In a variety of subject areas, including language learning, information technology and engineering, blended learning has also been shown to enhance learning through collaborative and self-paced learning approaches (K. K. & Maskari, 2019)[9]. Asaqli (2020) [10] found that student engagement can be measured in three ways, including behavior, emotional and cognitive. It also mentioned that blended learning has the benefit of facilitating collaborative discussions between teachers and students, which can lead to more opportunities for communication and closely linked to active student participation.

2. Theoretical Background

Social Learning Theory and Theory of Planned Behaviour are the primarily theoretical framework of this study. They both focus on the interaction between individual learning and social influences.

Bandura proposed social learning theory and emphasized to examine education from the perspective of the joint functioning of cognition and behaviour (Ganesh et al., 2019) [11]. One core ideas of the theory is that psychological changes in learning do not occur in a vacuum and are mediated by cognitive processes. It means learning process could be influenced by educators, peers and individuals personal behavior and emotions in the learning situation.

TPB is one widely accepted behaviour theories that considers individual behaviour with social influences to explain the behavior of technology applications. The core constructs of TPB include perceived behavior control, self-efficacy and subjective norms (Zhang et al., 2019) [12]. Perceived behavior control is individual`s perception when practice or conduct certain behavior. It can facilitate or hinder an individual's behaviour.This study chose perceived control of behaviour as the independent variable, motivation as the mediating variable and self-efficacy as the dependent variable. And social influence, professional background and gender were as moderating factors.

3. Model Conceptualization and Hypotheses Development

3.1. Perceived Behavior Control

Perceived behavioral control (PBC) in blended learning is learner`s ability to control the factors that may impact on their learning behavior (Mafabi et al., 2017) [13]. PBC is an important element of the theory of planned behavior. Previous research in education has found PBC explains the extent of how available the resources and opportunities are to students (Leonard et al., 2004) [14]. Higher

perceived behavior control leads to higher affective ratings and engagement tendencies for the system used (Martın & Jimenez, 2011) [15].Thus, the hypotheses is formed as follows:

H1: Perceived behavior control has significant positive impact on motivation

H2: Perceived behavior control has significant positive impact on self-efficacy

3.2. Motivation

Motivation in blended learning is the willingness of learners to make an effort, expend energy and time to engage in blended learning (Tai, 2006)[16]. Learners`s motivation is proved to perform three main functions: motivating individuals to produce learning behaviour, directing them towards specific learning goals, and maintaining and regulating their behaviour (Leone et al., 2017[17]). In a study about students` information literacy conducted by Aharony and Gazit (2018) [18] found that motivation is a predictor for self-efficacy in online background.

H3: Motivation has significant positive impact on self-efficacy

3.3. Self- Efficacy

In this context, self-efficacy refers to individual's judgement of personal ability to engage in blended learning, to finish homework and achieve personal goals (Jungert et al., 2013)[19]. Self-efficacy could support students` confidence and concentration to solve problems and achieve academic goals (Schunk & Mullen, 2012) [20]. It enables individuals to take action when faced with challenges or to take responsibilities for high confidence required work, such as mentoring and helping others (Ganesh et al., 2019)[21]. It has been proved to be influenced not only by former experience and performance in using information systems, but also be able to impact willingness to use this technology in the future (Drumm, 2019)[22].

However, self-efficacy is not a stable psychological element. It could be impacted by learner's background and other external factors then presented on learners` participants.

The moderating effect of gender varies across social contexts and technological situations in some extent, and it is valuable to test the gender moderation in different contexts (Venkatesh and Morris, 2000) [23]. Many studies have mentioned gender as an important factor when it comes to accept and continue to use information technology and electronic devices (Shao & Chen, 2020) [24]. Zander et al. (2020) [25] mention that girls generally have lower self-efficacy in mathematics learning and are less able to self-improve than boys. This may be one of the reasons why girls are still in the minority in STEM fields. Hägg et al.'s (2022) [26] study on entrepreneurship education also mentioned that gender balance in the classroom as part of the educational environment and student socialization, could positively influence students' entrepreneurial behavior. It is partly because gender is closely related to social norms that shape students' perceptions and attitudes. Additionally, gender imbalance between students and teachers can also affect students' participation in classroom discussions (Opie et al., 2019)[27]. Thus, this study explores gender as one of the moderating factors to explore the development of self-efficacy in blended learning.

Another influencing factor is the student's academic background. Discipline differences in higher education have long been of interest to researchers, due to different disciplines would focus on different natures of knowledge, such as theoretical or practical (Foung & Chen, 2019)[28]. The impact of major on a student is subtle and multifaceted. A study on entrepreneurial intentions of engineering students mentioned that disciplines could moderate students' motivation to start their own entrepreneurship (Alam et al., 2020) [29].

