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The effects of classroom goal structures on the creativity of junior high school students

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Previous studies have indicated that situational factors can influence students’ creativity. However, no studies have specifically examined the relationship between classroom goal structures and student creativity during real classroom activities. For this study, we recruited 232 seventh-grade students from Taipei City and randomly divided them into the following three classroom goal structure groups at the start of the semester: an enhanced group with a mastery classroom goal structure, an enhanced group with a multiple (mastery and performance) classroom goal structure and a control group. Before receiving the experimental manipulation, the students’ level of creativity showed no significant differences. After six weeks, the students in the enhanced groups with mastery classroom goal structure and multiple classroom goal structure exhibited superior fluency, flexibility and creativity compared to those in the control group. However, the creativity of the students in the enhanced groups with mastery classroom goal structure and multiple classroom goal structure showed no significant difference. This indicates that the mastery classroom goal structure itself can sufficiently enhance students’ creativity. The results of this study support the existence of a causal relationship between classroom goal structures and student creativity. When teachers develop an appropriate learning climate in classrooms with an emphasis on mastery goals, students’ creativity and creative expression can be stimulated. We also discuss the theoretical and extendable implications of this study based on the results.

\textbf{Keywords:} classroom goal structure; creativity

\textbf{Introduction}

Creativity is the most essential skill for working talent in the twenty-first century. In today’s era of diverse information and fierce competition, how to exhibit students’ energy and their creativity is the most important goal of current education. Edwards (2003) likened learning and creativity to two sides of the same coin, and both represent vital issues in education. From a macro perspective and definition, creativity is the basic component and condition of successful teaching and learning. Lubart (2008) contended that creative thinking can stimulate people’s learning process as a mechanism of knowledge construction. Furthermore, creativity can be improved through educational projects and school environments. However, questions emerge
regarding how to enhance learners’ creativity in the formal teaching and learning situation – classroom. Among postulations attempting to answer the questions, Wu (2002) highlighted the importance of evaluating motivational climate in classroom; that is, it should be emphasised to explore which classroom learning conditions benefit students’ creativity from a motivational perspective.

Numerous studies have highlighted the effects that classroom environment has on creativity and identified the factors of educational environments that stimulate or inhibit individual creativity (e.g. Fleith, 2000; Houtz, 1990; Starko, 1995). However, merely examining and specifying each particular environment variable that may potentially influence creativity, these studies did not seriously consider the issue with an integrative approach based on classroom climate. Classroom goal structure is theorised as one of the situational dimensions in the research of achievement goal theory. Ames (1992) defined classroom goal structures as learners’ subjective perceptions of the learning climate developed by teachers in the classroom. Initially, classroom goal structures could be classified into two types: mastery and performance classroom goal structures. Mastery classroom goal structures refer to learners’ perception that the learning goals developed by teachers in classrooms emphasise understanding, mastery and improvement of personal abilities. The performance classroom goal structure refers to learners’ perceptions that the learning climate developed by teachers in classrooms emphasises competition and ability comparisons (Urdan, Midgley, & Anderman, 1998). Numerous studies have indicated that classroom goal structures can influence learners’ motivations, emotions, learning participation, achievements and performance. Mastery classroom goal structures correlate with adaptive behaviour patterns and performance classroom goal structures correlate with the minimally adaptive or non-adaptive behaviour patterns (Ames & Archer, 1988; Kaplan, Gheen, & Midgley, 2002; Karabenick, 2004; Peng & Cherng, 2005; Wolters, 2004).

Regarding researches on creativity, the results of certain extant studies support a relationship between personal goal orientation and creativity (Archer, 1997; Hong, Hartzell, & Greene, 2009; Simmons & Ren, 2009). Numerous researchers have insisted that classroom goal structures should be incorporated to understand learner creativity and have agreed that various classroom environmental factors can influence students’ creativity (Beghetto, 2005; Hennessey, 2010; Wu, 2002). However, no empirical studies have explored whether classroom goal structures based on the concept development of personal goal orientation can be used to assess individual creativity or whether the effects various classroom goal structures have on creativity differ. Recently, scholars have proposed the concept of multiple goals, that is learners have more than two goal orientations simultaneously (Cherng, 2003; Linnenbrink & Pintrich, 2001; Ng, 2008; Pintrich, 2000). This notion has been applied to classroom goal structures, forming the concept of multiple classroom goal structures, that is learners perceive that teachers emphasise more than two learning goals in the classroom. However, this concept is used only to investigate the learning behaviour or strategies of learners and supports that multiple classroom goal structures are superior to single mastery goal structures for learning behaviour or strategies (Lin & Cherng, 2006; Linnenbrink (2005)). However, whether this concept can be used to investigate creativity has not been determined. Furthermore, whether the single mastery or multiple classroom goal structure is superior for creativity has not been explored. Both these issues are investigated in the present study.
The definition and assessment of creativity

Generally, scholars researching creativity have emphasised that creativity is involved in the link between uniqueness and usefulness (Amabile, 1996; Shally, Zhou, & Oldham, 2004). However, because of their varying research interests and approaches, scholars have provided diverse definitions of creativity. Extant studies have explored these definitions using the 4 P’s of creativity as follows (e.g. Rhodes, 1961): (1) person: the personality traits of highly creative people are examined (e.g. Amabile, 1987; Feldhusen, 1995); (2) product: the establishment of standards for creating products is emphasised (e.g. Finke, Ward, & Smith, 1992; Perkins, 1988); (3) process: the process or procedures of creating products and creativity are analysed (e.g. Mednick, 1962; Wallas, 1926); and (4) press/place: the environments that facilitate or inhibit creativity are discussed (e.g. Amabile, 1996; Shally et al., 2004). Numerous scholars have further highlighted that creativity results from the interaction of multiple factors, such as the componential model of creativity developed by Amabile (1983), the investment theory developed by Sternberg and Lubart (1996) and the interactive perspective model of creativity proposed by Gardner (1993). In summary, path the development of creativity researches showed study focus transitions from uni-dimension to multi-dimension and from personal level to socio-cultural level. Besides, previous studies gradually recognised equal the significance of cognitive, affective and other variables.

