



EFFECTS OF TEACHING METHODS AND GENDER FACTOR ON LEARNING EFFECTIVENESS IN A VOCATIONAL UNIVERSITY IN TAIWAN: AN APPLICATION OF QUASI-EXPERIMENTAL DESIGN METHOD

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Abstract

This study aims to explore the effects of teaching methods and gender factor on learning effectiveness in a vocational university in Taiwan with convenient sampling of the population, i.e. all the teachers (lecturers and above) and students in the university concerned. In addition, the statistical analysis method adopted in this study is the Two-way Univariate ANCOVA (two independent variables, one dependent variable, and one covariate) of the quasi-experimental design method. The research findings suggest that (1) teaching methods and gender factor have significant interactive effects on learning effectiveness; (2) the teaching methods by male teachers and female teachers exhibit the same effects on post-test learning effectiveness; and (3) as far as teaching methods are concerned, Teaching Method 1 (i.e. the combination of traditional and flipped teaching) by male teachers reports more significant effects on post-test learning effectiveness than Teaching Method 2 (i.e. flipped teaching) or Teaching Method 3 (traditional teaching) on a standalone basis. Teaching Method 1 (i.e. the combination of traditional and flipped teaching) by female teachers shows more significant effects on post-test learning effectiveness than Teaching Method 2 (i.e. flipped teaching), and Teaching Method 2 (flipped teaching) on a standalone basis demonstrates greater effects than Teaching Method 3 (traditional teaching). The results can serve as a reference to teachers in vocational universities and education authorities in Taiwan.

Keywords: learning effectiveness, quasi-experimental design method, flipped teaching

RESEARCH MOTIVATIONS AND OBJECTIVES

Flipped education, one of the most important education issues in the world, is being promoted by the Ministry of Education in

Taiwan. Many researchers hold a positive attitude toward flipped teaching and the integration of information technology into teaching activities.

Thanks to the internet and information



technology, revolutionary changes are happening to the way teachers teach and students learn. Teachers are breaking away from the role of being a knowledge provider to becoming a facilitator and coordinator of the students' learning process; while students are also getting away from the "copying and memorization equals high test scores" learning model to that of a self-initiating learner model. Digital teaching materials, Massive Open Online Courses (MOOCs) are all self-learning materials for students; while classroom discussion has become the catalyst for effective learning outcomes [1]. However, when the teachers in the school are poised to implement the flipped teaching method, are students willing to accept the self-initiated learning? One of the most important elements of successfully implementing the flip learning method is the willingness of students to take initiative in learning. Under the impact of a low-birth rate, many schools in Taiwan are facing the challenge of recruiting students. Some schools comprise on the quality of students in order to ensure a sufficient source of new students. It is difficult to know whether students wish to acquire vocational skills or have other agendas in mind. Is it easy to encourage students to learn actively? This is the first motivation of this study.

The increasing gender parity has been changing the previous male-dominant landscape for university teachers. The vocational universities in Taiwan adhere to the principle of gender equality in the recruitment of teachers. In some schools, the number of full-time female

teachers has exceeded that of full-time male teachers, and the percentage of female teachers has been on the rise. Are there any differences in the effect on the same teaching method from male teachers and female teachers on learning effectiveness of students? This is the second motivation of this study.

Also, are there any differences in the effect of various teaching methods on the learning effectiveness of students? The difference in the combined effects of teaching methods and gender factor on learning effectiveness is a topic worthy of academic attention. This is the third motivation of this study.

In sum, this study sought to explore the effects of teaching methods and gender factor of teachers on the learning effectiveness of students in a vocational university in Taiwan. The research purposes are as follows:

- (1) To understand whether there are significant interactive effects from the teaching methods and gender factor of teachers on the learning effectiveness of students;
- (2) To examine whether teaching methods by male teachers and by female teachers have different effects on post-test learning effectiveness, with pre-test learning effectiveness set aside; and
- (3) To investigate whether the three different teaching methods by male teachers and by female teachers have different degrees of impacts on post-test learning effectiveness, with



pre-test learning effectiveness set aside.

LITERATURE REVIEW

Teaching Methods

This study classifies teaching methods into three types: (1) Teaching Method 1, the blended teaching by combining traditional and flipped teaching; (2) Teaching Method 2, i.e. flipped teaching; and (3) Teaching Method 3, i.e. traditional teaching.

Traditional Teaching

This study defines traditional teaching as the lectures-driven teaching method whereby students listen and absorb, in the opposite sequence of the flipped teaching.

