The integration of SCAMPER creativity technique and morphology design method for enhancing the process of lighting fixtures design

Dr. Mohamed Shohdy Ahmed
Lecturer, Metal Products and Jewelry Department – Faculty of Applied Arts – Helwan University

Abstract

Among the existing numerous problem-solving techniques used in design, SCAMPER technique, has proven to be the most successful and most gaining ground for application. SCAMPER technique uses a set of directed, idea-spurring questions to suggest some addition to, or modification of, something that already exists. Morphology is a creativity enhancement design method that is gaining acceptance in a wide areas of design activities. Observing work of design students and the evaluation of their outcome, level of creativity is the least element that gained appreciation from evaluators. Work exhibited by students lack in rigor the required level of originality, fluency and flexibility and to a lesser extent the level of illumination. Hence comes **the question**, Is it possible and to what extent can scamper technique integrated with morphology method enhance some of the attributes of creativity of a design program's ability to meet the creativity requirements in their lighting fixtures design works? Therefore **the main objective** of the present study has been to Set up a design procedure that is capable to provide students with the knowledge, mental skills and professional proficiency necessary to support innovative capacity and creativity among students in the field of lighting design. **Methodology;** Analytical Descriptive, and survey methods. **Hypothesis** of the study to match with the current study queries are; There is a significant difference between the current and the expected performance of the students before and after the application of the proposed design program, and The program will noticeably raise the efficiency of students and enable them to innovative design fixture carrying creativity attributes. **Main results** of the study include; The proposed design program extends the horizons of lighting design and allows for fluency, flexibility, and originality attributes to contribute to enhance students work. Also, if subjected to few adjustments the program would be utilized to fit other design fields. and according to views of questionnaire arbitrator the proposed design program satisfies the study hypothesis and provides an organized mechanism, to achieve certain creativity attributes and innovative ideas in students work

Keywords:

Scamper, morphology, creativity, design process

Introduction

SCAMPER technique, has proven to be the most successful and most gaining ground for application among the existing numerous problem-solving techniques used in design,. SCAMPER technique uses a set of directed, idea-spurring questions to suggest some addition to, or modification of, something that already exists. It has received much attention as a learning tool in the area of design that fosters awareness, drive, fluency, flexibility, and originality. The stimulus comes from being asked to answer queries that one would not normally pose.

When included in design situations, SCAMPER is used to produce original ideas. The creative process thrives on preparation, concentration, incubation, illumination, and verification (product testing)

Morphology is a creativity enhancement design method that is gaining acceptance in a wide areas of design activities. Observing work of design students and the evaluation of their outcome, level of creativity is the least element that gained appreciation from evaluators. Work

exhibited by students lack in rigor the required level of originality, fluency and flexibility and to a lesser extent the level of illumination.

Statement of the problem

Observing work of design students and the evaluation of their outcome, level of creativity is the least element that gained appreciation from evaluators. Work exhibited by students lack in rigor the required level of originality, fluency and flexibility and to a lesser extent the level of illumination. Hence comes the question, Is it possible and to what extent can scamper technique enhance some of the attributes of creativity to enhance the current program's ability to meet the creativity requirements in their lighting fixtures design works?

Objective

Setting up a design program that is capable to provide students with the knowledge, mental skills and professional proficiency necessary to support innovative capacity and creativity among students in the field of lighting design

Methodology:

Analytical Descriptive method

Hypothesis:

- There is a significant difference between the current and the expected performance of the students before and after the application of the proposed design program
- The program will noticeably raise the efficiency of students and enable them to innovative design fixture carrying creativity attributes.

Theoretical Background:

Creativity is a phenomenon whereby something new and somehow beneficial is formed. The created item may be insubstantial (such as an idea, a scientific theory, a musical composition or a joke) or an innovative physical object such as a product design.