Regarding studies related to creativity assessments, Hocevar and Bachelor (1989) identified the following eight types of creativity assessments: divergent thinking tests, attitude and interest inventories, personality inventories, biographical inventories, ratings by others, judgments of products, eminence research and self-reported creative activities and achievements. Among them, the concept of divergent thinking tests originated from the structure of intellect theory developed by Guilford, which can be employed to understand the process of individual creative performance. Divergent thinking tests require individuals to produce as many responses as possible to a given prompt, and the primary assessment indicators are fluency (number of responses), flexibility (category shifts in response), originality (uniqueness of responses), and elaboration (refinement of responses) (Scott, Leritz, & Mumford, 2004). Well-known divergent thinking tests are the divergent production test developed by Guilford, the Torrance Tests of Creative Thinking, and the tests compiled by Wallach and Kogan (1965) and Williams (1980). These tests have been widely employed in creativity research and education.

Numerous scholars have doubted the validity of the divergent thinking test. They argued that divergent thinking is not equivalent to creativity (Mouchiroud & Lubart, 2001) but an aspect of creativity (Amabile, 1983; Runco, 1986). However, these tests are reliable and predictive of some expressions of real-world creativity (Runco & Okuda, 1991), and theoretical and empirical studies have verified the relationship between divergent thinking and creativity (Guilford, 1968; Runco, 1985). Extant studies have shown that divergent thinking tests have dominated the field of creativity assessment for several decades. Currently, divergent thinking tests are a primary tool for creativity assessment (Runco & Acar, 2012; Sternberg, 1999). Therefore, for this study, we set divergent thinking ability as an indicator of creative performance or expression.
The effects classroom situations have on creativity.

The situational factors for creativity have been discussed since the 1980s (Simonton, 2000), primarily focusing on environmental variables influencing individual creativity. Numerous studies have supported the significant effects that situational factors have on individual creativity and product creation (Hunter, Bedell, & Mumford, 2007; Shally et al., 2004). In the educational context or situation, extant studies have explored the relationship between classroom climate and creativity. Dudek, Stroble and Runco (1993) maintained that observing variables related to classroom climate is beneficial for understanding the factors stimulating or inhibiting the creative development of students. Furman (1998) contended that classroom climate is an essential variable for enhancing or reducing students’ creativity. Only when students are situated in a free environment without worries can their intrinsic motivations stimulate their participation in problem-exploration activities. Other studies have identified additional factors that enhance creativity, which are as follows: allowing time for creative thinking; rewarding creative ideas and products; encouraging sensible risk-taking; allowing mistakes; questioning assumptions (Sternberg & Williams, 1996); identifying interests and problems; generating multiple hypotheses; emphasising broad ideas rather than specific facts; and reflecting on thinking processes (Starko, 1995). Factors that inhibit creativity include the following: evaluations, competition, restricted choices, conformity pressure, frequent failures and rote learning (Amabile, 1989); an inability to share ideas; ideas are ignored; mistakes are not allowed; and one correct answer is required (Fleith, 2000).

These studies identified either single or independent situational factors that influence creativity; however, they did not discuss creativity considering the classroom climate formed by various situational factors. Achievement goal theory was used as the theoretical basis for this study. According to achievement goal theory, goal orientations provide a framework for interpreting and reacting to events, of which classroom goal structures are conceptualised as competence-relevant environmental emphases made salient through general classroom practices and the specific messages that teachers communicate to their students (Ames, 1992; Ames & Archer, 1988). In other words, classroom goal structure focuses primarily on the effects situational factors have on the students’ learning process and outcomes. Epstein (1989) stated that the factors influencing the formation of classroom goal structures include tasks, authority, recognition, group, evaluation and time (TARGET). Ames contended that teachers can communicate information concerning goals behind achievement behaviour through tasks, authority and recognition/evaluation in learning situations, thereby influencing learners’ beliefs and behaviours.

Following earlier perceptions of achievement goal theory, two goal structures were emphasised, that is the mastery and performance goal structures (Ames & Archer, 1988; Middleton & Midgley, 1997; Urdan et al., 1998). In addition to these commonly used two-factor classroom goal structures (Lau & Nie, 2008; Turner et al., 2002; Wolters & Daugherty, 2007), numerous studies have referenced the revised goal theory and developed the following three-factor classroom goal structure: (a) a mastery classroom goal structure, where the classroom environment focuses on engaging in academic work to ‘develop competence’, especially task-based and impersonal competence; (b) a performance-approach goal structure, where the classroom environment focuses on engaging in academic work to ‘demonstrate competence’, especially normative competence; and (c) a performance-
avoidance goal structure, where the classroom environment focuses on engaging in academic work to ‘avoid displaying incompetence’, especially normative incompetence (Murayama & Elliot, 2009). The construction of three-factor goal structures is supported by empirical studies (Kaplan et al., 2002; Karabenick, 2004; Schwinger & Stiensmeier-Pelster, 2011; Wolters, 2004). For this study, we did not include the manipulation of performance-avoidance goal structure in the teaching experiments since avoidance focus has maladaptive characteristics which may have negative effects on learners according to the achievement goal theory (Elliot, 1999).

