

# Fostering Creativity in Design Education: Using the Creative Product Analysis Matrix with Chinese Undergraduates in Macau

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## Abstract

The purpose of the present study is to explore to what extent the use of a more structured mode of assessing creative products – specifically, the CPAM – could beneficially influence design students’ product creativity and creative processes. For this qualitative inquiry, following our CPAM-based intervention, students wrote’ reflective papers in response to five open-ended questions, and these papers were used as the major source for data analysis. Three major themes were found during the data analysis: (a) creative approaches to generating products; (b) positive and negative experience in the creative and learning process; and (c) the effects of introducing the CPAM model. It is suggested that the CPAM model could be used as a set of criteria with which design educators could objectively assess students’ creative products, as our participants found it easy to understand.

**Keywords:** creativity, qualitative inquiry, CPAM, art and design education, Macau

## 1. Introduction

### 1.1 Introduce the Problem

Creativity is viewed as an important competency for learners in general (Dollinger, 2011; Ellis & Lawrence, 2009; Lemons, 2011), and this is especially the case with students and practitioners of art and design (Carabine, 2013; Clarke & Cripps, 2012; Dorst & Cross, 2001; Wong & Siu, 2012). Following this line of thought, it has been argued that creativity should be central to assessment in art and design education (Cheung, 2012; Eshun & de Graft-Johnson, 2012). As such, a number of strategies for enhancing student creativity have been proposed and used (Bruton, 2011; Hargrove, 2012; Wood & Jensen, 2012).

A review of the literature on creativity reveals its division into two major lines of research, one focused on *creative product* and the other on *creative process* (Howard, Culley, & Dekoninck, 2008). For those seeking to foster creativity in educational contexts, these threads have important implications. Indeed, it can be argued that any creativity-training intervention must consider these two aspects of creativity if it is to succeed.

Lindstrom (2006) describes an approach to assessing creative performance used in Sweden’s National Agency for Education, comprising two dimensions: product and process. Three of its criteria relate to creative products: (a) clarity of intention, (b) color, form, and composition, and (c) craftsmanship. For the creative process, four criteria are used: (a) investigative work, (b) inventiveness, (c) ability to use models, and (d) capacity for self-assessment (p. 56). Using exploratory factor analysis, Lindstrom (2006) found that creativity in the visual arts consists of two main dimensions – product and process – that should be evaluated separately when considering students’ creative work.

### 1.2 Purpose of the Study and Research Question

As Besemer and O’Quin (1999) suggested, the potential use of the CPAM is to assist students to improve the creativity of their products. Thus, the purpose of the present study is to explore to what extent the use of a more structured mode of assessing creative products – specifically, the CPAM – could beneficially influence design students’ product creativity and creative processes. For this qualitative inquiry, following our CPAM-based intervention, students wrote’ reflective papers in response to five open-ended questions, and these papers were used as the major source for data analysis. As well as offering pedagogical insights to design educators, it is hoped that this investigation of the possible use of the CPAM model within design education will be of benefit to future researchers on creativity and design education. Accordingly, the research questions that guided this study were:

- 1) To what extent did the students become aware of their distinctive experience of the creative process while designing?
- 2) How did knowledge of CPAM impact on students' learning and product creativity?

## 2. Literature Review

A demand for fostering creativity has become a universal discourse across different nations, reflecting the globalization of economic activity (Craft, 2003). The function of education serves as a building block of human capital by equipping students with knowledge and creative capacities (Lin, 2011). Policy-making and curriculum reform were carried out in order to fit this need (Shaheen, 2010).

Livingston (2010) argues that the goal of promoting creativity in higher education "is not how to teach creativity, but rather how to understand, harvest, and build up the very creativity that every student already processes and uses" (p. 62). Concerning promoting creativity in design education, Lau, Ng, and Lee (2009) found that numerous creativity training approaches in existing literature and can be briefly grouped into five main categories: identifying and mapping attributes (e.g., mapping notes or critical analysis); making possibilities; changing and shifting perspectives (e.g., divergent thinking); making associations and analogical thinking; probing emotion and the subconscious (p. 72).

Besemer and Treffinger (1981) proposed a model, the Creative Product Analysis Matrix (CPAM). The main purpose of CPAM is to help non-practitioners to evaluate creative products in a systematic manner, and it has been found especially useful in increasing the generalizability of the judgments of creative products made by untrained judges (Besemer & O'Quin, 1999). Another important function of the CPAM identified by Besemer and Treffinger's original study was that it helped art students to develop their self-assessment skills, which in turn increased their creative performance.

