International Journal of Latest Engineering and Management Research (IJLEMR)
ISSN: 2455-4847
www.ijlemr.com || Volume 03 - Issue 04 || April 2018 || PP. 48-53

The Effects of Flip Teaching and Prior Knowledge of Accounting on Learning Effectiveness: an Application of Quasi-Experimental Design Method

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Abstract: The research objective of this study is to explore the effects of flip teaching of the Fundamental Accounting course of a certain technical college in Kaohsiung, and of the prior knowledge of accounting, on learning effectiveness. This study applied the Purposive Sampling method on the research population. The primary test subjects of this study are college students, who are studying, or have studied, the Fundamental Accounting course, and full-time and part-time instructors of the Accounting subject of a certain technical college in Kaohsiung. In addition, the statistical analysis method adopted in this study is the Covariate Analysis of Two - Factor Single Covariate (i.e., two- independent variables, one- dependent variable, and one- covariate) of the Quasi-Experimental method. The findings show: (1)When compared with the pilot-test learning effectiveness, flip teaching has positive effects on the post-test learning effectiveness, but the effects are not significant; (2)When compared with the pilot-test learning effectiveness, students' prior knowledge of accounting has significant and positive effects on post-test learning effectiveness; and (3)When compared with the pilot-test learning effectiveness, flip teaching and prior knowledge of accounting have impacts on the post-test learning effectiveness, but the effects are not significant, nor interactive. The findings of this study may serve as a reference for accounting instructors of technical & vocational colleges and decision-makers of education authorities to use in their teaching designs and policy- making.

Keywords: Flip Teaching, Prior Knowledge of Accounting, Learning Effectiveness, Quasi-Experimental Design Method

I. INTRODUCTION

The concept of flipped classroom was developed by chemistry teachers, Jon Bergmann and Aaron Sams of the Woodland Park High School in the Rocky Mountains of Colorado State, in the United States, in 2007. The two teachers wanted to ameliorate the issue of students missing classes, and began using a screen - capture software program to record PowerPoint presentations and voice narrations. The pre-recorded videos are uploaded to YouTube for students to view and learn online. Upon discovering the positive effects of this method, the teachers began to assign video lectures for students to view at home as homework, and designed in-class interactive sessions to complete the assignments, and to assist with teaching students who ran into difficulties during the laboratory portion of the course. This process also garnered positive reaction, and thus the combined methods became known as "Flipped Classroom".

With the advent of knowledge-based economy era of information internet technology, Bergmann & Sams【1】adopted inverted instruction, which requires students to preview curricula, and blended learning, which mixes internet teaching and traditional classroom teaching, to help students achieve higher level of learning objectives. In this process, the students must be responsible for their own learning. They can also receive personalized learning assistance at the same time.

Furthermore, over the years, "Accounting" has been listed as a required subject in professional courses in the standard curriculum published by the Ministry of Education, especially designed for technical & vocational colleges and schools of management in Taiwan, because Accounting offers the necessary professional knowledge required in the future workplace in the fields of finance and economics. Thus, whether or not the technical & vocational college students' study interests of and abilities in fundamental accounting cultivated during high (vocational) school, and their prior knowledge of fundamental accounting (including bookkeeping) significantly affect learning effectiveness when studying professional accounting courses in technical & vocational colleges, is one of the important topics worthy of discussion at the present time.

Based on aforementioned motivations, the "the Covariate Analysis of Two - Factor Single Covariate" of the "Quasi-experimental method" was adopted in this study, and college students, who are studying, or have studied, the Fundamental Accounting course, and full-time and part-time instructors of the Accounting subject of a certain technical college in Kaohsiung are the research population for sampling. The main objectives of this study are summarized as follows:

(1) To understand whether flip teaching has positive and significant impact on post-test learning effectiveness.

(2) To understand whether prior knowledge of accounting has positive and significant impact on post-test learning effectiveness; and

(3) To understand whether flip teaching and prior knowledge of accounting have positive and significant interactive impact on pilot-test learning effectiveness.

II. LITERATURE REVIEW

Definition and Dimensions

Definition of flip teaching and prior knowledge of accounting and related literature

In this study, the conceptual definition of flip teaching is "Students study online materials by themselves first and then teachers answer their questions and guide discussion and practice in class. This is a flip from traditional education method, which teachers give lectures first and students do homework at home. Therefore, it is also called flipped classroom." The above definition is summarized from the following literature.

