EVALUATING THE CREATIVITY OF A PRODUCT USING CREATIVITY MEASUREMENT TOOL (CMET)

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ABSTRACT

This paper discusses the creativity evaluation of a mechanical engineering product namely “Rocket Motor” by using a quantitative measurement tool, which is a web-tool called Creativity Measurement Tool (CMeT). This tool is useful to measure product creativity based on four dimensions: Novelty, Usability, Effectiveness and Aesthetic Value. Each dimension encompasses several characteristics that are significant to assess the creativity of the product. A total of 100 novice respondents from engineering field were asked to rate the product on a scale from 1 to 4 with detailed descriptive of each scale for each characteristic. The results are reported in percentages according to each dimension and the overall score. Based on the CMeT result, the inventor can identify which dimensions that need to be emphasised and improvised.

Keywords: Creativity measurement tool, creative, creativity dimension

1. Introduction

The term ‘creative’ comes from the Latin word *creatus* that means, “to make, bring forth, produce”. Various definitions have been discussed by academic scholars from different disciplines; from arts, literature, psychology, economy, politics, language to science, technology, engineering as well as mathematics. The notion of ‘creative’ is inevitably subjective and inexplicable to a certain extent. Since the exact definitions of ‘creative’ slightly differs across discipline, many scholars concur that the term ‘creative’ is associated with novelty and usefulness. However, the product should have these two traits in order to qualify it as ‘creative’. It is because, if a product is original and unique but not beneficial to the society or something that is useful but not innovative cannot be considered as creative (Piffer, 2012). Nevertheless, the definition of creative does not limited to only these concepts. For many decades, the concept has included the idea of beauty, appropriateness, effectiveness and many more in exemplifying the creativeness of a product, which depends on human judgment.

When a creativity of a product is based on human judgment, the results show significant variations in the interrater reliability (Christiaans, 2002). The understanding of ‘creative’ is fairly different from one person to another. The cultural and educational background, perception, expectations, environment can influence the way people perceive about the definition of ‘creative’. In simplest way, we can say, different people have different way of interpreting creativity. Therefore, because of this subjectivity in measuring creativity, it sparks interest among modern scholars to develop a measurement tool that are able to assess creativity in objective manner.

In a modern and competitive business world, creativity of a product is very important. Consumers do not purchase a product not only because of the designs or functions, but they are looking forward to purchase product that is ‘creative’. Horn and Salvendy (2006) stated in their paper “the
consumers’ preferences for the product play a role in determining product creativity”. Since the demand of creative product is demanding every day, education is heading towards to produce not only high IQ and intelligent graduates but also creative graduates. Cropley and Cropley (2000) stated that ‘creativity adds something to intelligence’. Being able to recall the factual data, understand the theory, and apply logical thinking are not adequate to qualify student as ‘intelligent’ or ‘gifted’. By referring to revised Bloom’s Taxanomy (2001), recall, understand, and applying the facts require simple cognitive functions or lower order thinking skills. Unlike analyse, evaluate and create which require more abstract and complex cognitive functions. The latter shows higher order thinking skills which are integral in becoming a creative person. Since the current global marketplace seeks for innovation in a product, the education should place more importance in producing students who are able to be independent, creative problem solvers and risk taker.

2. Theoretical Framework

According to Candy and Bilda (2009), the assessment of creativity means that we set a certain value to a certain phenomenon that we called ‘creativity’. In order to evaluate creativity, the characteristics or definition of creativity should be developed first. From their research, the we can judge creativity by looking at the responses that were given by the audience, the features of the new product itself and the abilities of the product creator. Among these three perspectives, the product creativity is the most appealing way to judge product creativity. This is because it is a common practice, easier to evaluate, observable and tangible. In this research we will focus on this perspective in developing the assessment tool.

Bessemer and Triffenger (1981) cited from O’Quin & Bessemer (2006) has developed a model called Creative Product Analysis Model (CPAM) and later on improvised to become Creative Product Semantic Scale (CPSS) in 1989. This model is composed based on three important factors : Novelty, Resolution and Elaboration & Synthesis. These attributes are the basis on qualifying the product is either creative or less creative than existing product.

![Figure 1 Besemer and O'Quin's model for evaluating attributes of creative products](image)

The first dimension is novelty. This attribute is usually the first thing that people will mention in order to explain product creativity. Novelty comprises the originality and newness in making the product which involve materials, ideas, processes, and the concepts. The product is perceived as a creative one when it meets the current demand but with some additional innovative features and is not extremely different from the present product. A product that is extraordinarily innovative which
people nowadays cannot relate it with the current product, it might turn out to be a weird one rather than creative. Gruenwald (1992) citing from O’Quin & Bessemer (2006) explained that when the idea is too extraordinary and beyond the market needs, it is often a sign of a failed product.