Flipped teaching

The conceptual definition of flipped teaching in this study is "a learning model where students learn the online course materials first, then have their questions answered by the teacher, and participate in the guided discussion and experiments during the classroom hour. This model flips the concept of the traditional model, where teachers lecture in the classroom and students do their lessons at home, thus it is also called flipped classroom." This study integrated the ideas proposed by Forsey, Low and Glance [2] as the sub-dimensions for flipped teaching: (1) lower-order learning—refers to the students' learning during the second half of school; and (2) higher-order learning—refers to the students' learning during the first half of school, and performed verification respectively. The above mentioned conceptual definition concerning flipped teaching is summarized from the

following literature review.

Hamdan, McKnight, McKnight, & Arfstrom [3] proposed in 2013 the key concept of flipped classroom, using the word FLIP, where F means flexible learning environment, and where the method is Learner centered with intentional content, and where the teachers must have professional knowledge and attitude.

Bergmann & Sams [4] argued that the so-called flipped classroom is not an innovated teaching strategy, but it flips the teaching procedure of a traditional classroom, and blends technology into the teaching method (video, in particular), in which the inverted instruction requires students to prepare ahead. The method adopts a blended learning model that utilizes the internet for delivering instructions and the traditional face-to-face teaching, so as to help students achieve their goals with a higher level of learning. That is, before going to the class, students should take the initiative to prepare for the class, while the teacher utilizes the time that was designed for face-to-face classroom instruction to guide students in completing their homework, and to help students in solving course problems, in addition to facilitating the opportunity for students to participate in classroom discussions and to engage in classroom activities. As a result, the interaction between the teacher and the students is greatly improved. It can even help students to achieve their goals with a higher level of learning. During this process, students must take responsibility for gaining knowledge on their own, while receiving individualized learning



assistance (achieving the goal of Differentiated Instruction) in the classroom.

Chou [5] suggested that flipped classroom refers to the learning model where "students prepare the lesson before the class, and attend interactive discussions during the class." There are many ways to achieve lesson preparation and interactive discussions. The learning method of Flipped Classroom adopts the mobile learning method for pre-class preparation, and cooperative learning for in-class interaction between students and the teacher.

Additionally, Liu [6] pointed out that flipped classroom, or as termed, flipped teaching, is where F means flexible learning environment, and where the method is Learner centered with intentional content, and where the teachers must have professional knowledge and attitude. The key to implementing flip learning, or inverted classroom, is twofold: (1) before the class, the teacher uploads or links the recorded instruction contents (or relevant ready-made materials) to a knowledge platform for students to learn, on their own initiative, the provided contents and to record the problems they encounter during the learning process; and (2) during the class, the teacher responds to the questions that student encountered, and conducts discussion-based cooperative learning or individualized guidance. This method—in which students learn the online course materials first, then have their questions answered by the teacher, and participate in the guided discussion and experiments during the classroom hour, flips the concept of the traditional model, where teachers lecture in the

classroom and students do their lessons at home, thus it is called flipped classroom.

Forsey et al [2] proposed that if the course contents of humanity studies (including educational fields) are oriented to lower-order learning (remembering and understanding learning activities), and that if students don't feel they gain much from the classroom sessions, i.e. they only need to read materials or watch relevant video without going to the classroom, and can still pass the exam or turn-in reports, they will choose to be absent or not pay attention in the class [2]. However, higher-order learning activities, i.e. higher-order and individualized learning (for example: solving math problems, or social topic discussions), are time-consuming, and are more difficult for the traditional teaching method to achieve.

Hau [7] argued that the concept of a flipped classroom is focused on putting students in the center: teachers flip (i.e. transform) the traditional teacher-centered idea of the past and turn it into a concept that focuses on the student. By blending appropriate technological tools (video, in particular) in to the teaching process, students are required to learn the basic content ahead of time; during the class period, students are guided by the teacher and have more opportunities to interact with peers and the teacher for more higher-order, individualized learning (for example: solving math problems, and discussing social issues).

Additionally, the four pillars of flipped classroom contain the four principles that enable teachers, who want to implement flipped



classroom, to get a quick start: (1) select a topic that can be completed in a 15-minute lecture: the teaching method of flipped classroom applies to topics that students can master themselves. Teachers should prepare ahead of time videos or information that students can easily understand-quality over quantity; (2) clearly define the time frame for a planned discussion during the class period, similar to coaching a team-practice with a pre-designed game plan, rather than a student-run discussion or self-study period; (3) do not apply flipped method to all subjects, since it is not the only teaching method available. To get started, the teacher might apply the flipped method to various subjects at a frequency of one class period per week; and (4) design an alternative program for students who have no internet access at home. The flipped teaching method is dependent on pre-class preparation. If the preparation requires an internet connection to complete, teachers must consider a substitute program to provide information for pre-class preparation for students who have no internet access or who have no computers [8].

