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An Experimental Study of Flipped Classroom to Enhance Students' Basketball Teaching Design Ability

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Abstract

This study takes the teaching innovation of compulsory basketball courses as the research object in the context of teaching innovation of information technology in physical education disciplines in Chinese higher education. It adopts the method of using literature, action research and mathematical statistics. An experimental study was conducted on the application of the offline combined with online group flipped classroom teaching model in the basketball major compulsory course to explore the impact of the model on improving students' basketball instructional design ability. The experiment shows that the post-test t-test result of instructional design ability is -32.217 with a p-value of 0.000, and the experimental group is significantly better than the control group in terms of instructional design ability. It is concluded that the application of offline combined with online group flipped classroom teaching model can very significantly improve students' basketball instructional design ability. The aim is to construct a scientific and feasible teaching practice model for the teaching innovation of physical education courses, and to promote the educational quality change and teaching innovation of physical education professional courses.

Keywords: compulsory basketball course, flipped classroom, basketball teaching design ability, instructional innovation

1. Introduction

According to the spirit of the document ‘The Ministry of Education of the People's Republic of China on the Implementation Opinions on the Construction of First-class Undergraduate Courses’ (Teaching Gao [2019] No. 8), the national colleges and universities are required to comprehensively promote the reform and innovation of curricula, strengthen the in-depth fusion of modern information technology and education and teaching, and encourage the innovation of innovative teaching methods aimed at enhancing the effectiveness of teaching and learning, and to solve the problem of the innovation of teaching and learning teaching mode. Ding, H. (2006): Strengthen teacher-student interaction, student-student interaction, to solve the problem of innovative, critical thinking training, to put an end to the phenomenon of teachers full of irrigation, students passive listening. Enhance the depth of course learning, learning participation and challenge, highlighting the student-centred teaching concept.

Compulsory basketball professional courses are both professional platform foundation courses and one of the necessary skills courses for sports students in internship, employment and work, and the cultivation of instructional design ability is crucial for students. Chen, C. Z. (2017): However, the main problem at present is the poor teaching effect of using the traditional teaching model to cultivate students' instructional design ability. In order to significantly improve students' instructional design ability through the teaching of compulsory basketball courses, this study constructs the “online-offline combined group flipped classroom teaching model”. The aim is to improve students' instructional design ability and classroom learning efficiency through the application of the model, and to verify the effectiveness of the model with experiments.

2. Research Object and Method

2.1 Research Object

The innovation of offline combined with online group flipped classroom teaching mode of the compulsory

course of basketball major is taken as the research object.

2.2 Research Methodology

2.2.1 Literature Method

To search the relevant literature on the research of innovative teaching in physical education programme at home and abroad between 2015-01/2023-10, and to select and proofread it.

2.2.2 Action Research Method

In the natural and real educational and teaching environment, in accordance with the talent cultivation programme of undergraduate physical education majors and the syllabus of compulsory basketball courses, using modern information technology, carry out the research on the innovation of offline combined with online group flipped classroom in compulsory basketball courses, generalize the law, target the problems in compulsory basketball courses, and continuously explore in action research to improve and solve the practical problems in the innovation and practice of teaching compulsory basketball courses.

2.2.3 Mathematical and Statistical Method

Through the teaching experiment, collect the pre-test and post-test data of the experimental subjects, use SPSS27.0 on the data within and between the experimental and control groups, carry out one-way ANOVA, paired samples T-test and independent samples T-test, and arrive at the results of the experiment through data analysis.

3. Offline Combined with Online Group Flipped Classroom Teaching Model for Compulsory Basketball Course

3.1 Theory of Offline Combined with Online Group Flipped Classroom Teaching Mode

Kontos, A. P. (2012): Based on the concept of OBE, the teaching principle of five combinations is adopted: 1. teaching means combining the basic theory of basketball and information technology teaching tools; 2. teaching process combining student-led and teacher-guided evaluation; 3. teaching implementation process combining flipped classroom teaching and online case-based teaching; 4. teaching monitoring measures combining instructional design ability test and flipped classroom teaching effect; 5. teaching experience combining textbook learning and online course MOOC resources; 6. teaching experience combining textbook learning and online course MOOC resources. The teaching experience that combines online course MOOC resources. On the basis of this theory, we constructed the offline combined online group flipped classroom teaching mode for the compulsory course of basketball.