The second dimension is resolution. A product that is high in resolution and novel means that it is a creative product. The term ‘resolution’ defines a well-functioning product, easy to use, well-crafted, beneficial and meet the needs of the problematic situation. Any product must have its own function, serves a specific purpose and offer solutions to a problem. When a product that is novel but impractical, it is not creative. The usefulness of a product is undoubtedly one of the important attributes to qualify a creative product.

The last dimension is originally known as elaboration and synthesis. However, due to the term is quite challenging to understand, Besemer and O’Quin renamed this factor as ‘style’. This dimension describes the presentation or the appearance of the product to the audience. This dimension values the aesthetics qualities of a product, the complexity of the product and how it can enhance the people’s impression to make it as a creative product.

In 1989, O’Quin and Besemer (1989) have developed a measurement scale called Creative Product Semantic Scale (CPSS). CPSS contains 55 adjective pairs, each answered on a 7-point response scale. The development of CPSS helps many people especially managers in business industry to decide about new ideas or products more on well-grounded basis rather than relying on their intuition. This measurement scale provides a better judgment and solid decision than what they previously practice.

![Figure 2 Besemer and O’Quin's example of subscales in CPSS](image-url)

3. Development of Creativity Measurement Tool (CMt)

Based on the dimensions created by Bessemer and O-Quin, our research team adapts the model by adding one more dimension which are novelty (novelty), usability (resolution), effectiveness, and aesthetic value (style). A new dimension (effectiveness) is added in order to fulfill the current demand of sustainability. Each dimension is defined as follows.

The first dimension is novelty. Novelty projects originality and newness in ideas, materials, processes (production of products) and concepts of making the product. Second dimension is
Usability. This dimension considers the appropriateness, functionality and adaptiveness of the product to its targeted audience and purposes. The third dimension is Effectiveness, which considers effective use of materials, processes and solutions to problems of making the product. Finally is Aesthetic Value describes the stylistic components of the product which include design, artistic qualities (colour, texture, details) and use of materials.

Creativity Measurement Tool (CMeT) is a measurement tool to assess creativity according to 4 dimensions. CMeT has been developed in order to assess creativity of a product in a more comprehensive way. Each dimension contains several items that display creativity and semantic differential scale is used to measure it. For your information, this tool was in preliminary stage when the research was conducted and we are still improving the tool. This paper intends to report the preliminary findings of the product creativity hence it will offer some insights on how to improve the tool in the future.

In CPSS that was introduced by Besemer and O'Quin's, they used adjective pairs as the items to be assessed. However, in CMET, we selected adjectives and nouns and we described each item briefly. In order to select suitable adjectives or nouns to be considered in CMeT, we consulted the experts in mechanical engineering field. We also referred to previous literatures from different fields, for example, engineering, mathematics, information technology and the like and examine their definition of novelty, resolution and style in respective field. After we selected the items for each dimension, we did a factor analysis and selected the most prominent and statistically significant items before we added them into CMeT.

The earlier stage of CMET, there are 34 items to be evaluated. After pilot testing and a few analysis, we narrowed down the items to 23 items only. In terms of the response scale, we adapted semantic differential scale. We opt to use this version rather than 7-point response scale because some of the items are quite difficult to get its exact opposites. To avoid inconsistency in developing the tool, we decided to describe each item in each dimension using 4-point Likert scale (refer figure 3). Such scale depicts clear distinction between ordinary product and creative product. Below are the examples on how each item in CMeT is described according to semantic differential scale.

<table>
<thead>
<tr>
<th>Material Durability</th>
<th>Not durable</th>
<th>Less durable</th>
<th>Durable for short period of time</th>
<th>Durable for a very long time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unexpected</td>
<td>Very ordinary and does not trigger interests</td>
<td>Rather ordinary and can possibly trigger interests</td>
<td>Reasonably surprising and triggers interests</td>
<td>Very surprising and triggers high interests</td>
</tr>
<tr>
<td>Dynamic</td>
<td>Cannot be adapted at all and only function in one situation</td>
<td>Cannot be adapted and can function in different situations</td>
<td>Can be adapted and can function in a few situations</td>
<td>Easily adapted and can function in many different situations</td>
</tr>
<tr>
<td>Inspiring</td>
<td>Not Inspiring</td>
<td>Slightly inspiring</td>
<td>Adequately Inspiring</td>
<td>Highly Inspiring</td>
</tr>
</tbody>
</table>

