How Creative Mindset Is Involved in Positive Emotions and Attitude that Affects Creative Design Process

Joungyun Choi[(✉)]

College of Environmental Science and Forestry, State University of New York, 1
Forestry Dr., Syracuse, NY 13210, USA
jchoi@esf.edu

Abstract. Creativity is an important problem-solving tool on the design context. People who are in design education treat creativity as an important component of their self-identity. Thus, it is imperative to develop and be mindful of creativity in design education. Most traditional design fields focus on creative outcomes that impact revenue, trends, and popularity. However, this current research shows that it is even more important to focus on people's state of mind (mindsets) and attitude in building their creative ability. Depending on people's attitudes toward their projects, some design solutions are more creative than others. The primary research objective of this study is to identify the presence of design students' creative mindset and how it is manifested in their work. This research also seeks to determine how the creative mindset operates and develops with respect to students' creative performance by incorporating the concept of the fixed/growth mindset toward creativity. The qualitative data established the fact that: (1) The creative mindset involves students' attitude toward design projects and is manifested as a positive attitude, such as having an open mind and demonstrating readiness at the beginning of their design process; (2) A positive attitude from students' creative mindset is closely related to learning goals, which is one of the main concepts of the growth mindset; (3) The creative mindset greatly affects the outcome of the design, and more specifically improves one's design ability, which contributes to student success from a long-term perspective.

Keywords: Creative mindset · State of mind · Positive emotion ·
Growth mindset · Open mind · Learning goal · Design education ·
Higher education · Decision to be creative · Problem solving · Design ability

1 Introduction

Given that our society is becoming more complex, and people are undeniably facing a wider array of problems, design processes are considered to be an important tool for tackling complex social and cultural problems. Designers use design thinking, which provides us with a new way of tackling problems and encourages us to adopt divergent approaches and new solutions [1]. Currently, design is perceived as a crucial means of fostering creativity and innovation when employed as a problem-solving tool,

insomuch as the solutions should not be banal or useless; rather, they should be novel and useful. Thus, design is a field that inherently involves a *creative* problem-solving activity and necessitates making decisions to fulfill certain objectives. From the definitions and conceptions of design, it is important to understand how creativity operates in the design process. Designers' ideas develop as their problem-solving progresses. Therefore, each designer constructs his or her own representation of the design problem, dealing with a problem that becomes specific to him or her [2]. In practice, different designers, supposedly solving the same design problem, reach different solutions [3]. In this process, some design solutions are more creative, while others are considered as less creative.

Design educators often see a similar process in the area of design education. Although students may have the same design project, they approach it with different design solutions. These various design solutions produce different processes and outcomes: some designs are more innovative, while others are less so. There are many reasons why students perform differently in their creative design processes. However, through my own experience and observation, there is a common reason – their attitudes – that explains how they approach design projects. However, their thinking habits precede their attitude formation.

This research originated from my interest regarding these two different attitudes and their subsequent outcomes. Why then do students act differently? Where do these attitudes come from? Do they adopt a certain mindset in terms of their new design project, like I do? If so, do these mindsets toward a design project affect their creativity? How do these mindsets influence students' creativity? The design area in higher education requires a high level of creativity for problem solving throughout the design process. Each design outcome tends to be unique and non-repetitive in its conception and development. People who are in design education treat creativity as an important component of their self-identity. If students' creativity can be affected by their mindsets, then investigating students' mindsets should be a first priority with respect to how they work differently.

The current research has the following perspective: the creative mindset is related to a growth mindset toward creativity. The concept of a growth mindset is based on the theory of implicit beliefs. Implicit belief theory is one of the most important concepts in educational psychology. This theory explains people's beliefs regarding their psychological traits and abilities, which plays an important role in influencing their own motivation and behavior [4]. According to research regarding implicit beliefs, people hold different beliefs that represent their state of mind and explain how and why they behave the way they do. Some people perceive their abilities as fixed (fixed mindset: unable to develop/change), while other people believe that their abilities are malleable (growth mindset: able to develop/change) [5]. This conceptualization shows how people develop beliefs about themselves; additionally, it shows how fixed and growth mindsets create their psychological worlds, influencing their thoughts, feelings, and behaviors. These mindsets explain why some people are motivated to work harder, and why others fall into patterns of passivity and self-defeating behavior. When people decide to do something, they believe that they can create, develop, change, and make a situation better. Thus, the creative mindset is related to a growth mindset toward creativity; in other words, the creative mindset can be learned and developed. While

analyses of fixed and growth mindsets are rarely provided within the creative domain [6–8], a few studies regarding the fixed/growth mindset concept of creativity will be reviewed. This research will adopt specific methods to demonstrate the relationship between the concept of fixed/growth mindsets and the creative mindset.