Through the open teaching implementation form of pre-study teaching content before class, group flipped classroom teaching in class, and assessment of teaching design ability, a three-dimensional offline combined with online group flipped classroom innovative teaching model for the basketball major compulsory course is constructed. Zhang, Huaizhao, & Huang, Dongyi(2020): Based on the theory of student-centred education, the basketball skill movements are made into a short-video online MOOC resource in line with the learning habits of modern students according to the ‘six-step teaching method’ of explaining and demonstrating, practicing with bare hands, decomposing, assisting, correcting errors and practicing methods, so that the students can follow the online teaching design and take the ‘student-centred’ teaching method as a basis for the online classroom. Students can carry out group flipped classroom teaching based on the online teaching design and offline with ‘student-centred’, so that students can learn to solve the practical problems of teaching content design, teaching method and practice method innovation, achieve the perfect integration of classroom teaching unity and students’ individuality, and improve students’ motivation, initiative, innovation and creativity in learning.

3.2 Teaching Design and Implementation Route of "OCOFM" Innovation Model

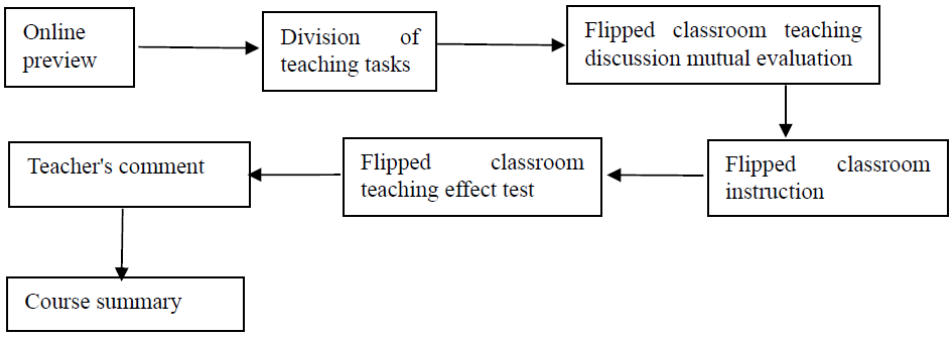

Figure 1. Road map for Instructional Design and Implementation

3.3 Practical Application of Offline Combined with Online Grouping Flipped Classroom Teaching Mode in Basketball Major Compulsory Course

3.3.1 Pre-learning

Before the start of the offline course, students, through the online MOOC course of the basketball professional compulsory course, firstly make pre-course online pre-study of the 6 modules of the basketball technical movement teaching in this class, to understand the teaching content, teaching design, teaching methodology, teaching implementation and teaching process of this class, so as to get ready for the flipped classroom teaching. If students did not preview all 6 teaching modules online, it would be difficult for them to carry out the teaching practice of flipped classroom.

3.3.2 Apply Offline Combined with Online Group Flipped Classroom Teaching Mode to Cultivate Students' Instructional Design Ability in a Student-centered Way

Students carry out offline combined with online grouping flipped classroom offline combined with online grouping flipped classroom in small groups, with 6 people in each group, divided into several groups. Flipped classroom teaching content in accordance with the online teacher's teaching design, each person randomly selected 1 teaching module, 6 teaching modules are: 1. technical movement explanation and demonstration; 2. unarmed footwork exercises; 3. different angles and different stages of the decomposition of the demonstration; 4. auxiliary teaching; 5. easy to correct mistakes; 6. a variety of exercises and training methods. Members of the group in accordance with the order of extraction, one as the teacher and the other as the student rotation to start the flipped classroom teaching, student-centered teaching, so that students in the teaching practice to improve their own teaching design capabilities.

3.3.3 Measurement of Flipped Classroom Teaching Effect

Through the randomized flipped classroom teaching practice sampling test, to test the improvement of students' teaching design ability, to avoid the flipped classroom formality but not reality. Before each class, the teacher randomly draws a number of groups, and then randomly draws one student from each group, so that the student can represent the group to carry out flipped classroom teaching. According to the actual situation of each group's flipped classroom teaching, the teacher will give targeted evaluation and give the corresponding evaluation score of teaching design ability, and carry out quantitative evaluation of the process of students' teaching design ability.

