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Using Creativity Levels as a Criterion for Raters Selection in Creativity Assessment

Yuan Yin[1], Kamyar Hazeri[2], Shafina Vohra[3], Haoyu Zuo[4], Shu Huang[5], Bowen Zhan[6], Peter R N Childs[7]

[1]*Imperial College London, London, UK*
y.yin19@imperial.ac.uk
[2]*Imperial College London, London, UK*
k.hazeri13@imperial.ac.uk
[3]*Imperial College London, London, UK*
s.vohra19@imperial.ac.uk
[4]*Imperial College London, London, UK*
h.zuo19@imperial.ac.uk
[5]*Imperial College London, London, UK*
h.zuo19@imperial.ac.uk
[6]*Imperial College London, London, UK*
b.zhan19@imperial.ac.uk
[7]*Imperial College London, London, UK*
p.childs@imperial.ac.uk

Abstract

This study aims to identify how raters' creativity levels affect the creativity assessment results and whether raters can be divided based on their creativity levels instead of their experience on creativity. The results indicate that raters' cognitive-process-related creativity levels can affect the results of creativity assessment. This result supports the possibility that raters can be determined based on their creativity level to assess creativity outputs.

Keywords: Design creativity, design evaluation, idea generation, assessment

1 Introduction

Creativity is the ability to image or invent something valuable and novel (Sarkar & Chakrabarti, 2011; Yin et al., 2021). Creativity assessment measurements have been extensively investigated (Amabile, 2018; Besemer & O'Quin, 1999; Cropley et al., 2011; Haller et al., 2011). Creativity assessment measurements are mainly promoted based on personality traits (Costa & McCrae, 1992; Epstein et al., 2008; McCaulley, 1985; Taylor & Fish, 1979; Torrance, 1976), creativity expression styles (Basadur et al., 1990; Epstein et al., 2008; Kirton, 1976; Kumar et al., 1997), divergent thinking (Auzmendi& Abedi, 1996;

Guilford, 1968; Menashe et al., 2020; Runco et al., 1994; Torrance, 1990), environmental effects (Amabile & Gryskiewicz, 1989; Walberg & Anderson, 1968), and creative achievements (Ludwig, 1992; Richards et al., 1988).

Existing research has tried to identify suitable raters for different creativity assessment methods. One popular division way on raters is whether they are experts or non-experts in creativity. Kaufman et al. (2008) required 10 experts and 106 non-experts to assess the creativity of 205 poems using CAT. The results showed that the creativity level assessed by experts was lower than that of the non-experts (correlation 0.21). This indicated the raters' experience on creativity can be a rater-division way. This division way has been broadly used in existing creativity assessment methods to suggest who should be the best raters. From existing research, experts raters were suggested when using Creative Product Analysis Matrix (CPAM; Besemer & O'Quin, 1999), Creative Product Semantic Scale (CPSS; Besemer & O'Quin, 1987), Consensual Assessment Technique (CAT; Amabile, 1982), Torrance Tests of Creative Thinking (TTCT; Torrance, 1990), and Abbreviated Torrance Test for Adults (ATTA; Torrance & Goff, 2002) to assess creativity. Non-experts raters were suggested when using Creative Solution Diagnosis Scale (CSDS; Cropley & Cropley, 2008), and Product Creativity Measurement Instrument (PCMI; Horn & Salvendy, 2009) to assess creativity.

Although different raters have been suggested for different assessment methods, some researchers mentioned that assessment results from different raters were the same. Haller et al. (2011) required five experts and five non-experts to evaluate the creativity levels of 55 students' outputs by a five-point Likert scale. The results showed that experts and non-experts had a similar rating ability (correlation 0.87; Runco et al. 1994).

Based on the previous studies, whether non-experts or experts should be the raters of creativity assessment remains controversial. A reason why people think experts should be raters may be that experts have a stricter standard for creativity or have a more objective understanding of creativity assessment criteria than non-experts. The reason why people think non-experts and experts have no differences in assessing creativity is that creativity assessment is mainly based on raters' critical abilities. Non-experts raters' critical abilities are the same as that of experts raters (Perkins & Perkins, 2009).

