Received: December 21, 2017
Revision received: May 22, 2018
Accepted: May 23, 2018

www.estp.com.tr
DOI 10.12738/estp.2018.6.166 ♦ December 2018 ♦ 18(6) ♦ 2661-2676

Research Article

Learner- Centered Flipped Classroom Teaching Reform Design and Practice—Taking the Course of Tax Calculation and Declaration as an Example*

Meiling Lu[1]
Jinan University

Qingchi Han[2]
Guangdong University of Finance & Economics

Abstract

The learner-centered teaching concept and the flipped classroom teaching method are effectively combined to become an important mode for today's mixed teaching reform. The "rain classroom" has provided an effective platform for the combination of the two. First of all, we use the "rain classroom" teaching platform and take a course as an example to study the learner-centered flipped classroom teaching reform design. The main teaching methods are grading of ability level, after-school study group, case study, and online and classroom interactive Q&A. Secondly, through the investigation of students' learning ability and willingness to learn, the teaching framework is designed to be suitable for students to learn and for teachers to teach students according to their aptitude. Finally, by paying attention to the real-time feedback of the effect of students using the flipped classroom, this paper proposes problems that should be paid attention to when implementing the flipped classroom. The results show that the course has been successful after its setup and implementation. The learner-centered teaching method, which respects the ability level classification of learning initiative, can complement the after-class content with the classroom content, and effectively improve the teaching and learning effects.

Keywords

Learner-Centered • Flipped Classroom • “Rain Classroom” Platform • Curriculum Reform

*The work was supported by Guangdong Natural Science Foundation, No: 2018A0303130116.
[1]Department of accounting, Jinan University, Guangzhou 510632, China. Email: 710819911@qq.com
[2]**Correspondence to:** Qingchi Han, School of Economics, Guangdong University of Finance & Economics, Guangzhou 510302, China. Email: hqchi2012@126.com

Citation: Lu, M. L, Han, Q. C. (2018). Learner-Centered Flipped Classroom Teaching Reform Design and Practice—Taking the Course of Tax Calculation and Declaration as an Example. *Educational Sciences: Theory & Practice, 18(6),* 2661-2676. http://dx.doi.org/10.12738/estp.2018.6.166

The learner-centered talent training mode has been well recognized and received strong support from the education departments and educators in recent years. China's "*National Medium- and Long-Term Education Reform and Development Plan (2010-2020)*" has specified the requirements for talent cultivation and the comprehensive development of students' personality to "accelerate the establishment of a learner-centered talent training mode." In 2018, the Ministry of Education of China issued the "*Education Informatization 2.0 Action Plan*". By 2022, China will generally improve the information application level and the information literacy of teachers and students, and build an "Internet + Education" platform. It can be seen that the teaching reform of traditional classroom teaching is imperative.

On the one hand, after 20 years of research, people have studied the definition of “learner-centered” in various online and traditional classroom and school environments, confirming that in most cases, taking learners as the center helps to complete high quality teaching (McCombs, 2012, 2013a, 2013b; Satoshi, 2016; Debiec, 2018). As early as 1994, "the coolest school in America", the Minnesota New Country School (MNCS) had encountered challenges of learner-centered teaching for teachers and students during development (Aslan & Reigeluth, 2015). Some studies have also found that learner-centered teaching method is influenced by specific national cultures and can promote or seriously hinder learners from learning independently (Boyadzhieva, 2016). In particular, when teachers fail to implement learner-centered teaching practices, the results actually do more harm than good (Schuyler, Steele & Pane, 2016).

On the other hand, the goal of learner-centered online teaching is to provide an environment that is consistent with constructivist learning theories (Fishman et al., 2013). Researchers and curriculum teachers are committed to providing students with a good learning environment. Research has found that flipped classrooms provide a positive learning environment for students and teachers (Akhondi, Yarmohammadian & Haghani,2015; Chen, Wang & Chen,2014), and compared to traditional classrooms, the effect of flipped classroom teaching has improved significantly (Baker, 2000; Lage, Platt & Treglia, 2000; Butt,2014; Burgoyne & Eaton,2018; Tugun, 2018). This type of teaching has been very popular in recent years (Abeysekera & Dawson, 2015; Giannakos, Krogstie & Chrisochoides, 2014; Shyr & Chen, 2017; Lo, Chi & Hew,2018). Burcak (2014) found that a variety of learner-centered teaching methods combined with user-centered design can improve students' motivation in different cognitive and emotional areas. How to formulate an effective curriculum teaching scheme in combination with the flipped classroom under the concept of learner-centered is of great significance for improving the quality of teaching.

The Individualized Learning Programs (ILPS) is a useful tool to promote learner-centered education and can be used by learners at all levels. At present, the learning ability and characteristics of higher vocational students are quite different. In the design of teaching, we must consider both the overall framework of the curriculum, and the individual differences of students, moreover, we must fully follow the idea of teaching students according to their aptitude. “Rain Classroom” was officially promoted and freely used in China in April 2016 with the help of WeChat platform, achieving a mixed teaching mode of flipped and online classroom. It is convenient for teachers to carry out teaching practice, such as pushing video, exercise, and audio pre-study courseware to students' mobile phones, teachers and students can communicate and feedback in a timely

manner; it also can fully mobilize students' enthusiasm, such as real-time answering in class, bullet screen interaction, and red envelope lucky draw, etc.; furthermore, it provides complete three-dimensional data support, personalized reports, and automatic task reminders for teachers and students, so as to make teaching and learning clearer. As of March 15, 2018, more than 200,000 classes were using it all over the world, with more than 3 million registered users. Blumberg (2016) pointed out that using more learner-centered or more teacher-centered practices in a course depends on the characteristics of the course and the audience. Therefore, taking the rain classroom platform as an example of specific curriculum design, how to make full use of the flipped classroom while taking learners as the center, and how to fully mobilize the learner's learning motivation and initiative combined with the learners' characteristics are realistic problems worthy of our solution.