4. Experimental Design of the Model of "OCOFM" for the Compulsory Course of Basketball

4.1 Independent and Dependent Variables

1. Independent variable: online and offline group flipped classroom teaching model.

2. Dependent variable: basketball instructional design ability.

4.2 Sample

50 male students in 2 classes of 2023 majoring in Physical Education in the College of Physical Education of Guangzhou University are taken as the sample of the study.

4.3 Experimental Design

4.3.1 Experimental Grouping

Table 1. Experimental grouping information table

Type	Group	Class	Specialization	Number of people	Independent variable applied
Control class	Group 1	Class 233	Physical education	25	None
Experimental group	Group 2	Class 234	Physical education	25	Imposed independent variable

This study divides the experimental subjects into 2 groups, Group 1 is the traditional offline teaching control group, Group 2 is the offline combined with online grouping flipped classroom teaching mode reform experimental group, the specific grouping information is shown in Table 1.

4.3.2 Experiment Time and Place

Experiment location: He Shijie Gymnasium, Guangzhou University.

Experiment time: April 1, 2024 - May 31, 2024

Experimental hours: a total of 8 teaching weeks. Each group had 1 class per week, and each class was 90 minutes long, totaling 16 credit hours. The 1st experimental class was for pre-test, the 2nd to 7th experimental classes were for teaching experiments, and the 8th experimental class was for post-test, and the experimental and control groups had the same weekly schedule.

4.3.3 Purpose of the Experiment

The teaching experiment was used to verify whether the application of offline combined with online grouping flipped classroom model in the required course of basketball can improve students' instructional design ability more effectively than traditional teaching.

4.3.4 Experimental Hypothesis

The combination of offline and online group flipped classroom teaching model can significantly improve students' basketball instructional design ability.

4.3.5 Analysis of Experimental Subjects' Learning Situation

Chinese junior and senior high school physical education teaching basically adopts the traditional indoctrination teaching method. Teachers teach, students learn, and students basically do not participate in instructional design, so their basketball instructional design ability is at a relatively low level before they enter the university to participate in the basketball major compulsory courses, and there is a very large space for improvement.

4.3.6 Teaching Experiment Content Design

According to the teaching schedule of the compulsory basketball major course in Guangzhou University Sports College in 2023, both the control group and the experimental group were carried out by myself in the second semester of the 2023-2024 academic year with the same teaching content, and the 6th to 14th weeks (the 10th week was a holiday) were chosen as the experimental time for this study. Basketball left-handed dribble three-step layup was selected from the 8-week teaching content as the experimental sample for the instructional design ability test of this experimental study, and all the students were tested on the instructional design ability of this content before the beginning of the experiment, and the students were allowed to take the video of instructional design and email it to the teacher to record the test data. Test data were collected in the same way at the end of the experiment. Quantitative data from the instructional design ability test was used to evaluate the instructional design ability of each group.

4.3.7 Control of the Experiment

4.3.7.1 Control of Experimental Conditions

In the experiment, the experimental class and the control class are parallel classes with the same grade level, the same lecturer, the same teaching site and equipment, and the same teaching content. The control group adopts traditional teaching methods, and the experimental group applies the group flipped classroom teaching mode combining online and offline, and teaches according to the teaching contents specified in the syllabus of the compulsory course for basketball majors. Before the experiment, the students in the two groups were tested on their instructional design ability, and the data were screened to exclude the samples that had a small impact on the results, and to make the sample data of each group normally distributed, to ensure that there was no obvious

difference in the dependent variable pre-test between the two groups, and that the number of experimental samples between the two groups was roughly the same, and then to carry out the formal teaching experiments.

4.3.7.2 Experimental Sample Control

In order to avoid the students as experimental subjects to produce abnormal state of mind to affect the experimental effect, the entire experiment on all students using single-blind experiment, that is, only the teacher knows, students do not know they are the subject of the experiment, the experimental design and implementation of the experiment is confidential to the students, and to ensure that the 2 groups of students in the practice time, rest time, attendance are the same, to prevent the results of the experiment from the other controllable factors lead to error.

