Exploring the Influence of Teacher-Student Interaction on University Students' Self-Efficacy in the Flipped Classroom

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Abstract

The purpose of this study is to explore the impact of teacher-student interaction on undergraduate students' self-efficacy in a Chinese university setting. Students came from natural science, management, economics, medicine, engineering and humanities. The empirical results demonstrate that teacher-student interaction has positive impact on students' self-efficacy and their preference of the flipped classroom. Furthermore, the positive relationship between teacher-student interaction and students' self-efficacy is partially mediated by students' preference of the flipped classroom. Educators should focus on student-centered learning and motivate students' preference of the flipped classroom. Students should be encouraged to actively participate in the flipped learning as well. It contributes to the reform of the flipped classroom and improvement of teaching quality in the universities.

Keywords: teacher-student interaction, self-efficacy, flipped classroom

1. Introduction

Rapid development of information technology has changed teaching and learning models. The flipped classroom has burgeoned. The literature indicates that the flipped classroom offers positive academic outcomes after a decade of research (Chen et al., 2017; Brewer & Movahedazarhouligh, 2018). It is concluded that the flipped classroom can not only improve students' learning performance and promote their confidence, but also provide collaborative learning and peer-assisted learning to help students engage in the flipped model (Akcayir & Akcayir, 2018). The flipped classroom is a student-centered teaching approach and philosophy that has challenged instructors to renew their teaching ideas and concept (He, 2014), and students to make the shift from passive learning to active learning as well. There has been a boom in the adoption of online education because of the global outbreak of COVID-19. One of the characteristics of the flipped classroom is that it combines the advantages of online and face-to-face instruction. Therefore, it will help to drive the sustainable and healthy development of online education.

However, researchers have demonstrated little interest in teacher-student interaction in the flipped classroom. Teacher-student relationship has been neglected in higher education study (Hagenauer & Volet, 2014). Considering prior studies mainly focused on theoretical studies or subject-specific areas (Zhang, 2017), quantitative studies and cross-disciplinary studies may contribute to understanding teacher-student interaction. Consequently, the objective of this study is to analyze the influence of teacher-student interaction on university students' self-efficacy in the flipped classroom environment. The study will be beneficial to interdisciplinary researches of teacher-student interaction and harmonious relationship between university teachers and students.

2. Literature Review

Teacher-student interaction has been regarded as one of the critical issues in the higher education context. Learner-centered teacher-student relationship helps draw attention to the students and learning processes as critical to students' learning outcomes (Lambert & McCombs, 1998; Cornelius-White, 2007). Relationship between teachers and students influences students' learning outcomes significantly (Zhang, 2019). Chickering and Gamson (1987) suggested that frequent faculty-student contact is the most important factor to motivate students in undergraduate education. Generally, active teacher-student interaction is positively related to students' academic and social success. The environments of teacher-student interaction have been changing because of the

growing availability of internet and artificial intelligence technologies. Compared to traditional teaching, the flipped classroom is more complex and flexible in the component of teaching materials and processes.

The flipped classroom has different features in interactive subjects, contents, methods and stages. It provides active and good opportunities for interaction during teaching processes between teachers and students, and among students. According to Hosam et al. (2020), the utilization of flipped classroom promotes the students' engagement. The flipped approach was found to facilitate the interaction with the teachers and learners (Mzoughi, 2015). By high intensity interaction and collaborative learning forms, the flipped classroom can enhance the students' problem-solving ability and reinforce their sharing of ideas and involvement. Thus, it can stimulate their overall development (Feng et al., 2016). Zeng and Zhan's (2016) survey of teaching effects based on 2,739 students in undergraduate colleges stated that teaching models using new technologies such as the flipped classroom and MOOC can significantly improve the classroom teaching effect. The more, the better.