Previous studies have used classroom goal structures to discuss various learning behaviours; however, some studies have investigated the potential relationship between classroom goal structures and creativity. Wu (2002) suggested that classroom goal structures can be used to explore the relationship with students’ creativity. Amabile (1996) maintained that intrinsic motivations are the important component for developing creativity and that emphasising learning goals is akin to emphasising intrinsic motivations. Therefore, learning-oriented motivational climate have a significant positive impact on students’ cultivation of creativity. Beghetto (2005) contended that when teachers implement assessments, mastery goal structures are more advantageous for creative expression compared to performance goal structures. However, these propositions were not supported by empirical evidence.

Because the support of empirical evidence is lacking, we analysed the relationship between classroom goal structures and creativity based on six primary structures proposed by Epstein (1989): tasks, authority, recognition, grouping, evaluation and time (TARGET). Focusing on TARGET, Ames (1992), instead, suggests that task, evaluation, recognition and authority are important learning structures in the classroom and further explains how they influence students to form their personal achievement goal. For instance, mastery classroom goal structure is created when students are provided with varied and novel tasks, students have the rights to make decisions by themselves and students are evaluated based on individual improvement and mastery. Extant studies have indicated that individuals situated in a mastery classroom situation exhibit more adaptive behaviour patterns, such as enhanced interest in learning; positive attitudes to learning; higher levels of participation, effort and persistence; and willingness to face adventure and challenges (Pintrich & Schunk, 2002; Wolters, 2004). These types of behaviours are aligned with the components of intrinsic motivation and the characteristics of highly creative people (Ames & Archer, 1988; Collins & Amabile, 1999). On the other hand, performance classroom goal structure is created when students are not given varied and novel tasks, when the teacher holds authority, and when students are evaluated based on normative assessments. Extant studies have indicated that individuals situated in performance classroom goal structures show more maladaptive behaviour patterns, including higher levels of anxiety, lower levels of participation, less effort and less persistence when confronting difficulties (Pintrich & Schunk, 2002), whereas highly creative people endeavour to avoid exhibiting these behaviours. Therefore, we infer that the mastery classroom goal structure is more advantageous for developing creativity compared to the performance classroom goal structure.

Previous studies have contended that learners may have more than two goal orientations when engaging in one task, that is the multiple goal perspective (Baron & Harackiewicz, 2001; Cherng, 2003; Pintrich, 2000). Currently, the two primary perspectives are: (a) the mastery perspective (normative goal theory view) argues that the combination of high mastery and low performance goals can lead to optimal
consequence because mastery goals are adaptive and performance goals are maladaptive for learning achievements; (b) the multiple goal perspective (revised goal theory view) reconsiders the detrimental effects of performance-approach goals and emphasises that both the mastery- and performance-approach goals can have positive effects on learning achievements in that an individual having the two types of goals at the same time may obtain the best beneficial achievement outcome (Cho, Weinstein, & Wicker, 2011; Linnenbrick & Pintrich, 2001).

For further clarifying the two theoretical stances, Baron and Harackiewicz (2001) propose four combinations by mastery goals and performance approach to examine possible effects: (a) additive goal hypothesis: mastery and performance-approach goals have their own independent and positive effects on one particular dependent variable, but there is no interaction effect between the two types; (b) interactive goal hypothesis: mastery and performance-approach goals have interaction effect on one particular dependent variable; in the other words, the individual will obtain the optimal achievement outcome when the two types of goals are adopted regardless of their independent effects; (c) specialised goal hypothesis: mastery and performance-approach goals have desperate effects on different dependent variables (for example, mastery goal highly associates with learning interests, but performance-approach goal predicts higher grades); and (d) selective goal hypothesis: the individual can select different goals based on different contexts instead of adopting the mastery and performance-approach goals simultaneously. The findings of Baron and Harackiewicz (2001) revealed that adopting both mastery and performance goals can obtain the best benefits, supporting the multiple-goal perspective.

Baron and Harackiewicz (2001) applied their multiple-goal hypothesis to goal pursuits on the personal level. Further, Lin and Cherng (2006) and Linnenbrink (2005) extended those ideas to the contextual level of the classroom and examined whether the single mastery classroom goal structure or the multiple classroom goal structure combining the mastery and performance-approach classroom goal structures could produce optimal behaviour patterns. Linnenbrink examined the effect of classroom goal condition (mastery, performance-approach and combined mastery/performance-approach) on various learning outcomes in a sample of upper elementary students. The results showed the most beneficial pattern in help-seeking and achievement when students perceived both mastery and performance-approach classroom goal structure. Lin and Cherng (2006) found that students who received the cues of multiple-goal structure increased their subjective ability with time and performed better for the problem-solving questions. The results of these studies have supported the perspective of multiple goals; in other words, the effect of the multiple classroom goal structure is more beneficial to students’ learning behaviour and strategies compared to the single mastery classroom goal structure. However, these results only explain students’ learning behaviour and strategies; no extant research explores which types of classroom goal structures have the optimal effects on students’ creativity.