Interest in creativity involves many definitions and concepts pertaining to a number of disciplines: psychology, cognitive science, education, philosophy (particularly philosophy of science), technology, theology, sociology, linguistics, business studies, songwriting, and economics, covering the relations between creativity and general intelligence, mental and neurological processes, personality type and creative ability, creativity and mental health; the potential for fostering creativity through education and training, especially as augmented by technology; and the application of creative assets to enhance the efficacy of teaching and learning. But it is a fact that the ambiguity surrounding the concept of creativity seems to render the phenomenon either elusive or trivial.

What is creativity?

Panagiotis Kampylis (2013) remarks that the majority of creativity definitions intersect at the following key components for understanding creativity:

1. Creativity is a key ability of individual(s).
2. Creativity presumes an intentional activity (process).
3. The creative process occurs in a specific context (environment).
4. The creative process entails the generation of product(s) (tangible or intangible).

All relevant studies state that creative products must be novel original, exceptional, eccentric and appropriate (valuable, useful) to some extent, at least for the creative individual (s).

They mainly define creativity as “a mental and physical activity that occurs in a specific time-space, social and cultural framework and leads to concrete or intangible outcomes that are original, valuable, ethical and desirable, at least to the creator(s)”.

Creativity is the bringing into being of something which did not exist before, either as a product, a process or a thought.

Someone would be demonstrating creativity if he/she:

- Invent something which has never existed before
- Invent something which exists elsewhere but you are not aware of
- Invent a new process for doing something
- Reapply an existing process or product into a new or different market
- Develop a new way of looking at something (bringing a new idea into existence)
- Change the way someone else looks at something

Accordingly, creativity attributes, would include;

- Fluency (Thinking of and listing many ideas)
- Flexibility (Thinking from different perspectives)
- Originality (Coming up with unique ideas)
- Elaboration (Building upon an existing idea – adding details)

Creativity forms the core activity of a growing section of the global economy — the so-called "creative industries" — capitalistically generating (generally non-tangible) wealth through the creation and exploitation of intellectual property or through the provision of creative services. Creative professions include art, design, theater, television, radio, motion pictures, related crafts, as well as marketing, strategy, some aspects of scientific research and development, product development, some types of teaching and curriculum design, and more. Since many creative professionals (actors and writers, for example) are also employed in secondary professions, estimates of creative professionals are often inaccurate. By some estimates, approximately 10 million US workers are creative professionals; depending upon the depth and breadth of the definition, this estimate may be double. Cross, N. 1984

Isaac Newton's law of gravity is popularly attributed to a creative leap he experienced when observing a falling apple. Creativity is also seen as being increasingly important in a variety of other professions. Architecture and industrial design are the fields most often associated with creativity, and more generally the fields of design and design research. These fields explicitly value creativity, and journals such as Design Studies have published many studies on creativity and creative problem solving.[Cross, N. 1984]

Fields such as science and engineering have, by contrast, experienced a less explicit (but arguably no less important) relation to creativity.

Three components of creativity:

Figure (1) Three components of creativity

Expertise is, in a word, knowledge, figure (1) – technical, procedural, and intellectual. Motivation is the Incentive and the Stimulus, but not all motivation is created equal. An inner passion to solve the problem at hand leads to solutions far more creative than do external rewards, such as money. Creative thinking skills determine how flexible and imaginatively people approach problems.

Creativity and the Design Process

Creativity is a quality that is highly valued, but not always well understood. Those who have

studied and written about it stress the importance of a kind of flexibility of mind. Studies have shown that creative individuals are more spontaneous, expressive, and less controlled or inhibited. They also tend to trust their own judgment and ideas-- they are not afraid of trying something new.

A common misunderstanding equates creativity with originality. In point of fact, there are very few absolutely original ideas. Most of what seems to be new is simply a bringing together of previously existing concepts in a new way. The fact that creative thinking is based on a knowledge of previous work in one's field is the justification for teaching the history and foundations of a given field as a resource for future research and creative work. It is possible to develop ones ability to think intuitively and creatively. The exercises assigned in this class are in part intended to expand these skills.

Thus creativity is the ability to see connections and relationships where others have not. The ability to think in intuitive, non-verbal, and visual terms has been shown to enhance creativity in all disciplines. It has also been shown that the creative process is very similar in all fields.