This paper reports the flipped classroom teaching design of the rain classroom platform of for GuangZhou Civil Aviation College (GZCAC) accounting major required course "*Tax Calculation and Declaration*". The specific teaching design is considered from three aspects: first, how to design an effective flipped classroom teaching based on the rain classroom platform? Second, compared with traditional classroom teaching, do students like the rain classroom platform? The third is whether students adapt to such teaching design? These three questions were answered by author Meiling Lu in a two-part survey of students in March and June 2018 when she first used the "rain classroom" flipped teaching for this course.

The second part of the paper is about the learner-centered teaching idea, the flipped classroom teaching method, the application of the rain classroom teaching platform and the application status of the "*Tax Calculation and Declaration*" course. Next is the design part of the teaching content innovation path of the "*Tax Calculation and Declaration"* course, including specific curriculum arrangements and feedback on teaching results. The fourth part is problems that should be paid attention to when applying the flipped classroom, mainly from three perspectives: education department, teachers and students. The last part is the conclusive suggestion.

Application status analysis of learner-centered "*Tax Calculation and Declaration*" flipped classroom

Characteristics and current status of learner-centered design

The learner-centered teaching method is supported by many scholars (Blumberg & Pontiggia, 2011; Burcak, 2014; Satoshi, 2016). The US Coursera platform has innovated its operation mode under the guidance of the learner-centered concept and achieved breakthroughs in teaching reform. China's vocational education was the first to introduce this educational concept and practice it (Deng, 2017). Blumberg & Pontiggia (2011) developed a metric for learner-centered courses. Cowan (2013) pointed out abilities required for succeeding in online learning, but provided little guidance to those who do not perform well in online self-assessment. Aslan & Reigeluth (2016) pointed out that the case should be better revised and evaluated to facilitate technical support for the learning of the students.

Characteristics and current status of flipped classroom teaching

With the development of information technology, the learner-centered talent training mode is mostly applied

in smart classroom teaching, one of which is the flipped classroom teaching, and it has been paid more and more attention by scholars and students (Butt, 2014).

The core of flipped classroom is to move the teaching process in the classroom to the outside of the classroom. The formal classroom time is used to allow students to collaborate and interact. Students use the mobile terminal and network equipment to learn independently after school, and control the progress of the learning by themselves, and they can ask the teacher in the classroom about the questions they encountered during learning. From 2007 American chemistry teacher Jonathan Bergmann and others used the flipped teaching for the first time until the global famous school video open class and Khan Academy micro-video, etc., and the practice of exploring the transformation of teaching and learning under the support of flipped classroom information technology has become one of the important contents of the school teaching reform practice (Zhu, Guan & Qiu，2015). The "online learning" and "classroom teaching" under the flipped classroom teaching mode has effectively promoted the efficiency and effect of teaching (Qiu & Qiu, 2015).

Teaching effect and performance metrics of flipped classroom

Professor Marcy P. Driscoll, Dean of the Florida State University, School of Education, uses online learning as an example to indicate that technology per se cannot solve problems and change the teaching paradigm, and the focus of educational technology is on how teachers can use new tools to solve practical problems. Lai & Hwang (2016) combine self-regulating strategies with flipped learning to improve students' self-efficacy. Strategies for planning and using learning time enable them to learn effectively and achieve better academic performance. Wang (2017) considered the activity of designing attractive and step-by-step problem-solving as the core of an effective flipped classroom, and a self-reflecting and self-assessing learning culture helps to stimulate active participation in online learning activities. Therefore, we need to study how to use the rain classroom platform to design attractive flipped classroom teaching activities and improve the application effect of the curriculum.

Characteristics and teaching status of the "*Tax Calculation and Declaration*" course

One of the characteristics of the "*Tax Calculation and Declaration*" course is that there are many formulas and many rules, which are difficult to master. Due to the limitation of class time, it is difficult for students to thoroughly understand the influence of factors in such a short period of time, so the efficiency of classroom teaching of "*Tax Calculation and Declaration*" needs to be improved. From the perspective of teaching, knowledge points should be divided according to the importance; but from a legal perspective, any law clause is a focus, and each formula of the tax law must be accurate and errorless for tax units and taxpayers. As a transmitter of knowledge, we must not only teach students the ability to know all by knowing one method, but also the most comprehensive and up-to-date theoretical knowledge and practical experience when conditions permit, however, the traditional classroom can hardly achieve that. While its very advantageous for the "*Tax Calculation and Declaration*" course to adopt the flipped classroom teaching mode.

