

RESEARCH ARTICLE

Divergent Thinking and Writing Self-Efficacy: A Study of Undergraduate Students in Zhejiang Province

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ABSTRACT

The study aims to explore the relationship between university students' creative tendencies and academic achievement. When it comes to the learning environment, age, gender, and subject major, self-efficacy acts as a moderating element. The study used a quantitative methodology; data were collected online from 265 undergraduate students in Zhejiang Province in a variety of subject areas utilizing surveys, and SPSS was used for data analysis. The main objective of the study is to find out the relationship between academic achievement and creative tendencies among university students. The findings emphasize how important it is to support students' conviction in their academic ability by demonstrating the critical mediating role that academic self-efficacy plays between creative tendencies and academic accomplishment. Furthermore, it was shown that the learning environment played a significant moderating role in improving the beneficial effects of creativity on academic success. Age inversely mitigated this association, the study also found. Diverse student requirements necessitate customized instructional techniques, as demonstrated by the distinct moderating effects of gender and subject significance. These findings have a wide range of implications, including developing educational practices and policies that foster creative and self-sufficient learning settings. Understanding the importance of both contextual and individual elements in determining academic outcomes, teachers can put strategies into place that meet the diverse requirements of their students and foster academic success as well as personal development and readiness for new challenges.

INTRODUCTION

In today's rapidly developing knowledge economy era, dominated by globalization, the field of education has given significant importance to the academic accomplishments of students at the college/university level. Academic achievement is often regarded

as a critical indicator of a student's academic competence and potential for future success (York et al., 2019). Academic achievement is linked closely to a student's immediate academic performance and determines their future career paths and personal growth (Finn and Rock, 1997). In higher education,

academic achievement is too significant, as it is directly related to a college student's graduation qualifications, employability, and active participation in mainstream society (Abong et al., 2023; Farrington et al., 2012). Understanding the intricate relationship between cognitive processes and academic self-belief is paramount for educational advancement (Khan et al., 2020). The dynamic between divergent thinking, which is a core component of creativity and encompasses the ability to produce multifaceted and original ideas to quandaries, and writing self-efficacy, which is determined by an individual's judgment of their writing capabilities to complete tasks, is explored in the current research. While divergent thinking is fundamental to all creative domains and academic problem-solving, writing self-efficacy directly affects academic performance and motivation (Rosak-Szyrocka et al., 2022; Ullah et al., 2020). Therefore, profoundly imparted in educational psychology literature, these constructs allow us to understand academic skill development better (Huang et al., 2023; Sissing et al., 2017). Divergent thinking, marked by creativity and originality, the ability to generate multiple solutions to predicaments, and Writing self-efficacy, which involves writing skills compared to the specific self-perception of skill and competence, seem vital variables worth considering (Jam et al., 2011; Ngamkaiwan, 2018; Zhang et al., 2023). Writing self-efficacy, people's trust in their capability of performing a specific writing task, contributes to academic performance in every field of learning (Rijal, 2016; Wang et al., 2022). Therefore, the interaction of these constructs underpins the overarching goal of this study, which is the association between divergent thinking and writing self-efficacy among undergraduate students in Zhejiang Province. Historically, divergent thinking has been necessary for education scholars (Guibang et al., 2023; Zhang et al., 2024). It has been further justified by multiple research works demonstrating the ability to cultivate creative problem-solving and flexibility in learners. This improves grades and equips the learners with active tools to work in the 21st-century dynamic work environment (Puente-Díaz and Cavazos-Arroyo, 2017).

According to Zuo et al. (2021), writing self-efficacy is

a powerful predictor of the caliber of written work, even though writing anxiety and attitudes in second languages (L2) are not typically connected to one another or writing performance. Students' resistance and perseverance during the writing process, as well as the finished output, bear witness to its effects. Therefore, the vacuum in the current literature analysis suggests that more study be done on the intersegmental interaction between these fields, especially in the particular context of Chinese higher education, notwithstanding how theoretically independent they are.

This is especially poignant, given that China has been historically characterized by its educational approach to a more liberal style that encourages critical and creative thinking (Redifer et al., 2021). The present study aims to address this gap by examining the correspondence between divergent thinking and writing self-efficacy among undergraduate students in Zhejiang Province by investigating whether these make a legitimate significant connection and whether this may differ by field of study, department, and class years.

The study also seeks to explore the potential moderating influences of demographics (i.e., gender, class years, major) on this link, thereby helping to enrich the knowledge of how cognitive and self-regulatory mechanisms interact to produce written academic discourse—a cornerstone of undergraduate education. The importance of this work extends beyond research to practices in which educators, curriculum designers, and policymakers engage. Given the multiple and nuanced ways in which writing self-efficacy and divergent thinking were found to be related in this study, it could inform the development of targeted interventions and the design of innovative and responsive writing pedagogies to improve students' divergent-thinking skills and creative problem-solving abilities and to cultivate students' writing expertise.

Divergent thinking and writing self-efficacy are critical for writing (Redifer et al., 2021). However, relatively little research has examined their interrelations, especially in the context of Chinese education. In fact, with the ongoing educational reforms in China emphasizing the move from traditional education focusing on rote memorization

to education that fosters creativity, critical thinking, and self-regulated learning (Armstrong, 2009), the lack of empirical data studying how divergent thinking correlates with writing self-efficacy among Chinese undergraduates represents an essential gap in the literature. Zhejiang Province in China provides a striking example of this discrepancy and exceptional performance on academic achievement tests and educational, cultural, and demographic influences, if any, which are essential to consider. Although speculative, the thoughtful, creative individualism fostered in Western cultures in general, and the United States, in particular, may differ substantially from the perception of creativity in collectivist Chinese culture and the self-efficacy in creative skills associated with divergent thinking.