Essentially the design process is a problem-solving process, and the designer, just like the laboratory scientist, will be most successful if the problem is approached in a systematic manner. Successful fine artists generally follow the same pattern in developing their creative ideas, though they may be less conscious of the process they are following. Initially the researcher or designer/artist will tend to experiment in a rather random manner, collecting ideas and skills through reading or experimentation. Gradually a particular issue or question will become the focus of the reading and experimentation. The next step is to formulate a tentative problem, and begin to explore that topic. Eventually the problem is refined into a research question or design problem that the person will then pursue through repeated experimentation. In design or fine arts production, this takes the form of works created in a series. Each effort solves certain problems, and suggests issues to be dealt with in the next work (or experiment). Working in a series is the most important stage of the design process. The ability to experiment, to value and learn from mistakes, and build on the experience achieved is the hallmark of a the truly successful and creative individual, whatever the field.

The characteristics of a creative designer are the common personality distinctiveness attributed to any creative person;

- curious and optimistic
- seeks problems and sees problems as opportunities, interesting and emotionally acceptable
- challenges assumptions and enjoys all challenges and doesn't give up easily: perseveres, works hard
- comfortable with imagination and always able to suspend judgment

However, designers use their creativity within a context or according to demand for a product or a service.

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Creativity Tools:

- SCAMPER
- Brainstorming
- Mind-mapping
- Problem solving
- Method 635
- Mental provocation
- Blamestorming**!**
- TRIZ

And many others. The number of creativity techniques reaches around 100 different techniques, however, the above ones are the most common.

Figure (2) A derived technique expanding the elements of investigation

Scamper

Scamper is one of the most useful thinking tools. It incorporates many of the others. It ties in well with "Synthesis" in Blooms Taxonomy, figure (2). Using what you know and creating something new. Scamper is a general-purpose checklist that helps you to think of changes you

can make to an existing product or to create a new cc

Morphological approach in design

The term *morphology* comes from classical Greek (*morphe*) and means the study of **shape** or **form**. It is concerned with the structure and arrangement of parts of an object, and how these *conform* (i.e. fit together) to create a whole or Gestalt. The "objects" in question can be physical (e.g. an organism or an ecology), social (e.g. an organization or social system) or mental (e.g. linguistic forms, concepts or systems of ideas). (Zeiler, 2009)

Morphological approach or general morphological analysis is a method developed by Fritz Zwicky (1967, 1969) for exploring all the possible solutions to a multi-dimensional, non-quantified complex problem.(Jones, J. C. 1992) . Among others, Zwicky applied morphological analysis (MA) to his studies and the development of planes and systems. As a design problem-solving technique, Morphological approach was designed for multi-dimensional, non-quantifiable problems where causal modeling and simulation do not function well, or at all. Zwicky developed this approach to address seemingly non-reducible complexity: the system allows for reduction by identifying the possible solutions that actually exist, eliminating the illogical solution combinations in a grid box rather than reducing the number of variables involved. A detailed introduction to morphological modeling is given in Ritchey (Ritchey 2006).

Consider a complex, real-world problem, like those of marketing or making policies for a nation, where there are many governing factors, and most of them cannot be expressed as numerical time series data, as one would like to have for building mathematical models. (Ritchey 2006).

The conventional morphology approach here would be to break the product under consideration down into parts, isolate the vital parts (dropping 'trivial' components) for their contributions to the output and solve the simplified system for creating desired models or scenarios. (Zwicky . 1967). The disadvantage of this method is that ordinary consumer products do not behave rationally: more often than not, a simplified model will break down when the contribution of the 'trivial' components becomes significant. Also, importantly, the behavior of many components will be governed by the states of, and their relations with, other components – ones that may be seen to be minor before the analysis (Ritchey,1998)..

Morphological approach, on the other hand, does not drop any of the components from the product itself, but works backwards from the output towards the system internals. (Ritchey 1998). Again, the interactions and relations get to play their parts in morphological approach and their effects are accounted for in the analysis.