For blended learning, the impact of discipline difference has also been proved by previous research. Research of self-efficacy based on accounting students conducted by Mooi (2006)[30] found that, students with higher self-efficacy would to predict their learning outcome positively,

and then make more efforts to it. But it did not imply that more motivated and higher self-efficacy could bring better the learning outcomes will be, the conservative self-efficacy students might benefit more.

H4: Gender difference has significant moderation on factors impact on self-efficacy.

H5: Major influence has significant moderation on factors impact on self-efficacy.

3.4. Social Influence

The social influence in blended learning refers to the pressure from important others make students think they need to participant. It belongs to social norms (Mafabi et al., 2017) [31]. Taylor et al. (2011) [32] mentioned peer influence might be stronger than other in universities in American. In a study of Chereau and Meschi (2021) [33] about entrepreneurial self-efficacy, they found that the entrepreneurial environment created by parents or families will constitute a different learning context and lead to difference in students' self-efficacy in entrepreneurship.

Based the literature and analysis before, the main hypothesis is:

H6: Social influence has significant moderation on factors impact on self-efficacy.

H6a: The teachers` influence (Social influence 1) has significant moderation on factors impact on self-efficacy.

H6b: The families` influence (Social influence 2) has significant moderation on factors impact on self-efficacy.

H6c: The peers influence (Social influence 3) has significant moderation on factors impact on self-efficacy

3.5. The Conceptual Framework of Study

In summary, the conceptual framework of this study is as follows Figure 1.
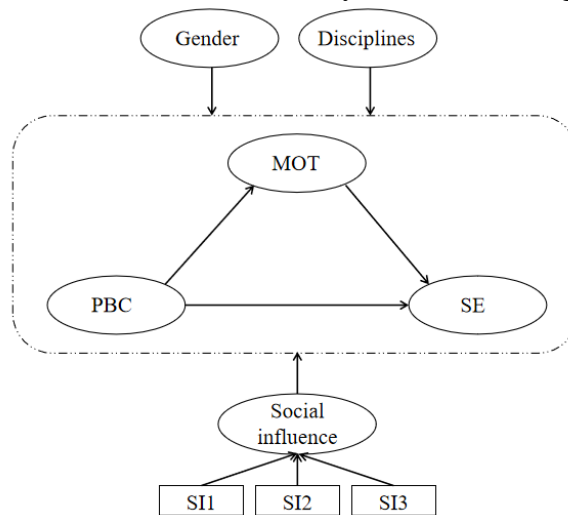

Figure 1: Conceptual framework

4. Research Methods

The questionnaire was composed of three parts, screening questions, demographic information and the main part "factors impact on self-efficacy in blended learning". The main body of the questionnaire containing 17 items to measure the conceptual framework with 5-point Likert scale.

The online questionnaire was distributed to undergraduates among five public universities in

Chengdu and invited them to engaged in the survey voluntarily. The demographic information is in table 1. There was found that 53% of the students were majoring in social sciences (mainly study in languages, education and management) and 47% in engineering (mainly study in computer software engineering, mechanical engineering and energy and power engineering).

Table 1: Demographic information

Item	Category	No.	%
Gender	Female	228	45.6
	Male	272	54.4
Academic year	1	96	19.2
	2	133	26.6
	3	184	36.8
	4	87	17.4
Majors	Social sciences	265	45.6
	Engineering	235	53
Total		500	47

5. Data and Measurement Model Analysis

The normal distribution of each scale item and the Cronbach`s Alpha of the variables were examined. The results were as follows table 2.

Table 2: Normal distribution test and scale item descriptive statistics scale

	Mean	Std. Deviation	Skewness	Kurtosis	Cronbach`s alpha
MOT1	4.08	0.816	-0.644	0.255	
MOT2	4.22	0.823	-1.037	0.958	
MOT3	4.28	0.779	-0.993	0.958	
MOT4	4.15	0.906	-0.966	0.639	
MOT5	4.17	0.882	-1.122	1.246	
MOT6	4.27	0.764	-1.059	1.583	
MOT7	4.21	0.794	-0.971	1.259	
MOT	4.198	0.640			0.890
PBC1	4.08	0.685	-0.627	1.149	
PBC2	4.11	0.659	-0.458	0.543	
PBC3	4.08	0.639	-0.443	0.801	
PBC	4.09	0.539			0.747
SE1	4.05	0.775	-0.32	-0.661	
SE2	4.03	0.717	-0.312	-0.261	
SE3	4.06	0.753	-0.3	-0.634	
SE4	3.88	0.731	-0.392	0.112	
SE	4.01	0.609			0.835

Cronbach`s alpha is a common used statistic value to evaluated the internal consistence (Chinnasee et al., 2020) [34]. The internal consistency of the entire scale was 0.851. In general, higher than 0.6 to indicate the scale is acceptable (Hair et al., 1989) [35].The convergent and discriminant validity of the scale presented in the Table 3 as the values of AVE and CR. All variables have good convergent validity since the value of AVE is around 0.5 while that of CR is higher than 0.7. Table 4 shows that the discriminant validity is also acceptable.