Similarly, the extensive system of competitive examinations and severe parental expectations in China from which students are forced to navigate from preschool through post-secondary schooling. In recent decades, creativity and self-regulated learning have become central to student success (Anastasiou and Michail, 2013). This shift in the educational landscape highlights that students need both knowledge and cognitive and metacognitive skills to be creative in applying them as they solve complex problems (Pretz and Nelson, 2017). Divergent thinking, a cognitive process linked with creativity, involves thinking about a topic in various ways to generate multiple solutions to a problem. It is suggested that it is critically important for students' academic and long-term success in personal and professional achievements (Andres, 2020; Rubalcaba, 2022). The present study addresses these significant gaps by systematically exploring the relationship linking divergent thinking and writing self-efficacy in Zhejiang Province (China) undergraduates.

LITERATURE REVIEW

Previous studies link student judgments of their writing self-efficacy, which have considerable potential to impact their writing quality through the integrative effects of effort, interest, attention to detail, perseverance, and resilience under stressful conditions (Pajares, 2003). In this context, self-efficacy is defined as students' relative confidence (Bong, 2008; Bong and Skaalvik, 2003) about their

writing and writing-related abilities. Previous investigations of a possible connection between students' self-efficacy and their actual writing ability show no consistent pattern, with considerable research showing a positive correlation between these factors (Multon et al., 1991; Pajares, 1996; Prat-Sala and Redford, 2012), and some research indicated no such correlation (Jones, 2008; Ong, 2015), regardless of students' language competency.

Creative tendencies

In the late 20th century, psychologists Sternberg and Lubart (1991) started taking a closer look at creative thinking, and its role in human development is now greatly acknowledged. Studies show that one of the four original theories was Guilford's Structure of Intellect, which was proposed in 1950. The theory outlined 18 creative abilities, including flexibility, fluency, originality, and elaboration, which were folded into five intellectual factors (Guilford, 1981). Guilford's theory emphasizes the rich variety and complexity of thinking processes and has been very influential in subsequent research on creativity (Sternberg and Lubart, 1991).

Creative attributes are essential qualifications for organizational innovation and competitive ability. Some people are more creative and, therefore, better suited to this work (Amabile, 1996). Creativity research has become more sophisticated over the years, encouraged by technological advances and more sophisticated data analysis methods (Smallheer and Dietrich, 2019). Big data is mined for patterns and trends in creative products, displacing older forms such as patents (Simmons et al., 2014). Creativity research is passed through processes of rich development. It was seen as having a unique impact on a variety of disciplines. Educational researchers gave up the notion that creativity might be something a person is born with to be accepted as a trait of the psychological makeup that could be nurtured and developed, a process of education or training. Creativity was considered a complex multi-dimensional configuration consisting of cognitive components, emotional values, and sociocultural determinants for the psychological world (Rudowicz, 2003).

Altshuller (1984) theory of Inventive Problem Solving (TRIZ) was introduced as another crucial idea. TRIZ, a

theory of invention, uses a large database of patents to identify "regular laws" about the innovation process (Becattini and Cascini, 2016). TRIZ's theory provides a methodical perspective for comprehension and has made it possible to research creative instruction in state-run businesses and educational institutions (Mohammadi et al., 2019). Researchers in the fields of management and educational psychology have begun to examine the characteristics of children's creative tendencies. Teachers are interested in this subject because it explains how children with varying creative tendencies learn in different ways. Teachers should help kids develop their ability to think creatively, according to Yang and Zhao (2021) study on the importance of creative tendencies in children's learning and academic performance. Therefore, researchers in this area have started exploring the relationship between creative tendencies and general cognitive abilities, personality aspects, and subjective mental conditions. A research provided in-service professional development to show that creative thinking is a multi-dimensional system that includes the intelligence of individuals, the strength of particular veins within it, an individual's style, and influences from elements of one's personal history and the social and physical environment. Creativity takes on a critical role in the management field in the east for organizational innovation and adaptive change. Increasingly, it spawned more and more interdisciplinary enterprises as computers assisted in applying theories from various orientations to develop in-depth, in-depth creativity.

Self-efficacy

The concept of academic self-efficacy is derived from Bandura (1977). The theory of self-efficacy, a part of social cognitive theory and defined by Bandura (1977) as self-efficacy, is a person's perception of their ability to successfully perform a job or task, which can influence both the choices people make and the effort they put forth. Academic self-efficacy involves students' beliefs about their capabilities for learning activities and academic achievement (Schunk and DiBenedetto, 2022). According to Bandura (1997), self-efficacy comes from four primary sources of experiences: Enactive mastery experiences (the most influential), vicarious -experience (seeing others perform successfully), social persuasion, and

physiological states.

These can be essential methods for nurturing self-beliefs in educational environments and can include instruction methods, peer modeling with particular students or groups, and such groups discussing the task at hand (Bandura, 1997).

Studies on the effects of students' learning motivation, learning tactics, and academic accomplishment have long been a part of the academic self-efficacy literature. Not only are students with high academic self-efficacy highly motivated to learn, but they also don't typically employ learning tactics. According to Zimmerman (2000), children that engage in proactive behaviors like self-reinforcement and environmental reconfiguration are considered active in this school of thought. Another area that is extensively studied is the connection between learning technique and academic self-efficacy.

Students with higher self-efficacy tend to use cognitive and metacognitive strategies to learn more about painting, planning, and self-reflection (Artino, 2012; Pajares, 2003). Bandura (2013) stated that students with higher academic self-efficacy were more resilient in the face of setbacks or unfair treatment. They were able to cope more effectively. A sizable literature on self-efficacy examines the relationship between self-efficacy and academic performance, and the preponderance of evidence supports a positive relationship (Bandura, 2013; Multon et al., 1991). Students also demonstrate greater resilience and adaptability in the face of challenges. The relationship between academic self-efficacy and academic achievement According to numerous researchers, this topic is essential. There is ample evidence to show that academic performance corresponds with self-efficacy (Pajares, 2003; Redifer et al., 2021).