Learning effectiveness

Learning effectiveness refers to the changes imparted on a student concerning knowledge, skills and attitudes as observed at the end of the teaching ([9]; [10]). The conceptual definition of "learning effectiveness" in this study can be defined as "that which can be measured by indicators of three explicit variables, namely: students' grades after learning in school, demonstrated professional skills, and proficiency

results from various external exams." Its manipulation definition is briefly described as follows: (1) School grades: refers to, during the process of learning in school, the test scores obtained after learning; (2) The number of professional certificates: refers to the number of professional certificates obtained from various professional proficiency exams after the process of learning in school or other venues of capability training; and (3) External examinations: refers to the process and effectiveness of participating in various external professional proficiency tests after the process of learning in school or other venues of professional training. The above-mentioned conceptual definition and dimensions of learning effectiveness are derived from following the literature reviews:

Chen [11] pointed out that the definition of learning effectiveness refers to "the indicator that is used to measure a student's learning effectiveness, and is one of the important criteria used to evaluate teaching quality."

Kao [12] believed that learning effectiveness is the level of familiarity with curriculum contents post teaching activities.

Kao [13] indicated that learning effectiveness is the behavioral capacity exhibited by learners after the teaching and learning process.

Wen [14] defined learning effectiveness as "a student's learning performance, including formative and summative evaluation results."

Li [15] pointed out that learning effectiveness refers to "a student's learning



results obtained by way of a certain form of assessment, which may include time, tools, or indicators, as conducted by an assessor on the student after a period of time of certain learning activities."

Lin [16] defined learning effectiveness as: "it is an indicator for measuring learning outcomes, and is one of the most important criteria used for assessing teaching quality. It refers to a student's learning results, as measured on Cognitive, Affective, Psychomotor Domains with defined test tools, after the learner has spent a prescribed time studying in a certain field. The methods used for assessing learning effectiveness should include factors: accuracy, completion time, expected difficulty, complexity, and proper values for the answer, thus offering a more fair and reasonable assessment method. Teachers may use various learning performance records for the evaluation, such as oral exams, writing exams, hands-on operation, reports, homework, worksheets, quizzes, and regular assessment tests. All of these are broad definitions of learning effectiveness. If defined from a narrower perspective, it may refer to academic performance on each subject, or on the

average performance of a combination of subjects."

Concerning the methods for measuring learning effectiveness, scholars have derived a variety of perspectives and research findings.

Chen [17] suggested that learning effectiveness is the behavioral capacity exhibited by learners and measured with a variety of tests after a period of time post learning activities.

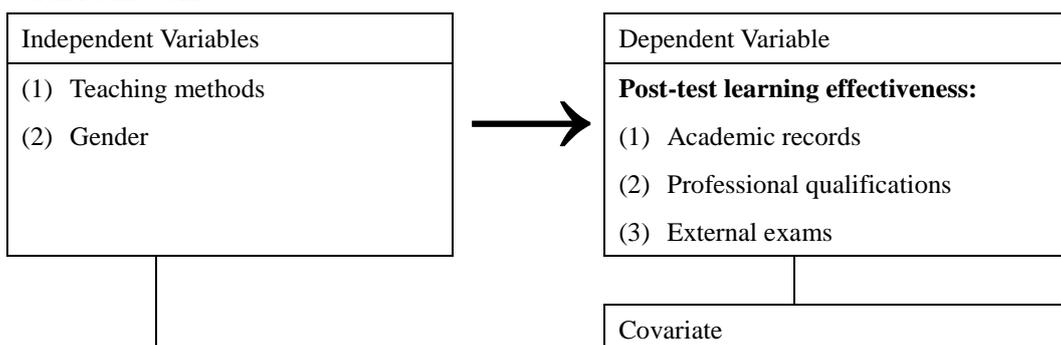
The research of Jones [18] suggested that learning effectiveness is affected by factors, such as learning styles, course design, and teaching.

The study of Loo [19] also suggested that learning effectiveness is affected by factors, such as learning styles, course design, and teaching. In terms of the assessment for learning effectiveness, in general, the assessment results can be obtained directly from students' grades, their abilities to acquire professional certification, and their performance results from participated external exams.