Table 3: Results of convergent validity

Variables	Factor Loading	CR	AVE
SE1	0.700	0.806	0.509
SE2	0.761		
SE3	0.676		
SE4	0.715		
PBC1	0.715	0.706	0.449
PBC2	0.546		
PBC3	0.733		
MOT1	0.656	0.848	0.446
MOT2	0.689		
MOT3	0.754		
MOT4	0.765		
MOT5	0.566		
MOT6	0.600		
MOT7	0.621		

Table 4: Result of discriminant validity

	PBC	MOT	SE
PBC	0.670		
MOT	0.203***	0.668	
SE	0.591***	0.253***	0.713

Note: *p=0.05, **p=0.01. ***=0.001

6. Differential Analysis

In order to have an understanding of the demographic differences in the data, independent sample T-test and one way-ANOVA test were conducted by SPSS to analyse whether there was a significant difference between gender, majors and academic years.

6.1. Independent Samples T-test for Gender and Majors

Through independent sample t-tests, the study found that the standard deviation on motivation of females was larger than that of male. It indicated that female students' data were more discrete on the scale items of motivation. The variable perceived behavior control shown significant difference between male and female students according to Table 5.

Table 5: Independent sample T test result for Gender

	Female	male	t	p
MOT	4.14±0.75	4.25±0.53	-1.77	0.85
PBC	4.04±0.56	4.13±0.53	-1.98	0.05
SE	4.01±0.60	4.00±0.63	0.184	0.07

Showed in Table 6, students study in social science and engineering, there was a significant difference in the motivation. The mean value of the motivation was 0.21 higher for engineering students than for social sciences students.

Table 6: Independent sample T test result for majors

	Social science	Engineering	t	p
MOT	4.10±0.60	4.31±0.67	-3.59	0.00
PBC	4.13±0.50	4.05±0.58	1.62	0.10
SE	4.05±0.56	3.95±0.65	1.85	0.07

6.2. One Way-ANOVA Test for Academic Years

One-way ANOVA was chosen to test for differences between the grades. The results show that motivation and self-efficacy are significant differences by academic year. It can be seen in Table 7, the first grade students have more disparate views on blended learning and a larger gap in self-efficacy. Compared to other grades, first grade scored lower in perceived behavioral control and self-efficacy.

Table 7: One-way ANOVA test result for academic years

	Y1	Y2	Y3	Y4	F	P
MOT	4.10±0.73	4.07±0.57	4.28±0.61	4.35±0.64	5.115	0.002
PBC	3.98±0.70	4.12±0.46	4.35±0.64	4.20±0.64	1.988	0.115
SE	3.88±0.70	4.07±0.47	4.20±0.64	3.98±0.70	3.784	0.011

7. Measurement Model and SEM Analysis

Structural equation modeling is a method for building, estimating and testing causal relationship model (Henseler et al., 2014)[36]. Table 8 shows the metrics of model fit, all of which meet the criteria.

Table 8: Model fit result

	Notation	CFA model	SEM model
CMIN/ DF	< 5.00 (Awang, 2012; Al-Mamary and Shamsuddin, 2015)	125.18/74 or 1.69	125.18/74 or 1.69
Goodness of Git Index (GFI)	≥ 0.85 (Sica & Ghisi, 2007)	0.97	0.97
Adjusted Goodness of Fit Index (AGFI)	≥ 0.80 (Sica & Ghisi, 2007)	0.95	0.95
Comparative fit index (CFI)	≥ 0.80 (Bentler, 1990)	0.98	0.98
Normed fit index (NFI)	≥ 0.80 (Wu & Wang, 2006)	0.96	0.96
Root mean square error of approximation (RMSEA)	< 0.08 (Pedroso et. al., 2016)	0.04	0.04

7.1. Mediating Effect Model Analysis

As showed in Table 9, the paths of the mediation model are all supported by the data,hypotheses 1 to 3 are proved. The second half of the mediation effect (MOT→SE) is significant at the 0.01 level and the other paths are significant at the 0.001 level. Perceived behavior control could significantly predict motivation (B=0.182, p<0.001) and self-efficacy (B=0.69, p<0.001), regression

equations were formed. The mediating variable motivation also could positively impact on self-efficacy (B=0.19, p=0.004<0.01). From the standardized regression weight, the most powerful variables of the model is the independent variable, perceived behavior control (β=0.563, p<0.001).