Concept and evaluation criteria of academic achievement

Academic achievement is a multifaceted concept covering a student's accomplishments and success in the academic domain in any or all academic task types, from regular knowledge mastery to high-level thinking efficiency (Winne and Nesbit, 2010). Academic achievement also includes a student's sustained, strategic allocation of effort in academic areas, performance on standardized tests, success

or failure on particular everyday classroom-related activities (e.g., homework assignments, reports, classroom activities), and performance on tests based on a specific curriculum or standardized ones. As students move to higher grade levels, academic achievement standards and assessment of academic achievement may differ significantly between elementary, middle, and high school and between high school and college or university (Cheng, 2020; Stronge, 2006). At the lower levels, notably the elementary and secondary levels, academic achievement is mostly about learning the basics, including reading, writing, and mathematics. With increased academic exposure—high school and college levels—academic assessment focuses more on students' ability to think critically, problem-solve, and think creatively (Abong et al., 2023; Huang et al., 2023). Farrington et al. (2012) demonstrated that teacher evaluations could inform students' performance and behavior day-to-day. As such, the evaluation of teachers may offer an inroad into noncognitive components of learning. However, the problem of subjectivity in teacher assessments and their suggestion of bias is troubling (Stronge, 2006), particularly as assessments tend to compromise fairness and accuracy when conducted in a biased manner. The rationale for peer and self-assessment in education included bringing critical thinking and self-reflection to the evaluation process (Zimmerman and Schunk, 2001). However, the critique that the procedures remain inherently devoid of objectivity and consistency may equally compromise their accuracy and reliability in an assessment context.

Relationship between creative tendencies and academic achievement

The relationship between creative tendencies and academic achievement could be addressed from several aspects. First, creative thinking is considered an important ability that can help individuals solve problems and generate new ideas; secondly, abilities are critical for achieving academic success. According to Guilford (1967), creativity can be divided into several dimensions: fluency, flexibility, originality, and other ability dimensions. These abilities can enable students to develop breakthroughs while working on complex and demanding academic tasks.

Second, creative tendencies are closely tied to

students' learning motivation and engagement. Creative activities can trigger students' curiosity and exploratory impulses and thus increase their intrinsic motivation and engagement in learning (?, 2009). Moreover, when students create activities (e.g., project learning, solving authentic problems), they focus on working and collaborating with others. As a result, they tend to have better academic performance. Affirmative associations between creative tendencies and academic achievement are also supported by empirical research. Much of the research found positive relationships between creative tendencies and academic achievement. Kim (2011) concluded that creative thinking ability was significantly positively related to academic performance in the multiple-grade participant school. This implies that creative thinking ability has direct promotion effects on academic achievement.

Meanwhile, some studies suggest that the influence of creative tendencies on academic achievement might be moderated by students' learning environments and teaching approaches. Starko (2013) argued that in a teaching environment that encourages creative thinking, the effects of creative tendencies on academic achievement are more potent. This indicates that the educational environment and teaching strategies that are beneficial to fostering intrapreneurship can be crucial in inspiring and strengthening students' creative potential.

Buyse et al. (2008) reported that creative tendencies in some specific areas are related to academic achievement, such as in specific science and mathematics courses. It is emphasized that creative thinking is needed to understand complex concepts and find solutions in science and mathematics education (Sriraman, 2005). It can be evaluated creative tendencies can be explained in general academic achievements, and this has also theoretically been explained and demonstrated through empirical research.

Therefore, when educators and policymakers design educational strategies and curricula, they should consider ways to cultivate and enhance students' creative thinking skills to improve their academic performance. Furthermore, the studies mentioned above also suggest that to improve student academic achievement, it is essential to introduce creative teaching strategies and innovative

educational environments (Liu et al., 2023).

Academic self-efficacy and academic achievement

The theoretical interrelationship between academic self-efficacy and academic achievement can be accounted for from the perspective of social cognitive theory (Bandura, 2013; Brown et al., 2016). According to Bandura (2013), self-efficacy is an individual's belief in their ability to control natural events. Such beliefs determine how people feel, think, and motivate themselves. With a high sense of self-efficacy, individuals consider challenging tasks as opportunities to engage in deep learning in which they set challenging goals, lead motivated lives, develop deep learning strategies, and increase achievement activities. Academic self-efficacy refers to students' beliefs about their capability to produce designated levels of performance that exercise influence over events. Thus, students with high self-efficacy will also set higher learning goals, feel greater motivation to master tasks, and use deeper learning strategies (Arztmann et al., 2023). Moreover, self-efficacy has been found to mediate the effects of learning capabilities on performance (Zimmerman and Schunk, 2001), and it shapes students learning behaviors and attitudes; students high in self-efficacy are more likely to engage in positive learning behaviors, such as actively looking for help, participating more in discussions, and completing more learning tasks (Pajares, 1996). It also shapes students positive attitudes to learning (Chan and Hu, 2023). Furthermore, students with high self-efficacy are more likely to be resilient; that is, they are more likely to recover from setbacks, continue to work on the task, be said of activities (Pajares, 1996), and are less likely to cease learning simply because they have failed (Kim, 2011). According to Honicke and Broadbent (2016), young people have high levels of academic self-efficacy and are likelier to have good academic performance. Their conclusions indicate that boosting students' self-efficacy in higher education may be essential to improving academic performance.

Students' academic self-efficacy in Science, Technology, Engineering, and Mathematics (STEM) is positively related to performance in these subject areas; even under harsh conditions, their perseverance carries them over and how they might be engaged or not yet planning on becoming involved

with one of those fields following college. Arztmann et al. (2023) concluded that academic self-efficacy positively correlates with academic achievement. The discovery of this relationship gives us a significant clue about educational practice. Students' academic performance is improved substantially by promoting their self-efficacy. In the teaching medium, educationalists and planners should improve the conditions under which students may browse a manuscript by providing them with plenty of opportunities and positive encouragement.