Bergmann & Sams【1】argued that flipped classroom is not a new teaching strategy. Instead, it reverses the traditional classroom teaching order. It is an inverted instruction where technology (especially videos) integrated into teaching so that students can preview in advance. Flipped classroom also adopts blended learning, which blends internet teaching and traditional face-to-face teaching to help students achieve a higher level of learning objectives.

Chi【2】pointed out that flip teaching allows teachers to implement real two-way communication teaching activities in classroom learning environment where they can interact with students face to face. The students can actively explore problems, think and establish an attitude of self-learning.

Moreover, Mok【3】believed that flip teaching can achieve individualized preview and guidance, compared with traditional classroom learning.

Touchton【4】 found that, compared with traditional teaching, flip teaching can (1) broaden the scope of learning and (2) strengthen the outcomes of learning process.

In addition, Long, Logan, Waugh【5】argued that the concept of flip teaching is opposite to the concept of traditional teaching. In flipped classrooms, teachers have to provide pre-class videos or other learning materials to engage students in the student-centered self-learning and teaching model.

The conceptual definition of prior knowledge of accounting in this study is "the ability to understand the entire accounting cycle and have basic "bookkeeping" ability."

Definition of learning effectiveness and related literature

In this study, the conceptual definition of learning effectiveness is "the impact on and achievement of the learners after learning. The measurement indicator is their academic record. The above definition is summarized from the following literature.

Wang【6】 believed that learning effectiveness is the impact and outcome that a learner acquires through learning, which includes instructor's teaching, learning environment, course curriculum and learning outcomes.

Huang【7】 pointed out that learning effectiveness is the accumulated ability and accomplishment a learner acquires after the course is completed, through active participation in the experience of the teaching process.

Huang【8】believed that learning effectiveness is the indicator for measuring a learner's learning outcomes. For students, learning effectiveness is the outcome that can only be recognized after students have experienced a long period of school education.

Literature Review on Pairwise Correlations of the Dimensions of this Study

Literature regarding the impact of flip teaching on learning effectiveness

The literature regarding the relevance of flip teaching and learning effectiveness is summarized as follows:

Lu【9】pointed out that a flipped classroom combined with a problem-oriented teaching method can effectively enhance learning outcomes. The problem-oriented teaching method can significantly improve learning motivation.

Ogden【10】found that students think that flip teaching can help improve students' learning outcomes and strengthen students' self-learning ability.

In addition, Obonyo & Leh【11】pointed out that the flipped classroom model provides a lot of technology to promote teaching and learning, and the results showed that the flipped classroom model can have a positive impact on students' learning experience.

Tsai【12】pointed out that the rise of flip teaching has changed the traditional educational thinking and subverted the traditional teacher-centered teaching model. Students become the center of learning. Therefore, it is believed that flip teaching can effectively improve the outcome of teaching and learning.

To sum, this study proposed the following hypothesis:

Hypothesis 1 (H_1): When compared with the pilot-test learning effectiveness, flip teaching has positive effects on the post-test learning effectiveness, but the effects are not significant.

Literature regarding the impact of prior knowledge of accounting on learning effectiveness

We have not found any literature on the relevance between prior knowledge of accounting and learning effectiveness. However, in this study, we subjectively believed that prior knowledge of accounting is relevant to learning effectiveness. Therefore, this exploratory study proposed the following hypothesis:

Hypothesis 2 (H_2): When compared with the pilot-test learning effectiveness, prior knowledge of accounting has positive and significant impact on post-test learning effectiveness.

Literature regarding flip teaching and prior knowledge of accounting on learning effectiveness

We have not found any literature on the relevance between prior knowledge of accounting and learning effectiveness. However, in this study, we subjectively believed that prior knowledge of accounting is relevant to learning effectiveness. Therefore, this exploratory study proposed the following hypothesis:

Hypothesis 3 (H_3): When compared with the pilot-test learning effectiveness, flip teaching and prior knowledge of accounting has positive and significant interactive impact on post-test learning effectiveness.

III. RESEARCH METHOD

Based on the above research motives, purpose and literature review, this study deducted research hypotheses, and constructed a conceptual research framework, as shown in Figure 1.