Some researchers promoted that the reason on whether experts or non-experts can be the better raters is uncertain maybe because of the unclear boundary between experts and non-experts. Now, the experts and non-experts are divided based on their experience in creativity. However, this experience period boundary has not been agreed on. Some researchers use five-year experience in creativity as the boundary while some use 10-years. Therefore, another way to determine who should be the raters to avoid this unclear boundary is expected.

Researchers have found that creativity assessment process is a subjective assessment process (Amabile, 1982;Chen et al., 2002; Hennessey et al., 2008; Freeman et al., 2015; O'Quin & Besemer, 1989). Raters have their own implicit rules and theories in understanding what is creativity (Haiying, 2014; Haiying & Pang, 2015; Mouchiroud & Lubart, 2001). These rules and theories may affect the assessment results. In other words, the assessment results are affected by raters' creativity levels. Therefore, who should be the raters in assessing creativity may be determined by the creativity levels of raters (Suler, 1980).

Therefore, this study tried to identify (i) how raters' creativity levels affect the results of their assessment process; (ii) whether raters can be suggested based on raters' creativity levels. The

results are expected to promote a new way to decide who is the better raters and help researchers to select the best raters in assessing creativity process.

2 Method

2.1 Participants

This study recruited 90 Chinese designers (45 males and 45 females, aged 18-35) who have experience in assessing creativity for design works, theses, competitions, or posters. Also, the participants have no limitations in their reading abilities and could use phones or computers to finish the questionnaire by themselves.

2.2 Methodology

The questionnaire was divided into three parts: basic data collection, using four creativity assessment criteria (originality, elaboration, fluency, and flexibility) to assess six selected ideas, and finishing two personal creativity assessments inventories: Competencies Inventory for Individuals (ECCI-I; Epstein et al., 2008) and Cognitive Processes Associated with Creativity (CPAC; Miller, 2014)).

2.2.1 Selection of creativity assessment criteria

Torrance and Goff (2002) suggested that creativity assessment is based on four criteria: fluency, originality, elaboration, and flexibility (coefficient = 0.84; Kharkhurin & Samadpour, 2008). Fluency is a reflection of how many ideas the individual could generate; Originality is used to evaluate the ability to generate novel ideas; Elaboration refers to the ability to express ideas in detail; flexibility is the ability to deal with different kinds of information. For each selected idea, participants were asked to provide a score from 1 to 5 for each creativity assessment criterion. A lower score means a worse performance. For example, for fluency, "1" means the least fluent while"5" is the most fluent.

2.2.2 Selection of target assessed outputs

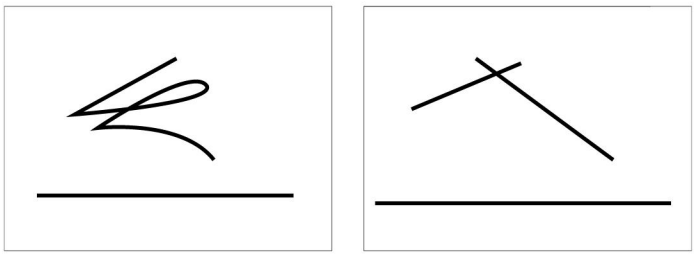


Figure 1. Two single-idea figural response tasks

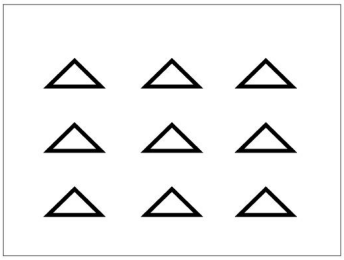


Figure 2.The multiple-idea figural response task

The six ideas assessed in this study were selected from the research of Shen and Lai (2014). In Shen and Lai's (2014) paper, they included top-two-student figural responses tasks results.

The figural response tasks included two single-idea figural response tasks (Figure 1) and one multiple-idea figural response task (Figure 2). The single-idea figural response task asked the students to generate an idea based on the given figure and named them. The paper used "single-idea task" to represent the expression of "single-idea figural response task". The multiple-idea figural response task asked the students to generate nine ideas using the given nine same triangles. The paper used "multiple-idea task" to represent the expression of "multiple-idea figural response task". A total of six ideas selected. Four of them are single-idea task results and two are multiple-idea task results. All creative outputs are available in Shen and Lai's (2014) paper and are not displayed in this paper out of the copyright consideration.