The CPAM is a three-factor model, consisting of *novelty*, *resolution*, and *elaboration/synthesis*. Novelty concerns the originality of the concepts underlying a product as well as the methods used to present it. Resolution refers to how well the product fits into its context: i.e., its functionality, usability, and accessibility. The last factor, elaboration/synthesis, pertains to aesthetic and stylistic perspectives. These three factors are further divided into nine facets. For novelty, these are originality and surprise; for resolution, logic, usefulness, value, and understandability; and for elaboration/synthesis, organic qualities, craftsmanship, and elegance.

The development of the CPAM is to help students as well as teachers improve the accuracy and validity of judgments of creative products. Based on the CPAM model, Basemer and O'Quin (1986) developed the Creative Product Semantic Scale (CPSS) as an evaluation instrument to creative products. The assumption of the CPSS is grounded in that untrained judges, with the help of validated and reliable instrument, can make informed judgments of creativity in products. The CPSS instrument has evolved different versions (Besemer, 1998), which was shortened from 55 item pairs to 43 items.

The CPSS instrument is scored on 7-point Likert-type scales, ranging from 1 to 7 between bipolar adjectives such as *old-new*. Each of the nine subscales is created of four or five items. Subscale scores are constructed by taking the mean of the items that make up the subscale. For example, the subscale *Elegant* has five items (pairs of adjectives): *graceful-awkward*, *refined-busy*, *coarse-elegant*, *repelling-charming*, and *attractive-unattractive*. A participant's score for *Elegant* is computed by taking the mean of the scores for these items.

## 3. Method

The research was undertaken at City University of Macau, a small private university in the Macau Special Administrative Region of China. A qualitative approach was selected, as the best means of exploring the participants' perceptions. Our methodological approach is rooted in the fact that, as educators, our classroom experiences are tightly interwoven with those of our students, and the idea that reflecting upon experiences themselves will enable us to discover the true impact of a learning intervention. This article therefore attempts to capture specific moments that help us understand learning outcomes from the perspective of the students' creative processes, with the wider aim of promoting creativity in education.

### 3.1 Participants

This study employed purposive sampling. A total of 68 second-year undergraduates (43 women and 25 men) from the Department of Art and Design were selected to participate in the study. The students were informed that taking part in the study was a course requirement.

### 3.2 Instruments

For purposes of the current study, the researcher developed a grading sheet based on the CPAM model, incorporating its three main factors and their nine sub-components as discussed above. Each subsidiary nine facet was scored on a 5-point Likert-type scale, ranging from 1 (least favorable) to 5 (most favorable). Thus, the total score an individual

respondent could obtain ranged from nine to 45 points. This grading sheet was distributed to students before they designed their projects: in this case, using the graphic-design program Adobe Illustrator to design weapons for a computer game. This assignment was a normal part of their foundation course in comics and animation.

The instructor used the grading sheet as an example during in-class discussion of the CPAM model, and informed the students that their projects would be assessed using the grading sheet. After finishing their design projects, in order to help them to further understand the CPAM model and its components and underlying concepts, they were asked to use the grading sheet to assess each other's projects. It was expected that this peer-assessment phase would further reinforce the effects of the intervention.

### 3.3 Data Collection

To gain an understanding of the students' perceptions of the CPAM model and its possible effects on their creative and learning processes, each was asked after finishing their project to write a reflection paper in response to five open-ended questions. These reflection papers were treated as core documents for further qualitative analysis. The main reason we used this method instead of interviews was to allow the participants sufficient time for critical self-reflection and introspection, and therefore provide more detail about their private feelings and perceptions during the experiment. The five questions were: (a) What is the most creative part of this project? (b) What are the most challenging parts of your creating process? (c) What do you think of the CPAM model? (d) How do you think the CPAM model related to your project? and (e) What lessons have you learned from the process of creating the project?

### 3.4 Data Analysis

Thematic analysis was used for the qualitative data, which were initially translated from Chinese into English by the researcher, and then coded in small segments and sorted into meaningful categories (Creswell, 2007). All the coding and content analysis involved a constructive process of thematizing these categories through the use of the qualitative data analysis software HyperRESEARCH 3.5 (2013) for further analysis.

## 4. Results

Three main themes emerged from the data. These were: (a) creative approaches to generating products; (b) positive and negative experiences in the creative and learning processes; and (c) the effects of introducing the CPAM model. Each theme is discussed in more detail in the following section.