Table 9: Standardized Regression Weight and Regression Weight analysis results

	Standardized Regression Weight	Regression Weight	S.E.	C.R.	P
PBC→MOT	0.203	0.182	0.051	3.56	***
PBC→SE	0.563	0.69	0.078	8.804	***
MOT→SE	0.139	0.19	0.066	2.896	0.004

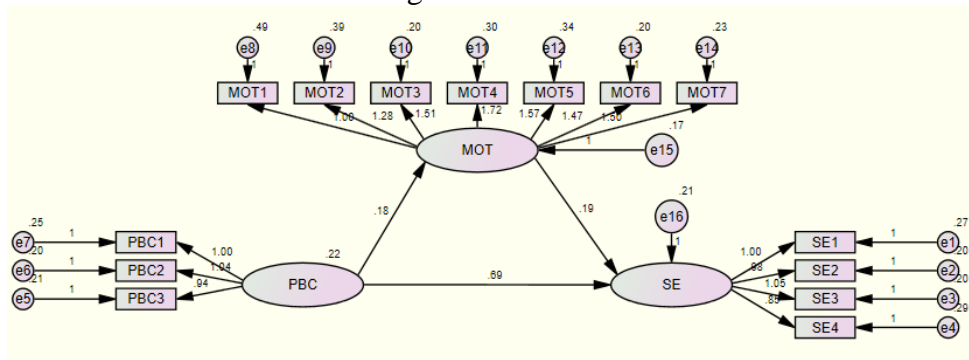The SEM test results of AMOS are as Figure 2.

Figure 2: SEM results

7.2. Gender Moderating Effect Analysis

To explore whether there are differences in perceived behavior control and how it impact on self-efficacy and verify hypothesis H4 and H5, this study continue to investigate the moderating effect of gender. AMOS was used to model groupings for comparative analysis. Chi-square difference values of these models are checked. The model is stable.

Illustrated in Figure 3, the regression weight value indicated that the mediating model is not supported by data of male. This is because the males presented insignificant in the first half of the mediation model (PBC→MOT), while in the second half (MOT→SE), the males' motivation negatively influenced self-efficacy at a significant level of 0.05.
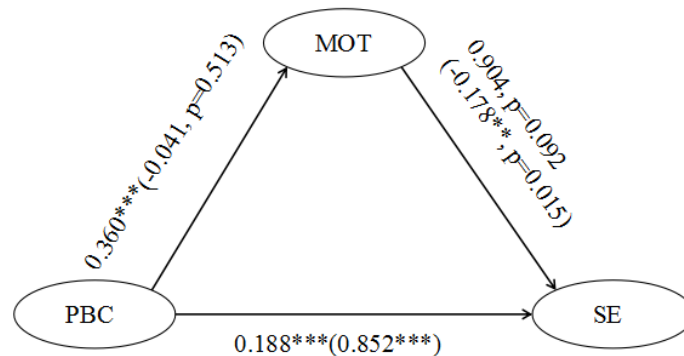
Note: Values outside brackets are female, values in brackets are for males; ***p<0.001

Figure 3: The regression weights of the moderating effect of gender

The standardize regression coefficients are presented in Table 10 to compare the moderator

effects. Firstly, males` perceived behaviour control (β=0.792, p<0.001) had a significantly higher contribution to self-efficacy than females (β=0.434, p<0.001). But for indirect effects, female students (β=0.285, p<0.001) showed a higher predictive power of motivation on self-efficacy, while male students (β=-0.137, p=0.015<0.05) showed a negative moderating effect of motivation on self-efficacy at a lower level of significance. The critical ratio of differences between parameters of measurement weights model, all values are greater than 1.96, indicating gender plays an important moderating role in the pathway. Hypotheses 5 to 8 are all supported by data.
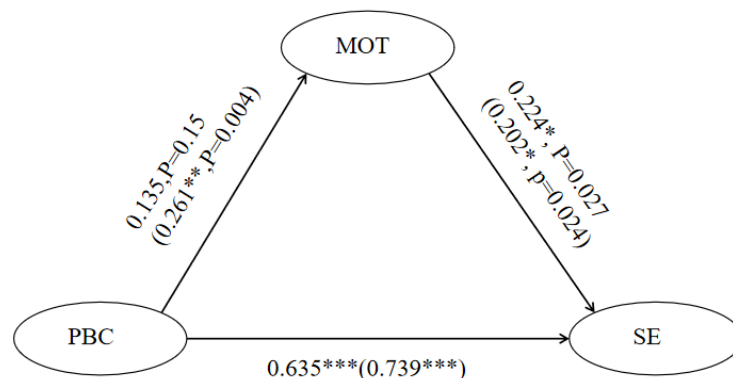
Table 10: The standardized regression weight and the critical ratio of the difference between parameters

	Female				Male				Critical Ratio of the Difference Between Parameters
	β	S.E.	C.R.	P	β	S.E.	C.R.	P	
PBC→MOT	0.372	0.085	4.495	***	-0.049	0.054	-0.564	0.572	6.561
PBC→SE	0.128	0.088	1.904	0.057	0.792	0.103	9.896	***	-4.053
MOT→SE	0.598	0.096	6.829	***	-0.137	0.100	-2.590	0.010	-6.194

7.3. Disciplines Moderating Effect Analysis

Amos was also used to analysis the moderating effects of disciplines. Comparing indicators of model fit result and chi-square test degrees of freedom could fine that the model is stable.