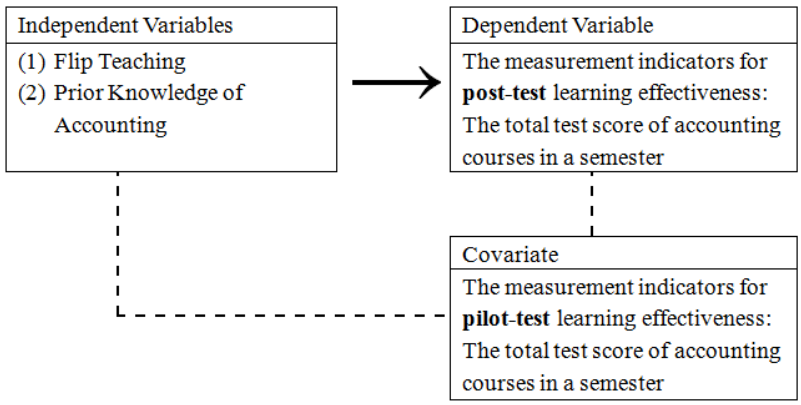

Figure 1 Research Framework

Sampling Method and Questionnaire Design

This study applied the Purposive Sampling method on the research population, and conducted tests on college students, who are studying, or have studied, the Fundamental Accounting course, and full-time and part-time instructors of the Accounting subject of a certain technical college in Kaohsiung. This study issued 10 copies of questionnaire to experts as a Pilot-test. After revising the questionnaire according to experts' feedback for improvement, a Post-test was conducted. The Purposive Sampling method was used to formally distribute 250 copies of questionnaire. There were 212 copies of valid returned samples, a valid returned rate of 84.8%.

Moreover, the five-point Likert scale is used to measure the questionnaire, where various degrees of agreement are given scores from five to one, with 5 being strongly agree and 1 being strongly disagree. The higher the level of agreement, the higher the score; conversely, the lower the score.

The six-question questionnaire regarding flip teaching was designed based on literature, particularly the questionnaires from Tsai【12】and Chi【2】.

Secondly, the questionnaire relating to prior knowledge of accounting is designed by this study. There are a total of three question items.

Additionally, the questionnaire relating to learning effectiveness is derived from recapitulating Huang【8】questionnaire with additions and other improvements. There are a total of five question items.

Quasi-Experimental Design Method

The statistical analysis method adopted in this study is the the Covariate Analysis of Two - Factor Single Covariate (two-independent variables, one-dependent variable, and one-covariate) of the Quasi-Experimental method. The two independent variables were the flip teaching as adopted by accounting instructors and the "Accounting Literacy" of college students, who are studying, or have studied, the Fundamental Accounting course in a certain college in Taiwan. The dependent variable was post-test learning effectiveness, and the covariate of this study was pilot-test learning effectiveness. It is worth mentioning here that the measurement indicator of learning effectiveness of this study was academic record. These data were obtained from the questionnaires of this study.

Tools for Statistical Analysis

(1) The reliability analysis of the questionnaire is measured by Cronbach α coefficient; while validity analysis relies on Expert Validity (or Content Validity).

(2) Statistical Analysis

The statistical analysis method adopted in this study was the Covariate Analysis of Two-Factor Single Covariate (i.e., two independent variables, one dependent variable and one covariate). The two factors were two independent variables: flip teaching and prior knowledge of accounting (a and b), and the covariate (c) is pilot-test learning effectiveness. The dependent variable (y) is the post-learning effectiveness. The purposes were to explore: (1) whether flip teaching has positive and significant impact on post-test learning effectiveness, when compared with the pilot-test learning effectiveness; (2) whether prior knowledge of accounting has positive and significant impact on post-test learning effectiveness, when compared with the pilot-test learning effectiveness; and (3) whether flip teaching and prior knowledge of accounting have positive and significant interactive impact on post-test learning effectiveness, when compared with the pilot-test learning effectiveness.

Second, Bryman & Cramer【13】argued that intra-group regression coefficient homogeneity test should be conducted before the analysis of covariate (ANCOVA) to determine whether the Covariate Analysis of Two - Factor Single Covariate (i.e., two independent variables, one dependent variable and one covariate) is applicable to a study. Furthermore, if the F value of covariate is significant, then post hoc analysis is conducted, using "adjusted means" as the standard for comparison to find the pair that presents significant differences. Lastly, three factors were taken into consideration when selecting covariates in this study, that is: (1) it has to relate to the dependent variable, rather than an experimental treatment; (2) if the correlation between two covariates is above .80, then only one of them is selected as the covariate for the study; and (3) when there are fewer test subjects, less covariates should be selected. It is easier to control extraneous variables when there are more covariates, thus rendering a more accurate statistical test in an experimental treatment【14】.

