

TOOLS OF THINKING PREFERRED BY MANUFACTURING STUDENT OF UTeM

Norunnajjah Ahmat

Institut Pengurusan Teknologi dan Keusahawanan
Universiti Teknikal Malaysia Melaka, Melaka, Malaysia

E-mail: najjah@utem.edu.my

ABSTRACT

This article meant to investigate the choices of thinking tools among Manufacturing Student of UTeM. The manufacturing student involved was one BMFG from the Faculty of Manufacturing. There are 10 groups in the class. Each group were given an assignment to write one out of seven thinking tools taught in the class. The thinking tools are Brainstorming, Mind Map, SCAMPER, 6 Thinking Hat, SWOT, CPSP and Design Thinking. The finding is that these manufacturing students preferred three thinking tools which are mind map, SCAMPER and 6 Thinking Hats; wherein mind map is the major choice. It is remarkable that there seven choices of thinking tools and yet only three stakes out. This research is important because it will explore if their choices are due to their characteristic of learning style and environment that need mind map than others. The other reason is that these thinking tools are easier to consume and use. Next factor could be that these thinking tools are the best for them in learning activities.

Keyword: Thinking tools, manufacturing students

1.0 INTRODUCTION

Thinking tools are important because the student can use it with the multiplicity of crucial and complicated thinking such as assessing, examining and judgment making. Thinking tools help the students to measure complex skill such as creative and critical thinking, besides collective conundrum resolving. By applying these tools, the students are developing the designing and the assessment skills. The teaching of thinking tools in the subject of Creative and Critical Thinking, allow learners to embody what they be taught and understand utilizing various figurative formalism. Exploring the task of pondering devices is key to deciding whether these kinds of instruments can bring about a genuine additional worth of appraisal abilities amongst the learners.

There are seven thinking tools presented in the subject of Creative and Critical Thinking. They are Brainstorming, Mind-map, SCAMPER, 6 Thinking Hat, SWOT, CPSP and Design Thinking. The subject is offered to all students because critical thinking can help them to have a sensible thoughtful reasoning when determining what to consider or do as describe by Ennis (1993). Then, critical thinking is very important for student to learn it involves the experienced symbiotic aptitudes of calculating the reliability of causes, scrutinizing the value of opinions, make up interpretations by means of cognitive and gathering choice or cracking delinquent as defined by Lai and Viering (2012).

This kind of subject often appear in Program for International Student Assessment (PISA) in evaluation of science, mathematics and comprehension. It was utilized as component of crisis-resolving measurement with foremost emphasis on assessment of the accessible proof, hypothesis, and prospective resolution. Then, the critical thinking could be denoted to find the competence of an distinct to positively inhabit in the procedure of making conclusion or resolution delinquent by examining and measuring indication, advices, entitlements, confidence, and different opinion of understanding, fusing and making linking between data and wiles, rendering evidence and assembly extrapolation by means of intellectual fitting to the condition.

In short, rational tools are important because it enhance the critical thinking of student when they want to deal with situation relate to comparative analysis, categorization, reasoning, determining the authenticity, creating, or designing analogy and metaphor; and decision making.

2.0 LITERATURE REVIEW

There are a lot of thinking tools available in this world from A-Z letters. Student may choose from Active Listening, a thinking tool that provide an instructional skill where students learn the correct way of listening; to Y Chart thinking tool where student learn how to do a collaborative studying approach when discussing a multidimensional topic. However, the thinking tools included in the subject of Creative and Critical Thinking offered at UTeM are seven. They are Brainstorming, Mind Map, SCAMPER, 6 Thinking Hat, SWOT, CPSP and Design Thinking.

What is brainstorming? Madison Avenue broadcasting director Alex Osborn established the innovative method and printed it in his 1953 manuscript, "Applied Imagination." All the time, scholars get rendered several advances to this unique procedure. The method shown here brings this investigation into account, so it's perceptively distinct from Osborn's method. Brainstorming melds a serene, unofficial attitude to dilemma deciphering in conjunction with ingenious theory. It inspires folks to reach up the ideas and proposals that be able to, at the beginning, seem like a bit ridiculous. Certain of these recommendations know how to transform into distinctive, innovative justifications to a conundrum, while others can provoke yet further concepts. This accelerates to make folks issued by "pushing" them away of their conventional approaches of reasoning. Consequently, throughout brainstorming rallies, persons ought to stay away from denouncing or gratifying concepts. Simply striving to start possibilities and crack down erroneous expectations about the problem's edges. Assessment and appraisal at this point indicates plan construction and restrict originality. Do appraise proposals in the ending of the period – this time is to dive into blends further, using conventional methodologies.

Wherefore chose Brainstorming. Its plan is one of the best indispensable methods in prompting inventiveness and resolving challenges in the scholastic, industrial, business, and partisan disciplines. Jarwan in 2005 stated that brainstorming needs the usage of mind to the dynamic puzzle resolving and the brainstorming phase chases to nurture inventive explanations to crises. Moreover, in 2008 said that, conversely, resourceful idea is well-known as a compound intelligent action attempting to immediate a compelling objective to look for results or finding initial answers that have being not founded before. In the meantime, Hoing (2001) discovered it as the plentiful reasoning that contains the severing up of outdated thoughts, creating new contacts, increasing the limitations of understanding and the commencement of magnificent theories (Abdullahi Naser Mohammad Al-Mutairi, 2015).