The morphology approach is used in this study to enhance the creativity level of students using SCAMPER by giving them technique that allow them to organize their thoughts and arrange what they reach of design elements into a full design structured with all required design elements.

Aims of the design program:

After going through this design program, a student should be able to have a clear knowledge of the following:

Knowledge and understanding: Upon finishing the current integrated design program the student should be able to:

- State the basic information and basic system components used in lighting design.

- Decide the nature and determinants of lighting design and quantities of elements required.
- describe the means of external lighting design and the most important advantages of employing each.

Mental skills , Upon finishing the current integrated design program the student should be able to:

- analyze the lighting products, features, components and lighting sources types.
- determine the healthy illumination levels in different places and different work situations.
- improve the functions of various lighting fixtures employing variations in each component and applying morphology procedure.

Professional and practical skills: Upon finishing the current integrated design program the student should be able to:

- Substitute replacing different components, materials, or even technology used.
- Combine variable features of lighting fixtures design information and logical scientific analysis of the types of lighting integrating, mixing , and merging features with other assemblies or services,.
- Adapt the lighting fixtures to a different situation, different user by altering and changing functions,. Also it may include the use of a part of another element in a different context..
- Modify, adjust, or change features, increase or reduce in scale, change shape, modify attributes (e.g. color).
- Put to another use, replacing the situation the lighting facility is used in or by using the lighting unit differently.
- Eliminate – remove elements, simplify, reduce to core functionality
- Reverse, rearrange, turn inside out or upside down, or use reversal purposes, at this level reverse engineering is employed heavily.
- Intgrate morphology procedure and standard steps to find a variation of solutions in all the above professional skills applying design solutions to problems in lighting systems

General skills and movable: Upon finishing the current integrated design program the student should be able to:

- Use modern technological means
- Communicate with others colleagues and fellows in design team

Structure of the design program

The design program is divided into three phases which are planning, organizing and presentation. Each section consists of duration, aims, content, training strategies, teaching aids and evaluation.

- Planning
- Duration
- Objectives

After going through this design program, the student should be able to:

- Mention the definition of process of lighting fixtures design.
- List the contents of process of lighting fixtures design.
- List the uses of process of lighting fixtures design and its importance.
- Understand the instructions in creating each contents of process of lighting fixtures design
- Recognize the different forms of famous fashion designers portfolios. Figure (2)
- Give examples of different types of process of lighting fixtures design