2   Method

The current study is based on the personal experiences of design students, as well as design educators. The purpose aims to investigate whether design students decide to be creative (creative mindset) when they start new design project. This study examines whether the creative mindset has a positive connection with the growth mindset in terms of creativity. Such a positive connection would establish the fact that students can develop their creative mindsets in their design projects. In seeking to understand these phenomena, methodological triangulation is used. There were three phases in the process of the study, which were as follows: an implicit belief of creativity (fixed versus growth mindsets toward creativity) survey, direct in-depth interviews, and observation. The survey used three different sections of questions: the mindset test [7–9], the Goals Inventory (GI) test [10], and the self-perception of creativity test [7–9] to identify students with a high growth mindset toward creativity. After the survey, direct in-depth interviews were conducted with the students who were identified as having growth mindsets toward creativity. The aim of the interviews focused on how to determine whether students had a creative mindset, as well as to identify the relationship between the creative growth mindset and the creative mindset. Participant observations were conducted throughout the research, between the survey and the interview, as well as during the interview. In the participant observations, the primary sources of data were what people said and how they behaved. Through their conscious and/or unconscious behaviors or conversations, students' attitudes toward creative design work could be identified. The purpose of these participant observations was to understand how design students' varied attitudes toward creative design work affect their creative design performance/outcomes by incorporating the experiences of growth mindset students and relating these experiences to their creative mindsets.

2.1   Participants and Setting

The sample for the current study consisted of 179 students who agreed to participate in this research since the first step of the study was used existing survey to the design students. The students were enrolled in a variety of design subject matter tracks, such as graphic design, architecture, interior design, product design, and apparel design in a couple of different major universities located in the US Midwest. These students were selected from two introductory-level design classes and two advanced-level design classes. After the participants took the fixed/growth mindset survey, the in-depth interviews were conducted with 12 students who demonstrated a growth mindset toward creativity. Throughout the process of the implicit belief tests regarding creativity and the interviews with the growth mindset students, participant observation was conducted to understand the relationships among the tests, interviews, and students'

performance/design outcomes. Participation in this study was voluntary. The implicit belief tests regarding creativity took approximately 10 min in their classrooms, while the interviews took about an hour in a quiet area in the building. Each participant was given a $30 gift card as an incentive to participate in the direct interviews.

2.2   The Implicit Belief Test Regarding Creativity

In the initial phase of this study, participants were given the survey to measure their implicit beliefs about creativity, including the fixed/growth mindset test [7–9] the Goals Inventory (GI) test to determine students' goal orientations [10], and the self-perception of creativity test [7–9]. Participants were presented with a hard copy of the consent form before they took the tests. After reading and signing the informed consent forms, the test copies were distributed. The tests took about 10 min to complete. The results of the tests were used to select participants identified as having high growth mindsets toward creativity. The test consisted of 20 questions in total. These questions measured the mindset and goal orientations, along with three items to evaluate self-perceptions of creativity.

Dweck and Leggett [5] argued that there is a strong relationship between goal orientations and mindsets; thus, people who hold a growth mindset exert more effort and have more confidence, since they tend to form learning goals. Therefore, measuring students' goal orientations, particularly identifying students with learning goals is an important factor in researching fixed/growth mindsets [5, 8]. Overall, researchers have shown that fixed and growth mindsets are moderately negatively correlated, and growth mindsets have been shown to represent learning goals, which is a primary concept for developing self-efficacy. Based on the overall ideas of these previous studies, three measurements were implemented in this research: Fixed/Growth mindset toward Creativity, Goal Orientations and Self-efficacy of Creativity.

Participants indicated their responses to each item with a six-point Likert scale (1 = strongly disagree to 6 = strongly agree). The collected responses from the survey were analyzed and run to score and identify high growth mindset students (>4 growth mindset on a scale from 1 to 6). When scoring the data, negatively coded variables were reverse coded.