Thus, it has been shown that previous studies have identified the various individual classroom situation variables that may potentially influence learners’ creativity (e.g. Dudek et al., 1993; Fleith, 2000; Furman, 1998), and no extant research discusses creativity based on overall classroom learning climate. Additionally, previous studies have only explored personal level achievement goal theory (personal goal orientation) and creativity (e.g. Archer, 1997; Hong et al., 2009; Simmons & Ren, 2009). Presently, it appears that there are no extant studies attempting to understand individual creativity based on contextual-level achievement goal theory (classroom...
goal structures); needless to mention that the importance of multiple classroom goal structure is obviously ignored. This review forms questions of this study to investigate if there is a relationship between classroom goal structure and creativity and what type of classroom goal structure (single or multiple) has the most beneficial effect on creativity.

In fact, it is beneficial to view creativity as one of the necessary learning competences. By recognising that, in 2002, the Ministry of Education of Taiwan proclaimed the ‘white paper on creative education’ with the aim of establishing a Republic of Creativity. Further, cultivating students’ creativity is set to be a major goal in the Grade 1–9 Curriculum. Accordingly, in general, creativity can be regarded as students’ learning consequence or learning behaviour. As Lin and Cherng (2006) and Linnenbrink (2005) elaborated that students’ perception of both mastery and performance-approach classroom goal structures will produce the best learning outcome, this study also argues that classroom goal structures can bring about certain effects on learners and hypothesises that multiple classroom goal structures can produce optimal effects on creativity.

**Method**

**Participants**

The study participants were 142 seventh-grade junior high school students from six classrooms at two schools located in Taipei City. The number of male (67) and female (73) students in this study was approximately equal. The average age of the participants was 12.65. We recruited seventh-grade students (i.e. the first year of junior high school) from Taiwan who were just starting school because the seventh grade is a new start for the junior high school education phase (i.e. the first year of junior high school). All the seventh-grade students are divided into various classes using the normalised class assignment method. In other words, the participating students are randomly assigned to various manipulation or treatment situations. For all the students, the assigned mathematics teachers were newly recruited. This mitigated the effects that the classroom learning climate developed by previous teachers may have had on the participating students, ensuring that the classroom goal structures perceived by the students were the results of the experiment manipulation. The participating students were randomly assigned to six classes: two classes to the enhanced group with mastery classroom goal structure, two to the enhanced group with multiple classroom goal structure (combining the mastery and performance-approach goals) and two to a control group. Special needs students were excluded from this experiment.

**Teaching experimental design**

A between-subject design was adopted for the study. The independent variable was classroom goal structure with three treatment levels, including the enhanced group with mastery classroom goal structure, the enhanced group with multiple classroom goal structure (combining the mastery and performance-approach goals) and the control group. The dependent variables were fluency, flexibility and originality scores in the divergent thinking tests. Regarding the classroom goal structure manipulation, considering the limitations of real teaching situations and to prevent interference into the autonomy of teachers’ education methods, we referenced the manipulation methods employed in extant studies (e.g. Lin & Cherng, 2006; Linnenbrink, 2005) and
emphasised the manipulation of the evaluation/recognition dimension proposed by Ames (1992), which enabled the teachers to communicate messages to the students through question answering, homework assignments, and test feedback to develop various classroom learning climate. Based on the enhanced groups with mastery and multiple classroom goal structures, we developed different teachers’ manuals titled ‘Mathematics Teaching Projects Incorporating Classroom Goal Structures’. In the manual, five teaching practices, including ‘propagating the purposes of learning mathematics’, ‘presenting slogans for learning mathematics’, ‘asking questions’, ‘arranging assignments’ and ‘conducting examination’, were prepared for manipulating different classroom goal structures. The characteristics of the three experimental levels are detailed below.

(1) The enhanced group with mastery classroom goal structure.

(1) Definition: the teachers emphasised that the learning goals were to understand, master and develop mathematical abilities. The teachers communicated messages advocating effort and progress and highlighted that the process of learning mathematics involves comparisons of oneself, not competing with others, and that making mistake is a part of learning.

(2) Teaching practices:

- ‘propagating the purposes of learning mathematics’, ‘asking questions’ and ‘conducting examination’: Teachers told students that (a) learning is for increasing mathematic competence and understanding and mastering the content of mathematics; (b) scores are not very important, but understanding the learning content is; (c) correct answers to the questions show that you have grasped the related content and worked hard on it; and (d) making errors is part of learning since finding what causes the errors and proceeding with correction can result in progress.

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- ‘presenting slogans for learning mathematics’: Teachers posted slogans on blackboard with the contents: ‘Always try to understand mathematics!’, ‘Compare my own progress!’ and ‘Making mistakes is part of learning!’ in every class.

(2) The enhanced group with multiple classroom goal structure

(1) Combining the mastery and performance-approach goals, the teachers of this group highlighted that the students must ‘prove their mathematical
abilities’ in addition to understanding, mastering and cultivating mathematical skills. The teachers communicated messages advocating effort and progress and emphasised the importance of achieving high test scores. Therefore, the goal of learning mathematics for this group was not only to compare one’s own development, but also to compete with others.

(2) Teaching practices:

- ‘propagating the purposes of learning mathematics’, ‘asking questions’ and ‘conducting examination’: Teachers stressed that (a) showing mathematic competence and earning good scores are the main purposes of learning mathematics; it is also important to develop learning ability of mathematics, understanding and mastering mathematical contents; (b) performing better than before is equally important to performing better than others; (c) correctly answering questions means you are smart and your hard working; and (d) examination can identify if you fully understand the learning contents and reveal whose performance is the best by the scores.
- ‘arranging assignments’: Teachers asked students to study hard for completing the assignments and told them that intense practice in mathematics can not only increase mathematic knowledge, but also lead to obtaining good scores demonstrating mathematic ability.
- ‘presenting slogans for learning mathematics’: teachers posted the slogans on blackboard with the contents: ‘Always try to understand mathematics!’ , ‘Compare my own and other students’ progresses!’ and ‘Must earn excellent scores to prove my mathematic ability!’