THEORETICAL FRAMEWORK

The study's theoretical framework synthesizes social cognitive theory and creativity theory to explore the influence of creative traits and academic self-efficacy on college students' grades. Social cognitive theory underlines the role played by personal beliefs in shaping behavior. Self-efficacy is the belief in one's own competence to manage one's concerns. It determines their level of work, their perseverance in the face of unsurmountable hurdles, and something else crucial in times of adversity: inclusion when this whatsoever. The goal of creativity theory is to understand the inner workings of creative people. Guilford (1967) creativeness model, for instance, sees problem-solving and invents fluency, adaptability, and originality as essential components of success. It is assumed that creative inclination is an independent variable predicting academic achievement within the parameters of this study. This is due to the fact that pupils who are able to think creatively and with foresight should be better at addressing difficulties (Kim, 2011).

Academic self-efficacy is also regarded as an independent variable predicting academic achievement related to students' motivation to learn, persistence in the face of challenges, and coping strategies in general (Pajares, 1996).

The authors of this study considered potential moderate variables, such as the learning environment and students' background characteristics, that could influence the relationships between creative tendencies, academic self-efficacy, and academic achievement. For instance, the supportive characteristics of the learning environment and the availability of resources could influence how

far creative tendencies transform into academic outcomes (Starko, 2013). Similarly, students' background characteristics, such as gender, socioeconomic status, and subject major, may moderate the relationship between students' self-efficacy and academic achievement.

Along with creative tendencies, academic self-confidence, and the development of faculty skills, this theoretical framework helped us understand how these factors together impact academic performance. The framework for multivariate analysis is methodologically essential in selecting and identifying significant factors and how they relate to different learning settings or student populations. Therefore, it aimed to contribute significantly by providing an overarching theoretical model of all these complex relationships among creative dispositions, academic self-efficacy, and academic performance to benefit educational practice.

Hypothesis development

Creative tendencies and academic achievement: Although there has always been a connection between creativity and academic achievement, there has only been a recent upsurge in theoretical and empirical research on this relationship. The theoretical foundation for how creativity could improve cognitive processes can be found in Guilford (1967) model of creative thinking, which highlighted fluency, flexibility, and originality as essential qualities. These imaginative constructions are integral to the process of solving problems and coming up with fresh, original concepts, two skills that could be vital for success in a learning setting. Empirical data, such as the one provided by Kim (2011), who reported a study confirming the association, lend credence to this topic. She examined whether any relationships between creative thinking ability and academic achievement support the suggestion that success in the academic world involves creative thinking. These are not data establishing a causal relationship, but they are data that suggest an association that warrants further attention. The hypothesis proposed here draws from Guilford's theoretical work and empirical evidence, such as Kim's, arguing about the potential impact of creativity on educational outcomes, suggesting that creativity might positively influence academic performance. It is part of an ongoing debate in

the scholarly literature about the place of creative thinking in becoming and being educated. Therefore, we hypothesize that;

H1: There is a positive relationship between creative tendencies and academic achievement.

Academic self-efficacy and academic achievement

: Academic self-efficacy is one of educational psychology's most widely researched areas, particularly regarding academic achievement. This line of research originates from early work grounded in Bandura (1977) social cognitive theory, which described self-efficacy as an individual's belief in his or her capability to execute the behaviors required to produce specific performance attainments. According to this theoretical perspective, individuals with a strong sense of personal efficacy are likely to view complex tasks not as threats to be avoided but as challenges to be mastered. Pajares (1996) continued this line of research through empirical exploration, ultimately proving that self-efficacy and performance are positively related. This work found academic self-efficacy to predict students' (1) academic achievement significantly. In short, strong beliefs in one's capabilities are essential within the educational context. Increasing students' beliefs in their academic capabilities may be critical to enhancing their academic achievement. Therefore, we hypothesize that;

H2: There is a positive relationship between Academic self-efficacy and academic achievement.

The mediating role of academic self-efficacy: One fundamental principle of educational psychology is that creative tendencies intersect with academic self-efficacy to facilitate academic achievement. Self-efficacy, rooted in Bandura et al. (1986) social cognitive theory, is an individual's belief in their ability to execute the behaviors necessary to produce specific achievements. This self-belief is a significant concern in educational settings in that it impacts students' motivation and engagement in learning activities (Bandura et al., 1986). Creative tendencies are widely acknowledged for fostering innovative and adaptive thought and conferring problem-solving abilities, which are critical in academic contexts. Therefore, Bandura et al. (1986) theory predicts that the benefits of creative tendencies for education should be maximized by high self-efficacy.

Strong creative talent individuals may be better equipped to convert their creative abilities into academic success if they also exhibit strong self-confidence in their academic abilities (Bandura et al., 1986). Pupils that have a high sense of their own abilities think they can achieve their goals (Zimmerman, 2000). Additionally, the influence of self-efficacy on students' learning has been acknowledged in terms of their actions and attitudes. Students who feel confident in their ability to complete assignments are more likely to be persistent and engage in creative work (Zimmerman, 2000).

Because creative tasks require more independent learning behaviors than traditional learning, so academic self-efficacy should be considered a personal attribute and a significant contributor to creativity in educational settings. The effort to develop each would suggest that students need creativity and a robust sense of academic self-efficacy. This self-belief can catalyze students' ability to channel their creative capabilities in academic arenas effectively. Therefore, self-efficacy traits are not creative and can scaffold creative skills and performance into academic outcomes (Schunk and Pajares, 2002). Therefore, we hypothesize that;

H3: Academic self-efficacy mediates a relationship between creative tendencies and academic achievement.

The moderating role of learning environment and students' background characteristics: Creative talent interaction within an educational context is complex and dynamic in contributing to a student's academic achievement. Arzmann et al. (2023) expectancy-value theory demonstrates that environmental and individual circumstances notably influence academic motivation and performance. Knörzer et al. (2016) has indicated that to foster and develop creative abilities, the learning environment is highly significant. A positive educational environment that furnishes opportunities and resources, in turn, fosters the burgeoning of aptitudes and contributes supplementary to academic accomplishment. Students from different backgrounds may express and act on their creative capacities in ways particular to the unique academic contexts from which they come, resulting in various academic outcomes. Thus, the interplay of the learning environment,

personal background, and creative propensities is a comprehensive way to understand academic achievement. This way recognizes that though native abilities are central to academic success, they are filtered by the external and internal context of student learning and development. Considering the above argument, we hypothesize that;

H4a: Learning environment moderates an effect between creative tendencies and academic achievement.