IV. RESEARCH ANALYSIS AND RESULTS

With regard to the reliability analysis of the flip teaching and prior knowledge of accounting questionnaires, Cronbach α coefficient was higher than 0.8, which indicated good reliability of the questionnaires, as shown in Table 1.

Table 1 Reliability Analysis on the Flip Teaching, Prior Knowledge of Accounting, and Learning Effectiveness Questionnaire

Reliability Analysis	Dimension	Cronbach α coefficient
Flip Teaching, Prior Knowledge of Accounting, and Learning Effectiveness Questionnaire Survey	Flip Teaching	0.764
	Prior Knowledge of Accounting	0.782
	Learning Effectiveness	0.813
Overall Scale		0.786

As for the validity, the questionnaire of this study adopted expert questionnaire, which in itself has sufficient content validity. In addition, after compiling and analyzing the following computer reports, the findings show:

Table 2 A Summary Table of the Simple Main Effect Analysis of Flip Teaching, and Prior Knowledge of Accounting in Post-Test Learning Effectiveness

Sources of Variation	SS	DF	MS	F	Post Hoc
Factor (flip teaching, prior knowledge of accounting)					
in a1 (Flip teaching)	134.24	2	67.12	1.55	
in a1 (prior knowledge of accounting)	221.12	2	110.56	2.55**	Learning Effectiveness (Post-Test) > Learning Effectiveness (Pilot-test)
在 a1*a2	243.32	3	81.11	1.87	
Error	86.88		43.44		

*P<0.05 **P<0.01 ***P<0.001

According to Table 2,

(1) When compared with the pilot-test learning effectiveness, flip teaching has positive effects on the post-test learning effectiveness, but the effects are not significant; thus, Hypothesis 1 (H_1) is not supported.

(2) When compared with the pilot-test learning effectiveness, prior knowledge of accounting has positive and significant impact on post-test learning effectiveness; thus, Hypothesis 2 (H_2) is supported.

(3) When compared with the pilot-test learning effectiveness, flip teaching and prior knowledge of accounting have impacts on the post-test learning effectiveness, but the effects are not significant, nor interactive; thus Hypothesis 3 (H_3) is not entirely substantiated.

V. CONCLUSIONS AND RECOMMENDATIONS

According to the above analysis and results, the conclusions and contributions of this study are given below followed by the limitation of the study and recommendation for follow-up studies.

Conclusions

(1) The research findings show that Hypothesis 1 (H_1) is not supported, i.e., "When compared with the pilot-test learning effectiveness, flip teaching has positive impact on the post-test learning effectiveness, but the effects are not significant."

(2) The research findings show that Hypothesis 2 (H_2) is supported, i.e., "When compared with the pilot-test learning effectiveness, prior knowledge of accounting has positive and significant impact on post-test learning effectiveness.

(3) The research findings show that Hypothesis 3 (H_3) is not entirely substantiated; i.e., "When compared with the pilot-test learning effectiveness, flip teaching and prior knowledge of accounting have impacts on the post-test learning effectiveness, but the effects are not significant, nor interactive."

Summarizing the above, in the field of professional accounting courses in technical & vocational colleges; flip teaching is one of the teaching methods that aids the normal "face to face" teaching method. It must provide diverse and applicable curriculum to truly advance the learning experience, and cannot completely replace the learning effectiveness of the traditional "face-to-face" teaching.

Research contributions

The results of this study can be provided as a reference to accounting instructors in technical & vocational colleges in Taiwan for teaching purpose and to the decision-making authorities in education field for formulating educational policies.

Research Limitation

Despite the limited resources, this study was conducted in a rigorous manner at every phase of the research. However, the following research limitations still exist:

(1) Due to a limitation of resources, this study only focuses on the college students, who are studying, or have studied, the Fundamental Accounting course, and full-time and part-time instructors of the Accounting subject of a certain technical college in Kaohsiung as the research subjects. The research scope does not cover all freshman students and accounting instructors of every college in Taiwan.

(2) This study sampled the population by means of purposive sampling, which is one type of non-probability sampling. Although it has higher recovery rate of valid samples, such method may cause sampling bias and thus affects the results.

Recommendation for Future Studies

(1) Because the main subjects of this study were limited to college students, who are studying, or have

studied, the accounting course, and full-time and part-time instructors of the Accounting subject of a certain technical college in Kaohsiung. For extensive data, the follow-up researchers can try to expand the scope of this study for further analysis.

(2) The follow-up studies can adopt simple random sampling or stratified random sampling when sampling the population.

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