**Figure 3** Example of items and response scale in CMeT

4. Methodology

4.1 Sample and data collection method

Novice respondents from engineering field were selected to evaluate one mechanical engineering product. In this study, novice refers to people who have experience in the industry among 1-3 years and have basic knowledge about mechanical engineering product. Next, one mechanical engineering was identified by a qualified expert in the field as a product to be evaluated. The
product was “Rocket Motor”, and still in an early stage of development and has room for improvement. After the product and the respondents have been identified, the respondents were gathered and asked to fill up the questionnaire on CMeT website. Before they filled up the questionnaire, the respondents were informed about the products through slide shows, video, and demonstration of the product prototype.

4.2 Instruments

CMeT was used to evaluate the mechanical engineering product. There were 4 dimensions: novelty, usability, effectiveness and aesthetic value. Each dimension contains a few attributes that were related to each dimension. From 34 items in the early stage of the development, only 23 items were chosen. Factor analysis was computed in order to discover major common factors. For novelty dimension, there were 6 items : original, new, obvious, valuable, unexpected, and challenging. Next, is usability dimension, which included 6 items : learnable, operable, practical, size, dynamic, and material durability. Under effectiveness dimension, there were 4 items: cost, maintenance, safety and marketability. Lastly, was aesthetic value dimension which consisted of 7 items : trendsetting, organized, commercialization, inspiring, green, elegant, and risk-taking. All of these items were evaluated according semantic differential scale. The finding is then reported in percentages.

5. Finding & Discussion

5.1 Reliability analysis

By using SPSS Version 19, reliability analysis was computed. For this questionnaire, the Cronbach Alpha for this questionnaire is 0.781, and it was an acceptable value.

5.2 Descriptive statistics

The findings showed that males respondents was higher than females with a total of 80 male respondents (80.0%) and 20 female respondents (20.0%). All of the respondents were novice in engineering industry and have experience less than 3 years in this field.

5.3 Discussion

The discussion will be explained according to dimensions as it will give a clear view on which dimension should be emphasised and improvised. The average percentage of each dimension was calculated and the score would be then described. For this research, 0-25% means that the product is ordinary or bizarre, 26-50% means that the product has few creative features but still quite common in the market, 51 – 75% means the product is somewhat creative and has potential but several works should be implemented to make it as a creative product and lastly, 76 – 100% means the product is innovative and creative.

For the first dimension, which was novelty, “Rocket Motor” showed a percentage of 77.6%. The respondents believed that the ideas of the product was very innovative and rare; the materials used and processes involved in making the product were bold and stimulated new questions for further works. In terms of usability, the product was rated 75.9%, it is quite practical in its usage, size, durability, for its target users; the operation can be learned and the functions meets the current needs. For the next dimension, effectiveness, this product only received 51.3% , which means it was not really effective in the mass market. The product could be quite risky and dangerous since it was a motor of a rocket and only suitable to be marketed in its industry only. Finally, the assessment of aesthetic value dimension portrayed the highest level of creativity with a percentage of 91.3%.
Although the product was just a prototype, the overall style of the product was smart, meticulous and appealing to the respondents. After we summed up the score for each dimension and calculated the average score, “Rocket Motor” received 74.0%, which categorized the product under somewhat creative product but has potential to become a great creative product.

![Figure 4 The assessment of Rocket Motor in percentages](image)

Based from the description above, we can observe that this product needs some major improvement in terms of effectiveness of the product. This product is only effective when it is combined with a rocket body. The nature of the product itself, might as well influence the respondents’ view of the effectiveness of the product. On the other hand, this CMeT probably need some modification especially in terms of the attributes displayed in this dimension. The lack of information about the product and the number of attributes that were the least among the other dimensions, may also contribute to the vast difference of percentages. Overall, we believed that CMeT is a measurement tool that can assist users to evaluate the creativity of a product. However, a few alterations on the measurement tool should be made, especially the attributes and the semantic scales.

6. Conclusion and Future Recommendation

In conclusion, the findings showed that a quantitative measurement tool is possible to help users to evaluate their product creativity. Although CMeT is still in preliminary stage and constantly being reviewed, the potential of measuring product creativity quantitatively is bright. More creativity assessments are recommended. It should not be limited to engineering product only but could be applied to various products across the fields; a measurement tool that is applicable to all needs. Detailed investigation on selecting the right attribute and semantic scales should also be further examined and explored.

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References


