

# A Multimethod Approach for Supporting Reflection and Creativity in Online Collaborative Courses

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## Abstract

Cultivating the capacity to create and reflect has been a prominent feature of professional training in numerous disciplines. Through teaching strategies, creativity and reflection abilities can be enhanced. In this article, we report the findings of a new multimethod approach (including narrative essay writing, high-level prompts, and online collaborative learning strategies) that provides a learning environment to influence students' creativity and reflection. Graduate students in an online course of a national university in southern Taiwan served as participants. Through the multimethod approach, we analyzed and discussed students' reflection, creativity, and academic emotions after learning. The results revealed that students' reflective and creative abilities were enhanced, and the students held positive emotions toward the multimethod approach. This approach may aid teachers in the design of learning activities and guide online collaborative learning activities.

**Keywords:** Online collaborative learning, Creativity, Academic emotions

## 1 Introduction

Creative and reflective abilities are fundamental skills that students should have for future life [1-2]. Through teaching strategies, these abilities can be inculcated [3-4]. However, because of the pressure of entrance examinations, schools in Taiwan usually adopt a curriculum of knowledge memorization, and most teachers use traditional lecturing methods as their major teaching strategy [5]. Hence, stimulating creative or reflective abilities in students in Taiwan is irrelevant [6]. To enable students to adapt to the fast-changing world after graduation, many higher education institutions are actively developing strategies for teaching reflective abilities and creativity [4, 7]. Therefore, in this study, a new multimethod approach (with narrative essay writing, high-level prompts, and

online collaborative learning strategies) was developed and used for improving students' creative and reflective abilities. Numerous studies have explored the benefits of using multimethod approaches in computer-supported collaborative learning research [8-9].

An increasing number of higher education instructors are considering the possibility of using online learning methods as an instructional strategy [10-11] because web-based technology has created various new learning environments [11-12]. Furthermore, online collaborative learning environments can enhance writing skills, critical thinking skills, and knowledge construction and reduce anxiety [13]. Numerous teaching strategies can be applied in online collaborative learning to foster a student's reflective and creative abilities and academic emotions. Thus, online collaborative learning formed part of our multimethod approach.

To foster students' creativity, a narrative essay writing strategy was applied. Creativity means using cognitive, imaginative, and evaluative functions to discover facts, problems, concepts, and acceptable solutions [14]; thus, writing is an effective strategy for facilitating creativity [15-17]. A common measure of creativity in narrative essay writing is writers' schemata, which include creativity, memories, imagination, experiences in relation to themes, and feelings [18-19].

According to Kolb [20], reflection is a process that involves initial perception, reinterpreting existing experiences, and interpreting raw experiences. Graesser and Person [21] observed that learners who were asked suitable questions achieved satisfactory learning performance. Redfield and Rousseau [22] and Chen, Wei, Wu, and Uden [23] have revealed that high-level question prompts assisted learners to achieve improved learning performance, because to answer comprehension questions, learners must redefine or elaborate on the details of the questions, which cannot be found in the learning materials.

Positive and negative emotions influence learning,

and academic emotions are highly relevant to the learning process and its effectiveness [24-26]. Um et al. [24] and Kort et al. [26] have explored whether positive emotions further enhance learning effectiveness through self-motivation and satisfaction and whether online collaborative learning environments reduce anxiety [13].

Most related studies have focused on topics such as learning effectiveness, collaborative ability, and communication skills [27-28], and a few have addressed how online collaborative learning evokes students' creative and reflective abilities and investigated the correlation between academic emotions and the fostering of these abilities. Therefore, in this study, a multimethod approach, including narrative essay writing, high-level prompts, and online collaborative learning strategies, was used to foster reflection, creativity, and positive academic emotions in higher education students. We subsequently investigated the effect of the multimethod approach on the students after learning.

The study addressed the following questions:

- creativity enhanced by the multimethod approach (including narrative essay writing, high-level prompts, and online collaborative learning strategies)?
- What is the effect of the multimethod approach on reflection level?
- What is the effect of the multimethod approach on academic emotions?