2.3   In-Depth Interview

When the survey was completed, 12 participants with an average score higher than or equal to 4.0 (>4 growth mindset on a scale from 1 to 6) were selected to continue to the interview phase. To determine the answers to the research questions, as well as the related questions (Do design students have creative mindsets? How do they describe their creative mindsets? Do creative mindsets have a similarity with the growth mindset regarding creativity?), a qualitative data collection method was used with in-depth interviews consisting of open-ended questions to identify participants' implicit beliefs about creativity and creative mindsets. Direct face-to face interviews were conducted because the observation of social cues such as facial expressions, body posture, or voice tone is an important part of the interview in determining participants' thinking habits, states of mind, and implicit beliefs. interviews were designed to collect

descriptive data in the participants' own words and to develop an understanding with regard to participants' opinions and experiences. The interviews took approximately one hour each in the participants' design studios, where they usually spend their time in the creative design process on campus. Incentives were given to participants to elicit more active participation, and the interviews were audio recorded after participants signed the interview consent form. All interviews were recorded and transcribed; moreover, the interview situations were documented in field notes. The data were analyzed through an inductive content analysis.

2.4 Observations

Throughout the entire research process, participant observations were conducted to examine their behavior/performance and outcomes of the creative design process. The observation took place through nonparticipant observation: although the researcher entered the classroom and met with the students directly to ask about their feelings and thoughts about their work, the researcher did not become a member of the context, nor did the researcher participate in their activities. To enhance the validity of the observation data, the observation took four months (one semester) in two different design studio classes that were selected for phase 1 (the tests). Two classes were visited within two time periods (4 h) a week during the entire semester. The observations were made when the participants were given a new project and time to work on their own. In this way, the relationship between participants' creative mindsets (decision to be creative) and creativity (developing their project) in the design process could be observed through their behavior. Students' design processes were observed in detail, starting from the research to the production/presentation in order to record them objectively, without the researcher's personal bias. Throughout the design process, the participants were sometimes asked about their feelings and thought processes regarding their projects, and their responses were documented in written format. To analyze the field notes, (1) the collected data were organized into a narrative format of a day; (2) the narrative format of the information was organized, according to the outline of the research questions; and (3) a deductive content analysis was used, which "starts with the counting of words or manifest content, then extends the analysis to include latent meanings and themes" [11]. The outlined text information was analyzed to determine the frequency of the contents (students' habits of action). This information was later compared to the research questions and interview findings to match with students' performance and the creative mindset.

3 Results

Results from the observations: Two distinct groups of students with different attitudes toward their design projects were observed and selected from the broadly focused observations. There were students with neutral attitudes in between the two distinct groups; however, only the performance of the high growth mindset students and the high fixed mindset students were observed. Then, subsequently, only the high growth

mindset students were selected and were invited to participate in the in-depth interviews. Their responses were then analyzed to address the research questions. At the beginning of the observation, two different groups were distinguished based on ten attributes that were selected from the frequency of content (students' habits of action). The ten attributes are as follows: (1) Active engagement; (2) Time management; (3) Relevant conversation; (4) Having an open mindset to critique; (5) A high attendance rate; (6) Mindfulness of the project; (7) Generating ideas; (8) Willingness to take challenges; (9) Preparing class materials and assignments; and (10) Sharing knowledge. These attributes were largely identified from students with high scores of implicit beliefs as having a growth mindset toward creativity. They usually engaged actively in class exercises, worked more than they were required, and managed their time well so that they always stayed on top of due dates. They tried to generate different ways of solving problems in given projects, and they were willing to share their knowledge with others. After the high creativity growth mindset students were identified from the survey, the narrowly focused observations took place in order to concentrate on high performance students' behaviors and outcomes. The most obvious characteristic of the growth mindset students was having an "open mind" among all of the ten attributes. All 12 participants (100% of the growth mindset students) had an open mind in terms of accepting others' critiques, accepting challenges, and collecting different ideas from various sources. However, not all participants with a high growth mindset did well on their project from the beginning. A total of 42% of the participants (5 out of 12 participants) showed a lack of both diverse ideation and development of their final outcomes on their first couple of projects. From the broadly focused observations, there was no significant difference in the first quarter of the semester with respect to their current design skills. However, when there was challenge or confusion in the assignment, the fixed mindset students clearly suffered from their confrontation with the challenge or the confusion. They ended up with the same level of work from the very beginning stage of the design process. There was no improvement throughout the project. They generally reacted with self-doubt and disruption, deciding quickly that they were not good at doing the project. That led them to give up easily. This would put them at a disadvantage to succeeding in the class. The growth mindset students were equivalent in the design skills that they brought to a task. However, they ended up displaying much different levels of performance and outcomes. From the narrowly focused observations, this appears to have occurred as a result of how they approached the project. Through their open-minded approach to a project, the challenge or confusion of an assignment allowed them to progress and improve in later projects. It turned out that being open minded was an essential attribute for students in influencing their success in their outcomes. An open mindset led students to enjoy their challenges or obstacles. They also remained very confident that they would succeed, saying things such as, "I almost got it now" or asking for a few more chances on the assignment because they were almost getting it. This group tended to maintain the positive mood they had displayed during a difficult assignment, but some of them become even happier about the assignment. The images below (Fig. 1) show the improvement in Student 3's (from Fig. 1) divergent thinking process in the same condition and criteria.