4.4 Measurement and Data Collection and Statistics

4.4.1 Pre-experimental Measurement Data Collection

Pre-experimental instructional design ability test was conducted for all experimental subjects. Each student was asked to shoot a teaching video, which was uploaded to the teacher's designated email address after class, with the teaching content of left-handed dribbling three-step layup, and the video time was controlled to be about 10 minutes. Teachers in accordance with the quantitative evaluation table of instructional design ability determined in the experimental design, according to each student submitted pre-laboratory instructional design ability video for quantitative scoring, to realize the quantitative assessment of the experimental subject's instructional design ability, the original pre-laboratory test of quantitative scores of instructional design ability records are kept.

4.4.2 Organization and Statistics of Pre-experimental Test Data

Summarize the data after quantification of each group's preexperimental instructional design ability test, perform descriptive statistics on the data within each group, perform variance chi-square test on the pre-test data between groups, and ensure that there is no significant difference between the pre-test data of the 2 groups' experiments and the chi-square of the pre-test data by eliminating the samples.

4.4.3 Post-experimental Data Collection

After 8 weeks of teaching experiments, the teacher conducts a post-experimental basketball teaching design ability test for all students, and the teacher asks each student to shoot a teaching video of about 10 minutes in length and send it to the designated email address, with the teaching content of left-handed dribbling and three-step layup. Apply the quantitative evaluation form of basketball instructional design ability, score according to the instructional design video submitted by students after the experiment, quantitatively score the results of each test after the experiment, realize the quantitative assessment of instructional design ability of the experimental subjects, and record and save the original quantitative achievement of instructional design ability of the post-experiment test.

4.4.4 Organizing and Statistics of Experimental Post-test Data

Perform normal distribution test and variance chi-square test on the post-test data of each group. Conduct a paired-sample t-test on the pre-test and post-test data of each group to test whether there is a significant difference between the pre-test and post-test within each group, and then conduct an independent-sample t-test on the post-test data of the experimental group and the control group to see whether there is a significant difference between the post-test data of the two groups.

5. Analysis of Experimental Research Results

5.1 Analysis of Experimental Pre-test Data

The results of the normal distribution test of the pre-test data: the Shapiro-Wilk statistic was 0.968 for the control group and 0.925 for the experimental group, and the significance value (Sig.) was 0.599 for the control group and 0.053 for the experimental group, which were both greater than 0.05. This indicated that the pre-test data of the two groups conformed to the normal distribution.

The result of the test of variance chi-square of the pre-test data: the Levene's significance level is 0.867, which is much higher than the commonly used significance level of 0.05. Therefore, we can not reject the original hypothesis, that is, we believe that the variance of the 2 groups is equal, and that the data have chi-square of variance.

The result of one-way ANOVA of the pre-test data: F value is 0.002, significance (p value) is 0.961, much higher than the commonly used significance level of 0.05, which means that in 96.1% of the cases, we will get similar F value, indicating that the difference of the means between the groups is not significant, and there is no significant

difference of the means between the 2 groups, and the difference of the means between them can be regarded as being caused by the random error rather than the difference of groups. The difference in mean values between them can be considered to be caused by random error rather than by the difference in groups.

Summary of pre-test data analysis: the statistical description of the pre-test data shows that there is no significant difference in the instructional design ability between individuals within the groups before the experiment, this is due to the fact that students have few opportunities to improve their instructional design ability before entering the university. This result is in line with the analysis of the students' academic profile as well as the experimental hypothesis of this study. The analysis of the pre-test data shows that the average overall level of students' instructional design competence in the groups before the experiment was very low. The pre-test ANOVA chi-square test and one-way ANOVA analysis yielded that the instructional design competence of the experimental and control groups were chi-square on the pre-test data of the experiment and there was no significant difference. This provides a guarantee that the experimental study will be carried out and will help to accurately assess the effect of the intervention after the instructional intervention, and if the results of the posttest data show a significant difference, we can assume that the difference in the dependent variable is caused by the intervention of the stem independent variable and not due to the initial between-group difference.

5.2 Analysis of Experimental Post-test Data

Posttest data normal distribution test results: the control group Shapiro-Wilk test statistic is 0.968, the significance value (Sig.) is 0.599, which is greater than 0.05. This indicates that the data of the control group did not significantly deviate from the normal distribution, and the data of the control group conformed to the normal distribution.

