

## The Effectiveness of Flipped Classroom and Cooperative Teaching Methods on the Creativity of Students

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### ABSTRACT

**Background:** Creativity is the process of evolution, development, and reconstruction of existing knowledge, which is regarded as problem-solving. The present study aimed to investigate the effectiveness of flipped classroom and cooperative teaching methods on the creativity of senior high school students.

**Methods:** The research method was quasi-experimental, with a pre-test and post-test design and a control group. The statistical population included all high school students in Ahvaz in the academic year 2019-2020. Using the cluster-random sampling method, one school was randomly selected from the all-girls senior high schools in Ahvaz. Forty-five students were selected and randomly divided into two experimental groups and a control group (n=15 per group). The research instrument included the Abedi's Creativity Test (CT). The experimental groups were taught using flipped classroom and cooperative teaching methods, while the control group received usual training. Data analysis was done using a one-way analysis of covariance.

**Results:** The mean±SD of the creativity for the flipped classroom, cooperative teaching, and control groups in the post-test phase were 126.60±15.39, 135.90±17.52, and 98.45±13.66, respectively. The results showed that both the flipped classroom and cooperative teaching methods enhanced the creativity of senior high school students (P<0.001).

**Conclusions:** According to the results, there was no significant difference between the two methods in terms of creativity in the students. Therefore, the flipped classroom and cooperative teaching methods can be employed to promote students' motivation and creativity.

**Keywords:** Education, Cooperative behavior, Creativity, Flipped classroom, Effectiveness, Students

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## Introduction

Creativity is the basis for active education. If learning is defined as providing conditions under which learners can knowingly change their methods for reaching a goal, this process should be directed and performed in creative situations (1). Creativity is the process of evolution, development, and reconstruction of existing knowledge, which is regarded as a type of problem-solving. Creativity refers to the process of sensing problems or deficiencies in information, hypothesizing about problem-solving and resolution of deficiencies, evaluating and testing the hypotheses, revising and re-testing them, and finally, communicating the results to others (2, 3). Soh defines creativity as the ability to correlate farfetched objects, concepts, and beliefs (4). Chen and Chiu define it as the process of creating anything new and valuable that depends on various factors such as knowledge, information, age, experience, intelligence, and thinking styles (5). Creativity does not have a direct relationship with knowledge but is directly related to the policies of the education and evaluation system and the proper use of thinking styles. It can be argued that creativity is a factor closely tied to learning. If mental activity is one pole of creativity, sociocultural factors form the other pole (6). As education is a cultural and acquired activity, it can promote the learners' creativity. In the composition of its main elements (fluidity, flexibility, and innovation), creativity is improved under the effect of education, and innovation is boosted (7).

Teachers adopt different teaching methods to promote creativity in students. During the past decades, educational standards have focused on the potential value of inclusive learning contexts where learners are actively involved in high-level learning activities and use inclusive methods such as problem solving in small groups, self-assessment, peer review, and group discussion in classrooms (8). The flipped classroom has become one of the most popular pervasive techniques (9, 10). The approach was evolved considerably in schools and high schools after being employed as an educational strategy in higher education (11).

This educational strategy, initially presented by Novak and Patterson (12), combines a collaborative classroom using online learning resources and activities to assist instructors in understanding inclusive requirements, providing timely feedback, and planning courses to fulfill the needs of all learners (13). Learners acquire instructional content, such as written material, instructional videos, instructional slides, audio files, and so on, outside of the instructional environment (e.g., at home), and as a result, classroom instructions are replaced with these activities. Therefore, it is called a "flipped classroom" (11). This type of training consists of two parts: classroom interaction and communication skills training and computer-assisted learning outside the classroom. As a result, the flipped classroom methodology combines conventional and contemporary teaching methods, which are beneficial in accomplishing learning objectives (14).

As the emphasis in flipped classrooms is on the application of the acquired concepts and innovative activities, rather than the memorization of facts, learners achieve a deeper understanding of the teaching materials (15, 16). One of the benefits of this method is that it provides the foundation for individual learning, accessibility to information anytime and in any location, repeated observation depending on reading speed (17). It controls the learning process, reading speed adjustment, choosing the study time and place, and persistent accessibility to content (18, 19). Many studies have noted the effectiveness of flipped classrooms in increasing students' creativity and motivation, learning, academic achievement, understanding and creativity, progress and creativity, self-efficacy beliefs and intrinsic motivation, and academic skills and creativity (20-26).