Tax regulations change frequently, while teaching materials lag behind to a certain extent. Since 2017, China has fully implemented the reform of "replacing business tax (BT) with value-added tax (VAT)", and since 2018, the "five certificates in one business license" is implemented and the environmental tax begin to collect, in all these changes we can see that, our textbooks are lagging behind the tax laws. This problem requires teachers to keep abreast of the latest tax information and adjust the teaching content in a timely manner to ensure the timeliness and accuracy of knowledge transfer. Generally speaking, teachers need to submit teaching contents, syllabus and teaching plans before the formal class. Due to the changes in the tax law, for the traditional classroom teaching, the original teaching arrangement is easily disrupted because of the insertion of new contents, while the flipped classroom teaching mode can arrange these changes outside the classroom to meet the timeliness requirements of teachers to teach new knowledge to students.

Students lack sufficient capacity to handle integrated business. When processing tax-related business, students' calculation is inaccurate and they cannot make corresponding accounting entries, which are the basic working abilities that corporate finance personnel should have. Most of the current textbooks are written separately according to the tax law and financial accounting. In the course of teaching, some school would teach the two courses of accounting and tax law separately, financial accounting focuses more on learning of criteria and less on tax law knowledge. While the teaching of tax law only explains law of tax, focuses more on the calculation of taxes and fees, it separates the original inseparable relationship between the two curricula, and it is difficult for students to achieve the integration of the two. The teaching mode of flipped classroom can use communication media to add some contents such as *Tax Accounting*, *Tax Planning* and other courses for students' self-study after class, so as to make up for the shortcomings of traditional classroom teaching.

Under the traditional teaching method, the teaching of the course *Tax Calculation and Declaration* gets boring easily. By applying the flipped classroom teaching, the teaching of *Tax Calculation and Declaration* can be more interesting, but it's difficult for the textbooks of *Tax Calculation and Declaration* to be vivid and interesting. The flipped classroom teaching mode can integrate various elements such as video, animation, and pictures online, making the teaching content more interesting, so as to attract learners to watch the videos. The length of the video is normally 3-5 minutes, and the knowledge points are thoroughly explained, so that learners can repeat the viewing many times and improve the learning efficiency. Combining after-class pre-study and review with the classroom explanation, discussion, comment and Q&A can arrange the teaching time and adjust the teaching content appropriately to better meet the needs of learners.

For theory + practice mode of traditional *Tax Calculation and Declaration* course, the class time is not enough, the efficiency is not high. In order to cultivate students' ability to combine theory with practice, each tax theory knowledge will have corresponding declaration practices. Taking the 72-hour class schedule as an example, if there is no separate training course for declaration practice, normally, the theory and practice will be divided equally, each with 36 class hours. Such an arrangement is difficult to drive the knowledge points home. By applying flipped classroom, teachers record the practical training as a video, and students can learn it by themselves after the class, and finish the practical training tasks in groups. For difficult links, teachers can explain and answer them in the online classroom, which not only saves the classroom teaching time, but also cultivates students' hands-on ability and teamwork ability.

Design of innovation path of the teaching content of *Tax Calculation and Declaration* course

Overall teaching design process

Combined with the teaching characteristics of flipped classroom - starting from the teaching objectives and teaching problems, the teaching activities run through the entire teaching process, and the entire teaching design process is constructed with reference to the ADDIE model in the following chart.

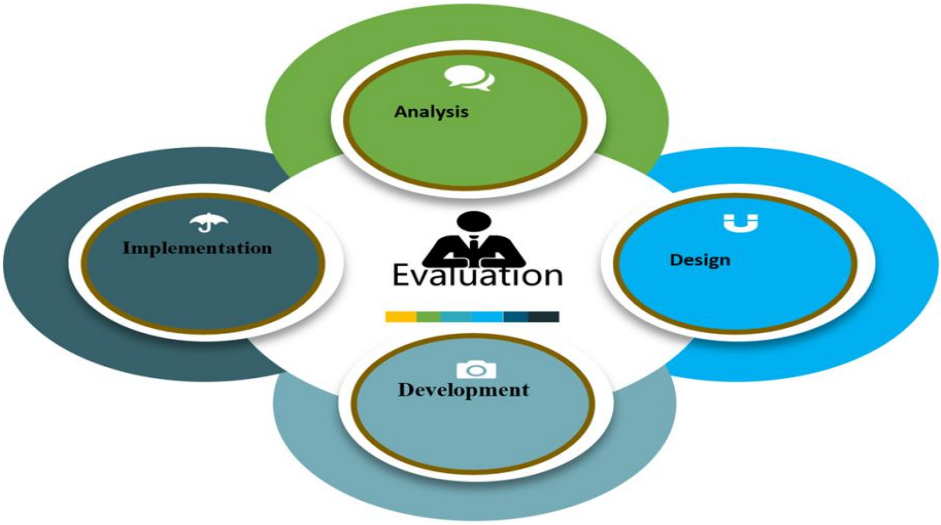

Figure 1. Teaching design flow chart

In the Figure 1, analysis and design are prerequisites, development and implementation are the core elements, evaluation is the summary and guarantee, and the three are inextricably linked. Teachers use the design, development and implementation links to select appropriate teaching resources, teaching methods and teaching techniques to produce targeted courseware, videos, question banks, etc., they guide the learners in an orderly manner to stimulate their interest in learning and improve learning efficiency, meanwhile they encourage learners to participate in the learning process, improve the state of out of control in the learning process; meanwhile, they receive feedback from various parts through the evaluation phase and optimize the system in time, adjust the learner's learning pace, and improve their learning initiative (Gagne & Briggs, 2010).