Fig. 1. Improvement in Student 3's divergent thinking process

Results from the Interviews: From the results of the narrowly focused observations and the growth mindset survey, 12 students with a high creative growth mindset were selected. From the interviews, (1) The students' thinking mode changes to being more open and looking for something more unique when embarking upon a new design project. Sixty-seven percent of the participants (8 out of 12) with high growth mindsets reported that they "changed" their way of thinking when starting a new project. This "change" means that the participants *got ready* to dive into their projects. In particular, their thinking mode changed to being open and looking for something more unique (creative mindset); (2) A creative mindset is described as a positive attitude, such as an open mind and readiness toward a design project. Participants were asked to describe what a creative mindset is in their perspective. The most common descriptions of a creative mindset reported by participants included a "starting point to be creative," "a mind that starts something positively," and "an activity of throwing questions to oneself that are raised from curiosity and interest in something." In this description, the creative mindset is usually apparent at the beginning of the design process. A creative starting point encourages students to have a positive attitude toward their projects. A positive attitude was described using several different words, which were repeated and stressed over time during the interviews: "open mind," "readiness," "decide," and "mode (approach)." Again, a creative mindset is a matter of people's state of mind and attitude on how they start a project.

4   Discussion

Two major findings contribute to defining the conclusions of the research objectives. Based on these findings, this study provides four important concepts, which involve: (1) the creative mindset; (2) the relationship between the creative mindset and the concept of the growth mindset; (3) the relationship between the creative mindset and students' performance/success in a project.

(1) The creative mindset: The creative mindset involves students' attitudes toward design projects and is manifested as a positive attitude, such as open mind and readiness, which is evident at the beginning of their design process: This concept of the creative mindset is highly meaningful in terms of dealing with the first research question, which examines whether such a creative mindset exists when students are given a design project, and how the creative mindset is manifested. Although the way in which the creative mindset was expressed differed,

depending on the participants' experience, *all of the participants articulated the notion that their "decision to be creative" occurs at the beginning of their project.* The creative mindset is generally seen in students' performance, which is indicated by a positive attitude, such as having an open mind and being ready to take on the project. As previously addressed in the finding chapter, all participants shared their experience regarding their design process. They reported that their design process is quite consistent with every type of project, and at the outset, their research, idea elaboration, and ideation sketches demand the most creativity in the design process. In this way, they consciously or unconsciously "change" their thinking mode to be open minded and to look for something more unique (the decision to be creative). This creative way of starting a project encourages students to have a positive attitude toward their projects. This positive attitude was described using several different words, such as "open mind," "readiness," "decide," and "mode (approach)." Also, these positive attitudes could be found from the following ten attributes: (1) Active engagement; (2) Time management; (3) Relevant conversation; (4) Having an open mind to critique; (5) A high attendance rate; (6) Mindfulness of the project; (7) Generating ideas; (8) Willingness to take challenges; (9) Preparing class materials and assignments; and (10) Sharing knowledge that was identified during the observations. Again, the creative mindset is a matter of people's state of mind and attitude in terms of how people start the design process.