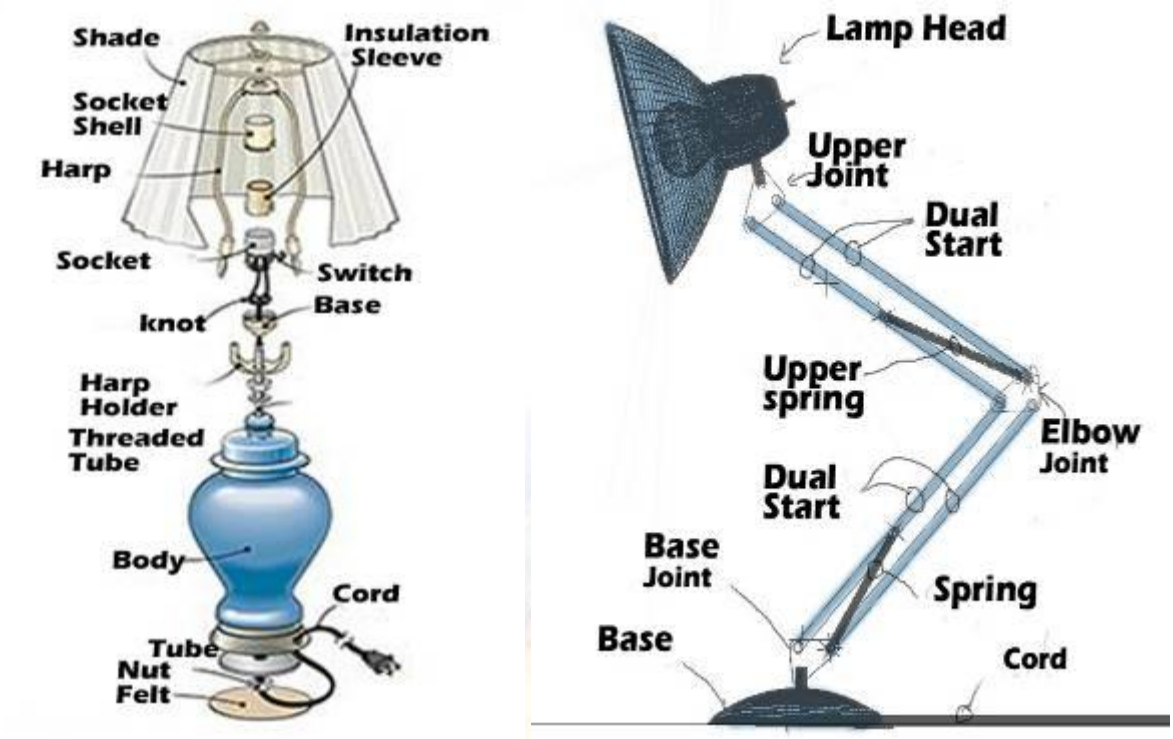

Figure (2) Standard component of a table lamp

The program contains following elements:

- The definition of process of lighting fixtures design.
- The contents of process of lighting fixtures design
- The uses of process of lighting fixtures design and its importance.
- Examples of different types of process of lighting fixtures design

The design development procedure:

When students were given the task of developing a desktop lighting using the integration of both morphology with scamper techniques.

Each student was given 4standard components. Then he/she was asked to carry out the development process using elements of scamper technique. When finished with creatibg a huge number of morphologically different shapes the student used morphology technique to arrange all the available variations of elements varying in shape, color and size in different combinations. The results were remarkable. Each student, with different capability and skill managed to a large extent to design hundreds of conceptual designs.

Team creativity was encouraged. The most important developments in civilization have come through the creative process, but ironically, most people have not been taught to be creative as a group. Therefore, students were trained to prove their creativity as individuals but more importantly as a group. The team creativity was not taken into account only individual production. The evaluation of the group creativity has been published elsewhere (Shohdy 2015).

Students were allowed to either use any computer aided drafting application (3D Srtudo Max, AutoCAD, or Sketchup). In the same time they were allowed to use their manual drawing capabilty to illustrate their preferences and alternatives.

Basic components given to students to work with:

1. Reflector, shade or hat (the upper part of the lighting fixture)
2. Holder (This is the elements that holds the lighting source)
3. Base (stem) This is a a versatile part that can take any possible shape. and certainly is the most important part that gives the lighting unit its shape.

4. light source (students were able to employ a very extensive list of lighting sources including, ordinary bulbs, fluorescent tubes, LED, power saving sources.

Students were trained on using scamper and morphology in different design situations for two consecutive weeks. The third week students were asked use their knowledge in creativity Developed by Bob Eberle, the changes SCAMPER stands for are:

S – Substitute – components, materials, people.
C – Combine – mix, combine with other assemblies or services, integrate.
A – Adapt – alter, change function, use part of another element.
M – Modify – increase or reduce in scale, change shape, modify attributes (e.g. colour).
P – Put to another use.
E – Eliminate – remove elements, simplify, reduce to core functionality
R – Reverse – turn inside out or upside down, or use Reversal.

Improving Products and Services

Alex Osborn was a master at using perspective changes to suggest new ideas. He developed a comprehensive list of simple questions, which can be used either individually or in groups, designed to support creative and divergent thinking.

- What materials or resources can you substitute or swap to improve the product?
- What other product or process could you use?
- What rules could you substitute?
- Can you use this product somewhere else, or as a substitute for something else?
- What will happen if you change your feelings or attitude toward this product?

Figure (3) Substituting

Substitute

- What materials or resources can you substitute or swap to improve the product?
- What other product or process could you use?
- What rules could you substitute?
- Can you use this product somewhere else, or as a substitute for something else?
- What will happen if you change your feelings or attitude toward this product?
- What can be replaced to answer previous questions?