Design framework for the combination of rain classroom *Tax Calculation and Declaration* "teaching-learning" and the flipped classroom

In 2017, at an education conference, Dr. Ward Cates of Lehigh University pointed out that the current researches have paid too much attention to the function of new technologies, while ignoring how to design

optimized teaching under technical support, making it difficult to achieve effective teaching. The core of educational technology field is the teaching design, not the teaching media. Teachers should use clear learning objectives to guide the entire teaching activities, pay attention to the interaction and practice of learning activities, and promote students' active learning. Teachers need to effectively guide students to explore, and should focus on encouraging students to cooperate with each other in the process of exploration (Chen et al., 2018). Because the discussion and exchange between peers helps students improve their academic performance (Smith et al., 2009). The design of the "Rain Classroom" platform is divided into three parts: pre-class, in-class and after-class, forming a circular mechanism of preparation, implementation and feedback. Before the class, teachers determine the standard of the course teaching ability according to the abilities required by the talent market, and then carries out development and design. The part of the theoretical knowledge that is easy to self-study is transferred to the pre-class study. In the classroom, teachers can focus on the knowledge points that students have difficulty understanding or misunderstanding in the pre-class study, and supplement some profound knowledge content. In the classroom, students and teachers use the "rain classroom" to learn and teach together. Rain Classroom has a variety of functions for teachers and students to use in class, such as the setting of "not understand" button, timed exercises, bullet screen function, red envelope for quick response, etc., which can all enliven the classroom atmosphere and make students focus their attention, so as to effectively reduce the phenomenon that college students play with their mobile phones in class and improve the utilization of classroom time. The classroom teaching data can also be displayed on the teachers' mobile phones simultaneously, which can help teachers to quantitatively understand the students' learning effect, master their learning trajectory, and better mobilize their participation, so as to better realize the integration of teaching and learning. The specific teaching design framework is shown below:

Table 1
Design Framework of Rain Classroom Flipped Teaching for Tax Calculation and Declaration

	Pre-class	In-class	After-class
Teachers	1. Talent demand survey	1. Self-service attendance	1. Online Q&A
	2. Able to use rain classroom	2. Learning effect detection	2. Back stage data analysis
	3. Resource construction	3. Supplementary explanation	3. Interaction with students
	4. Determine the teacher	4. Class Q&A	4. Supervised learning
	5. Test running	5. Comment and instruction	5. Resource perfection
	6. Resource update and perfection	6. Publish new tasks	6. Publish new tasks
Students	1. Be familiar with platform operation	1. Problem solving	1. Self-learning
	2. Understand the rules of the course	2. Advanced learning	2. Level selection
	3. Pay attention to platform push	3. Classroom test	3. Teamwork
	4. Complete learning on time	4. Classroom discussion	4. Results upload
	5. Timely feedback	5.Classroom feedback questions	5. Feedback questions

Tax Calculation and Declaration **flipped classroom teaching design**

The teaching goal of *Tax Calculation and Declaration* course is to cultivate students' application ability,

which is mainly divided into two major teaching modules: tax calculation and tax declaration. The teaching duration is 72 hours, and the textbooks are selected to be the third version of *Tax Calculation and Declaration* Published by the Higher Education Press, the editor is Weiyang Liang. The reference books include 2018 junior-level accountant textbook *Basic Economic Law*, 2018 certified public accountant textbooks *Tax Law*, *Tax Accounting* and *Tax Planning*

Student ability level division. According to the theory of advanced organizer, it is better for learners to have a "fixation point" of knowledge before learning new knowledge, and the learning process can be carried out more smoothly. According to the learner-centered training mode, Hanewicz, Platt & Arendt (2017) set the learning task to the level of a “buffet”, which allows students to complete tasks selectively. If you want to get an A, you need to do more tasks. The results show that 36% of students complete tasks far beyond what should be accomplished with high scores. Lim & Nadeau (2016) found that well-organized student-led interest groups are a great way to provide focused extracurricular activities that enable students to apply their leadership and organizational skills to effectively make up for the professional themes that are missing in the generalist curriculum. In view of this, this paper divides learners' ability to learn new knowledge and spontaneously form study groups. The specific classification criteria are as follows:

Table 2
Ability Level Division

Ability classification	**Ability level**	**Target requirement**	**Assessment criteria** (see filter rules below)
Professional ability	1. Basic application ability	Minimum requirements for talent cultivation	Qualified
	2. Primary application skills	The primary accountant's ability is that one can independently complete the basic tax work	Medium
	3. Intermediate application skills	The intermediate accountant’s ability is that one can complete all tax work and has certain tax management abilities	Good
	4. Advanced application skills	The CPA’s ability is that one can manage the overall tax business.	Excellent
Social ability	Teamwork ability	Study groups work together to complete project learning tasks	Teachers evaluation
	Communication and coordination ability	Effective communication among students	Students mutual evaluation

The students’ level division needs to consider a variety of factors in advance. First, the teacher will make a preliminary division according to the scores of basic accounting and other specialized courses that the students have completed, then combine with the entrance psychological test results and consult the counsellors and specialized course teachers to initially determine a reference level. Then the teacher will talk to each student and the talking is to encourage them to work aiming at the highest level.