Figure 1. Examples of weapon designs

### 4.1 Creative Approaches to Generating Products

Figure 1 shows examples of students' weapon designs from the class. Most of them combined two different concepts in order to create unique weapons. For example, one student devised a knife that could be concealed in a pair of high-heeled boots. Another inspired by the shapes of fish, created a fish knife in which the tail of fish was the handle and the body of fish the blade. One other student created a magic wand that combined the ears of wolf and a bow-tie knot, and a male student's long curved blade was inspired by the shape of the crescent moon and a fishhook. One female student discussed how her idea emerged from her personal life:

Creativity comes from life and personal experience. My project is closely related to my personal experience. In winter, I have seen beautiful snow and that stays in my mind all the time, so in my creation the first idea that pops up is the theme of snow. I do believe that the best creativity comes from passion in my heart. That manifestly beautiful scenery in my mind emerges as creativity. Although everyone is different in his design style, I bring what I like into my creation in order to present my own creativity.

Most of the students seem to have thought that the most creative parts of their design were the overall appearance of the weapon and their color choices. They believed their creative action was supported by bringing together diverse elements,

either from nature or from man-made products, to create unique weapons. One male student wrote, "I think the most creative part of my weapon is its shape. Novel form makes people feel fresh and more special." Of course, some students considered functionality as well as aesthetics when designing their weapons. As one student mentioned, "in this project, I consider that the most creative part is its functionality, because it is not only simple and elegant but also thinking outside the box."

Still others mentioned the creation of unique logos for their weapons as the most creative aspect of the project. For example, one student transformed the shape of a Dark Jedi from Star Wars into a logo for a hidden weapon for women. In other words, creativity does not emerge from nowhere. As one student put it, "creativity and innovation is a high-risk thing." Most students firstly surfed the web seeking information about weapons and looking for others' work to refer to. Then, they attempted to combine two different types of objects, in order to create a unique look for their own weapon.

#### *4.2 Positive and Negative Experiences in the Creative and Learning Processes*

Most of the participants mentioned that the principal difficulties they faced in the creative process involved the use of color schemes and shadowing for the purpose of making their weapons look more three-dimensional. Some students also considered the texture and tone of their weapons, while others considered adding special effects for their weapons. As a result, many of the students reflected that they had devoted the greater part of their time and energy to dealing with the issue of color. As one noted, "The most difficult part is coloring. Making color bright and gaudy is a troublesome task, which even makes me lose my patience!" Another complained that "because we didn't do this before, we needed to experiment non-stop. It is not difficult, but trouble!" Yet another wrote, "I haven't done that before, so I feels terrible! I am not good at coloring and don't know how to make it more delicate and three-dimensional. I learned the tricks through countless efforts." One student made the point that "because a weapon is a three-dimensional object, in design it is important to consider how to present the change from two-dimensional to three-dimensional. I think the trick is in variation of colors and presentation of objects' shadows." Another mentioned a higher-order difficulty: "when I radically change the structure of a weapon, the paradox between usability and aesthetic keeps bugging me."

As might be surmised from the above selection of comments, most of the students were new users of Adobe Illustrator. Their course was a graphic-design foundation course focused specifically on using this software to create marketable products. Because of their limited knowledge of this software, most students recognized that it was one of their blocks to freely creating products. One student wrote, "I lack the skills to execute what I want. It takes time to practice." Another stated, "I faced lots of difficulties while trying to finish this project. First, because I am not familiar with the software, the process was hard going at the start. I always confused the uses of each tool, so I wasted lots of time on that!" One student described her difficulties in finishing this project:

First, I don't have enough information in my brain to imagine any weapon, so it limits my ideas for weapon design and construction. Second, I just learning Adobe Illustrator and not an expert, so I experience tremendous problems and difficulties in operating the software. Speaking of coloring, the choice of color is also important. I got lots of help from a teacher and classmates on running the software and color schemes.

While most students felt frustrated about navigating the software, they nevertheless appreciated that this project was a good opportunity to practice the use of this powerful digital design tool and learn about it more deeply as an important aspect of their career training. One student stated,

I feel that in some ways my knowledge and experience is shallow. I should build a database for myself to include all kinds of useful materials and design elements, thereby I can generate more satisfying works through what I have learned. I think the weapon design project is interesting and fresh. In order to do this project, I discussed it with my friends who play games all the time, and also reviewed some related books and information.

Another student discussed how she dealt with her difficulties. "There are some parts that are hard to deal with. Also my thoughts are not clear enough, to the point that the whole process is not smooth. So I checked tutorials on the web and got help from others." One student shared this experience:

I feel that I have been upgraded in skill at using this software via accomplishing this project. I didn't know where to begin because I had never learned this software. The learning progress was quite slow and I felt lost in the process. After I completed this project and made a weapon, I felt satisfied and it gives me a sense of achievement. I like the teacher's way of teaching and I learn a lot!