## 2 Literature Review

### 2.1 Online Collaborative Learning

Several teaching tools used in computer-supported collaborative learning have been proven to enhance creativity and problem-solving ability in addition to having a positive influence on the learning process and skills development [29-31]. Online collaborative learning is a commonly used strategy in Taiwan for increasing group interactions because it is a well-developed teaching method in higher education, and online learning activities are effective at enhancing the reflective ability of learners [32-33]. Online collaborative learning has many advantages, such as improving students' communication and enhancing comprehension and team-learning motivation [34]. In collaborative teaching, meaningful learning in a social context should be developed so that students can introduce personal characteristics and responsibilities into it. Lin and Griffith [13] suggested that online collaborative learning environments have the advantages of evoking cognitive, sociocultural, and psychological skills and can enhance writing skills, critical thinking skills, and knowledge construction. Additionally, these learning environments can increase

participation, interaction, and motivation, as well as reduce anxiety. During knowledge construction, interaction and participation result in the learner conveying personal ideas and perspectives [35].

### 2.2 Emotions and Learning

Emotions have a substantial influence on cognitive processes such as perception, attention, learning, memory, and problem-solving ability [36]. Academic emotion is the term used for the reactions triggered in a learning process [37]. It is well established that positive and negative emotions influence learning. Some studies have explored whether positive emotions further enhance learning effectiveness through self-motivation and satisfaction [24, 26, 38-39]. Some studies have reinforced that positive emotions promote creative problem-solving skills [40]. Mao and Li [25] used three emotion recognition methods to analyze students' academic emotion, and they provided feedback on the most suitable method to improve learning effectiveness based on the user's current state of learning.

Kort et al. [26] reported a correlation between learning and emotion, and they observed that different emotional states can lead to different learning outcomes. Therefore, learning during optimal emotional states might lead to superior learning effectiveness in students. Pekrun et al. [37] explored positive emotions (e.g., Enjoyment, Anticipatory joy, Hope, Joy about success, Satisfaction, Pride, Relief, Gratitude, Empathy, Admiration, and Sympathy, and love) and negative emotions (e.g., Hopelessness, Anxiety, Sadness, Disappointment, Shame and guilt, Anger, Jealousy and envy, Contempt, and antipathy and hate) that influence learning outcomes. Kort et al. [26] stratified the emotions affecting learning into five sets of negative and positive emotions: Anxiety-Confidence, Boredom-Fascination, Frustration-Euphoria, Dispirited-Encouraged, and Terror-Enchantment.

Because quantifying the data of participants' academic emotions is difficult, the semantic differential technique was used in this study to explore students' emotions. The semantic differential technique, developed by Osgood et al. in 1957 [41], is an attitude-measuring method used for measuring the word meaning or concept of participants. In this technique, participants select the appropriate position of some sets of polar adjectives, nouns, or verbs on the designed scale. It is commonly used in sociology, social psychology, and psychological research to understand the attitudes and perspectives of individuals concerning the surrounding environment or research targets. In the last step of the semantic differential technique, the scale is converted into values based on a rubric, revealing the overall attitude intensity of the participant. The semantic differential technique is based on synesthesia theory or the sensory experience. Occasionally, when sensory organs receive stimuli, people experience specific

sensations; for example, someone might have different feelings toward “cold” and “warm” colors (e.g., blue and red, respectively).

The semantic differential method has been used in numerous research fields. For example, Sagara et al. [42] used it to explore the semantic structure of the Japanese and English languages. They selected 88 adjective pairs and 150 concept words for participants to rate semantically. The following four interpretable factors were extracted from the results: Moral Correctness, Magnitude, Sensory Pleasure, and Dynamism. The differences in the semantic structures of Japanese and English were represented by these four factors.

Inoue and Kobayashi [43] explored 68 groups of self-concepts and personality classifications of children from a database of 233 papers and articles using the semantic differential method. Hsu et al. [44], also using this method, examined the telephonic conversation patterns of samples by using a group of 14 related words. They revealed that words such as creative, mature, and exquisite matched the preferences of the subjects.

In a study by Osgood et al. [41], participants were asked to evaluate 50 pairs of semantically related words for a concept by using a fixed evaluation scale. Through these meaning-dependent vocabularies, the concept's significance for the subject was measured. The analyzed results were presented quantitatively and corresponded to the strength of the individual feeling or concept differences of the research target. In addition, this method can also be used by non-English-speaking people [41, 45].

### 2.3 Reflection in Learning

Reflection is essential in learning processes and promotes learning performance [46-47]. Therefore, numerous higher education institutions are actively promoting students' reflective ability to help them cope with the fast-changing world [23].