(3) Control group

(1) This group comprised classes that did not receive any manipulation during the teaching experiments. The teachers conducted courses using general classroom teaching methods and did not communicate any type of classroom goal structure messages. The results of the students in this group were compared to those of the students in the teaching experimental groups.

(2) The teachers did not highlight the purpose or goal of learning mathematics.

According to the study record, both experimental groups received 54 sessions of experimental manipulations during the experimental period, including one session of teachers’ advocating the purposes of learning, 16 sessions of asking questions, seven sessions of arranging assignments, six sessions of providing examination feedback and 24 sessions of slogan presentation. Besides, to prevent irrelevant extraneous variables from influencing the experiment results, we controlled the teacher teaching styles, experimental teaching content and the experimental implementation; the schedule is explained as follows: first, four mathematic teachers were selected to join the teaching study and two of them were from the same school. Before the teaching experiment intervention, we communicated and negotiated with the four teachers who participated in the teaching experiments, assigning them to the most appropriate experimental group based on their self-reported teaching goals. To understand whether the teaching styles would confound the experimental results, we compared
the differences in fluency, flexibility and originality scores of the students in classes taught by four teachers using a pretest. The results indicated that the fluency, flexibility and originality of the students in the various groups did not differ significantly ($F_s(3138) = 1.70, 1.97, 1.48, p > .05$).

Second, the present study only manipulated teaching instructions and provided the same textbook version (Kang Hsuan version) to the teachers of the six classes for other parts of teaching contents. To ensure adopting the same teaching techniques, all teachers followed and used the teaching manual, guidance and aids of the textbook. For applying the experimental manipulation of teaching, before the teaching experiments, every teacher received a handbook of ‘Applying Teaching Techniques of Classroom Goal Structure to Mathematic Teaching’ (contained ‘definition and types of classroom goal structure’, ‘course objectives, contents, and teaching duration’, ‘introduction for the learners of the study’ and ‘special considerations for the periods before and after teaching’) and undertook a 3-h training enabling them to understand the designed teaching content. Moreover, they had a 2-h discussion with researchers for the details of teaching before each experimental teaching unit during the teaching experiment.

Third, we trained five people to monitor and record every class and course (excluding those provided to the control groups). The monitors were trained in advance and understood the key points and characteristics of the various experiments. Before each course, the study researchers confirmed the key experimental points with the monitors and instructed the monitors to confirm the manipulation for each course with the teachers before the course started. During the courses, monitors examined and recorded the actual teaching situations and unexpected events using checklists that served as a reference for evaluating the teaching climate of each course. After the courses, the monitors reported the classroom conditions of the day to the researchers, returned the checklists or record lists and adjusted and reviewed relevant matters based on the classroom conditions for that day.

**Procedure**

Before beginning the teaching experiment intervention (i.e. the first class in the first week of the semester), all the students completed the first divergent thinking test. Excluding those in the control group, the students were taught the experimental teaching plans of the enhanced group with mastery classroom goal structure (two classes) and the enhanced group with multiple classroom goal structure (two classes). It took one and half months to finish the teaching experiment during the fall semester of 2012. (four courses per week for a total of 24 courses per class). After the experiments, the participating students completed the classroom goal structure scale and the second divergent thinking test.

**Measures**

Ames and Archer (1988) maintained that the goal beliefs of learners can be influenced by their experience of various contextual fields; therefore, goal research is domain-specific. Additionally, for this study, we had to incorporate classroom goal structures into teaching of a specific subject for manipulation; mathematics is an essential subject among junior high school courses in Taiwan. Solving mathematics
questions is a problem-solving process, which is highly correlated to creativity (Haylock, 1987a; 1987b), and Haylock used mathematics to develop divergent thinking problems; therefore, the measurement tool selected for this study was focused on mathematics.

**Divergent thinking abilities**

For this study, we conducted measurements using two mathematical divergent thinking tests. The first divergent thinking test was referenced from the revised mathematical divergent thinking problems developed by Peng, Chen and Huang (2011) and revised based on the nine-dots areas tests created by Haylock (1987a; 1987b; 1997) (Figure 1). In the test, students were instructed to draw as many shapes measuring 2 cm² as possible within 10 min. Based on the perspective of Wu (1998), we constructed norms for scoring based on the participant responses. Regarding fluency, each 2 cm² shape received one point. Regarding flexibility, we classified the responses of the participating students into 24 categories based on the concepts of area calculation; each response that belonged to a category received one point. Regarding originality, we collected 2930 responses from the students. A response that was similar to more than or equal to 5% of all the responses received zero point, a response that was similar to between 2 and 4.99% of all the responses received one point and a response that was similar to less than or equal to 1.99% of all the responses received two points. To examine test reliability, for avoiding raters’ subjective judgment biasing the scoring of the creativity test, 10 copies of the test were randomly selected to be scored by two raters. Person’s product-moment correlations were calculated and they showed that the scorer reliability of fluency, flexibility and originality scores were .94, .99 and .99, respectively, all reaching a .05 significance level. The analyses indicated a high scorer reliability of the test.