The light source can be switched from bulbs or energy-saving bulbs to LED bulbs. The goal is changing the product for the better in terms of the longevity of the light source-savings in electricity, which does not radiate heat from the possibility of replacing the reflector (shade) to any other material may emit heat that arise from light sources as also reflected in the size of the reflector and consequently the whole unit. The LED bulbs with less size but with the same illumination power and a greater saving in energy. The set of lighting units, figure (4) make all design changes to the size and provide the use of less raw materials and therefore a better economy

Also they, despite the minimum change of the original design they offer an advantage of the

LED bulbs it the characteristics of perennial bulbs may run up period to 15 years and therefore can get different shapes and designs new and diverse examples of the piece and Miley

Figure (4)

Combine

- What would happen if you combined this product with another, to create something new?
- What if you combined purposes or objectives?
- What could you combine to maximize the uses of this product?

How could you combine talent and resources to create a new approach to this product?

What can be combined to answer previous questions

We can integrate parts Holder and Base

thus we get the various forms of office lighting unit as the example Next

Figure (5)

Adapt

- How could you adapt or readjust this product to serve another purpose or use?
- What else is the product like?
- Who or what could you emulate to adapt this product?
- What else is like your product?
- What other context could you put your product into?
- What other products or ideas could you use for inspiration?

What can adapt to answer previous questions

This is done by adapting the energy source to another power source as illustrated in the following example

Figure (6) An led lighting unit that uses USB as a power source

Figure (7)

Combine

- What would happen if you combined this product with another, to create something new?
- What if you combined purposes or objectives?
- What could you combine to maximize the uses of this product?
- How could you combine talent and resources to create a new approach to this product?

Figure (8)

Adapt

- How could you adapt or readjust this product to serve another purpose or use?
- What else is the product like?

- Who or what could you emulate to adapt this product?
- What else is like your product?
- What other context could you put your product into?
- What other products or ideas could you use for inspiration?

Figure (9) adapting light to any specific use or place.

Figure (10) Combining natural lighting sources with artificial sources to illuminate the grocery plant.

Modify

- How could you change the shape, look, or feel of your product?
- What could you add to modify this product?
- What could you emphasize or highlight to create more value?
- What element of this product could you strengthen to create something new?

Figure (11)

Put to Another Use

- Can you use this product somewhere else, perhaps in another industry?
- Who else could use this product?
- How would this product behave differently in another setting?
- Could you recycle the waste from this product to make something new?

Figure (12) standard light electrics were substitued by an oil flament where electricity is not available or when power is cut off.

Figure (13) Lighting is put to other use in this nose pendant, with a special mechanism it shines light when the girl breathes)

Eliminate:

Students asked themselves the following questions and answers came in the design elements that was eliminated partially. The remaining parts were the most vital.

- How could you streamline or simplify this product?
- What features, parts, or rules could you eliminate?
- What could you understate or tone down?
- How could you make it smaller, faster, lighter, or more fun?
- What would happen if you took away part of this product? What would you have in its place?

Figure (14) Reverse engineering is used here to employ space technologies, economical lighting fixtures in different household situation.

Reverse

- What would happen if you reversed this process or sequenced things differently?
- What if you try to do the exact opposite of what you're trying to do now?
- What components could you substitute to change the order of this product?
- What roles could you reverse or swap?