There was a delay between Shen and Lai's (2014) publication and when the study has been conducted. In Shen and Lai's paper, creativity has been assessed. If participants have read the paper before, their assessment results may be affected. Therefore, before the study, participants were asked whether they read the Shen and Lai (2014) paper before. The participants whose answer was yes were excluded from this study. In this way, the study may ensure the information delay does not have an influence on this study.

2.2.3 Raters' creativity assessment methods

The two personal creativity assessment inventories used in this paper were ECCI-i (Epstein et al., 2008; questionnaire from: https://mycreativityskills.com/) and CPAC (Miller, 2014). ECCI-i can assess personal creativity expression ability based on capturing, challenging, broadening, and surrounding (Epstein et al., 2008; Epstein & Phan, 2012). It is a 28-item questionnaire. Participants need to self-report their condition based on the statements using a 5-point Likert-type scale. CPAC is a 28-item 5-point Likert-type scale that can assess personal creativity in relation to the following six dimensions: idea generation, metaphorical/analogical thinking, idea manipulation, incubation, imagery/sensory, and flow.

The reason why the two inventories were selected is that the two methods could capture personal creativity from external and internal aspects respectively. To be specific, ECCI-i could evaluate the ides-express ability skills of an individual while the CPAC could reflect participants' cognitive process in the creativity process.

2.3 Procedure

After reading the information sheet and signing the consent form, participants were sent the questionnaire link through email. The questionnaire was built through Qualtrics. Participants were asked to follow the instructions to finish three parts inventories. In the first part, the questionnaire collected participants' basic information. In the second part, participants were asked to assess the six selected ideas (four single-idea task results and two multiple-idea task results) through the four creativity assessment criteria (fluency, originality, elaboration, and flexibility) from the score 1 to 5. The six selected ideas were shown at random. Finally, participants were asked to complete two personal creativity assessment scales (ECCI-i and CPAC). Participants took no more than a half hour to finish the entire questionnaires. The study was approved by the first author's institution. All participants were voluntarily enrolled in this study. Figure 3 displays the whole protocol for this study.