Another teaching method that trains active and creative students is cooperative learning, a teaching method in which learners work at different levels of implementation in small groups towards a shared goal and are equally in charge of other students' learning. Therefore, each learner's success helps the

other learners succeed (27). Cooperative learning is an educational approach to teaching and learning in which students collaborate to solve a problem, complete a task, or create a product. It is based on the principle that learning is inherently social, and participants in the learning process learn something through talking to each other (28). Cooperative learning has a strong theoretical background and precise experimental support. This method is supported by behaviorists and experts in learning. According to behaviorists, attempting to improve the group's performance is a positive aspect of this method. According to Bandura's social cognitive learning theory, when children observe what their friends do, they learn better; when they observe success in a group, their interest in learning is increased (29). Various studies have confirmed the effectiveness of cooperative learning in boosting creativity and reading skills, increasing creativity and academic achievement, mathematical creativity, improving self-regulation, creativity and academic motivation, and boosting creativity and motivation in language learning (30-32).

So far, a careful examination and study of boosting students' creativity has rarely been conducted in Iran for different reasons, and little planning has been made for this purpose. According to most scientists, conventional educational techniques do not encourage learners' creativity and instead function against their development in such areas. The evaluation and explanation of the flipped classroom and cooperative teaching methods on improving the creativity of high school students are among the most important innovations of this study. Accordingly, given that many studies have revealed that lack of academic motivation and lack of creativity seriously interrupt individuals' development and academic achievements, and given that adolescence and the youth seem to be the most vulnerable groups (33, 34), we should look for new scientific theories and solutions to promote academic motivation and lack of creativity. Accordingly, the present study sought to investigate the effectiveness of

flipped classroom and cooperative teaching methods on the creativity of senior high school students.

## Methods

### *Study Design*

The research method was quasi-experimental, with a pre-test and post-test design and a control group.

### *Setting*

The statistical population included all tenth-grade high school students in Ahvaz in the academic year 2019-2020. The study was conducted from October 2019 to January 2020.

### *Participants*

Inclusion criteria were that the students of each class be at the same level in terms of education and a lack of severe physical or mental problems. Exclusion criteria were the absence of more than two sessions in class. At the end of the training sessions, the experimental and control groups underwent a post-test in the same conditions.

### *Teaching Interventions in Intervention and Control Groups*

Both intervention groups were trained in the methods of flipped classroom and cooperative teaching, and the control group did not receive any training. Three teachers were selected and randomly assigned to experimental (flipped classroom and cooperative teaching) and control groups.

### *Intervention Group 1*

**Flipped Classroom Technique:** Before the commencement of class, the instructor arranged resources and materials, which included educational films and concepts, booklets, Internet blogs, and a virtual group. (Learners in the class attended the virtual group to access the instructor, ask questions, and solve their difficulties anytime and anywhere). Students obtained pre-session instructions and practiced subjects outside of the classroom. After that, when students

returned to the school, the environment was limited to problem solving and practice. Students furthermore specified various projects, implemented, and discussed them in the class. This technique was adopted during ten 75-minute sessions in accordance with the table of contents in the mathematics book.

### *Intervention Group 2*

**Cooperative teaching method:** To implement this method, the researcher gave the teacher in the experimental class information about the method and the most accurate way of implementing it. When the teacher became fully familiar with the method, the teacher and the researcher, as a teaching pair, demonstrated the method to the student in practice to familiarize them with it. In fact, they role-played the method for the students. As targeted and step-by-step questions are asked by the teacher and the learners give answers and find the solution to the problem in this method, in the teacher and researcher role-playing stage, some points about how the teacher asks questions, how the learners answer the questions, how the learner asks her training partner for help, how feedback is given, and how to praise the training partner were given to the students. Each cooperative teaching session lasted 75 minutes; the teacher taught the topic for 45 minutes, and the cooperative teaching method took 30 minutes. After teaching, the teacher appointed the pairs and, based on the students' interests or randomly, chose one of them as the teacher and the other one as the learner. The students changed roles constantly so that all of them would experience both roles. The student pairs were randomly changed after a week (2 sessions). The cooperative teaching method was implemented for 10 sessions of mathematics.

### *Control Group*

For the control group, the training method was traditional. In the traditional classroom, the usual training was lectured, and the teacher presented the materials and exercises. The students in the classroom often listened

and took notes. In this method, students do homework at home. The traditional training programs were also conducted in ten 75-minute sessions once a week.