For the second divergent thinking test, we organised ‘various shapes with a perimeter of 12 units’ (Figure 1) based on the concept developed by Haylock (1987a; 1987b; 1997). During this test, the students were instructed to draw as many shapes with a perimeter of 12 cm as possible in 10 min. For fluency scoring, each shape with a perimeter of 12 cm received one point. Regarding flexibility, we

![Figure 1. The first and second divergent thinking tests.](image-url)
classified the responses of the participating students into 14 categories; each response that belonged to a category received one point. Regarding originality, we collected a total of 2368 responses from all the students. A response that was similar to more than or equal to 5% of all the responses received zero point, a response that was similar to between 2 and 4.99% of all the responses received one point and a response that was similar to less than or equal to 1.99% of all the responses received two points. Similarly, 10 copies of the test were randomly selected to examine the scoring credibility. The scorer reliability of the fluency, flexibility and originality scores were .94, .98 and .99, reaching a .05 level of significance. Again, the analyses showed a highly satisfactory scorer reliability of the test.

**Classroom goal structure**

For this study, we employed the mastery-approach and performance-approach classroom goal structure subscales of the classroom goal structure scale compiled by Peng, Cherng, and Chen (2011) to examine the results of the experiment manipulation. The scale comprised a total of four subscales, that is a mastery-approach classroom goal structure subscale (six items, Cronbach’s $\alpha = .83$; e.g. ‘mathematics teachers focus on whether the students have learned something rather than their examination results’), mastery-avoidance classroom goal structure subscale (six items, Cronbach’s $\alpha = .92$; e.g. ‘because mathematics teachers are concerned that the students are not progressing in mathematics learning, they require the students to fully comprehend the textbooks’), performance-approach classroom goal structure subscale (five items, Cronbach’s $\alpha = .88$; e.g. ‘mathematics teachers are most concerned with how to increase the students mathematics grades’) and performance-avoidance classroom goal structure subscale (six items, Cronbach’s $\alpha = .90$; e.g. ‘mathematics teachers tell students that the purpose of learning mathematics well is to avoid seeming incompetent’). The complete scale comprised of 23 items. Participants completed the questions in the four scales by indicating their agreement using a 6-point Likert scale ranging from 1 (strongly disagree) to 6 (strongly agree). Furthermore, confirmatory factor analysis (CFA) of 913 Taiwanese junior high school students provided the following results: $\chi^2 (657, N = 913) = 1099.77$, $p < .05$; RMSEA = .06, GFI = .97, AGFI = .96, NFI = .91, NNFI = .92, CFI = .93 and IFI = .93. The factor loadings of the 23 measurement indices ranged between .44 and .88; the reliability of each item ranged between .19 and .78; the composite reliabilities of the mastery-approach classroom goal structure, performance-approach classroom goal structure, mastery-avoidance classroom goal structure and performance-avoidance classroom goal structure were .87, .83, .94 and .92, respectively; and the corresponding average variances extracted from the four factors were .53, .51, .72 and .66.

**Results and discussion**

*Creativity performance analysis of students in the three groups before the experimental manipulation*

In this study, we randomly divided the participating students into three experimental groups. However, to ensure that the initial creativity performance of the students did not differ significantly, we analysed the scores of the first divergent thinking test completed by the students. Table 1 displays the means and standard deviations (SD)
of the fluency, flexibility and originality of the students in the first test. These results show that the fluency, flexibility and originality scores of the students did not differ significantly ($F(2, 139) = .77, .086, .75, p > .05$), indicating that all the students had equal initial divergent thinking abilities.

### Classroom goal structure manipulation checks

Because the participants were seventh-grade students, they had not previously interacted with the mathematics teachers for their classes or groups; thus, no specific goal structure had been formed in the mathematics learning situations. Therefore, we did not conduct a pretest during this study regarding the classroom goal structure scale. After the teaching experiments, we assessed the students’ perceived classroom goal structures using a post-test conducted after completion of the one-and-a-half-month teaching experimental courses. Based on this, we conducted one-way analysis of variance (ANOVA) to examine the classroom goal structure scale post-test results. The independent variables were classroom goal structures (the enhanced group with mastery classroom goal structure, the enhanced group with multiple classroom goal structure and the control group) and the dependent variables were the participants’ subscale scores for the mastery classroom goal structure and the performance-approach classroom goal structures. We inferred that if the manipulation of classroom goal structures was successful, the mastery classroom goal subscale scores of the enhanced groups with mastery and multiple classroom goal structures would be significantly higher than those of the control group. Additionally, the performance-approach classroom goal subscale scores of the enhanced group with a multiple classroom goal structure would be significantly higher than those of the enhanced group with mastery classroom goal structure and the control group.

Regarding the scores for the mastery classroom goal subscale, the results indicate that the effect of the classroom goal structures reached a level of significance ($F(2, 139) = 16.68, p < .05, \eta^2 = .19$). The results of a posteriori comparison show that the mastery classroom goal subscale scores of the enhanced group with mastery classroom goal structure ($M = 4.99$) and the enhanced group with a multiple classroom goal structure ($M = 5.00$) were significantly higher than that of the control group ($M = 4.04$). The scores of the enhanced group with mastery and multiple classroom goal structures show no significant difference. Regarding the scores of the performance-approach classroom goal subscale, the results indicate that the effect of the classroom goal structures reached a level of significance ($F(2, 139) = 4.97, p < .05, \eta^2 = .07$). The posteriori comparison showed that the score of the enhanced group with multiple classroom goal structure ($M = 3.66$) was significantly higher.
than the scores of the enhanced group with mastery classroom goal structure ($M = 2.99$) and the control groups ($M = 3.16$) for the performance-approach classroom goal structure subscale. Additionally, the scores of the enhanced groups with mastery classroom goal structure and the control groups had no significant differences. These results indicate that this study successfully manipulated classroom goal structures.