One student pointed out that "it is important to have a good design idea, but at the same time using software expertly is also important. Otherwise, it will become awkward that you have a great idea but cannot make it happen because of not being proficient in using software. This is really a disadvantage to being a graphic designer." Another student believed the key was not skill but "patience, which is only the important quality of completing a project. It can conquer difficulties at some level and attain the goal." Along with patience, one female student noted passion as another

important quality:

Although I am a manga lover, I never thought of designing weapons. As far as creativity, it is interesting! This project makes me put what I love into practice and I truly believe that as long as we have passion about it we can make it. Although the process is kind of difficult, I am still willing to investigate and learn to complete this project. I hope next time the teacher can deliver another interesting project for us.

In short, most of our respondents believed that they needed more practice, and that practice makes perfect. They realized that it was not a simple task to design a weapon for a game, although it looks easy at the first glance. In addition, the “aha” moment needed time to incubate, and feeling stuck at the beginning, some students sought inspiration from outside resources. In completing this project, students acknowledged their disadvantages, but also actively handling their issues through consultation with others and Internet research.

#### *4.3 The Effects of Introducing the CPAM Model*

Perhaps unsurprisingly, given that the main purpose of the current study was to introduce the CPAM model as an intervention, most students made some mention of its effects on their weapon design and execution. Generally, they viewed the CPAM rubric as a guideline and foundation for their design direction, with some reporting that it helped them clarify their thoughts and focus on details. One student wrote, “My previous work only concerned my views and I never seriously considered whether others would accept it. The CPAM model helps me understand the preconditions for designing a project.” Another stated, “it helps me more clearly analyze problems and make a plan.” Others believed that the CPAM helped them to express their creative ideas more freely and overcome obstacles. One student noted that “using the CPAM makes me be clear about the direction and theme of my work and also helps me focus on details in order to refine my work.” Another pointed out, “Because the CPAM contains different dimensions, when designing a product, you cannot only focus on one element and not think of other perspectives. For instance, a product cannot only be focused on appearance without functionality, and vice versa. Thus, the CPAM does impact my production.” One student argued that

The CPAM model provides me with a goal for creative design. In the future, I will try to assess others’ work from the perspectives of the dimensions provided by the CPAM. I will also attempt to learn from others. Most importantly, these criteria can help me construct my future design projects.

On the other hand, some students reflected chiefly upon themselves, and suggested that using the CPAM model could help them develop their abilities to critique others’ work, as well as improve the quality of their own. One student stated, “by introducing the rubric of the CPAM, I will ask myself ‘am I creative enough?’ ‘Is my work refined enough?’ ‘How can I finish the project?’ and so on.” Another pointed out the importance of reflection for recognizing strengths and weaknesses:

As a designer it is important to reflect on what you have done... whether it is good or bad. Because in the process of reflection, you will realize your own problems and have a chance to improve that so that the next time, your work will become more perfect.

Although most students reported a positive influence of the CPAM on their work, not all of them welcomed this intervention. Some argued that the model had had no influence on their creations, or worse, might even block their creativity. One student wrote: “If we are too focused on this rubric, it might form an invisible frame so that we cannot think outside the box!” Another student, who claimed to have been completely influenced by the CPAM while working on his project, said that “creation and the direction of production stems from my personal skills and experience, which affect my work production. Everyone is different. This model cannot include all my unique ideas.” One student said he just followed his heart without considering the CPAM model:

I feel that the CPAM model introduced in the class has not affected my creation and creativity at all. Normally, I will have my own idea and follow my thought to complete the project. I think that as long as I work hard and revise my works based on teachers’ comments, everything will be fine. I just do what I do and leave the critiquing to others. I don’t worry about that.

Still others reported that they thought the CPAM was only a measurement and did not affect their approaches to creative production. One student viewed the rubric as a reflection of professional level, but as falling short of proving a creation’s quality. Another thought that the CPAM was “not fair enough because everyone’s opinion is different. Even worse, this rubric might limit our creativity and confuse our thoughts, which are disadvantages in design.” One student provides a suggestion for teachers who might use the rubric in the future:

In general, this rubric cannot reflect all perspectives on a work, so it is not suitable for assessing others’ works. It is better to include the creator’s own description of and statements about his work when assessing a product. If we don’t receive a message from the creator and only judge a work based on its appearance, the chances are that we

will not understand the hidden message and true meanings of the work.