Yet, some scholars reported the inconsistency to the previous results. For example, there were no significant impacts of the flipped classroom on students' learning. Compared to traditional classroom, the flipped classroom cannot improve students' grades, achievement, and performance (Davies et al., 2013; Hotle & Garrow, 2015; Ojennus, 2016). Further research should explore how the flipped classroom can affect the students' learning outcomes. Specifically, this study focuses the following two research questions:

1) How are teacher-student interaction and students' self-efficacy correlated to each other in the flipped learning context?

2) What is the effect of students' preference of the flipped classroom between teacher-student interaction and students' self-efficacy?

3. Research Hypotheses

3.1 Teacher-Student Interaction and University Students' Self-Efficacy

In the flipped classroom, teacher-student interaction consists of online interaction and classroom interaction. Online interaction between teachers and students, characterized by person-machine-person relationship, presents as human domination. It has numerous advantages, which utilizes multiple technological methods to break the time and space limitation. Despite these views, online interaction may not replace classroom interaction (Yang et al., 2010). The flipped learning was found to facilitate students to become active learners and participants, while teachers acted as instructors and promotors as well (He, 2017). The utilization of flipped classroom can help students internalize and transfer knowledge through affective interaction with teachers and peers in the classroom, thus reducing students' cognitive load (Ye et al., 2014).

Self-efficacy has been used in higher education to study students' learning approaches (Richardson et al., 2012). In the flipped classroom, self-efficacy, which is a psychological factor affecting learners' performance and success, is influenced by several factors. Online and classroom interactions between teachers and students provide considerable learning resources for the students, while teachers can solve the problems online or in the classroom. They improve the frequency and efficiency of teacher-student communication, and contribute to students to take charge of their own learning process. For example, they can pause or rewind media resources to review or revisit the learning materials (Bergmann & Sams, 2012). Hence, teacher-student interaction may reinforce students' belief or confidence to complete their tasks. Thus, we propose:

Hypothesis 1. Teacher-student interaction in the flipped classroom is positively related to university students' self-efficacy.

3.2 Teacher-Student Interaction and Students' Preference of the Flipped Classroom

Because of interaction between teaching and learning, teacher-student interaction is known to be a complex process. A national survey in Chinese colleges and universities found that there were several prominent problems in interactions of classroom teaching (Zhang, 2019). For instance, teachers could not remind students of their learning problems and requirements, or provide immediate feedback to students' assignments. Consequently, traditional teacher-centered teaching approach would not be accepted by the students. Conversely, the flipped classroom transforms teacher-centered teaching into student-centered teaching. The flipped approach supports knowledge teaching by offering opportunities for students' autonomy and self-directed learning. Face-to-face teaching encourages students' involvement as group discussion, cooperative learning, and presentation activities and problem solving. Students are motivated to participate in the teacher-student interaction, which they can obtain effective and objective feedback. Obviously, students prefer the flipped learning. Therefore, the following hypothesis is proposed:

Hypothesis 2. Teacher-student interaction is positively related to university students' preference to the flipped classroom.

3.3 The Mediating Role of Students' Preference of the Flipped Classroom

Gen Z-ers are digital natives who are used to digital living style. In digital learning environments, university students are capable of learning new knowledge and professional skills with multiple IT means. The flipped classroom applies internet and information technology to break through traditional classroom and teaching. It facilitates teachers and students to improve their communication. Students can obtain access to online information and resources and finish learning assignments based on online course platforms, thus teacher-student interaction may be enhanced. Undoubtedly, teacher-student interaction in the flipped classroom context stimulates students' learning interest and motivation, so they become more active participants. Hence, students' preference leads to successfully strengthen their confidence in the learning. Based on the above argument, we posit the following hypothesis:

Hypothesis 3. University students' preference of the flipped classroom mediates the relationship between teacher-student interaction and students' self-efficacy.