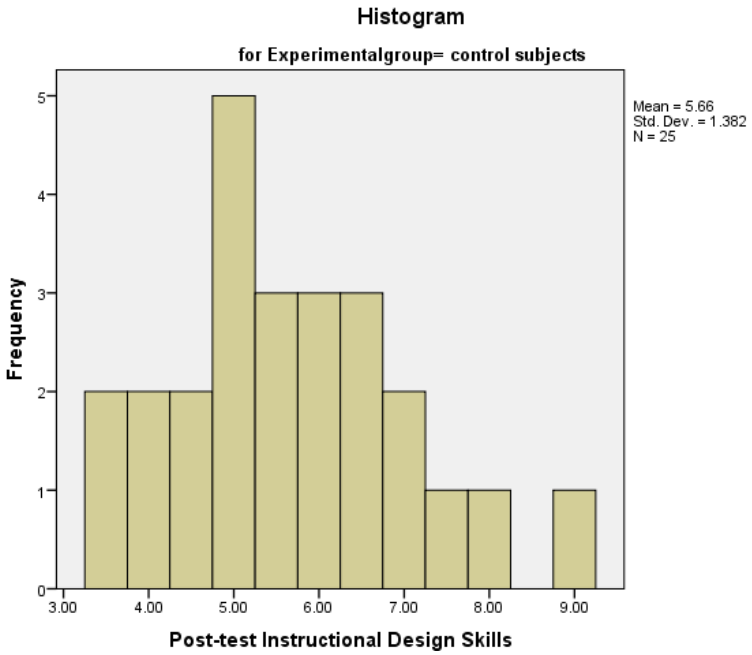

Figure 2. Control group normality test histogram

The statistic of the Shapiro-Wilk test for the experimental group is 0.918, the degree of freedom (df) is 25, and the significance value (Sig.) is 0.045, which is less than 0.05. This indicates that the data of the experimental group may have a significant deviation from the normal distribution. The reason for this result is due to the fact that the instructional model has a very significant effect on the improvement of students' Basketball Teaching Design Ability, resulting in 20% full scores on the students' posttest, which seriously affects the trend of the posterior normal distribution.

After removing the full scores re-do the normal distribution test on the remaining 80% of the data, the Shapiro-Wilk statistic is 0.952, the degree of freedom (df) is 20, and the significance value of the experimental group after the sample screening (Sig.) is 0.399, which is greater than 0.05. This indicates that the data of the screened experimental group did not significantly deviate from the normal distribution, and the data conformed to the normal distribution.

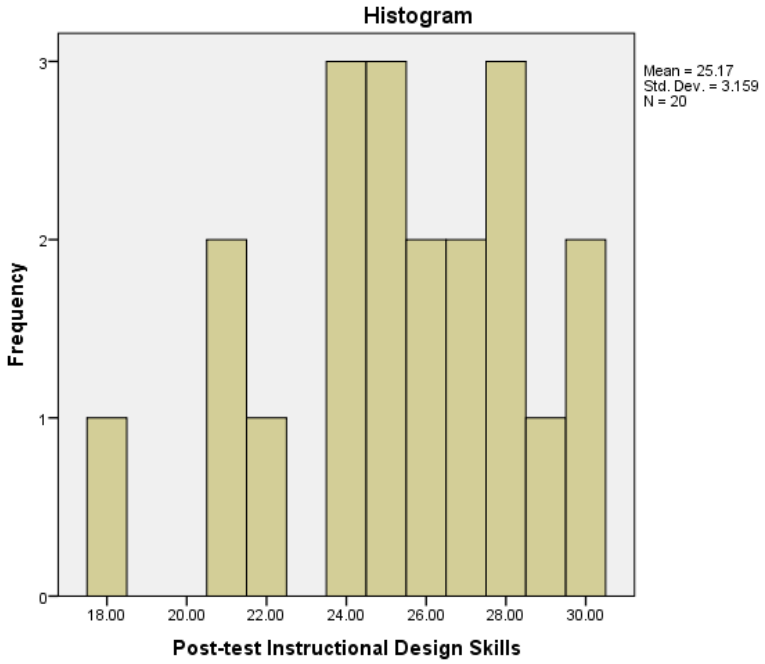

Figure 3. Histogram of test of normality of experimental group after sample screening

Posttest data ANOVA test result: the significance level (Sig.) of Levene's ANOVA test is 0.000, which is much less than 0.05. Based on this result, we can reject the original hypothesis of ANOVA chi-square, which implies that the variances between the experimental group and the control group are significantly unequal.