H4b: Background characteristics (age) moderate an effect between creative tendencies and academic achievement.

H4c: Background characteristics (gender) moderate an effect between creative tendencies and academic achievement.

H4d: Background characteristics (subject major) moderate an effect between creative tendencies and academic achievement.

These hypotheses provide a comprehensive theoretical lens for understanding the complex interactions among creative tendencies, academic self-efficacy, and academic achievement, considering the possible influence of the learning environment and student background characteristics, as shown in Figure 1. By testing these hypotheses, this study aims to reveal the critical psychological and environmental factors that enhance college students' academic achievement and provide a theoretical and empirical basis for educational practice.

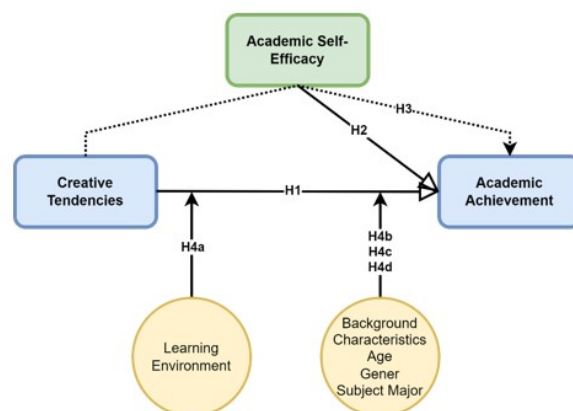


Figure 1: Conceptual framework

RESEARCH METHODOLOGY

This study employed quantitative research methodologies, demonstrates how, in actual schools in

Zhejiang Province, the relationship between creative tendencies and academic self-efficacy to success rates functions. This study employs a cross-sectional methodology to examine if there will be any changes in the near future and provides first-hand students with an accurate and concise understanding of these linkages in plain language. The ethical implications of this study were carefully considered in order to guarantee the privacy of each and every participant. The ethical rules and criteria of the appropriate review board or ethics committee were rigorously adhered to by this project, which was approved prior to the start of data collection. Participants were told that they could leave the study at any time, and that doing so would have a negative impact on them.

The questionnaire design was based on scales validated in previous literature to ensure the accuracy and reliability of measurement. Therefore, the study measured creative tendencies using the Torrance tests of creative thinking (Torrance, 1972), a well-established psychometric tool recognized for its effectiveness in assessing various aspects of creativity. This approach comprehensively understood the participants' creative abilities and problem-solving skills. Academic self-efficacy was evaluated through self-report questionnaires, specifically the academic self-efficacy scale, which reflects the conceptualization of self-efficacy by Bandura et al. (1986). This scale provided insights into the Student's beliefs in their capabilities to complete academic tasks, thus offering a nuanced view of their confidence in their academic skills. Data for the research came from school records and standardized test scores as measures of academic achievement.

The moderating variables affecting the relationship between individual characteristics and education were evaluated using school environment survey questionnaires and demographic background forms. This study focuses on choosing undergraduate students enrolled in various courses at the several universities in Zhejiang Province. It employs a convenience sample as part of its sampling approach. This selection strategy was used because it guaranteed that the sample within the particular courses was fairly representative of the academic fields and demographics covered in the study. As previously

mentioned, Wright (2005) supported the use of online surveys as a data collecting method, noting that they were effective and efficient in drawing in a wide range of participants for the study.

The utilization of online questionnaires by the study aids in improving the diversity, reach, and representation of the sample. Notably, complete participant anonymity was possible with online surveys.

Adopting online surveys, a method recommended by Wright (2005) for its efficiency in data collection, significantly expanded the sample scope and ensured the representativeness and diversity of the data obtained. This aspect was crucial in this study, especially for self-reported measures assessing creative tendencies and academic self-efficacy. Initially, a total of 325 students participated in the survey. However, after careful screening to exclude incomplete or inconsistent questionnaires, the final sample size was refined to 265 participants. This careful data quality control process was instrumental in ensuring the reliability and validity of the study's findings. The first step involved the reliability analysis of variables followed by descriptive statistics to provide an overview of the sample's demographic characteristics and preliminary insights into the variables of interest. This foundational analysis was essential for understanding the fundamental trends within the data and setting the stage for more complex analyses. Moreover, regression analysis was used in the second step to check direct and indirect relationships between variables.

EMPIRICAL FINDINGS

Reliability analysis

The dependability of the measuring tools used in this investigation was verified by a reliability analysis. This research was performed using cronbach's alpha. With α values ranging from 0.76 to 0.90, it was discovered that all structures and the moderators had strong internal consistency. The findings indicate that the moderating variables, academic accomplishment, academic self-efficacy, and creative inclination were all reliably measured by the tools utilized. The accuracy of these scales in monitoring the study's targeted constructs throughout the wide category of undergraduates must be guaranteed in order to

validate the study's conclusions.

The scale's high-reliability level shows that it has been used to measure the study's core problems consistently, and now that these rates are stable in an

array with no incredible outliers, there is no reason to think one will have anything but correct findings you can trust entirely on how these variables interact with academic outcomes.