Dewey [48] argued that reflection is caused and stimulated by the psychological status of a person; this type of status initiates the internal problem-solving process. When people encounter a confusing or problematic situation that cannot be effectively solved using previous experiences and solutions, they search, explore, analyze, and experiment with many possible actions to solve the problem until a solution is identified. This is why Dewey defined the concept of reflection as mental processing or a person's internal problem-solving ability. According to some researchers, reflection is a meta-cognitive ability, and it can be acquired through appropriate learning and training [49]. According to Boud et al. [50], the process of reflection should be understood in relation to the experiences reflected upon and the resulting outcomes. Furthermore, the reflection process has three stages and the outcomes are intangible. Nevertheless, it

has been suggested that the changes observed in learners' cognitive framework influence their behavior in the long term. According to Kolb [20], reflection is a process involving initial perception, reinterpretation of existing experiences, and interpretation of the raw experience.

Graesser and Person [21] reported that learners who are asked suitable questions achieve satisfactory learning performance. Redfield and Rousseau [22] and Chen, Wei, Wu, and Uden [23] have revealed that high-level question prompts assisted learners to achieve improved learning performance. In addition, many researchers have suggested that collaborative learning has positive effects on learning attitude and performance [50-51].

In this study, high-level prompts were comprehension or integration questions based on the research results of Chen et al. [23]. To answer the comprehension questions, learners were required to redefine or elaborate on the question details, which cannot be found in the learning materials. For example, “Please use your own words to describe why A is important?” To answer the integration questions, learners were required to connect two or three concepts to elaborate, infer, and solve the problem. For example, “Explain the differences between A and B.” Because the high-level prompts stimulated learners' internal motivation to find a workable solution, the approach fits the definition of reflection by Dewey [48].

### 2.4 Creativity in Learning

Numerous definitions of creativity exist. Dewey [52] defined creativity as the psychological process of problem-solving; therefore, creativity is interpreted as a problem-solving ability. According to Torrance [53], creation relates to the formation of a new hypothesis or making adjustments to a problem to solve it, and this ability to solve problems involves using creativity. Parnes [14] argued that creativity is using cognitive, imaginative, and evaluative functions to discover facts, problems, concepts, and acceptable solutions. Creativity is the ability to solve problems that an individual has not previously learned to solve [54]. Yu [18] indicated that narrative essay writing includes writers' schemata, including creativity, memories, imagination, experiences in relation to themes, and feelings.

Creativity can be evoked through teaching strategies [3], and several studies have indicated that collaborative learning is a useful strategy for fostering students' creativity [27-28]. Thus, in this study, we taught narrative essay writing according to the study of Harris [19], which included learning, sharing opinions, holding discussions, and presenting results as the learning scaffold. At the end of the group narrative essay assignment, students were inspired by the learning scaffold method of interaction.

### 3 Materials and Methods

#### 3.1 Participants

The course investigated in this study is an course at a national university in Taiwan focusing on the basics of affective computing. Participants, 37 graduate students (22-45 years old) majoring in E-learning Technology and Teaching (including in-service students), were divided into 9 groups: 8 groups of 4 people and 1 group of 5.

#### 3.2 Experimental Design

This study was designed mainly through the inquiry-based learning tool IKnow, which is a learning management system for online collaborative learning. According to the results of Ferris and Hedgcock [55], participants were randomly divided into groups for the experiment. Before the online discussion, all students had to study the teaching material (usually videos) in their spare time. In the beginning, all members of a particular group shared and explained a personal assignment in turn. Finally, after the online collaborative learning process, the teams integrated their opinions and submitted a group assignment. This study was conducted by only one teacher with more than 20 years of teaching experience and 8 years of online teaching experience.

The experimental activities included teaching, completing high-level prompt assignments (including individual and group assignments), and online collaborative learning (sharing and discussing of individual assignments and completing group assignments for each task).

At the beginning of the 6-week experiment, the instructor provided students with clearly defined learning goals and rubrics for the online discussion. The learning materials and methods were designed by the researchers in consultation with experts or teachers of e-learning. Each week, a different topic was covered. The instructor provided all students with specific discussion tasks and the expected outcomes before the learning activities started. On the basis of the discussion tasks and learning materials, students performed the online collaborative learning activity. The experiment involved 12 tasks (including individual and group assignments), each with different learning topics. In the process of performing experimental activities, students were inspired and urged to discuss topics in a deeper manner.

#### 3.3 Analysis Instrument

The data for analysis included a questionnaire with three aspects (creativity, reflection, and academic emotions), the assignment scores of the student, and group discussion content. A total of 32 questionnaires were returned, and 25 were valid.