Research Framework and Hypotheses

Based on the above research purposes and the literature review, this study developed the following research framework and hypotheses:

Research Framework



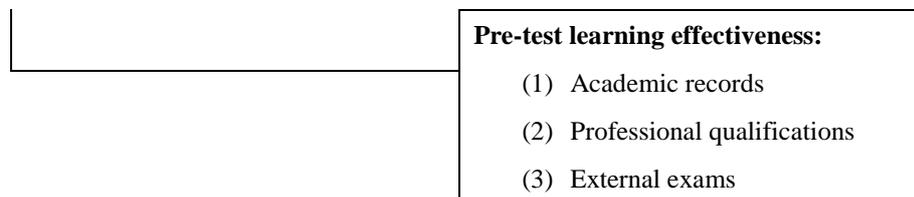


Figure 1 Research Framework

Research Hypotheses

This study developed the following three hypotheses:

- H₁: Teaching methods and gender factor of teachers have significant interactive effects on learning effectiveness;
- H₂: Teaching methods by male teachers and female teachers have the same effects on post-test learning effectiveness, with pre-test learning effectiveness set aside;
- H₃: The three different teaching methods by male teachers and female teachers have different degrees of impacts on post-test learning effectiveness, with pre-test learning effectiveness set aside.

RESEARCH METHODOLOGY

Sampling Method and Questionnaire Design

This study conducted a convenient sampling on the population and interviewed with the teachers (lecturers and above) and issued a questionnaire survey on the students regarding learning effectiveness in a vocational university in Taiwan. A total of 100 expert questionnaires were released as a pilot test and the post-test was constructed with the feedback from the experts and scholars. The formal survey issued 510

questionnaires, comprised of 260 to teachers and 250 to students. The study collected 468 effective questionnaires, at the recovery rate of 91.76%.

The measurement of the questionnaire was based on the Likert scale of five points, with five points indicating “strongly agree and one point suggesting “strongly disagree”. The higher the score, the higher the degree in agreement is.

The six questions in the questionnaire concerning flipped teaching combined Forsey et al【2】 and the questions developed by this study. All the nine questions about learning effectiveness were constructed by the author by covering three elements, i.e. academic records, professional qualifications and external exams.

Quasi-Experimental Design Method

This study employed the quasi-experimental design method by referring to teaching methods and gender factor of teachers in a vocational university in Taiwan as the two independent variables. The covariate is the effect of traditional teaching on the post-test learning effectiveness, defined as the pre-test learning effectiveness in this study. The teachers (lecturers and the above) of the sampled university use all the three teaching methods. Post-test learning effectiveness, i.e. the learning



effectiveness of the students in the sampled university is the only dependent variable in this study.

It is worth mentioning that the learning effectiveness is measured with three metrics, i.e. academic records, professional qualifications and external examinations. The data was sourced from the survey.

Statistical Tools

(1) The reliability analysis of the questionnaire was based on the Cronbach α coefficient. The validity analysis was equivalent to expert validity (also known as content validity).

(2) Statistical Techniques

The statistical analysis method of this study is the independent sample, two-way univariate ANCOVA (two independent variables, one dependent variable, and one covariate). Wherein, the two independent variables are gender factor (a) and teaching methods (b). The covariate (c) is the pre-test learning effectiveness. The dependent variable (y) is the post-test learning effectiveness. The research purposes are as follows: (1) to understand whether there are significant interactive effects from the teaching methods and gender factor of teachers on the learning effectiveness of students; (2) to examine whether teaching methods by male teachers and by female teachers have different effects on post-test learning effectiveness, with pre-test learning effectiveness set aside; (3) to investigate whether the three different teaching methods by male teachers and by female teachers

have varying degrees of impacts on post-test learning effectiveness, with pre-test learning effectiveness set aside. Before performing ANCOVA, a test on the homogeneity of regression coefficient of the group must be conducted to ensure that the two-way univariate ANCOVA method is appropriate for this study. Furthermore, if the F value of covariance 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. ([20]; [21]).