4. Method

4.1 Sample

We collected data from a Chinese university that explores the flipped classroom as teaching reform. This university allowed us to randomly select undergraduates with the flipped learning experiences. From 2018 to 2019, we sent out 649 questionnaires to the students in the classes and collected them onsite. Among them, 463 ones were effective (71.3% effective rate). Students were mostly female (73%). 20.5% were freshmen, 67.4% were sophomore, and 7.6% were junior students. They came from economics (17.1%), management (46%), natural science (21.2%), engineering (3.7%), medicine (8.9%) and humanities (3.2%).

4.2 Measures

In this study, we selected Fisher et al.'s (1998) 48-item teacher-student interpersonal behavior scale, which was revised by Xin (2000), to measure teacher-student interaction. The scale consists of eight dimensions as leadership, helping, understanding, student responsibility, uncertain, dissatisfied, admonishing, and strict behaviors. Each of the eight subscales contains six items. We calculated the scores of all items. Students rated each item in a five-point scale ranging from 0, "never", to 4, "always". Two sample items are "This teacher explains things clearly" and "We can decide something in this teacher's class".

Self-efficacy was measured using a ten-item general self-efficacy scale (GSES) developed by Schwarzer et al. (1997). Students rated each item on a four-point scale ranging from 1, "not at all true", to 4, "exactly true". Sample items are "It is easy for me to stick to my aims and accomplish my goals" and "I can solve most problems if I invest the necessary effort". Students' preference of the flipped classroom using one-item on a five-point scale ranging from 1, "strongly dislike", to 5, "strongly like".

Control variables such as students' gender, grade, and major were collected and controlled for, given that they may correlate with study variables and have relations between study variables.

5. Results

5.1 Confirmatory Factor Analysis

To ensure that we could assess teacher-student interaction as a higher order factor, we conducted a confirmatory factor analysis with Amos. The model showed the acceptable fit (χ^2 = 48.067, df = 6, χ^2/df = 8.011 RMR = 0.009, GFI = 0.974, NFI = 0.979, TLI = 0.915, CFI = 0.982; Kline, 2005). The model of self-efficacy demonstrated the acceptable fit (χ^2 = 258.193, df = 35, χ^2/df = 7.377, RMR = 0.037, GFI = 0.891, NFI = 0.851, TLI = 0.83, CFI = 0.868; Kline, 2005).

5.2 Descriptive Statistics and Correlation Analysis

Table 1 displays means, standard deviations, correlations, and Cronbach alpha coefficients of the studied variables. It is noted that teacher-student interaction was significantly correlated with university students' self-efficacy (r = 0.33，p < 0.01) and students' preference of the flipped classroom (r = 0.14，p < 0.01); students' preference of the flipped classroom and their self-efficacy were significantly correlated (r = 0.14，p < 0.01). These results provide initial support for above hypotheses.

Table 1. Means, standard deviations, and correlations of all variables

Variables	M	SD	1	2	3	4	5
1. Gender	0.27	0.44					
2. Grade	1.97	0.70	-0.13***				
3. Major	8.22	3.33	-0.09	0.33**			
4. TS interaction	1.88	0.40	0.25**	-0.04	-0.10*	(0.894)	
5. Self-efficacy	2.33	0.51	0.16**	-0.02	-0.07	0.33**	(0.868)
6. Preference	3.27	0.81	0.11*	-0.04	-0.09	0.14**	0.14**

Note. TS interaction=teacher-student interaction. Gender: 0=female; 1=male. Grade: 1=freshman; 2=sophomore; 3=junior; 4=senior; 5=other. Major: 1=philosophy; 2=economics; 3=law; 4=education; 5=literature; 6=history; 7=natural science; 8=engineering; 9=agriculture; 10=medicine; 11=management; 12=arts. Cronbach alpha coefficients are reported in parentheses on the diagonal.
* $p<0.05$, ** $p<0.01$, *** $p<0.001$ (two-tailed).