Teaching content arrangement and design taking VAT as an example. The design of the course content is mainly based on the seven learning situation modules of the textbook. Learning situation I is the tax declaration process, learning situation II is the VAT calculation and declaration, and other situations are the calculation of tax types and tax declaration. Taking the rain classroom application design of the teaching of VAT as an example, students need to complete the pre-study tasks assigned by teachers before the class,

participate in the teaching activities in the classroom, and complete the corresponding assignments according to their own ability level after the class. At last, teachers collect the back-stage data and form feedback evaluation. In order not to increase the burden on students, the length of study before and after class has time control. The specific content design is as follows:

Table 3
VAT Calculation and Declaration Teaching Content Arrangement and Design (12 hours)

Number of lectures	Ability level	Pre-class (assigned by teacher, completed by students) (learning like completing levels in a game)	Online learning time	In-class (teacher-student interaction, explanation mainly for 1-2 level)	After-class (teachers assign homework)	Online learning time
1	1	Pre-study courseware: 1) Definition of VAT and scope of taxation 2) Taxpayer classification Pre-study effect test questions: 3 objective questions	7′	1. Q & A 2.Supplementary explanation of taxpayer tax rate; classroom test 3. Preferential tax policy, classroom test 4. General taxpayer's taxable amount calculation: confirmation of sales.	Ability 1. Assignment	3′
	2	Add 2 pre-study effect test questions 2'	9′		Ability 2. Assignment	5′
	3	Pre-study courseware adds depth 10'; Pre-study effect test questions add 3 objective questions 3'	22′		Ability 3. Assignment	6 ′
	4	Pre-study courseware adds depth 10'; Pre-study effect test questions add 3 objective questions 3'			Ability 4. Assignment	10′
	5	Raise questions			Teachers collect feedback evaluation data + online Q & A	
2-6		Omitted			Omitted	

Note. 1) Steps completed by the students before class, learning like completing levels in a game, level-2 needs to complete level-1 first, level-3 needs to complete level-1 and level-2 first, and level-4 needs to complete level-1, level-2 and level-3 first. 2) After the class, the homework questions also need to be completed like completing levels in a game.

Flipped classroom learning tendency survey and preliminary implementation results

Questionnaire design and investigation. In order to better understand the students' interest in using Rain Classroom platform to implement flipped classroom teaching, introduce students of the teaching mode and assessment rules of the semester, and conduct a preliminary study willingness survey from the first week of the

class. The respondents were first-year students in the accounting profession of our school, 41 people from class-1, 39 people from class-2, totalling 80 people, and 69 people gave effective feedbacks. The questionnaire is designed to have 10 single-choice or multi-selective objective questions. The questions involve the premise of students' participation in the rain classroom, their participation willingness, expectations of the curriculum, the foundation of learning ability, and the motivation to learn. The survey results are as follows:

Table 4
Questionnaire and Feedback

Classification	Topic	Result			Pre		
		A	B	C	A	B	C
Student participation prerequisites	1. Does your mobile phone install WeChat? A.YES B.NO	69			1.0000***		
	2. Can your mobile phone watch videos? A. YES, B. NO	68	1		0.9855***	0.0145	
	3. Can your mobile phone's traffic support learning materials for about 5 minutes a day? A.YES B.NO	57	12		0.8261***	0.1739	
	4. Can your mobile phone use the campus wireless network? A. YES, B. NO	63	6		0.9130***	0.0145	
	5. If your communication expense increased because of using mobile traffic to watch course videos, are you still willing to use mobile phone for learning? A. YES, B. NO	56	13		0.8116***	0.1884	
	6. If the course videos don't consume traffic when watching, are you still willing to use mobile phone for learning? A. YES, B. NO	69			1.0000***		
Student participation willingness	7. For the traditional teaching and rain classroom flipped classroom mixed teaching, which one do you prefer to experience? A. Traditional teaching, B. Flipped classroom C. Does not matter	12	30	27	0.1739	0.4348	0.3913
Student curriculum expectations	8. What knowledge do you hope to learn in this course? (Multiple choice) A. Legal knowledge B. Tax declaration ability C. Comprehensive ability	3	7	59	0.0435	0.0145	0.8551***
Student ability foundation	9. During the last semester, how many specialized courses did you fail? (Basic accounting, Financial regulations and accounting professional ethics) A. 0, B. 1, C. 2	63	2	4	0.9130***	0.029	0.058
Student subjective initiative	10. In this course, no matter which teaching mode is adopted, will you study hard for reasons such as not failing? A. YES, B. NO	68	1		0.9855***	0.0145	

Note. */**/*** means results are significant at the 10% / 5% / 1% level compared to a null hypothesis that 50% of respondents will answer YES compared to an alternative hypothesis that more than 50% will answer YES.

According to the survey results, the basic conditions for students to participate in the rain classroom teaching are already available. The proportion of students who expect to adopt the flipped classroom is 43.48%, while 39.13% of the students are neutral about whether to adopt the rain classroom or not, and 85.51% of the students expect to learn the comprehensive ability. 91.3% of the students have a good ability level in professional basic courses, and the two classes have a similar proportion, which is about 1%. It can be seen that the starting level of students' learning ability is equal, and their willingness to learn is similar. Therefore, class-1 is randomly selected as the experimental group, and the class-2 is the control group. The academic achievement, subject perception value and teamwork ability of the two classes before and after receiving the flipped/traditional teaching mode are measured.