### *Data Collection Tools*

#### *Abedi's Creativity Test (CT)*

The students' creativity was evaluated at baseline and at the end of the training sessions. The data collection tool was a 60-item questionnaire that was developed by Abedi in 1992. This questionnaire measures four components of fluidity (11 items), innovation (11 items), flexibility (11 items), and expansion (11 items), and is scored on a three-point Likert scale (1 (low), 2 (moderate), and 3 (high)). The sum of the scores in the four components forms the total score of creativity. The minimum score is 60, and the maximum score is 180 (35). The content validity ratio (CVR) and content validity index (CVI) of this questionnaire were reported to be 0.91 and 0.90, respectively. In order to determine the face validity of the Persian version of CT, this scale was provided to several specialists (36). Noorbakhsh and Aghdasi reported a Cronbach's Alpha coefficient of 0.70 for the reliability of this questionnaire (26). In the current study, the Cronbach's alpha coefficient for the entire questionnaire was obtained as 0.83.

### *Sample Size and Randomization*

Using the cluster-random sampling method, 45 students were selected and divided into two experimental groups and a control group (n=15 per group). The specified sample size was selected according to G-Power software (effect size=1.60, test power=0.90, significance level=0.05). One school was randomly selected from the all-girls senior high schools in Ahvaz. Then 45 tenth-grade students were selected and randomly assigned to experimental and control groups. Three teachers were selected and randomly assigned to experimental (flipped classroom and cooperative teaching) and control groups. The teachers were randomly allocated into flipped classroom, cooperative teaching, and

control groups via the coin-throwing method.

**Statistical Methods**

An analysis of covariance (ANCOVA) was used to analyze the data. In order to observe the ethical principles, the participants were informed of the research goals and their procedures. Also, the researchers received written informed consent for participation in the research from the participants.

**Results**

The participants included 45 high school female students, aged 15.33±1.18 years old. Table 1 presents the mean and standard deviation (SD) of the studied variable in the experimental and control groups in the pre-test and post-test.

To test the normality of the collected data about the significance of Z value, the Kolmogorov-Smirnov test revealed that the research variables had a normal distribution. To test the homogeneity of variances (for the same variances of the experimental and control groups), Levene’s test was used (F=0.911; P=0.408). The results showed that the homogeneity of variances assumption holds, and covariance analysis can be used. Furthermore, to examine the assumption of the regression line slope homogeneity, an analysis of variance was performed (F=2.368, P=0.441). The non-significant

interaction indicated that the assumption of the regression line slope homogeneity holds. Therefore, this assumption was also true for the variables, and the analysis of variance could be performed.

The F-value of the one-way analysis of covariance for the dependent variable showed that, in the variable of creativity, a significant difference existed between “flipped classroom,” “cooperative teaching method,” and the control groups (F=13.05, P<0.001). Therefore, at least one of the teaching methods had a significant effect on the dependent variable. A Bonferroni’s post-hoc test was run to find out which treatment was effective and whether the two treatments significantly differed.

The difference between the means of the flipped classroom and the control groups in terms of creativity was 25.339, suggesting that the flipped classroom was effective on creativity (P<0.001). Moreover, the difference between the means of the cooperative teaching method and control groups in terms of creativity was 26.423, indicating that the cooperative teaching method was effective on creativity (P<0.001). Moreover, the difference between the means of the two teaching methods in terms of creativity was 1.083, demonstrating that no significant difference existed between the two experimental groups in terms of creativity (Table 2).

**Table 1:** Mean and standard deviation of creativity in experimental and control groups in pre-test and post-test

Variable	Phase	Flipped classroom	Cooperative teaching	Control	P value (between groups)
		M±SD	M±SD	M±SD	
Creativity	Pre-test	94.50±9.31	95.70±11.41	97.20±12.07	0.568
	Post-test	126.60±15.39	135.90±17.52	98.45±13.66	<0.001
P value (within groups)		<0.001	<0.001	0.819	

**Table 2:** The results of pairwise comparison of creativity in the experimental and control groups in the post-test stage

Variable	Groups	Mean difference	SE	P value
Creativity	Flipped classroom - Control	25.339	5.879	<0.001
	Cooperative teaching - Control	26.423	5.860	0.003
	Flipped classroom - Cooperative teaching	1.083	5.917	0.612

SE: Standard Error

## Discussion

The findings revealed that both the flipped classroom and cooperative teaching methods boosted the creativity of senior high school students. The results also showed that no significant difference existed between the two teaching methods in terms of creativity. This finding is consistent with the results of other studies (22, 23, 25, 26).