The result of one-way ANOVA for the post-test data: the F-value of 765.803 indicates that the between-group difference is large relative to the within-group variance. The level of significance was 0 less than 0.05 indicating that the between-group difference was statistically significant, i.e., there was a significant difference between the posttest data of the experimental and control groups.

Summary of the analysis of the post-test data: the mean value of the control group was 5.66, which indicates that the group had weak Basketball Teaching Design Ability, while the mean value of the experimental group was 26.14, and the high scores of the group indicate that they had strong Basketball Teaching Design Ability. Both the control group and the sample screening experimental group post-test data conformed to the normal distribution overall. The variance between the experimental group and the control group is significantly unequal, and there is a significant difference between the post-test data of the experimental group and the control group, and the experimental group performs well in the post-test of instructional design ability, which is much higher than that of the control group. This significant difference reflects that the application of the ‘offline combined with online group flipped classroom teaching model’ has a significant difference in developing students' instructional design ability.

5.3 Within-group Pre-test and Post-test Paired Samples T-tests

Table 2. Within-group pre-test and post-test paired samples t-tests

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Control group pre-test - post-test	-.880	2.766	.553	-2.022	.262	-1.591	24	.125
Experimental group pre-test - post-test	-21.32	3.64	.728	-22.822	-19.818	-29.288	24	.000

The mean of the paired difference scores for the control group is -0.88, which means that the control group scored, on average, 0.88 points higher on the posttest than on the pretest. The standard deviation is 2.766, indicating some variability in the distribution of paired difference scores. The standard error of the mean is 0.553,

reflecting the precision of the estimation of the mean of the paired difference scores. The 95% confidence interval for the difference scores is [-2.022, 0.262], and this confidence interval spans zero, indicating that it is not possible to determine whether the mean difference between the pre and posttests is significant. t-value of -1.591, degree of freedom (df) of 24, and significance level p-value of 0.125 greater than 0.05 indicate that the pairwise differences are not statistically significant, suggesting that there is no statistically significant change in the control group between the pre and posttests. There was no significant change.

The mean value of the paired difference scores for the experimental group was 21.32 and the experimental group scored significantly higher on the posttest than on the pretest with a difference of 21.32 points. The standard deviation was 3.64 and there was some variability in the distribution of paired difference scores. The standard error of the mean was 0.728, reflecting the precision of the estimation of the mean of the paired difference scores. The 95% confidence interval for the difference scores is [-22.822, -19.818]. This confidence interval does not cross zero, indicating that the experimental group has a significant mean difference between the pre and post-tests. t-value is -29.288, this very high absolute t-value shows the significance of the pairwise differences, and the degree of freedom (df) is 24, with a significance level p-value of 0.000 is less than 0.05, which indicates that the pairwise differences are statistically very significant, and that the experimental group has a significant improvement between the pre and post-tests.

To summarize: the results of the control group showed no significant difference between the pre-test and the post-test, indicating that there was no significant change in the performance of the control group during the period. The results of the experimental group showed a significant difference between the pre-test and the post-test, and the change was very significant, indicating that the grouped flipped classroom teaching model combining online and offline, applied to the experimental group, can very significantly improve the students' basketball instructional design ability.

5.4 Results and Analyses of Independent Samples T-test for Experimental Post-test Data

Table 3. Comparative analysis of test results between experimental and control groups

	control subjects (n=25) $\bar{X}$±SD	experimental group (n=25) $\bar{X}$±SD	T	P
Post-test on Basketball Teaching Design Ability	5.66±1.38	26.14±3.43	-27.673	0.000

Levene's test of chi-square F=17.582, Sig.=0.000 is less than 0.05 assuming that the variances of the two samples are not equal. t-test (assuming that the variances are not equal) t=-27.673, df=31.585, Sig.(two sided)=0.000 The results of the t-test indicate that there is a significant difference in the mean value of the samples of the two groups in terms of their performance on the posttest instructional design competencies (p value is much less than 0.05), so it can be assumed that there is a significant difference between the performance of the samples in the experimental group and the experimental group on the posttest instructional design ability.