A questionnaire derived from validated scales in related studies was used to explore the improvement in students' academic emotions and reflective and creative abilities achieved through taking the online collaborative learning course. All measures used a 4-point Likert-type scale, ranging from 1 (*strongly disagree*) to 4 (*strongly agree*). The Chinese version of the questionnaire was revised and translated by the researchers and approved by three experts or teachers.

The questionnaire measuring the reflection aspect was a modified version of that developed by Lin, Liu, and Yuan [56] and Liu [57]. Seven items measured this factor (e.g., "Reading peers' assignments can help me develop new ideas," and "Through the process of online collaborative learning, I have a deeper understanding of the topics discussed."). The internal consistency coefficient (Cronbach's  $\alpha$ ) was 0.910.

The Kaufman Domains of Creativity Scale (K-DOCS) [16] was used to measure students' creativity. It comprises five dimensions: Everyday, Scholarly, Performance, Science, and the Arts. In total 50 items measured creativity. Examples of the five factors included are as follows: "Finding something fun to do when I have no money," "Researching a topic using many types of sources that may not be readily apparent," "Learning how to play a musical instrument," "Constructing something out of metal, stone, or similar material," and "Taking a well-composed photograph using an interesting angle or approach." Cronbach's  $\alpha$  was 0.874.

A semantic differential scale, including six pairs of words with opposite semantic meanings, was used to analyze students' academic emotions. Among the six sets (12 words) of polar learning-emotional words concerning online collaborative learning, nine words were selected from the studies by Pekrun et al. [37] and Kort et al. [26], and three words were provided by the researchers. These words were approved and examined by three e-learning or education experts. The six sets of polar vocabularies included the following: Anxiety-Relief, Boredom-Enjoyment, Sorrow-Joy, Antipathy-Anticipatory Joy, Hopelessness-Pride, and Staying Aloof-Empathy. As an index to determine participants' personal feelings, all six pairs were scored 1-4 (Table 1). A mean score below 2 points indicated that the student' feelings tended toward the right side (negative emotions), and a mean above 2 implied that students' feelings tended toward the left side (positive emotions). Cronbach's  $\alpha$  was 0.931.

**Table 1.** Emotion sets related to learning in this study

Sets	Postive emotion items	1-4 points				Negative emotion items
Set 1	Relief	4	3	2	4	Anxiety
Set 2	Enjoyment	4	3	2	4	Boredom
Set 3	Joy	4	3	2	4	Sorrow
Set 4	Anticipatory joy	4	3	2	4	Antipathy
Set 5	Pride	4	3	2	4	Hopelessness
Set 6	Empathy	4	3	2	4	Stay aloof

### 3.4 Learning Management System

1Know, a learning management system, was used as a tool for online collaborative learning in this study. Figure 1, Figure 2, and Figure 3 present screenshots of the online collaborative learning material, discussion process, and discussion group lists, respectively.