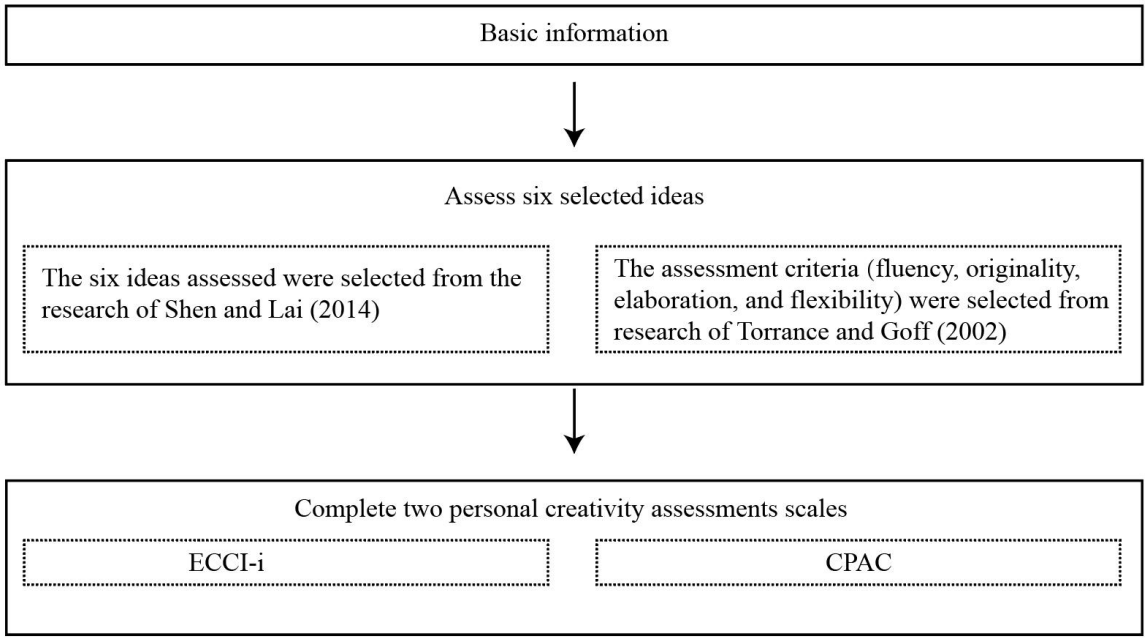


Figure 3. The whole protocol for this study

3 Results

3.1 Descriptive statistics for experts

The descriptive statistic results of the 90 participants were shown in Table 1.

Table 1.Mean value and standard deviation results

Task	Assessment Criteria	Mean value	Standard deviation
Single-idea task	Originality	3.73	1.45
	Elaboration	3.67	1.35
	Fluency	3.62	1.38
	Flexibility	3.55	1.41
Multiple-idea task	Originality	3.67	0.93
	Elaboration	3.63	0.95
	Fluency	3.56	0.93
	Flexibility	3.48	1.02

3.2 Relations between raters' creativity levels and assessment results

Repeated measures ANOVA was used to identify the relations between the raters' creativity levels and the different creativity assessment criteria (originality, elaboration, fluency, and flexibility). Two kinds of raters' creativity levels' division methods were represented by CPAC and ECCI-i separately. The repeated measures ANOVA results on the relations between CPAC and creativity assessment criteria were shown in Table 2. The repeated measures ANOVA results on the relations between ECCI-i and creativity assessment criteria were shown in Table 3.

For the single-idea task, the CPAC scores had a significant relationship with the results of the originality criterion ($F(1,78) = .4.497$, $P=.037<.05$), the elaboration criterion ($F(1,78) =12.203$, $P=.001<.05$), and the fluency criterion ($F(1,78) = 4.318$, $P=.041<.05$). The CPAC scores did not have a significant relationship with the results of the flexibility criterion ($F(1,78) = 2.078$,

P=.153>.05). The ECCI-i scores did not have a significant relationship with the results of the originality criterion (F(1,78) =2.564, P=.113>.05), the elaboration criterion (F(1,78) = 1.817, P=.182>.05), the fluency criterion (F(1,78) = .708 P=.403>.05), or the flexibility criterion (F(1,78) = .766, P=.384>.05).

For the multiple-idea task, the CPAC scores had a significant relationship with the results of the elaboration criterion (F(1,78) =5.715, P=.019<.05), and the fluency criterion (F(1,78) = 6.394, P=.013<.05). The CPAC scores did not have a significant relationship with the results of the originality criterion (F(1,78) = .473, P=.493>.05), or the flexibility criterion (F(1,78) = 2.919, P=.092>.05). The ECCI-i scores did not have a significant relationship with the results of the originality criterion (F(1,78) =.210, P=.648>.05), the elaboration criterion (F(1,78) = .696, P=.407>.05), the fluency criterion (F(1,78) = 1.252 P=.267>.05), or the flexibility criterion (F(1,78) = .080, P=.778>.05).

Table 2.Repeated measures ANOVA results on the relations between CPAC and creativity assessments criteria (originality, elaboration, fluency, and flexibility)

Task	**Assessment Criteria**	**CPAC**				
		Type III Sum of Squares	df	Mean Square	F	Sig.
Single-idea task	Originality	21.325	1	21.325	8.007	.006
	Elaboration	25.518	1	25.518	12.203	.001
	Fluency	11.491	1	11.491	4.318	.041
	Flexibility	7.585	1	7.585	2.078	.153
Multiple-idea task	Originality	.513	1	.513	.473	.493
	Elaboration	6.395	1	6.395	5.715	.019
	Fluency	6.923	1	6.923	6.394	.013
	Flexibility	4.158	1	4.158	2.919	.092

Table 3.Repeated measures ANOVA results on the relations between ECCI-i and creativity assessments criteria (originality, elaboration, fluency, and flexibility)

Task	**Assessment Criteria**	**ECCI-i**				
		Type III Sum of Squares	df	Mean Square	F	Sig.
Single-idea task	Originality	6.829	1	6.829	2.564	.113
	Elaboration	3.799	1	3.799	1.817	.182
	Fluency	1.884	1	1.884	.708	.403
	Flexibility	2.794	1	2.794	.766	.384
Multiple-idea task	Originality	.227	1	.227	.210	.648
	Elaboration	.779	1	.779	.696	.407
	Fluency	1.356	1	1.356	1.252	.267
	Flexibility	.114	1	.114	.080	.778

4 Discussion

In this section, the study will discuss the results and analysis the limitations of this research.