The experimental group that applied the independent variable offline combined with online grouped flipped classroom instructional model showed a very significant increase in the dependent variable instructional design ability than the experimental group that did not apply any independent variable using traditional instruction. From this we can conclude that the independent variable offline combined with online grouped flipped classroom instructional model has a highly significant effect on the dependent variable instructional design ability.

6. Discussion

The pre-tested means of instructional design competencies of the experimental and control groups were 4.537 and 4.78 respectively.The ANOVA chi-square test significance value was 0.163 and the variances of both groups were chi-square. One-way ANOVA F = 0.154, p = 0.696, the means of instructional design competence were similar for both groups.

The posttest means of instructional design competencies for the experimental and control groups were 24.703 and 5.66 respectively. p = 0.00 for ANOVA chi-square test, there was a significant difference in variance, and variance disproportionality was highly significant. One-way ANOVA F = 991.125, p = 0.000, there was a significant difference between the posttest instructional design competency means of the two groups.

The mean value of the paired samples t-test paired difference scores for the pretest and posttest of instructional design ability in the experimental group was -20.167, p value 0.000 There was a highly significant difference,

and there was a significant increase in instructional design ability between the pretest and posttest.

The t-value of the post-test t-test of instructional design ability was -32.217 with a p-value of 0.000, and the experimental group was significantly better than the control group in terms of instructional design ability.

7. Conclusion

1. Traditional teaching methods can also improve students' instructional design ability, but compared with the application of the Online-Offline Combined Group Flipped Classroom Teaching Model, the difference in the magnitude and effect of improvement is very large.

2. The application of the "online-offline combined group flipped classroom teaching model" can greatly improve students' instructional design ability.

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Authors contributions

Dr. Huaizhao Zhang and Dr. Songsak Phusee·orn were responsible for study design and revising. Dr. Huaizhao Zhang was responsible for data collection. Dr. Huaizhao Zhang drafted the manuscript and Prof. Songsak Phusee·orn revised it. All authors read and approved the final manuscript. Dr. Huaizhao Zhang's contribution is 55% and Prof. Songsak Phusee orn’s contribution rate is 45%.

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Competing interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Informed consent

Obtained.

Ethics approval

The Publication Ethics Committee of the Canadian Center of Science and Education.

The journal’s policies adhere to the Core Practices established by the Committee on Publication Ethics (COPE).

Provenance and peer review

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Data availability statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Data sharing statement

No additional data are available.

References

Chen, C. Z. (2017). Construction and application of the "MOOC + flipped classroom" teaching model in college badminton. *Journal of Sports Science, 24*(5), 98-101.

Ding, H. (2006). Design and application of "group cooperative teaching method" in shuttlecock elective course. *Journal of Shenyang Sports College, 04*, 113-116.

Gannod, G. C., Burge, J. E., & Helmick, M. T. (2008). Using the inverted classroom to teach software engineering. *In ACM/IEEE International Conference on Software Engineering*. IEEE. https://doi.org/10.1145/1368088.1368198

He, J., & Luo, J. (2016). Research on the application of hierarchical optimization in sports training in colleges and universities. *Journal of Sichuan Normal University: Natural Science Edition, 5*, 5.

Kontos, A. P. (2012). Depression and neurocognitive performance after concussion among male and female high school and collegiate athletes. *Archives of Physical Medicine and Rehabilitation, 93*. https://doi.org/10.1016/j.apmr.2012.03.032

Sergis, S., Vlachopoulos, P., Sampson, D. G., & Pelliccione, L. (2017). Implementing teaching model templates for supporting flipped classroom-enhanced STEM education in Moodle. *Springer International Publishing.* https://doi.org/10.1007/978-3-319-33808-8_12

Tenenbaum, G. (1999). The dynamics of goal-setting: Interactive effects of goal difficulty, goal specificity and duration of practice time intervals. *International Journal of Sport Psychology, 30*, 325-338.

Zhang, H., & Huang, D. (2020). A study on the reform of the assessment method of MOOC course for general basketball. *Journal of Guangzhou University: Natural Science Edition, 19*(6), 5.

Zhao, G. R. (2016). Current research status of goal setting. *Journal of Jilin Provincial Institute of Education, 32*(02), 165-167.