The biggest difference for disciplines between the regression equations constructed is the first half of the mediating effect (PBC→MOT), where perceived usefulness has no significant effect on motivation for engineering students, but this regression equation is significant for social science students. The results is presenting in Figure 4.

Note: Values outside brackets are engineering, values in brackets are for social science; ***p<0.001

Figure 4: The regression weights of the moderating effect of majors

According to the standardize coefficients in Table 11, although the direct effects were close, students major in social science have higher impact on self-efficacy from perceived behavior control. The positive effect of perceived behavior control on motivation was stronger for engineering majors (β=0.239, p=0.003<0.01). Whereas the difference in the moderating effect of majors on the pathway of motivation on self-efficacy was smaller, both being significant at the 0.05 level, the standardized coefficient was slightly higher for engineering majors (β=0.159) than for social science students (β=0.149). However, the values of critical ratio of the difference between parameters are less than 1.96. These differences are not significant statistically.

Table 11: The standardized regression weight and the critical ratio of the difference between parameters

	Social sciences				Engineering				Critical Ratio of the Difference Between Parameters
	β	S.E.	C.R.	P	β	S.E.	C.R.	P	
PBC→MOT	0.191*	0.066	2.523	0.012	0.239**	0.070	2.974	0.003	0.521
PBC→SE	0.589	0.095	7.423	***	0.533	0.103	6.207	***	-0.449
MOT→SE	0.147*	0.089	2.226	0.026	0.159*	0.098	2.258	0.024	-0.171

7.4. Social Influence Moderating Effect Analysis

Model 59 of the PROCESSv4.1 program prepared by Hayes and the Bootstrap test (5000 times) were applied to analyse three kinds of social influence, the independent variable was perceived behaviour control, the mediator was motivation, the dependent variable was self-efficacy, the control variables were gender, major and academic year.

7.4.1. Teacher Influence Moderating Effect Analysis

SI1 measures the teachers and instructors influence. From the analysis results in Table 12, the interaction term between SI1 from the instructor and perceived behavioral control was significant at the 0.01 level and showed a negative moderating effect toward to motivation.

Table 12: The moderating effects of SI1

	MOT			SE		
	coeff	t	p	coeff	t	p
Constant	-0.593***	-4.451	0.000	0.192	1.637	0.102
PBC	0.173***	3.328	0.001	0.497***	10.902	0.000
MOT	\	\		0.145***	3.647	0.000
SI1	-0.037	-0.680	0.497	-0.065	-1.390	0.165
SI1 x PBC	-0.297**	-3.127	0.002	0.126	1.492	0.136
SI1 x MOT	\	\		-0.053	-0.674	0.501
major	0.196***	3.511	0.001	`-0.098*	-2.026	0.043
academic year	0.066*	2.327	0.020	0.030	1.205	0.229
gender	0.083	1.502	0.134	-0.081	-1.684	0.093
R²	0.093***			0.261***		
F	8.47			21.71		
R²chng	SI1 x PBC	0.018**	0.002	0.003		0.136
	SI1 x MOT	\	\	0.001		0.5

Table 13: SI1 Bootstrap test result

SI1	Effect	se	t	p	LLCI	ULCI
-0.667	0.371	0.077	4.813	0.000	0.220	0.522
0.000	0.173	0.052	3.328	0.001	0.071	0.276
0.333	0.074	0.064	1.163	0.245	-0.051	0.200

Continued examining by Bootstrap test revealed that this moderating effect was significant only at low levels of SI1 (in intervals lower one standard deviation) in Table 13. When the influence from the teacher was low, its interaction term with perceived behavior control significantly attenuated the positive effect of perceived behavior control on motivation. The slope diagram is
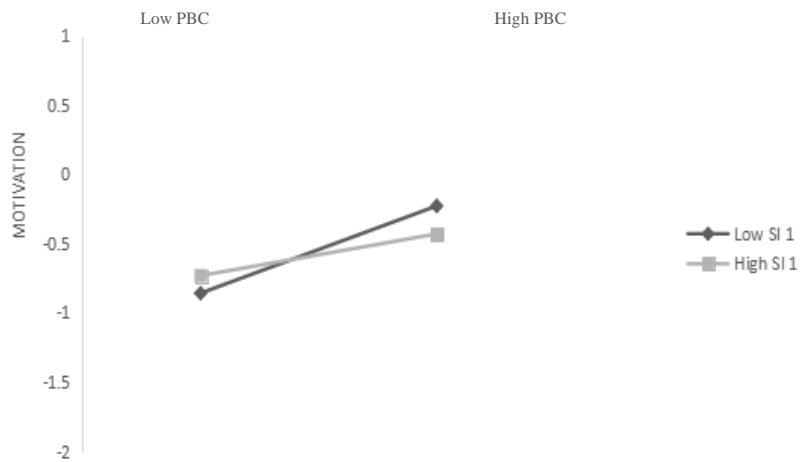
shown in Figure 5.