Analysis of the teaching effect after preliminary implementation of flipped classroom. In order to initially test the learning effect of the flipped classroom, after the learning of the first chapter of VAT law by situation one and situation two, after 4 weeks of study, a chapter test was conducted. Students of all four levels

can meet the ability requirements, and the design of preliminary judgment is reasonable. In order to further test whether the students' interest in learning and learning initiative are improved throughout the semester, and whether they can actively participate in the classroom, preview and review after the class, and whether their teamwork ability is improved, data from the 5th week to the 16th week by the end of the semester is collected, the results of student participation in the study are as follows:

Table 5
Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
E-preparation	12	38.42	2.91	30	41
C-preparation	12	7.33	4.16	2	16
E-participation	12	40.17	1.40	37	41
C-participation	12	34.42	2.31	30	38
E-assignments	12	39.58	1.38	37	41
C-assignments	12	26.92	3.00	21	31
E-questions	12	21.17	3.97	14	28
C-questions	12	2.75	1.76	0	6
E-teamwork	12	41.00	0.00	41	41
C-teamwork	12	25.17	3.38	18	29

Table 1 lists descriptive statistics for the primary variables of the experimental group and the control group. The average number of students using rain classroom flipped classroom teaching to conduct pre-school study was 38 people, while this number of the control group was 7 people. The number of participants in the experimental group was 40, while the average value of the control group was 34. The difference between the two groups was not much. In general, the flipped classroom is more conducive to mobilizing students' participation in the classroom. The average number of students in the experimental group that have finished homework was 40 people, while for the control group, this number was 27; in the aspect of after-class question-raising, there were 21 people in the experimental group and 3 people in the control group, which showed a clear contrast, indicating that the flipped classroom can effectively increase students' thinking after class. For the experimental group, the average teamwork number was 41 person-time, while for the control group, this number was 25 person-time, indicating that the flipped classroom teaching design can effectively improve the teamwork ability of the students.

Table 6
Learning Process t-Test

Variable	Obs	Mean	Std. Err.	Std. Dev.	t	p
E-preparation	12	38.42	0.84	2.91	19.94	0.000
C-preparation	12	7.33	1.20	4.16		
E-participation	12	40.17	0.41	1.40	12.43	0.000
C-participation	12	34.42	0.67	2.31		
E-assignments	12	39.58	0.40	1.38	13.47	0.000
C-assignments	12	26.92	0.87	3.00		
E-questions	12	21.17	1.15	3.97	17.58	0.000
C-questions	12	2.75	0.51	1.76		
E-teamwork	12	41.00	0.00	0.00	16.23	0.000
C-teamwork	12	25.17	0.98	3.38		

It can be seen from Table 6 that the significance (two-tailed) of the five aspects is less than 0.01, indicating that the difference between the experimental group and the control group is significant, which shows that after using rain classroom flipped teaching to design the teaching activities, the students' learning initiative and teamwork ability have significant changes, indicating that after the flipped classroom teaching, students will

use the rain classroom for their pre-class study, their enthusiasm for class participation is improved, and they are more motivated to complete the homework on time. At the same time, they have given more thinking about the course questions and they are more willing to work in teams.

Learning effect test. It can be seen from the results in Table 7 that the scores of students in the experimental group and the control group are significantly different, which further indicates that the use of the flipped classroom teaching design of the rain classroom platform effectively improves the student's academic performance. Through the design which connects pre-class, in-class and after-class studies, the students' enthusiasm is effectively mobilized, and they are more devoted to the flipped classroom learning, which further verifies the rationality of the teaching design.

Table 7
Learning Effect t-Test

Variable	Obs	Mean	Std.Err.	Std.Dev.	t	p
Expriment group	39	68.28	2.62	16.38	3.50	0.001
Control group	39	56.62	2.16	13.50		

In summary, through the analysis of questionnaire data, course data and academic performance, it is found that using the rain classroom platform to design learner-centered flipped classroom teaching practice activities can effectively mobilize students' learning initiative, and their teamwork ability is also improved to a certain extent, which has promoted the development of students' comprehensive ability.

Problems that should be paid attention to when applying flipped classroom

We need to get support from relevant departments to accelerate the information construction of campus

At present, most schools have a full WIFI coverage, and they are using various modern information technologies for the teaching, which is quite conducive to the implementation of flipped classroom teaching. For now, for schools of higher education that are on the list of the national double-A level construction, they have government financial support and sufficient financial resources, both hardware and software support can fully meet their needs. However, for some schools, they have insufficient capital investment and incomplete network construction. It is more difficult for these schools to implement the flipped classroom teaching. If the government and relevant departments can support them from various aspects, their information teaching will reach a whole new level.

Teachers need to improve their own quality, it's better for them to conduct teamwork and joint development

Many educators have realized the advantages of applying the flipped classroom. Now we are very close to the goal of achieving comprehensive education modernization by 2020 proposed by the Minister of Education (Chen, 2017), but some teachers have poor information technology skills and it is difficult for them to complete the design of a course independently, so the teamwork becomes critical. According to Professor Marcy Driscoll of Florida State University in 2017, "Technology per se cannot solve problems and change the teaching

paradigm, and the focus of educational technology is on how teachers can use new tools to solve practical problems''. Education leaders should achieve leadership and reform through the influence of three aspects: promotion, demonstration and teaching. (Chen, Yao & Zhong, 2018). This requires school leaders to fully play their initiative, lead team building, and lead teachers to complete the teaching reform tasks.