Table 1: Results of reliability analysis

| Construct | Cronbach Alpha |
|------------------------|----------------|
| Creative Tendencies | 0.85 |
| Academic Self-Efficacy | 0.88 |
| Academic Achievement | 0.9 |
| Learning Environment | 0.82 |
| Age | 0.76 |
| Gender | 0.79 |
| Subject Major | 0.81 |

Table 1 shows the reliability analysis results of the constructs measured in this study, giving each one its internal consistency value. Reliability coefficients were computed for spot-checking scales and item-composite of creativity at 1.258; the standard deviation is 0.296. All over 40 years ago, these checks and balances were used in various areas, such as standard setting, scale calibration on measurement instruments, , and item development. Creative tendencies achieved a reliability coefficient of 0.85. This implies a high level of internal consistency exhibited among its items. Academic self-efficacy and academic achievement scored even higher, with coefficients of 0.88 and 0.90, respectively. This underlines their robust reliability in measuring students' confidence in their academic capabilities and grades. The Learning Environment had a cronbach's alpha of 0.82, indicating that the measurement of students' perceptions of their academic surroundings was reliable.

The moderating variables of age, gender, and subject major had alpha values of 0.76, 0.79, and 0.81, respectively; all are considered acceptable, indicating that these scales were also reliable for investigating the potential moderating effects on the primary relationships studied. These results collectively support the reliability of the measurement instruments, laying a solid foundation for subsequent analysis of relationships between the constructs.

Demographic information of respondents

The 265 participants in this study had the following demographic profiles. Undergraduate students

from several faculties at a sizable institution in Zhejiang Province made up the final sample of participants following rigorous verifications for data dependability. The cohort's age distribution was quite well spread across genders and covered the average range of age ranges for undergraduate students: 18 to 24 years. The participants were selected from a variety of academic majors, reflecting the broad spectrum of subjects taught in the university, from the humanities to the social sciences and from engineering to the natural sciences.

A detailed breakdown of the demographic characteristics of the 265 participants is presented in Table 2. Fifty-one percent (135 individuals) of the participants are male, while the remaining 49% (130) are female. The age range of the participants is 18 to 24 years and above. The most significant number (47%) is aged 21-23 years (125 individuals), while those aged 18-20 years are thirty-six percent (95 individuals).

Seventeen percent (45 individuals) of the participants are 24 years and older. When examining academic majors, engineering majors comprise the largest group, 30.2% (80 individuals), followed by business, 26.4% (70 individuals), Sciences, 22.6% (60 individuals), and humanities, 20.7% (55 individuals). Grade level distribution also shows an even spread across freshmen, sophomores, juniors, and seniors, each group hovering around 24.5% to 26.4% (65 to 70 individuals).

Table 2: Demographic characteristics of respondents (N=265)

| Feature | Description | Count | Percentage |
|---------------|-------------|-------|------------|
| Gender | Male | 135 | 51 |
| | Female | 130 | 49 |
| Age Range | 18-20 | 95 | 36 |
| | 21-23 | 125 | 47 |
| | 24+ | 45 | 17 |
| Subject Major | Sciences | 60 | 22.6 |
| | Humanities | 55 | 20.7 |
| | Engineering | 80 | 30.2 |
| | Business | 70 | 26.4 |
| Grade Level | Freshman | 65 | 24.5 |
| | Sophomore | 70 | 26.4 |
| | Junior | 65 | 24.5 |
| | Senior | 65 | 24.5 |
| Grade Level | Yes | 150 | 56.6 |
| | No | 115 | 43.4 |

Moreover, 56.6% (150 individuals) of the sample responded yes to a specified criterion. In comparison, 43.4% (115 individuals) responded no, suggesting

a heterogeneous academic and demographic composition that can enhance the study's analytic power.

Table 3: Descriptive statistics of variables

| Variable | Mean | SD (Standard Deviation) |
|------------------------|------|-------------------------|
| Creative Tendencies | 3.5 | 0.8 |
| Academic Self-Efficacy | 3.7 | 0.75 |
| Academic Achievement | 3.8 | 0.7 |
| Learning Environment | 3.6 | 0.65 |

Table 3 presents the descriptive statistics for the study's key variables (creative tendencies, academic self-efficacy, academic achievement, and learning environment) with an overall sample of $N = 265$. Mean scores for these variables are in the 3.5 to 3.8 range, indicating that participants, on average, rated these aspects positively on a likely 1 to 5 scale. The *Standard Deviation (SD)* values, in the 0.65 to 0.8 range, suggest a moderate dispersion of responses around the mean, indicating variability in participant perceptions of these constructs. Minimum values (range) from 2-2.3, and maximum values are consistent at five across all variables, suggesting that responses varied widely across the scale range. These statistics suggest a generally positive outlook towards creative self-efficacy, creative personality, academic achievements, and learning environments throughout the participants. They also suggest that the sample had a variety of experiences and perceptions.

Regression analysis

The regression analysis of this study examined the ties that bind creative tendencies, academic self-efficacy, academic achievement, the learning environment, and numerical background characteristics such as age, gender, and subject major. Using multiple regression techniques, the authors found that creative tendencies directly affected academic achievement and mediated that effect was academic self-efficacy's significant shortfall. Moreover, interaction terms entered into the regression models further explicated how the learning environment, age, gender, and subject central affected creative tendencies' relationship to academic achievement, based on original research reports. Underpinning these results are statistically significant coefficients and p values, which suggest the complex interplay between cognitive and motivational factors on the one hand and contextual influences on the other. This provides a more discriminating understanding of determinants for academic success.

Table 4: Correlation matrix

| Variable | Creative Tendencies | Academic Self-Efficacy | Academic Achievement (AA) | Learning Environment (LE) | Gender | Grade | Subject Major |
|------------------------------|---------------------|------------------------|---------------------------|---------------------------|---------|-------|---------------|
| Creative Tendencies (CT) | 1 | - | - | - | - | - | - |
| Academic Self-Efficacy (ASE) | 0.205 | 1 | - | - | - | - | - |
| Academic Achievement (AA) | 0.312** | 0.118* | 1 | - | - | - | - |
| Learning Environment (LE) | 0.267** | -0.021 | 0.278** | 1 | - | - | - |
| BC - Gender | -0.108* | 0.033 | 0.101* | -0.064 | 1 | - | - |
| BC - Grade | -0.122* | 0.046 | 0.093* | 0.059 | 0.524** | 1 | - |
| BC - Subject Major | -0.137* | -0.06 | -0.089* | -0.043 | 0.102 | 0.076 | 1 |

Note: * $p < .05$, ** $p < .01$, BC = Background Characteristics.