A flipped classroom is a psychological theory about motivation, change, and flexibility. In fact, it delineates a general view of human behavior and experience, according to which any person can analyze his or her experiences and feelings. Based on the flipped classroom method, while we act differently at different times, we may also act differently at different moments; it is even possible that we show contradictory behaviors or demonstrate different behaviors under equal conditions. Accordingly, suitable and on-time changes and flexibility based on this theory can boost creativity. Not relying too much on a transcendental state and pole and their sufficient and balanced use boosts mental health and, consequently, purposefulness. In this way, students will have sufficient innovation, flexibility, and motivation (22).

Another finding was that cooperative teaching enhanced the creativity of senior high school students. This finding is consistent with the research results of other studies (30-32). The main goal of all educational institutions is to improve students' problem-solving ability and creativity. Creativity requires problem-solving, and creative people create or increase the complexity of problems before solving them. Therefore, it is only through creating these abilities that people can be prepared for coping with changing life conditions and new situations they constantly face. Therefore, the other educational goals in schools are pre-requisites taught to students to prepare them for acquiring problem-solving skills and creativity. By this, we mean personal and social skills that adolescents should acquire so that they can act more effectively, properly, and reliably towards themselves, other people, and society. In other words,

life skills are a set of abilities that lead to adaptation and positive and useful behavior and boost creativity in students (37). Overall, cooperative teaching helped the students achieve a set of goals related to intellectual growth, such as accurate understanding of the materials, comparing theories, understating the relationships between topics, evaluation, judgment, and creativity while also assisting them in acquiring social skills. Cooperative teaching in the form of small-group activities leads to the achievement of many goals related to ethical training, such as responsibility, respecting other people's rights, and valuing their work. Viewing students in creative problem-solving situations disrupts the balance between the student and the environment, and this will bring about intellectual growth or strengthen the person's cognitive structure (30).

Overall, the students became more creative people with the help of flipped classroom and cooperative teaching methods. A flipped classroom can revolutionize traditional teaching methods. The tests are given to the students online outside of the classroom, and the tasks that used to be completed at home are now done in the classroom. The flipped classroom as a unique approach has revolutionized the role of homework and classroom tasks. In the traditional teaching method, students acquired new knowledge in the classroom via lectures and practiced it at home. However, in the flipped classroom approach, they learn the concepts at home through videos and practice the skills in the class. The flipped classroom learning model provides an active and interactive environment for learning in which the teacher, as the director, guides the students while they are implementing the concepts and are actively and creatively engaged with the material (23). When a teacher designs and presents a video file appropriate for the topic, the class time is focused on the students' participation. Active learning is done through asking questions, tests, discussions, round-table talks, exploratory activities, craftsmanship, and the use of ideas that play a main role

in the flipped classroom and boost students' creativity. Moreover, cooperative learning is a type of interpersonal relationship that is characterized not only by cooperation, but also by sensitivity to other people's needs. It is a teaching method whereby students in small groups cooperate towards a joint goal, and feel responsible for their own and the other students' learning (31). It is, in fact, a teaching strategy for small groups. But any teaching method that uses groups cannot necessarily be cooperative teaching because cooperative teaching has certain requirements and methods, and as long as these requirements are not met correctly and at the right place, cooperative learning has not taken place.

### Limitations and Suggestions

Just female high school students in Ahvaz, Iran, were included in the study's statistical population. As a result, care should be exercised when extrapolating the outcomes to learners in other grades, other locations, and male students. Therefore, it is proposed that comparative research be conducted to analyze students from different grades, localities, and genders and compare the results.

### Conclusion

According to the results of the present study, the flipped classroom and cooperative teaching increased the creativity of high-school students. In this study, there was no significant difference between the two methods in terms of creativity in the students. It is suggested that teachers ensure appropriate conditions for growing the creativity of students and provide more opportunities for learning, creating a more suitable learning environment, and, in this way, boosting students' creativity.

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### Conflict of Interests

There are no conflicts of interest to mention.

### Ethical Considerations

In this study, questionnaires were filled with the participants' satisfaction, and written informed consent was obtained from the participants in this study. We also assured them that all information collected would remain confidential. The study was approved by the Ethical Committee of Islamic Azad University-Ahvaz Branch (code: ir.iau.ahvaz.rec.1399.043).

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