Teaching design should be reasonable, the assessment system should be complete, pay attention to student feedback, and adjust in time

How to make online learning conduct effectively is an important bottleneck for effectively implementing the flipped classroom. The flipped classroom mainly relies on the learner's self-learning. Due to the influence of students' initiative and self-control ability, some students muddle through their study perfunctorily or inactively, which would require teachers' pre-class design be reasonable. We can't aggravate the students' learning tasks because of the flipped classroom, so that phenomenon like conspiracy or hitchhike that are not conductive for the implementation of teaching reform would appear. As for the course of *Tax Calculation and Declaration*, setting an advanced knowledge mode is conducive to students' self-selection and teaching in accordance with their aptitude. In class, we should take care of each student as much as possible. Teachers need to adopt certain strategic mechanism, encourage students to ask more questions, and participate in classroom activities. After class, they should actively interact with students to increase communication between teachers and students. Drawing on (Zeeman, Wingo & Cox, 2018), by the end of the semester, according to the effect of the previous students, teachers should make timely adjustments to the teaching design for next students who will use this course, and prevent over-teaching at the same time (Chinai, Guth & Epter, 2018).

Conclusion

The purpose of the teaching reform of the course *Tax Calculation and Declaration* is to improve the quality of teaching, improve the efficiency of students' learning, and cultivate students' solid tax theory knowledge and strong practical application ability. Based on the theory of learner center, this paper analyzed the feasibility of applying the flipped classroom teaching in the course of *Tax Calculation and Declaration*, combining with the rain classroom which is a free mobile learning platform launched by Tsinghua University, it designed a flipped teaching framework for this course and applied it in practice. With its continuous application in practice and the continuous updating of the rain classroom function, for further examination of the teaching design and learning effects under this framework, we still need further practice and study.

References

Abeysekera, L., & Dawson, P. (2015). Motivation and cognitive load in the flipped classroom: Definition, rationale and a call for research. *Higher Education Research & Development, 34(1)*, 1-14. https://dx.doi.org/10.1080/07294360.2014.934336

Akhondi, A., Yarmohammadian, M., H., & Haghani, F. (2015). Designing an e-learning curriculum for spelling

on the basis of cognitive approach. *Contemporary Educational Researches Journal, 5(1)*, 08-11.

Aslan, S., & Reigeluth, C. M. (2015). Examining the challenges of learner-centered education. *Phi Delta Kappan, 97(4)*, 63-68. https://dx.doi.org/10.1177/0031721715619922

Aslan, S., & Reigeluth, C. M. (2016). Investigating "The Coolest School in America": How technology is used in a learner-centered school. *Education Tech Research, 64*, 1107-1133. https://dx.doi.org/10.1007/s11423-016-9450-9

Baker, J. W. (2000). The" classroom flip. *Using web course management tools to become the guide by the side*. Paper presented at the 11th International Conference on College Teaching and Learning, Jacksonville, FL.

Blumberg, P, & Pontiggia, L. (2011). Benchmarking the degree of implementation of learner-centered approaches. *Innovative Higher Education, 36(3)*, 189-202. https://dx.doi.org/10.1007/s10755-010-9168-2

Blumberg, P. (2016). Assessing implementation of learner-centered teaching while providing faculty development. *College Teaching, 64*,194-203. https://dx.doi.org/10.1080/87567555.2016.1200528

Boyadzhieva, E. (2016). Learner-centered teaching and learner autonomy. *Procedia-Social and Behavioral Sciences, 232*, 35-40. https://dx.doi.org/10.1016/j.sbspro.2016.10.008

Burcak, A. (2014). User-centered design through learner-centered instruction. *Teaching in Higher Education, 19(2)*, 138-155. https://dx.doi.org/10.1080/13562517.2013.827646

Burgoyne, S., & Eaton, J. (2018). The partially flipped classroom: The effects of flipping a module on "junk science" in a large methods course. *Teaching of Psychology, 45*(2), 154-157. https://dx.doi.org/10.1177/0098628318762894

Butt, A. (2014). Student views on the use of a flipped classroom approach: evidence from Australia. *Business Education & Accreditation, 6*, 33-43. http://www.theibfr2.com/RePEc/ibf/beaccr/bea-v6n1-2014/BEA-V6N1-2014-4.pdf

Chen, B. S. (2017). Doing a good job of socialist education with Chinese characteristics and meeting the party's nineteenth national congress with excellent achievements - Report on the work of the 2017 national education work conference. *Chinese higher education*, (Z1), 4-14.

Chen, R. H., Yao, Z. R., & Zhong, L. (2018). Leading the change of learning-AECT 2017 annual review and reflection. *Distance education magazine, 36*(1), 3-17. https://dx.doi.org/10.15881/j.cnki.cn33-1304/g4.2018.01.001

Chen, Y., Wang, Y., & Chen, N. S. (2014). Is FLIP enough? Or should we use the FLIPPED model instead?. *Computers & Education, 79*, 16-27. https://dx.doi.org/10.1016/j.compedu.2014.07.004

Chinai, S. A., Guth, T., Lovell, E., & Epter, M. (2018). Taking advantage of the teachable moment: A review of learner-centered clinical teaching models. *Western Journal of Emergency Medicine, 19(1)*, 28-34. https://dx.doi.org/10.5811/westjem.2017.8.35277

Cowan, J. (2013). A learner centered approach to online education. *British Journal of Educational Technology, 44*(6), E221-E222. https://dx.doi.org/10.1111/bjet.12109_2

Dawson, P. (2015). Motivation and cognitive load in the flipped classroom: definition, rationale and a call for research. *Higher Education Research & Development, 34*(1), 1-14. https://dx.doi.org/10.1080/07294360.2014.934336

Debiec, P. (2018). Effective learner-centered approach for teaching an introductory digital systems course. *IEEE Transactions on Education, 61*(1), 38-45. https://dx.doi.org/10.1109/TE.2017.2729498

Deng, Z. M. (2017). Research on the talent training mode of vocational colleges centered on learners. *Chinese vocational and technical education*, (31), 36-49.