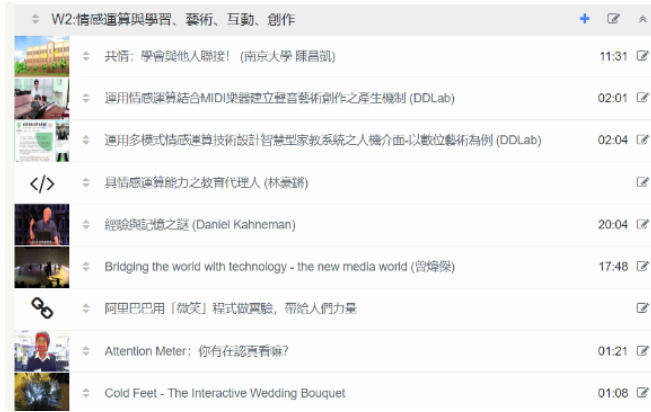


Figure 1. Screenshot of the online collaborative learning material

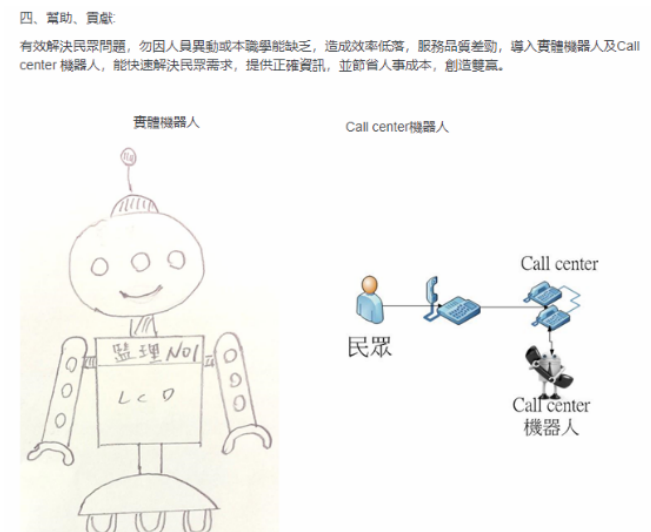


Figure 2. Screenshot of the online collaborative discussion process



Figure 3. Screenshot of the online collaborative discussion group lists

## 4 Results and Discussion

### 4.1 Multimethod Approach: Findings for Creativity

Table 2 lists the t test results for the students’ five dimensions of K-DOCS before and after the multimethod approach. The t test results of the four factors (Everyday, Scholarly, Performance, and Science) revealed significant differences ( $p < 0.05$ ) between the learners’ creativity before and after performing the learning activity. A positive association was observed between creativity and learning score of high-level prompts from narrative writing, which represented students’ creativity (Table 2). A paired-sample t test was conducted to compare participants’ creativity in high-level prompts from narrative writing.

Table 2. T test results for the five dimensions of creativity

Dimensions of K-DOCS	N	Mean	DS	t
Pre-experiment everyday	25	3.95	0.60	2.69**
Post-experiment everyday	25	3.40	0.66	
Pre-experiment scholarly	25	3.65	0.79	3.6**
Post-experiment scholarly	25	2.95	0.43	
Pre-experiment of performance	25	2.93	1.16	3.19**
Post-experiment performance	25	2.12	0.63	
Pre-experiment science	25	2.32	0.92	2.25**
Post-experiment science	25	2.80	0.75	
Pre-experiment artistic	25	3.40	1.08	1.14
Post-experiment artistic	25	3.08	0.80	

\* $p < 0.5$ . \*\* $p < 0.1$ . \*\*\* $p < 0.001$ .

In the online learning environment, students could learn and construct knowledge. Furthermore, students were engaged in an eventful learning process that stimulated reflection through interaction [58-59]. Studies have found that interaction and wide participation are effective for knowledge building and enhanced learning quality [60, 35]. Lau, Ng, and Lee [61] obtained similar results. They indicated that providing appropriate creativity training through the instructional design can impel and foster students’ creativity. The results in Table 3 also indicate that the multimethod approach of online collaboration, high-level prompts, and narrative essay writing provided a meaningful context for absorbing new information. Students’ personal experiences of interaction on the collaborative learning platform helped improve their critical thinking and problem-solving skills [6].

### 4.2 Multimethod Approach-based Findings for Reflection

Results of the analysis of learners’ reflection are presented in Table 3. The mean was 3.31 (1 = *strongly disagree*; 4 = *strongly agree*), with a standard deviation of 0.58. According to the analysis of reflection, most students had a positive attitude toward the multimethod

approach. As indicated in Table 3, most students agreed with the statements “Collaborative learning led to introspection among students; therefore, I enhanced

my understanding of learning concepts” and “Reading peers’ assignments encouraged me to develop new ideas” (mean > 3.52).

**Table 3.** Means and standard deviations for the reflective ability analysis

Items	Mean	SD
Q1.Teachers’ timely intervention in the group discussion will have an impact on the group’s discussion result.	2.88	0.78
Q2.Collaborative learning led to an introspection to the students, therefore, I enhanced my understanding of learning concepts.	3.08	0.64
Q3.I agree that group discussion is meaningful for social interaction among peers.	3.36	0.57
Q4.Reading peers’ assignments promoted me to develop new ideas.	3.52	0.51
Q5.In the process of interacting with my peers, I expanded my horizons and changed my view of things.	3.52	0.51
Q6.Through collaborative learning, I know more about the assignment of the course.	3.40	0.58
Q7.I can give substantial feedback to my homework assignments.	3.40	0.50
Average	3.31	0.58

Correlation analysis revealed a positive significant relationship between the reflection and assignment scores (Table 4). Students exhibited a positive attitude toward reflection after the experiment. The instructional design, as a scaffold in the experiment,

guided and supported students in the online collaborative learning environment. This can be deduced from the means obtained for each of the following statements:

**Table 4.** Semantic differential scores of academic emotions toward online collaborative learning strategies

Negative items	1	2	3	4	Positive items	N	Mean	SD
Anxiety	0(0%)	2(8%)	11(44%)	10(40%)	Relief	25	3.25	0.79
Boredom	0(0%)	5(20%)	13(52%)	6(24%)	Enjoyment	25	3.04	0.69
Sorrow	0(0%)	4(16%)	14(56%)	6(24%)	Joy	25	3.08	0.65
Antipathy	0(0%)	5(20%)	13(52%)	6(24%)	Anticipatory joy	25	3.04	0.69
Hopless-ness	0(0%)	5(20%)	11(44%)	8(32%)	Pride	25	3.13	0.74
Stay aloof	0(0%)	3(12%)	11(44%)	10(40%)	Empathy	25	3.29	0.69
Average							3.14	0.71

- In the process of interacting with my peers, I expanded my horizons and changed my perspective (mean: > 3.52).
- Reading peers’ assignments encouraged me to develop new ideas (mean: >3.52).
- Through collaborative learning, I know more about the course assignments (mean: >3.40).
- I can give substantial feedback about my homework assignments (mean: >3.40).

The results were the same as those of obtained by Redfield and Rousseau and Chen, Wei, Wu, and Uden [22-23]. These researchers revealed that using a strategy with high-level prompts enhanced students’ reflective ability. According to Nelson and Murphy [62], because students reviewed peer assignments from their own perspective in the group interaction, they learned more about their cognitive gap. Moreover, the multi-perspective-based feedback revealed the development of their reflective abilities through the group assignment [63].

### 4.3 Findings on Academic Emotions Toward the Multimethod Approach

Table 4 presents the results of the quantitative analysis of academic emotions for the online collaborative learning strategy. The mean value and standard deviation were 3.14 and 0.71, respectively. The analysis results suggested that most participants had positive academic emotions toward the online collaborative learning strategy. Most students’ feelings tended toward the right side of the scale, representing positive emotions, for the six pairs of words with opposite semantic meaning. Although some negative emotions (only one student felt anxiety) were perceived, overall, most students had positive feelings toward the strategy of this distance course. In the interview, the student with anxiety stated that she was afraid that her lack of confidence in her learning ability would affect her team members. Thus, lack of self-efficacy was the cause of the negative emotions perceived, not the online collaborative learning method. These results correspond with those of Trigwell et al. [64]. They observed that learners’ approaches to learning and their emotions are related to the quality of

their learning outcomes.

#### 4.4 Research Findings

Writing is a creative process. In this experiment, students were required to think deeply and use their reflective abilities to respond to the teacher's high-level prompts. Then, in the collaborative learning activity, students interacted and practiced critical thinking and reflective skills with their peers. Subsequently, students wrote their final responses to the teacher's high-level prompts. In this process, students' reflective and creative abilities were enhanced.

### 5 Conclusion

Reflection and creativity can be fostered through teaching. In this study, the integration of a question-based teaching strategy confirmed that a multimethod approach (including narrative essay writing, high-level prompts, and online collaborative learning strategies) can foster and enhance students' reflective and creative abilities. This experiment provided an instructional approach, namely the online learning strategy, which facilitated students' meaningful learning through interaction that enhanced their reflective abilities [57-58]. The group assignments proved that the online collaborative activity, that is, narrative essay writing, enhanced students' creativity because narrative essay writing developed a meaningful context for absorbing new information. Students' own experiences during interaction with the collaborative learning platform improved their critical thinking and problem-solving skills [17-18]. High-level prompts had a moderating effect on students' reflection levels. Students' academic emotions toward online collaborative learning were positive, and most students associated emotions such as relief, enjoyment, joy, anticipatory joy, pride, and empathy with it. In future studies, the effects of online collaborative learning can be more clearly depicted by combining more teaching strategies. The aforementioned results can be used to improve the learning and teaching process and the learning effectiveness of online collaborative learning environments [57].

Through a well-designed experiment and teaching approach, this study revealed that the multimethod approach (including narrative essay writing, high-level prompts, and online collaborative learning strategies) fostered and enhanced the reflective and creative abilities of participants. The authors suggest that teachers should conduct activities that foster reflective and creative abilities in students.

Regarding limitations, this was a case study. Therefore, inferences should be drawn cautiously. In addition, few students participated in this experiment, and all participants were in-service graduates who are

essentially different from college or high-school students.

In terms of future research, first, instead of practicing online collaborative learning, researchers may practice flipped learning to analyze the relationship between the multimethod approach of teaching and reflection or creativity. Second, other learning strategies can be used for comparison instead of the three learning strategies used in this study. Last, future studies should include a control group, which was absent in this study.

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