Figure 5: Slope diagram of the moderating effect of SI1 at high and low levels

7.4.2. Family Influence Moderating Effect Analysis

SI2 measures the influence from family or relatives. According to the analysis in Table 14, the interaction term between SI2 and perceived behavior control was significant at the 0.001 level and showed enhanced moderation in the effect of perceived behavior control on self-efficacy.

Table 14: The moderating effects of SI2

	MOT			SE		
	coeff	t	p	coeff	t	p
Constant	-0.607***	-4.581	0.000	0.198	1.691	0.091
PBC	0.167***	3.234	0.001	0.503***	10.904	0.000
MOT		\		0.153***	3.858	0.000
SI2	0.028	0.411	0.681	0.081	1.364	0.173
SI2 x PBC	0.380***	3.934	0.000	-0.090	-1.003	0.316
SI2 x MOT	\	\		-0.002	-0.022	0.983
major	0.198***	3.574	0.000	-0.104*	-2.146	0.032
academic year	0.074**	2.633	0.009	0.031	1.269	0.205
gender	0.082	1.483	0.138	-0.081	-1.687	0.092
R^2	0.103***			0.260***		
F	9.469			21.54		
R^2chng	SI2 x PBC	0.028***	0.000	0.001		0.316
	SI2 x MOT	\	\	0		0.983

Unlike the influence from teachers, the influence of significant family relatives illustrated in Table 15 enhances the effect of students' perceived behavior control on self-efficacy only at high levels. The slope diagram is shown in Figure 6.

Table 15: SI2 Bootstrap test result

SI2	Effect	se	t	p	LLCI	ULCI
-0.333	0.041	0.065	0.630	0.529	-0.086	0.167
0.000	0.167	0.052	3.234	0.001	0.066	0.269
0.333	0.294	0.057	5.146	0.000	0.182	0.406

Figure 6: Slope diagram of the moderating effect of SI2 at high and low levels

7.4.3. Peers Influence Moderating Effect Analysis

Compared to the other two influences based on the data presented in Table 16, no significant moderating effect was found for the peer influence.

Table 16: The moderating effects of SI3

	MOT			SE		
	coeff	t	p	coeff	t	p
Constant	-0.611***	-4.545	0.000	0.191	1.630	0.104
PBC	0.190***	3.643	0.000	0.502***	11.105	0.000
MOT				0.138***	3.564	0.000
SI3	0.057	0.819	0.413	0.028	0.461	0.645
SI3 x PBC	-0.144	-1.080	0.281	-0.056	-0.485	0.628
SI3 x MOT				0.135	1.394	0.164
major	0.206***	3.665	0.000	-0.097*	-2.000	0.046
academic year	0.074*	2.566	0.011	0.030	1.220	0.223
gender	0.079	1.413	0.158	-0.082	-1.717	0.087
R ^{2}	0.078***			0.257***		
F	6.99			21.27		
R ^{2}chng	SI2 x PBC	0.002	0.281	0		0.628
	SI2 x MOT	\	\	0.003		0.164

7.5. Moderating Effect of Peer Influence in Different undergraduates

Previous research implied that peer influence is consistently one of the strengths of blended learning. Blended learning provides a virtual learning communication environment that can enhance

interaction between student and teacher and peers through email, discussion boards and virtual classrooms (Jones et al., 2007) [37]. And in Poon's (2012) [38] discussion of the definition of blended learning, it is mentioned that blended learning enables students to learn independently and engage in peer discussion at their own pace. Further exploration of non-significant peer influences was therefore undertaken to find whether there are moderating effects of similar size but opposite effects that make peer influence insignificant.

7.5.1. Moderating Effects of Peer influence and Gender Differences

The following results in Table 17 were the multilayer regression in groups tests the moderating effect of gender differences and peer influence. From the results, for male students' self-efficacy, the interaction term of peer influence and motivation played a significant positive effect ($\beta=0.143$, $p=0.004<0.01$), weakening the original negative relationship between motivation and self-efficacy ($\beta=-0.177$, $p<0.001$). In contrast, in the females' peer influence was not observed to be significant.