RESEARCH AND ANALYSIS

Both of the Cronbach α coefficients were above 0.8, indicating good reliability of the questionnaire on teaching methods and learning effectiveness (Table 1). The expert questionnaire the formal questionnaire was based on had sufficient content validity and hence content validity of the formal questionnaire was warranted. Meanwhile, the analysis on the spreadsheets suggested that teaching methods and gender factor have significant interactive



effects (Tables 2~3). As shown in Table 4, the teaching methods by both male and female teachers have the same effects on the post-test learning effectiveness. As far as teaching methods are concerned, Teaching Method 1 (i.e. the blending of traditional and flipped teaching) by male teachers reports more significant effects on post-test learning effectiveness than Teaching Method 2 (i.e. flipped teaching) or Teaching

Method 3 (traditional teaching) on a standalone basis. Teaching Method 1 (i.e. the combination of traditional and flipped teaching) by female teachers shows more significant effects on post-test learning effectiveness than Teaching Method 2 (i.e. flipped teaching), and Teaching Method 2 (flipped teaching) on a standalone basis demonstrates greater effects than Teaching Method 3 (traditional teaching).

Table 1 Reliability Analysis of Questionnaire on Teaching Methods and Learning Effectiveness

Reliability analysis	Dimension	Cronbach α coefficient
Questionnaire on teaching methods and learning effectiveness	Teaching methods	0.851
	Learning effectiveness	0.863
Overall Scale		0.842

Table 2 Adjusted Means

Teaching method \ Gender	Teaching Method 1	Teaching Method 2	Teaching Method 3
Males (a1)	24.672	18.822	16.091
Females (a2)	23.821	19.132	15.493

Table 3 Covariant Analysis on Effects of Gender Factor and Teaching Methods on Post-test Learning Effectiveness

Source	Type III Sum of Squares	df	Mean Square	F	Eta Squared	Observed Power(a)
Covariance	186.512	1	186.512	34.342	.651	1.000
Gender	19.133	1	19.133	3.523	.152	.361
Teaching method	312.421	2	156.2105	28.763***	.782	.1000
Interaction	95.431	2	47.7155	8.786***	.541	.922
Error	92.322	17	5.431			

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

Table 4 Effects of Gender Factor and Teaching Methods on Standalone Basis on Post-Test Learning Effectiveness

Source of variance	SS	DF	MS	F	Ex-post comparison
A Factor (gender)					
b1 (Teaching Method 1)	4.321	1	4.321	0.796	Males = Females
b2 (Teaching Method 2)	21.071	1	21.071	3.880	Males = Females
b3 (Teaching Method 3)	18.212	1	18.212	3.353	Males = Females
B Factor (Teaching Method)					
a1(male)	144.43	2	72.215	13.297***	Teaching Method 1 > Teaching Method 2 Teaching Method 1 > Teaching Method 3
a2(female)	241.21	2	120.605	22.207***	Teaching Method 1 > Teaching Method 3 Teaching Method 2 > Teaching Method 3
Error	92.322	17	5.431		

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

As shown in Tables 2~4, all the three research hypotheses developed by this study were supported.

CONCLUSIONS AND SUGGESTIONS

Conclusions

This study drew the following conclusions on the basis of the research findings:

- (1) Teaching methods and gender factor of teachers have significant interactive effects on learning effectiveness;
- (2) Teaching methods by male teachers and female teachers have the same effects on post-test learning effectiveness, with pre-test learning effectiveness set aside;

- (3) As far as teaching methods are concerned, Teaching Method 1 (i.e. the blending of traditional and flipped teaching) by male teachers reports more significant effects on post-test learning effectiveness than Teaching Method 2 (i.e. flipped teaching) or Teaching Method 3 (traditional teaching) on a standalone basis. Teaching Method 1 (i.e. the combination of traditional and flipped teaching) by female teachers shows more significant effects on post-test learning effectiveness than Teaching Method 2 (i.e. flipped teaching), and Teaching Method 2



(flipped teaching) on a standalone basis demonstrates greater effects than Teaching Method 3 (traditional teaching).

Research Limitations

This study sought to accomplish each stage of research tasks as robust as possible. However, there were some research limitations due to limited resources:

- (1) As a result of limited research resources, this study only surveyed the teachers and the students of a vocational university in Taiwan. The research scope did not cover all the vocational universities in Taiwan.
- (2) There is extensive literature in Taiwan and overseas on the constructs of this study. However, the use of the quasi-experimental design method and the analysis of an independent sample with the two-way univariate ANCOVA was an innovation by this study in terms of research techniques.
- (3) This study conducted convenience sampling on the population. Whilst this method generates a higher recovery rate of valid observations, it may lead to a bias in sampling.

Suggestions to Follow-up Studies

This study only interviewed the teachers and students of a vocational university in Taiwan. Follow-up studies may expand the research scope to ensure a wider set of data or adopt an innovative approach in analysis and comparison.

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