### The effects of classroom goal structures on creativity

We investigated the scores for fluency, flexibility and originality of the students in the enhanced group with mastery classroom goal structure, the enhanced group with multiple classroom goal structure and the control group differed after the experimental manipulation intervention. Table 2 shows the mean and SD of the students’ fluency, flexibility and originality scores after the experiment manipulation. Regarding fluency, the results indicate that the scores of the three groups differed significantly ($F(2,139) = 6.99, p < .01, \eta^2 = .09$). The posteriori comparison results indicate that the fluency of the enhanced group with mastery classroom goal structure ($M = 10.18$) and the enhanced group with multiple classroom goal structure ($M = 8.57$) was significantly higher than that of the control group ($M = 4.52$). However, the scores of the enhanced group with mastery classroom goal structure and the enhanced group with multiple classroom goal structure show no significant differences. Regarding flexibility, the results show that the scores of the three groups differed significantly ($F(2,139) = 5.012, p < .01, \eta^2 = .07$). The posteriori comparison results indicate that the flexibility of the enhanced group with mastery classroom goal structure ($M = 4.08$) and the enhanced group with a multiple classroom goal structure ($M = 3.75$) was significantly higher than that of the control group ($M = 2.32$). However, the scores of the enhanced group with mastery classroom goal structure and the enhanced group with multiple classroom goal structure did not differ significantly. Regarding originality, the statistical results show that the scores of the three groups differed significantly ($F(2,139) = 6.54, p < .01, \eta^2 = .09$). The posteriori comparison results indicate that the originality of the enhanced group with mastery classroom goal structure ($M = 6.47$) and the enhanced group with multiple classroom goal structure ($M = 5.29$) was significantly higher that of the control group ($M = 1.73$). However, the scores of the enhanced group with mastery classroom goal structure and the enhanced group with multiple classroom goal structure did not differ significantly.

<table>
<thead>
<tr>
<th>Classroom goal structure</th>
<th>Fluency N</th>
<th>Mean</th>
<th>SD</th>
<th>Flexibility N</th>
<th>Mean</th>
<th>SD</th>
<th>Originality N</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enhanced group with mastery classroom goal structure (A1)</td>
<td>58</td>
<td>10.18</td>
<td>8.59</td>
<td>4.08</td>
<td>3.04</td>
<td>6.47</td>
<td>7.77</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enhanced group with multiple classroom goal structure (A2)</td>
<td>43</td>
<td>8.57</td>
<td>8.10</td>
<td>3.75</td>
<td>2.67</td>
<td>5.29</td>
<td>7.18</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control group (A3)</td>
<td>41</td>
<td>4.52</td>
<td>7.79</td>
<td>2.32</td>
<td>2.01</td>
<td>1.73</td>
<td>2.78</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
By focusing on the situational dimension of achievement goal theory, we used teaching experiment methods to examine the effects that classroom goal structures had on students’ divergent thinking abilities and further identify which classroom goal structures produced the optimal effects. The results indicated that the primary creativity of the learners had no significant differences. However, after the teaching experiments, the creativity of the students in the enhanced groups with mastery and multiple classroom goal structure was superior to that of the students in the control group. This conclusion agrees with the study hypothesis and verifies the positive effects classroom goal structures have on creativity. The statistical results indicated that the size of the effect that classroom goal structures had on fluency, flexibility and originality ranged between .07 and .09. Based on the standard developed by Cohen (1988), classroom goal structures have a medium-level experimental effect on creativity. However, some inconsistent outcomes to the hypotheses occurred, the effects of the single mastery and multiple classroom goal structures on creativity showed no significant differences, indicating that the multiple classroom goal structure that combines the mastery and performance-approach goals does not create additive effects and is not superior to the single mastery classroom goal structure. In other words, teachers can improve learners’ creativity by simply creating a single mastery classroom goal structure.

It is inferred that the mastery classroom goal structure highlights learning tasks of mastery and comprehension, and in that teachers should encourage students to face challenges and learn new things. This contributes to building a safe learning environment, where mistakes are considered a part of learning. This classroom situation is similar to that proposed by Carl Rogers, that is the condition for stimulating creativity is that a psychologically safe and free learning situation must be developed (Hennessey, 2010). This enables students to engage in creative or creation thinking activities more actively and positively and to produce more creative ideas. Students do not have to worry about whether their ideas are wrong or will be criticised by others. Thus, students are more willing to depart from the original framework and categories and produce ideas from varied and multiple perspectives. Furthermore, in safe, supportive environments and situations, students are more willing to accept challenges and engage in unprecedented behaviour and new activities to produce unique and original ideas. Accordingly, when students are situated in mastery classroom situation, the created effects of creativity behaviour and intrinsic motivation are similar. Therefore, the divergent thinking performance of the students receiving the mastery classroom goal structure was superior to that of the students in the general classroom situation.