Fishman, B., Konstantopoulos, S., Kubitskey, B., Vath, R., Parket, G. J., Johnson, H. (2013). Comparing the impact of online and face-to-face professional development in the context of curriculum implementation. *Journal of Teacher Education. 64* (5), 426-438. https://dx.doi.org/10.1177/0022487113494413

Gagne, R. M., & Briggs, L. J. (2010). Principles of instructional design. *Performance Improvement, 44*(2), 44-46. https://dx.doi.org/10.1002/pfi.4140440211

Giannakos, M. N., Krogstie, J., & Chrisochoides, N. (2014). Reviewing the flipped classroom research: reflections for computer science education. *Computer Science Education Research Conference*, 23-29. https://doi.org/10.1145/2691352.2691354

Hanewicz, C., Platt, A., & Arendt, A. (2017). Creating a learner-centered teaching environment using student choice in assignments. *Distance Education, 38*(3), 273-287. https://dx.doi.org/10.1080/01587919.2017.1369349

Jacksonville, F. L., & Blumberg, P. (2016). Assessing implementation of learner-centered teaching while providing faculty development. *College Teaching, 64*, 194-203. https://doi.org/10.1080/87567555.2016.1200528

Lage, M., Platt, G., & Treglia, M. (2000). Inverting the classroom: A gateway to creating an inclusive learning environment. *Journal of Economic Education, 31(1)*, 30-43. https://dx.doi.org/10.2307/1183338

Lai, C. L., & Hwang, G. J. (2016). A self-regulated flipped classroom approach to improving students' learning performance in a mathematics course. *Computers & Education, 100*, 126-140. https://dx.doi.org/10.1016/j.compedu.2016.05.006

Lim, F. A., & Nadeau, C. A. (2016). Student-led interest groups: an adjunct to learner-centered nursing education. *Nursing Education Perspectives, 37*(4), 232-235. https://dx.doi.org/10.5480/14-1495

Lo, C. K., Chi, W. L. & Hew, K. F. (2018). Applying "First Principles of Instruction" as a design theory of the flipped classroom: Findings from a collective study of four secondary school subjects. *Computers & Education, 118*, 150-165. https://dx.doi.org/10.1016/j.compedu.2017.12.003

McCombs, B. L. (2012). Educational psychology and educational transformation. *Comprehensive Handbook 7, of Psychology, Educational Psychology, 7*, 493-533. https://dx.doi.org/10.1002/9781118133880.hop207020

McCombs, B. L. (2013a). The Learner-centered model: From the vision to the future. *Interdisciplinary Applications of the Person Centered Approach*, 83-113. https://dx.doi.org/10.1007/978-1-4614-7144-8_9

McCombs, B. L. (2013). The learner-centered model: Implications for research approaches. In *Interdisciplinary Handbook of the Person-Centered Approach*. New York, NY: Springer, 335-352. https://dx.doi.org/10.1007/978-1-4614-7141-7_23

Qiu, N. S., & Qiu, X. Q. (2015). Research on the Evaluation and Improvement of Information Technology and College English Curriculum Integration. *Journal of Xi'an International Studies University, 23*(4), 74-77. https://dx.doi.org/10.16362/j.cnki.cn61-1457/h.2015.04.018

Satoshi, Y. (2016). Comparing core-image-based basic verb learning in an EFL junior high school: Learner-centered and teacher-centered approaches. *Language Teaching Research*, 1-29. https://dx.doi.org/10.1177/1362168816659784

Schuyler, I. G., Steele, J. L., & Pane, J. F. (2016). Poor implementation of learner-centered practices: A

cautionary tale. *Teachers College Record. 118*(13), 1-34. http://www.tcrecord.org ID Number:20563

Shyr, W. J., & Chen, C. H. (2017). Designing a technology-enhanced flipped learning system to facilitate students' self-regulation and performance. *Journal of Computer Assisted Learning, 34*(1). https://dx.doi.org/10.1111/jcal.12213

Smith, M. K., Wood, W. B., & Adams, W. K. (2009). Why peer discussion improves student performance on in-class concept questions. *Science, 323*(5910), 122-124. https://dx.doi.org/ 10.1126/science.1165919

Tugun, V. (2018). Impacts and opinions on the technology self-sufficiency of the students who are coding education in the flipped classroom adapted to the ARCS motivation model. *TEM Journal, 7*(2), 366-371. https://dx.doi.org/10.18421/TEM72-18

Wang, F. H. (2017). An exploration of online behaviour engagement and achievement in flipped classroom supported by learning management system. *Computers & Education, 114*, 79-91. https://dx.doi.org/10.1016/j.compedu.2017.06.012

Zeeman, J. M., Wingo, B. L., & Cox, W. C. (2018). Design and evaluation of a two-phase learner-centered new student orientation program. *Currents in Pharmacy Teaching & Learning. 10*(4), 86-492. https://dx.doi.org/10.1016/j.cptl.2017.12.020

Zhu, Z. T., Guan Y.Q., & Qiu H. X. (2015). Flip classroom domestic application practice and reflection. *Audio-Visual Education Research, 6*, 66-72. https://dx.doi.org/10.13811/j.cnki.eer.2015.06.012