Table 17: The moderating effect of SI3 and gender

	Female-SE			Male-SE		
	β	T	p	β	T	p
MOT	0.541***	8.915	0	-0.177***	-3.731	0
PBC	0.085	1.425	0.156	0.617***	13.482	0
SI3	0.026	0.457	0.648	0.017	0.352	0.725
Gender	0.032	0.556	0.579	0.062	1.316	0.189
Academic year	-0.116*	-2.054	0.041	-0.058	-1.237	0.217
Int_3MOT	-0.066	-0.995	0.321	0.143**	2.926	0.004
Int_3PBC	0.019	0.286	0.775	0.25	1.548	0.123
R ²	0.337			0.467		
Adjusted R ²	0.316			0.453		
F	15.947			32.998		
Sig.	0.000			0.000		

7.5.2. Moderating Effects of Peer Influence and Major Differences

Table 18: The moderating effect of SI3 and majors

	Social science-SE			Engineering-SE		
	β	T	p	β	T	p
MOT	0.149**	2.702	0.007	0.141*	2.35	0.02
PBC	0.465***	8.525	0	0.405***	6.819	0
SI3	0.038	0.689	0.492	0.003	0.058	0.953
Gender	-0.032	-0.586	0.558	-0.108	-1.834	0.068
Academic year	0.014	0.265	0.791	0.074	1.215	0.226
Int_3MOT	-0.016	-0.29	0.772	0.123*	2.113	0.036
Int_3PBC	0.08	1.473	0.142	-0.114	-1.943	0.053
R ²	0.278			0.259		
Adjusted R ²	0.258			0.236		
F	14.123			11.342		
Sig.	0.000			0.000		

When considering the major gap with peer influence, the SPSS multiple linear regression in Table 18 showed that for engineering students, the interaction term between peer influence and motivation enhanced the positive relationship between motivation and self-efficacy (β=0.123, p=0.036<0.05), whereas this moderating effect was not found on the data for social science students.

7.5.3. Moderating Effects of Peer Influence and Academic Year Differences

Combining academic year and peer influence reveals that for students in years 1 to 3, the moderating effect shown in Table 19 of peer influence did not present a statistically significant effect. For fourth-year undergraduates, the interaction term between peer influence and perceived behavioral control, on the other hand, was significant at the 0.01 level with a standardized coefficient of -0.303, weakening the positive effect of perceived behavioral control on self-efficacy.

Table 19: The moderating effect of SI3 and academic years

	Year 1-SE			Year 2-SE			Year 3-SE			Year 4-SE		
	B	T	p	B	T	p	B	T	p	B	T	p
MOT	0.232*	2.471	0.015	0.29***	3.364	0.001	0.042	0.622	0.535	0.079	0.752	0.455
PBC	0.485***	5.037	0.000	0.255**	3.086	0.003	0.43***	6.243	0.000	0.517***	5.049	0.000
SI3	0.112	1.325	0.188	-0.147	-1.816	0.072	0.081	1.245	0.215	0.094	0.852	0.397
Majors	0	0.002	0.998	-0.064	-0.757	0.45	-0.116	-1.768	0.079	0.086	0.824	0.412
Gender	-0.08	-0.912	0.364	-0.068	-0.844	0.401	-0.036	-0.555	0.58	-0.113	-1.194	0.236
Int_3 MOT	0.137	1.316	0.192	0.049	0.561	0.576	0.076	1.13	0.26	0.095	0.927	0.357
Int_3 PBC	-0.151	-1.445	0.152	0.132	1.597	0.113	0.116	1.665	0.098	-0.303**	-2.92	0.005
R²	0.403			0.231			0.268			0.321		
Adjusted R²	0.356			0.188			0.239			0.261		
F	8.488			5.362			9.196			5.336		
Sig.	0.000			0.000			0.000			0.000		

In summary, the results of the analysis of the hypotheses of this study are as follows.

8. Discussion

First, perceived behavior control is a strong predictor for self-efficacy and improving undergraduate's sense of control when they participate in blended learning could ensure the level of self-efficacy. Another finding of interest is the disparity between students of different academic years. The statistics show that undergraduates in the lower grades have relatively lower mean scores for both perceived behavioral control, motivation, and self-efficacy, with a greater degree of data dispersion.

Gender plays a significant moderating role in the model of perceived behavior control and motivation predicting self-efficacy. For female students, perceived behavior control has a positive effect on their motivation toward blended learning, while motivation are the most powerful contributor to self-efficacy in this model. This logic does not fully apply to male students, for whom perceived behavior control directly and positively influenced their self-efficacy but does not significantly influence motivations. Motivation, on the other hand, has a significant weakening effect on their self-efficacy. Looking back at previous research on self-efficacy, Karimi et al. (2014)[39] mentioned that self-efficacy can indeed be improved through education, but even at the

same level of education, female's self-efficacy is lower. Pelegrini et al. (2021) [40] mentioned that the statistical differences of self-efficacy was existed and female were more concerned about their self-efficacy. When motivation is higher, female devote more attention and expectation to behavior, which may be one reason why female's motivation can have a positive effect on self-efficacy.