Other students defended the CPAM. One called it “very creative and logical as a scientific measurement, and makes students more motivated to create.” Another stated that CPAM allowed him to “understand what is the point and what I should put more efforts into on my design, such as the quality of surprise. If my design cannot impress others through surprise, this might indicate that it is not a good design.” Another praised the model as “novel” and suggested that it would “help students write their design statements.” And another felt that CPAM could help students realize the general idea of their creations and lay the groundwork for future job training. In short, the majority of respondents felt that the CPAM model helped them practice independent thinking and inspired ideas that helped them accomplish the task at hand. In addition, some felt that it provided a more objective means of assessing the quality of creative production, and allowed them to see their work from the viewers’ perspective.

## 5. Discussion

Before turning to the broader implications of this study, certain limitations should be mentioned. To begin with, our focus on graphic design may mean that the results are not generalizable to other aspects of creative endeavor, even in the visual or performing arts. Moreover, it should be recognized that we have examined one cultural group from one institution. The CPAM approach could be tested against some other, rival approaches and/or a control group. Although by their nature, qualitative studies are not designed for generalizability, it would be interesting to conduct cross-cultural studies analyzing similarities and differences in the participants’ experience. Along related lines, the use of college students as our study sample allowed us to investigate only one professional level. To some extent, these students can be treated as semi-experts, but future studies would benefit from the recruitment of at least three groups – experts, semi-experts, and novices – whose accounts of the creative process could be compared and contrasted directly.

Nevertheless, our study had several findings that are of significance to the design-education literature. This qualitative study privileges the students’ experiences, voices and feelings to gain a better understanding of how a particular pedagogical approach in an undergraduate art and design program impacted creativity and learning. Three major themes were found during the data analysis: (a) creative approaches to generating products; (b) positive and negative experience in the creative and learning process; and (c) the effects of introducing the CPAM model.

In keeping with psychological creativity theory, most of our respondents employed associations to generate new ideas during what Mayer (1995) termed an *incubation period*, then consciously or unconsciously used them to produce new combinations, leading to what the same author referred to as *illumination*. In addition, our respondents’ knowledge played an important role in their generation of creative products, and this finding is also supported by prior research (Weisberg, 2006). Most of the students acknowledged that their lack of knowledge about existing weapons led to difficulty in creating new ones. As a result, they expended considerable effort familiarizing themselves with the structure of weaponry, immersing themselves in this topic until they had sufficient confidence to create their own.

When investigating these students’ design process, we found that they experienced a pattern similar to that identified by Wong and Siu (2012), consisting of situation, research, ideation, development, and realization (p. 443). As reported above, our respondents first encountered a task that was new to them, and in order to complete it, they engaged in research – whether via the web and by consulting peers and the teacher. Having confirmed their idea, students in the development stage faced another challenge due to their lack of expertise in using the required software. Some felt frustrated and depressed about their progress. They realized that more practice would be needed if they were to develop the technical and practical skills needed to design a decent product. After considerable effort marked by patience and passion, they felt a sense of accomplishment and were satisfied both with what they had learned by going through this process, and with its specific results.

Bearing in mind Giloi and du Toit’s (2013) discussion of various approaches to the assessment of students’ learning performance in higher education, we suggest that the CPAM model can be used in design-education contexts not only to assess creative products, but also as a bridge between process and product through the ongoing discussion between lecturers and students that it facilitates. The current study provides some evidence that the CPAM is a useful tool for design students, providing inspiration, direction, and guidelines for their production, as well as helping them to reflect upon different characteristics of work and providing them with a means of assessing their own and others’ work more objectively. Additionally, it is a valuable learning tool for individual seeking to understand their own strengths and weaknesses. Although some students expressed concern that this rubric might block their creativity, most students responded positively to the instructor’s introduction of the CPAM into the class, and suggested that it would be a useful tool during their further training and/or their future professional careers.

The major contribution of the current study is to the literature of art and design education, by proposing a viable creativity strategy for tertiary education. Clarke and Cripps (2012) have written that “artistry in teaching mirrors the creative process in that lecturers are constantly making choices in relation to their students and their curriculum and sometimes

their choices are in error” (p. 123). It is suggested that the CPAM model could be used as a set of criteria with which design educators could objectively assess students’ creative products, as our participants found it easy to understand. According to the design students’ statements, the CPAM enabled them to conduct a series of reflections on their design processes to better understand their strengths and weaknesses, and to overcome difficulties via focusing their energy more clearly on the tasks at hand. They believed that with passion and patience, eventually they would transcend their present creative limits and perform better on the next task.

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