5.3 Reliability Analysis and Common Method Bias Analysis

As shown in Table 1, all the variables demonstrated internal consistency with acceptable coefficient alphas, which were higher than the suggested cutoff value of 0.70 (Nunnally & Bernstein, 1994). As in this study using self-report data, common method bias may have affected the survey results (Podsakoff et al., 2003). We conducted common variance test with SPSS. The first factor extracted by principal component analysis explained 20.57% of the variance of all variables, lower than 50% (Hair et al., 1998). Thus, we limited the effects of common method variance.

5.4 Test of Hypotheses

Before testing the hypotheses, independent sample t-test analyses were conducted to evaluate the impacts of gender on students' self-efficacy and preference. The results showed that there were statistically significant gender differences in students' self-efficacy and preference scores. Analysis results of variance showed that grade and major had significantly influences on students' self-efficacy. Meanwhile, the results of multicollinearity test indicated that the index of tolerance and variation inflation index met the standards. Then, we used hierarchical regression analysis to assess the relationships.

As shown in Table 2, after entering the control variables, gender, grade, and major, teacher-student interaction in the flipped classroom was positively related to students' self-efficacy (b = 0.40，p < 0.001), and students' preference (b = 0.21，p < 0.05). H1 and H2 were supported. According to the three-step procedure of testing the mediation model (Baron & Kenny, 1986), the results of H1 and H2 met the first two requirements for mediation test. We thus entered students' preference to test the possible mediating effect on the relationship between teacher-student interaction and students' self-efficacy. Students' preference was found to be significantly related to self-efficacy (b = 0.06，p < 0.05), while the coefficient of teacher-student interaction was reduced in size but still significant (b = 0.39，p < 0.001), suggesting partial mediation. H3 was supported.

Table 2. Regression summary for the mediating role of students' preference

Variables	Preference	Students' Self-efficacy	
	Model 1	Model 2	Model 3
Gender	0.16	0.10	0.09
Grade	0.00*	-4.894E-6	1.000E-5
Major	2.811E-5**	8.711E-6	7.097E-6
TS interaction	0.21*	0.40***	0.39***
Preference			0.06*
R^2	0.05*	0.12***	0.13***

Note. TS interaction=teacher-student interaction. * $p<0.05$, ** $p<0.01$, *** $p<0.001$ (two-tailed).

6. Conclusion and Discussion

This study reports the effect of teacher-student interaction on university students' self-efficacy in the flipped classroom in China. Results and findings presented above show that teacher-student interaction could improve students' self-efficacy. Students' preference of the flipped classroom partially mediated the relationship of teacher-student interaction with their self-efficacy. Active teacher-student interaction could increase students' preference of the flipped classroom, thus enhance their self-efficacy as well. Hence, teacher-student interaction would have important impact on university students' self-efficacy in the flipped classroom.

The findings of the present study offer support to explain the influence of teacher-student interaction on students' self-efficacy in a Chinese higher education setting. Positive teacher-student interaction can promote university students' self-efficacy. Compared to the traditional classes, the flipped classroom requires teachers and students to comply with student-centered approach. What is important with this finding is that teachers and students should be prepared for the transformation of student-centered education. Teachers should use information technology to direct, supervise and assist students' online and classroom learning, and subsequently motivate students' preference of the flipped classroom. On the other hand, students should be directly involved and active in the flipped learning to improve their learning outcomes.

We suggest teachers might focus on students with low self-efficacy levels to encourage them to participate in the flipped learning. Those with low self-efficacy should be provided with more support in comparison with high self-efficacy students. Through active teacher-student interaction, learning in the flipped classroom could enhance students' self-efficacy. Conversely, the enhanced self-efficacy will be conducive to the construction of harmonious teacher-student relationship. In addition, this could improve the reform of the flipped classroom and enhance students' learning outcomes.

This research has limitations. One significant limitation is the samples used. They came from one university. Moreover, this study undertook a limited mediating variable. Third, self-rating scales were used. Further research can be extended to diversified colleges and universities. Research can also explore other mediating variables or moderating variables to check how teacher-student interaction affects students' self-efficacy. Finally, research samples can be extended in several aspects in future study.

Acknowledgements

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