The effect of multiple classroom goal structures on creativity was not superior to that of the single mastery classroom goal structure, seemingly supporting the normative goal theory. We infer two possible reasons for this disparity. First, classroom goal structures have varying effects on different behaviour variables. Lin and Cherng (2006) and Linnenbrink (2005) used students’ academic achievements, motivations, emotions, sense of happiness, help-seeking behaviour and various self-regulated learning strategies as dependent variables in their research. However, in this study, we emphasised the ‘creativity in the divergent thinking’ of learners. Therefore, classroom goal structures may produce different effects on learning behavior/results and creativity. The primary mechanism must be clarified in future research. Second, the concept of the performance-approach classroom goal structure is similar to that of extrinsic motivations. We inferred that when students perceive that teachers are
communicating messages of competition, demonstrating abilities superior to others and norm referencing, it is similar to perceiving the inducement of extrinsic motivations. Extant studies have indicated that extrinsic motivations may hinder creativity (e.g., Amabile, 1985, 1996; Amabile, Hennessey, & Grossman, 1986; Deci & Ryan, 1985). Therefore, the negative effects of the performance-approach classroom goal structure on creativity seem to mitigate the positive effects of the mastery classroom goal structure, which is disadvantageous for producing the expected additive effect for creativity, resulting in no significant differences between the effects of the multiple and single mastery classroom goal structures. To adhere to research ethics, we did not manipulate the single performance-approach classroom goal structure. Therefore, we do not understand the possible effects of the single performance-approach classroom goal structure on creativity. We suggest that future studies increase this experimental standard or level to compare the effects of the single mastery, single performance-approach and multiple classroom goal structures on creativity.

Conclusion and future suggestions

The results of this study verify that the classroom goal structures can indeed foster learners’ creativity and the single mastery classroom goal structure can have the better effect on it. The research contributions of this study are as follows: regarding research theories, extant studies have employed the concepts of intrinsic and extrinsic motivations to explore the relationship between motivations and creativity (Amabile, 1985, 1996; Choi, 2004; Deci & Ryan, 1985; Moneta & Siu, 2002) and investigated which motivations produce the optimal effects on creativity. However, in this study, we used achievement goal theory to identify which goal in the classrooms (i.e., classroom goal structures) emphasised by teachers was the most beneficial for creating learning climate that improved creativity. The results of this study verify that classroom goal structures influence creativity. We extended the concept of achievement theory to the field of creativity research and found that the mastery classroom goal structure produced an optimal effect on creativity. We suggest that future studies explore the feasibility of applying achievement goal theory to other fields (e.g., critical thinking). Regarding research methods, previous studies have employed questionnaires or correlational methods to explore the relationship between learning environment and creativity. For this study, we employed the teaching experiment method that incorporates classroom goal structure manipulation in the actual learning situations of mathematics courses to verify the effect that classroom goal structures have on creativity. In other words, we verified the causal relationship between classroom goal structures and creativity. This result possessed a certain level of ecological validity and explained the effects that actual learning situations have on creativity.

For focusing the improvement of learners’ creativity, most of the previous studies designed particular training plans or programmes and examined the research outcomes (e.g., Cropley, 1997; Nickerson, 1999). However, the possible application derived from these studies for cultivating creativity only can be realised by embedding the creativity training in formal courses through the arrangement and design of various activities. It is due to the fact that creativity is not a formal subject. But, in real situations, some difficulties, such as limited teaching time and costs of organised creativity courses, will hinder the possibility of directly putting the application into action. In contrast, the results of this study had reviewed that mastery or multiple classroom goal structures developed by teachers can clearly enhance the
creativity of learners. In other words, teachers can, by themselves, improve the students’ creativity by offering appropriate classroom learning climate. This strategy is more cost effective than organising creativity training courses. Therefore, the results of this study offer a better option for teachers who hope to improve the creativity of their students. Thus, we suggest that teachers build mastery oriented classroom situations, that is where students perceive that teachers believe the learning purposes are to understand, master and develop abilities, teachers encourage the students to challenge new concepts or activities and making of mistakes is considered a part of learning. By providing a safe and supportive learning situation for the study, students will be more active and positive, have greater willingness to accept challenges, and produce unique and novel ideas; thus, superior creativity is stimulated.

In addition, adopting the research design for conducting the experiment-embedded teaching contributed a satisfactory ecological validity to the present study, for it brought experimental settings into real mathematic learning situation of junior high school. It is expected to generalise the findings of the study to other comparable contexts. In contrast, the difficulty encountered for the limited availability of classes to participate the study would damage the conclusions of the study since the observed differences of learning outcome may be caused by the variations in schools and teachers, but not the effects of manipulated variables. In other words, although the present study did try its best to control the sources of participating students (all from the same Taipei metropolitan district), learning materials, and teachers’ teaching styles, it cannot guarantee to prevent all the nuisance factors involving the experiments. Therefore, we suggest selecting students and teachers from the same schools for the purpose of eliminating the hazardous effects due to the variation in school and teachers on the experimental results.

Finally, regarding suggestions for future research, this study primarily explored the effects of various classroom goal structures on divergent thinking. Extant studies have investigated the effects that both the personal and situational dimensions of achievement goals can have on learning behavior/results (Lau & Lee, 2008; Peng & Cherng, 2005; Wolters, 2004). Therefore, future studies should simultaneously explore how personal goal orientation and classroom goal structures can influence creativity. Furthermore, for this study, we used divergent thinking to represent creativity. However, based on the concept for problem category classification introduced by Wakefield (1992), divergent thinking problems (i.e. closed problem with open solution) differ from insight problems (i.e. open problem with closed solution, such as radiation problems) and creative thinking problems (i.e. open problems with open solution, such as writing a poem). The cognition processes and thinking methods employed differ when solving different problems. Therefore, future studies should explore whether classroom goal structures, the perspective of multiple classroom goal structures and the connection between personal goal orientation and classroom goal structures have different effects for different types of creativity questions.

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