(2) Relationship between the creative mindset and the concept of the growth mindset: The positive attitude (and emotion) from students' creative mindset is closely related to learning goals, which is one of the main concepts of the growth mindset. Fixed/Growth mindsets are involved in creativity. The growth mindset is manifested by a conscious effort to look for something new and develop creativity. For most of the time, participants keep looking for surprise associations in creating a new design. The participants reported that having a creative mindset always leads to gaining something new because of their open mind and readiness. An open mind allows people to have the desire to learn/try new things and master new projects successfully. Readiness for a project helps people overcome challenges. The creative mindset is a thinking pattern in which a person decides to approach solving a particular situation/problem creatively. This way of approaching a situation/problem leads a person to focus on more efforts to develop his or her creativity (Table 1).

(3) Relationship between the creative mindset and students' performance/success in a project: The creative mindset greatly affects the outcome of the design, more specifically, in terms of improving their design ability, which results in student success from a long-term perspective. This concept is mainly found from the observations. The growth mindset students, who start with creative mindsets, have a positive attitude toward design projects. As discussed in terms of the first concept, a positive attitude was associated with these behaviors: (1) Active engagement; (2) Time management; (3) Relevant conversation; (4) An open mind to critique; (5) A high attendance rate; (6) Mindfulness of the project; (7) Divergent thinking; (8) Willingness to take challenges; (9) Preparing class materials and assignments; and (10) Sharing knowledge. These positive behaviors significantly improve both

Table 1. Creative mindset vs. growth mindset toward creativity

"Creative mindset" vs. "Growth mindset toward creativity" in this study	
Creative mindset	*Decision to be creative* Thinking habits Attitudes Decision to generate new ideas, analyze these ideas and sell the ideas to others [12] The willingness to: 1. redefine problems in novel ways; 2. take sensible risks; 3. sell ideas that others might not initially accept; 4. persevere in the face of obstacles; and 5. examine whether their own preconceptions are interfering with their creative process [13]
Growth mindset toward creativity	*High growth mindset toward creativity* Implicit beliefs regarding creativity: self-perceptions of creativity How people think about their own creativity: They think that their creativity can be developed. Beliefs about the malleability of own creativity [4] The positive conceptions of psychological states th at are held by laypeople [12] Correlated with a learning goal orientation: The goal is to increase competence, and seek challenges that fostering learning Correlated with creative self-efficacy

the process and outcome, which ultimately affect students' grades in the class and their portfolio development. According to the findings of the study, half of the high creative growth mindset students did not engage in the creative design process, such as divergent thinking, rich ideation, and brainstorming during the first couple of projects. However, they likely possess self-esteem in their performance, which is a positive way of experiencing the creative process when they are fully engaged and are using their abilities to pursue the values of the class.

5   Conclusion

The explicit knowledge regarding the creative mindset from major finding of the study can support students' intrinsic motivation so that first, they believe that creative skills can be developed, and second, they can consciously make an effort to have positive emotions and attitudes toward their project to develop their creative mindset. Thus, by incorporating the concept of the growth mindset, an instructional element should include examples of how creative achievements are acquired after a process with multiple challenges to highlight the role of development and effort in the creative process. Also, knowledge about the relationship between the creative mindset and the concept of the growth mindset will help educators create an instructional environment and situation that can ignite students' creative mindsets. Particularly, creating a good atmosphere for the first impression of a project is important in leading students' creative mindsets, since the creative mindset involves students' attitudes toward the design project at the beginning stage. Also, the growth mindset is always involved in the process of creative

thinking. As a result, educators can take advantage of situations in which students might express unexpected and surprising ideas. From this situation, educators praise the process and effort of creative thinking more than the outcome/creative ability, which is very important in encouraging students' intrinsic motivation.

Recommendation for future research is to examine the level of inequality between students with growth versus fixed mindsets. The current research dealt with finding the phenomena of influential aspects from the creative mindset by relating it to the concept of the growth mindset in design education. Thus, the finding concerning the relationship between the creative mindset and the creative growth mindset is still critical. However, there should be a comparison of mindsets, performance, and outcomes between students who have a high growth mindset and a high fixed mindset to examine how these different mindsets affect students' creative design process, outcomes, and their resulting success and happiness. Since there are unexpected findings regarding the factors that help ignite the creative mindset and suggestions to develop students' creative mindsets, this comparison process would provide a better understanding of fixed mindset students and could provide more specific solutions to them.

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