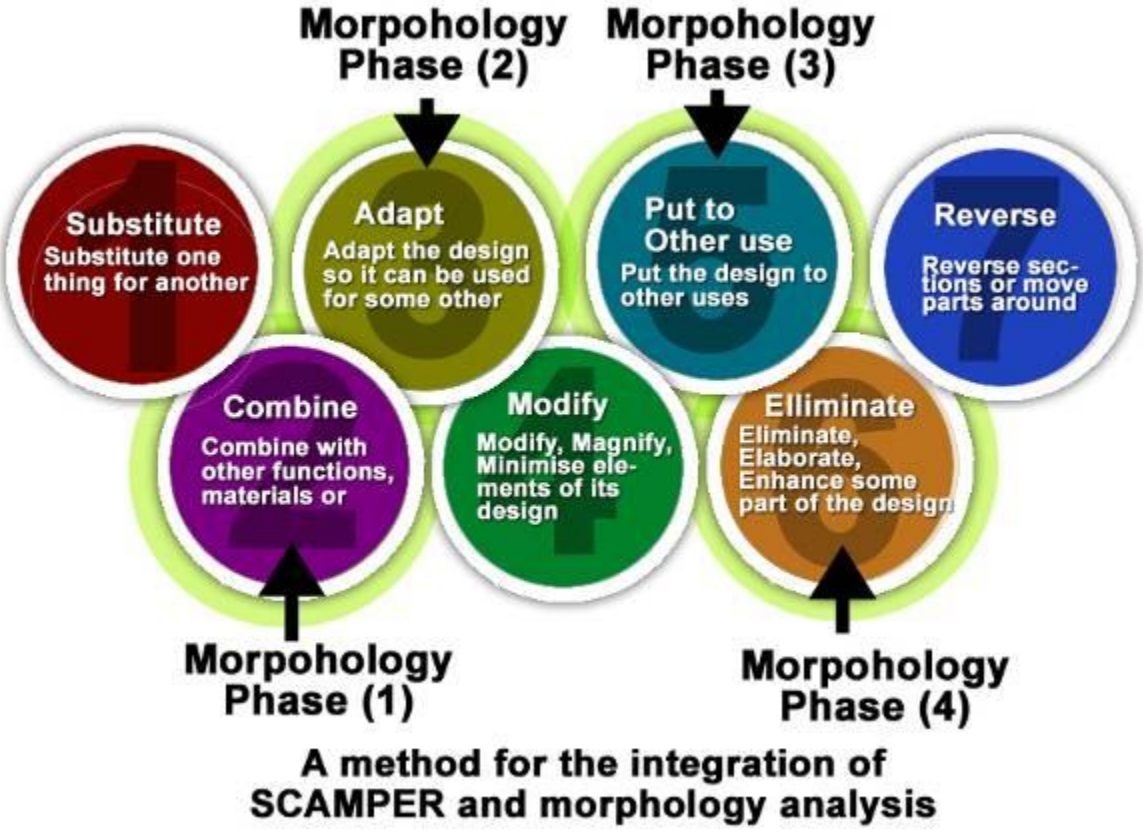

Figure (15) the integration scheme introduced by the author

Example of a morphological table:

Morphology has been introduced to in four only of the 7 phases of scamper. These are the phases that were seen by students as the most affective in creating a creative combination of elements figure (15).. Every student built his own morphological table containing a number of his choices of design elements. Then, every student used the morphological approach table to match his selections from each column with another level from the second column and so on. The student was allowed o drop any column provided he gets a full product. for example he could drop the stem column if he uses any other element to play the same role as a connection between base and light source holder. Final designs are shown partially in the following figure (16)

The results

Applying the program it has been noticed that, students have gained or developed their level of creativity. This is witnessed by the emergence of the following attributes clearly in evaluating students work.

- If creativity is measured by the fluency and versatility of designs provided by each student, then creativity was at it highest level compared to the number of alternative normally offered by the same student doing any design project.

Figure (16) Morphology table of Phase 1

- The students showed a high level of curiosity and they were always seeking problems. They saw problems as opportunities and as interesting and all the problems they faced were emotionally acceptable. Students enjoyed the challenge. Their capability to suspend judgment has helped them apply all design procedure steps showing comfort with imagination. They kept challenging assumptions and did not give up easily: perseveres, works hard
- The proposed design program extends the horizons of lighting design and allows for fluency, flexibility, and originality attributes to contribute to enhance students work.
- Being subject to few adjustments the program would utilized to fit other design fields.
- According to views of questionnaire arbitrator the proposed design program satisfies the study hypothesis and provides an organized mechanism, to achieve certain creativity attributes and innovative ideas in students work

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