4.1 Results discussion

The results showed the relationships between the raters' creativity levels and their assessment results. The ECCI-i was able to evaluate the basic skills that an individual needed to express his or her ideas. If the results showed that the ECCI-i scores have a significant relationship with the results of an assessment criterion, this would then mean that the raters' creativity-

expression ability levels will affect this assessment criterion. The CPAC reflected the participants' own creativity by reporting their cognitive processes in creative process. If the results show that the score of the CPAC has a significant relationship with the results of an assessment criterion, this means that the raters' cognitive-process-related creativity levels may affect this criterion assessment.

From the results, in the single-idea task (generating one idea based on one given graphic) and the multiple-idea task (generating nine ideas based on the same graphic), the ECCI-i scores does not affect the results of the four assessment criteria. This indicated that raters' creativity-expression ability do not affect the creativity assessment process. This may be because the creativity-expression ability levels are more likely to affect the rater's own creativity instead of affecting their results on assessing other's product creativity. However, considering the study uses the ECCI-i results to represent the raters' creativity-expression ability levels, the results may be not so reliable and worth further discussing.

The results also show that the CPAC scores affect the assessment of the elaboration criterion in both kinds of tasks. The CPAC scores also affect the assessment results of the originality criterion in the single-idea task. The flexibility criterion is not affected by the CPAC results. The effect of the CPAC scores on the fluency criterion assessment in the single-idea task is uncertain. In other words, the raters' cognitive-process-related creativity levels are likely to affect the results of the originality criterion assessment in the single-idea task, and the results of the elaboration criterion assessment in the single-idea task and the multiple-idea task. The raters' cognitive-process-related creativity levels have no effect on the assessment of the flexibility criterion.

These different effects may be attributed to the fact that originality is used to evaluate the ability to generate novel ideas, whereas elaboration is the ability to express ideas in detail. The assessment of the two criteria involves raters' judgment on what novelty is and how they think the ideas are expressed. Flexibility is the ability to deal with different information and it is idea-generator ability instead of the raters' ability. Therefore, the flexibility criterion assessment may not have relationship with the raters' cognitive-process-related creativity levels.

4.2 Limitations and future research

One limitation of this study is that it only tested two aspects of human creativity (cognitive-process-related creativity levels and creativity-expression ability levels) to replace the raters' creativity. Also, it used the CPAC results as a substitute for the raters' cognitive-process-related creativity levels and the ECCI-i results as a substitute for raters' creativity-expression ability levels. This may reduce the reliability of the results. To make the results more reliable, studies that can test more kinds of people's creativity are suggested. Furthermore, the reliability of the results is reduced because of the limited number of selected ideas. Therefore, studies on more assessment items and criteria need to be considered. Moreover, the two raters' creativity assessments, ECCI-i and CPAC, were conducted at the end of the questionnaire. The raters' creativity assessment results may also be affected because of this questionnaire order. Future studies need to recruit more participants and smartly test the raters' personal creativity levels and assess selected ideas' creativity.

5 Conclusion

The study detected (i) how raters' creativity levels affect the creativity assessment results; (ii) whether raters can be divided based on the raters' creativity levels instead of their experience with creativity. The results of this paper indicated that the raters' cognitive-process-related creativity levels affect the creativity assessment results while the raters' creativity-expression ability levels do not affect them. These results indicated that raters' creativity levels can affect the results of creativity assessment criteria and further supports the possibility that raters' creativity levels can be used to determine who can be qualified as raters in creativity assessment. In the future, the study will further detect which raters' cognitive-process-related creativity levels related to higher inter-rater reliability.

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