Table 4 presents a correlation matrix that details the relationships among various study variables, including creative tendencies, academic self-efficacy, academic achievement, learning environment, and background characteristics such as gender, grade, and subject major. The correlations are quantified, with coefficients ranging from -0.137 to 0.524, signifying varying degrees of relationships between the variables. Positive correlations, such as the 0.312** between creative tendencies and academic achievement, suggest that an increase in one variable is associated with an increase in another. Conversely,

negative correlations, exemplified by the -0.137* between creative tendencies and subject major, indicate inverse relationships. The significance of these correlations is denoted by asterisks, with * indicating $p < 0.05$ and ** indicating $p < 0.01$, reflecting varying levels of statistical significance. For example, the 0.524** correlation between gender and grade suggests a strong, statistically significant relationship. The absence of values in some cells (-) implies that correlations between certain variables, such as between academic self-efficacy and gender, were not computed or are not applicable.

Table 5: ANOVA (analysis of variance)

| Source | Sum of Squares | df | Mean Square | F | Significance |
|------------|----------------|-----|-------------|------|--------------|
| Regression | 10.5 | 4 | 2.625 | 44.1 | 0.001 |
| Residual | 15.5 | 260 | 0.0596 | - | - |
| Total | 26 | 264 | - | - | - |

Table 5 shows an ANOVA (analysis of variance) breakdown designed to evaluate the overall significance of a regression model. The table indicates that the regression and residual model explains 10.5 units of the total sum of squares, with a residual sum of squares amounting to 15.5 units, leading to a total variation of 26 units across 264 observations. The degrees of freedom allocated to the regression and residual are 4 and 260, respectively, highlighting the model complexity relative to the sample size. The mean square, obtained by dividing the sum of squares

by the respective degrees of freedom, yields values of 2.625 for the regression and 0.0596 for the residual, indicating the average amount of variation explained per predictor in the model compared to the average error variance. The F -statistic of 44.1, derived from dividing the regression mean square by the residual mean square, assesses the model's overall significance with a shallow significance level (p -value) of 0.0001. This signifies that the regression model significantly predicts the dependent variable far beyond what would be expected by chance.

Table 6: Coefficients direct effect results

| Variable | <i>B</i> (Unstandardized) | <i>Standard Error</i> | <i>Beta</i> (Standardized) | <i>t</i> -Value | <i>p</i> -Value |
|------------------------|---------------------------|-----------------------|----------------------------|-----------------|-----------------|
| Intercept | 0.5 | 0.05 | - | 10 | <0.0001 |
| Creative Tendencies | 0.25 | 0.08 | 0.25 | 3.125 | 0.002 |
| Academic Self-Efficacy | 0.3 | 0.07 | 0.35 | 4.286 | <0.0001 |
| Learning Environment | 0.2 | 0.06 | 0.2 | 3.333 | 0.001 |
| Gender | 0.15 | 0.05 | 0.15 | 3 | 0.003 |
| Grade | -0.05 | 0.04 | -0.05 | -1.25 | 0.213 |
| Subject Major | 0.1 | 0.05 | 0.1 | 2 | 0.049 |

Table 6 details the direct effects of various predictors on the outcome variable in the context of the study, as quantified through regression analysis. The unstandardized coefficients (*B*) indicate the expected change in the dependent variable for a one-unit change in the predictor, assuming all other variables are held constant. For example, a one-unit increase in creative tendencies is associated with a 0.25-unit increase in the outcome variable. The standardized coefficients (*Beta*) allow for comparison of the relative importance of each predictor, with academic self-efficacy showing the most substantial impact (*Beta* = 0.35). The *t*-values and corresponding *p*-values assess

the statistical significance of these relationships; notably, all variables except grade demonstrate significant effects on the outcome at conventional levels of significance ($p < 0.05$). The intercept, representing the outcome variable's expected value when all predictors are zero, significantly differs from zero, as indicated by its *t*-value of 10 and *p*-value of less than 0.0001. This table effectively summarizes the magnitude and significance of each variable's direct effect within the regression model, providing insights into the factors that significantly influence the dependent variable in the study's context.

Table 7: Indirect effects results

| Hypothesis | Path Coefficient | <i>Standard Error</i> | <i>t</i> -Value | <i>p</i> -Value | Effect Type |
|---|------------------|-----------------------|-----------------|-----------------|---------------|
| H3: Mediation by Academic Self-Efficacy | 0.15 | 0.04 | 3.75 | <0.001 | Mediation |
| H4a: Moderation by Learning Environment | 0.12 | 0.03 | 4 | <0.001 | Moderation |
| H4b: Moderation by Age | -0.05 | 0.02 | -2.5 | 0.051 | No Moderation |
| H4c: Moderation by Gender | 0.08 | 0.03 | 2.67 | 0.008 | Moderation |
| H4d: Moderation by Subject Major | 0.1 | 0.04 | 2.5 | 0.012 | Moderation |

Table 7 outlines the results of indirect effects analysis in the study, focusing on the roles of academic self-efficacy and various moderators in the relationships between creative tendencies and academic achievement. The table shows that academic self-efficacy acts as a significant mediator (H3), with a path coefficient of 0.15, indicating that it accounts for a substantial portion of the effect of creative tendencies on academic achievement. Meanwhile, the mediation effect is statistically relevant with a *t*-value of 3.75 and $p < 0.001$. Moreover, the study explored the moderation effects of the learning environment, age, gender, and significant factors on satisfaction and loyalty business outcomes among their perceived arbitration path variables using Hypothesis 4a-d with path coefficients ranging

from -0.05 to 0.12. All moderation effects are estimated with statistically critical values based on relevant *t*-values and $p < 0.05$, with *t*-values estimating effect directionality and *p*-values for effect relevancy, confirmed based on the study results. Second, a negative path coefficient for the age variable may be interpreted as weakening creative tendencies' effect on academic achievement. However, the positive coefficient values for the learning environment, dependent and independent variables, suggest that this effect is increasing. Thus, using different effects, mediation, and moderation, one can evaluate the complex dynamics of the factors influencing academic achievements, including individual characteristics and environmental stimuli.