The moderating effect of social influences occurs primarily in motivation toward blended learning. However, teacher influence is significant interacting with perceived behavior control only when it is at low levels, and it would weaken the positive effect of perceived behavior control on attitudes. Influence from family, on the other hand, is significant only at high level and could promote positive effects of perceived behavior control on attitudes. This suggests that perceived behavior control` supports toward to students' motivation could be reduced when teachers do not provide enough influence, but when the influence from family is high enough, the path could be supported. A case study of Park (2015) [41] about drama teaching methods supports this. Asian students show the tendency to recognize the teacher's role in assessing their learning above their own. Siddiqui et al. (2019) [42] argued that teachers is one important participant in a successful learning. Teacher could provide a supporting learning environment to improve students positive and autonomous. Research of Jones et al. (2007)[43] mentioned that compared with face to face classroom where teacher could communicate with students directly, it is disadvantaged for timid students in blended learning who do not like to engage in online activities regularly.

Another interesting finding is that the influence of peers is not significant in this model. For male students, peers influence could interact with motivation and significantly weaken the negative effect of motivation on self-efficacy. And for engineering students, peer influence can also have a positive effect on the same path. Similarly, peer influence did not have a significant effect on any of the 1st to 3rd year students, but it showed a significant negative effect on self-efficacy with the interaction term of perceived behavior control for the prospective graduates in their senior year.

Finally, there was no data support regarding the impact of disciplinary differences on students' self-efficacy in blended learning. This suggests that blended learning, and its accompanying instructional tools, are not discipline-specific, but instead can build on each other's good teaching models and curriculum, taking into account instructional design and content. This study does not demonstrate a statistically significant difference in self-efficacy and its impact factors for students from different majors in blended learning. From the previous studies, there are two possible reasons. The study by Foung and Chen (2019) [44] presented similar results. This may suggest that the classification of disciplines in the context of blended learning could be more detailed and take into account students' learning behavior and subjective experiences.

One possible reason is the discipline categories. Most of the participants involved in this study were from languages, management, computer software engineering, mechanical engineering. According to Biglan's (1973) [45] classification, engineering is an applied discipline corresponding to a pure discipline, and humanities is a soft science corresponding to a hard discipline. However, with the convergence of disciplines, some new majors are at the boundary of different disciplines, and also with the development of general education in universities, the "soft" majors like humanities have begun to include knowledge from many applied disciplines, such as statistics and big data, computational sociology, etc. This has narrowed the different nature gaps between disciplines.

The possible reason is the changes in assessment methods in blended learning. Blended learning often promotes and riches assessment and exam methods in HEIs. For example, the process of learning is more clear and quantitative, including the interaction with teacher and peers, and recording of assignments, these could help students from different majors to get a more comprehensive grades. Students from different majors receive a final score that combines multiple forms of assessment, rather than a grade determined simply by a final exam or essay, which narrows the gap between the final scores of students from different majors.

Therefore, in the context of blended learning, students of different majors have obtained relatively complete and satisfactory learning results, which makes their sense of self-efficacy and related factors do not show a significant gap.

9. Implications

First, self-efficacy seems strongly linked to individual student characteristics, therefore the design of the blended learning curriculum, teaching methods and styles are deserving attention and adaptation based on the students` situation.

The curriculum should be designed to take into account the requirements and status of students at different stages. For undergraduates in the early grades, more group work and peer interaction can promote motivation and perceived behavior control and thus have a more positive impact on self-efficacy. For upper grade students, it is important to consider that as prospective graduates, they might have different plans for future. Peer activities should be selective and can be grouped according to the different needs of the participants. As suggested by Aharony and Gazit (2019)[46], it is important for keeping high self-efficacy that individual is not exposed in enormous information. Because that would make people feel incapable to handle and lose confidence..

In terms of teaching methods and styles, lower grade students have lower motivation and perceived behavioral control in blended settings and need more highly supportive external environments to help them adapt and achieve high self-efficacy, including influences from teachers and families. For females, on the other hand, motivate teaching strategies could be applied to help them to maintain good attitudes toward blended learning and promote higher self-efficacy.

10. Limitation and Suggestions

There are certain limitations in this study. The sample for this study was focused on five universities in Chengdu, China, and given consideration of the level of economic development, higher education and information building in southwest China, the analysis results of data are geographically specific. It might limit the application and generalization. Secondly, the sample is only from public universities, private universities and vocational colleges are not included. In addition to the factors discussed in this study, blended learning could be influenced by other factors from the learner's background, such as the size of the country, and the timing of the implementation of blended learning, as mentioned by Poon (2014)[47].

Future research could expand the research model, enrich the sample and use a combination of qualitative research and case studies to better understand the factors that influence students' self-efficacy in blended learning.

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