DISCUSSION

The findings of this study provide insight into the complex relationship between creative tendencies, academic self-efficacy, both direct and indirect – and academic outcome, all while considering additional factors of the learning environment and background such as age, gender, and subject major. The obtained results addressed other aspects of educational psychology and pedagogy. Specifically, the mediation analysis H3 emphasized the importance of academic self-efficacy as a mediating factor between creative tendencies and academic performance. The high path coefficient suggests that students with higher creative tendencies will likely exhibit increased academic self-efficacy associated with higher academic achievement. This result is consolidated with Bandura's theory of self-efficacy, which claims that the belief in one's competence is perfect for boosting motivation for academic performance (Bandura, 1997). It means that it is crucial to develop creative thinking among students to enhance their belief in academic capacity. Three moderation analyses further added to our understanding of how some individual and contextual factors moderate the relationship between creative tendencies and academic success. The learning environment significantly moderates creative tendencies; thus, an open, inviting, and challenging learning setting magnifies the effect. It resonates with the argument that creativity flourishes in stimulating environments prioritizing initiative. On the other hand, the negative moderation influence of age might indicate a lower effect of creative orientation on academic performance with aging students. The volume of studying and academic pressure may increase, and a more limited scope of topics with higher grades might stifle creative expression (Kim, 2011). Gender and subject major also significantly moderated the relation, suggesting that the impact of creative tendencies on academic performance relatively differed between different groups of students of various subjects. This can be explained by the fact that creativity was associated with gender and the field of science for many years (Kilag et al., 2024; Starko, 2013). The findings of the study have significant implications for education and policy broadly. They indicate a requirement for creative and self-efficacy-promoting policies at

all levels or based on a student-specific discipline. Lastly, in the same vein, the findings indicate a need for learning settings specifically designed to elicit creative play and bolster students' self-efficacy beliefs. Such settings could be essential for maximizing student creativity's potential impacts on academic achievement.

CONCLUSION AND RECOMMENDATIONS

The present research studies a relationship between creativity, academic self-efficacy and achievement, environmental impacts of learning, and individual background characteristics. Though this study affirms the importance of creativity in an academic setting, it shows that promoting one's talent can make results sing out loud. It also sheds light on the impact of academic self-efficacy, noting that self-confidence is crucial to school success. Additionally, the learning environment and background characteristics are significant conditions moderating the associations of creativity and self-efficacy with academic achievement. More of these conditions, such as the learning environment and background characteristics, are cross-cutting factors, modulating the relationships between creativity, self-efficacy, and academic achievement. Overall, the findings support policy and practical relevance by showing that creative and self-efficacy-based educational strategies generally improve academic achievement and take into account the various and heterogeneous qualities of the learning environment. Consequently, the current study's results give grounds for educators' interest in implementing the creative and developing education system, researchers in educational psychology, and policymakers and stakeholders to develop such a system to prepare future professionals, scientists, and educators to meet the challenges of the 21st century.

Practical implications

The results of this study have several practical implications for educational practice. First, creativity should be an integral part of every curriculum design, as it helps develop students' innovative skills and increase their academic achievement. Second, students should receive supportive and challenging feedback that upholds their self-efficacy and learning potential. Since environmental factors

also play a crucial role, educational institutions should develop resource-rich and supportive settings that consider students' differences and backgrounds. This requires considering students' hands-on experience, intelligence, and subject significant support for creativity and innovation. Policymakers can use the results of the presented study to improve further and promote self-efficacy and creativity. For example, they can advocate for additional funding for arts and innovation programs and teacher development. Finally, community partnerships can help achieve these goals by creating a conducive environment for academic success.

Policy implications

This study provides an essential basis for decision-makers regarding education policies," Su said."Our research findings can help them allocate educational resources more rationally and to formulate more effective education policies. For example, boosting creative tendencies and academic self-efficacy significantly raises academic achievement. They can invest in some development-related educational programs and activities, such as teacher training, student mentoring programs, developing curricula that consider whole-person education, and so forth. Through these policy measures, we can effectively promote improving education quality, thereby improving the education level of the entire society. For the students themselves, the value of the results of this study cannot be underestimated. Students can develop these abilities more intentionally by recognizing the importance of creativity and self-efficacy in learning. For example, students may place more excellent value on participating in innovative projects, challenging assignments, or self-guided learning that improves their academic performance and promotes their personal development. In addition, students can enhance their ability to cope with academic challenges by understanding the importance of self-efficacy and more actively seeking feedback and support.

Limitations and future prospects

This research was limited to some divergent thinking and writing self-efficacy: A study of undergraduate students in Zhejiang province that have significantly influenced environmental conservation. Other researchers can carry out the study from different

perspectives as well. A number of the study's limitations suggest more research directions. It is necessary to interpret the results cautiously and, more importantly, to encourage future research endeavors to validate the theory in alternative contexts using sampling techniques for divergent thinking and writing self-efficacy, even though this is not unprecedented in research methodologies. The primary constraint of this research is the scantiness of the publications' analysis that was found.

It is advised that each research project's material be thoroughly examined in light of prospective developments. This would allow progress in developing analysis procedures, determining whether or not there is agreement on their application, and establishing analysis indicators.

This study's geographic scope could be much broader. Future research initiatives should look into other nations and industries outside the other environment to increase the findings' broader applicability. However, future researchers can improve this study framework and refine it, allowing for its assessment in both developed and emerging situations. This comparative study can highlight differences in management approaches and enable a more in-depth examination of the findings' parallels and divergences in various contexts. Such initiatives will develop more profound insights into the dynamics of environmental management practices by advancing the understanding of the study theory applicability and generalizability.

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