In the meantime, mind map, which was recognized by Tony Buzan as a note-taking exercise, is a submission which has the sovereignty of finding the judgements that the intellect has about a focus from unrelated standpoints, and which inspire the right and left parts of the intellect unruffled as an substitute to straight understood. It is assumed that mind maps have advantages such as memorizing, updating the ingenuity, decoding conundrum, concentrating

on a topic matter, and managing the reflections. It is believed that mind maps have an invaluable spot as a life cycle understanding tool these days after constructivist scheme is applied as starting point in the education-schooling development (Aliye Erdem, 2017).

Next thinking tool is SCAMPER, believed as an proper practice to encourage creative thinking talents. SCAMPER system was favored, primarily since it ultimately seeks to engender several perspectives which is to be anticipated from contradictory rational means (De Bono, 2000). Next, even if there have so much study about creative thinking approaches in creative narrative (MacKinnon, 1978; De Bono, 1992; Baer, 1993; Feldman & Benjamin, 2006; Smith & Smith, 2010), there are simply a not many papers regarding tutoring inventiveness using SCAMPER. Third, SCAMPER suggests an entertaining ambience for contemplating inventively. Furthermore, Scott, Leritz & Mumford (2004) highlighted in their meta-analysis that practices are more accessible, experimental, given fewer assistance regarding the practice of evidence instituted were inept to accomplish attainment from the teaching. Otherwise, the processes where persons were ordered concerning going with provided material in an coordinated pattern were spotted competent and successful in conditions of finishing of the teaching. SCAMPER is an archetype of the latter one because it proposes a significant structure to believe to be ingenious with its prominent queries as it was advocated in the Scott, Leritz & Mumford's (2004) study.

SCAMPER is an abbreviation which was formed by Edward De Bono in 2020. Every letter implies to a detailed reasoning method. S as supernumerary infers to work out alternate thoughts/substances as a auxiliary for the current idea/object. C as coalesce necessitates to produce new proposals by blending numerous and linked-disengaged visions. A as adapt/adjust indicates usage/revising previous ideas to make brand fresh ones. M as modify/lessen/augment conveys to deliver alterations on the existing piece by amplifying, decreasing, altering it. P as put to another utilizes suggests making use of an item in a distinctive and if possible, an unanticipated notion/location/position.

E as exterminate suggests removing a part of the remaining thing on behalf of fashioning a superior edition of it or of presuming out the outcomes of dismissal. Finally R as reorganize/inverse implies to reorganize or switch

over current condition/circumstances/directions/configurations with the intention of contemplating alternate ends, procedures, concepts (Melodi Ozyaprak, 2016).

Next acronym thinking tool is SWOT. The chronological setting of SWOT Assessment is as aged as the principle of tactical plotting. Therefore, it has been associated with tactical plotting and taken as the most important factor of the planned preparation method. SWOT Assessment started in the writing in the 1960's. This commencement moment is in correspondence with the perception of policy being utilized in the arena of corporate administration. Scholarly study on SWOT Assessment disclose that the source of the SWOT is ambiguous. Narrative assessment on the chronological advancement of the Assessment exposes that while several scholars acclamation to Harvard Business School, further academics ascribe the arrival of SWOT to Stanford University.

SWOT stand up for Strengths, Weaknesses, Opportunities, and Threats. It is a skill for evaluating these four characteristics in every business. SWOT is useful in analysing the most of what accomplished for the best benefit of any organization. It also able decrease the prospects of disaster, by identifying what is missing, and eradicating the oblivious risks. Using SWOT is important to create a plan that differentiates from other competitors, to compete productively in the market. Strengths are matters that the association does surprisingly well, or in a manner that divides from other competitors. Think about the rewards of the group has over other firms. These could be the inspiration of the team, gain access to specific items, or a solid set of industrial activities. In The Meantime, vulnerabilities, like strengths, are fundamental traits of an group, where can be focussed either on communities, assets, systems, or methods. Think about what could be expanded, and the sorts of patterns that should be averted. In one way, imagine or find out how others go to see about others. Are there any apparent shortcomings that be likely to be unsighted to? Take up time to look at how and why the rivals are performing good than others and what is inadequate contrasted to others (Emet Güre, 2017).

Then, opportunities are prospects or possibilities for something positive to materialize. They normally arise out of circumstances beyond corporation and necessitate an appreciation to what could take place in the forthcoming. They

may happen as improvements in the market functioned, or in the machinery utilized. Having been able to point and manoeuvre prospects be able to create a massive discrepancy to any company's capability to race and take the lead in the market. Believe about wonderful chances than can be spotted instantly. These don't require to be match marketers: much insignificant rewards can enhance the company's effectiveness. Anything intriguing marketplace developments either big or small, which could have an effect? One way is by looking out for modifications in government plan attached to the field. Furthermore, the adjustments in social forms, inhabitants' profiles, and routines can all heave up astonishing openings. Lastly are threats, that entail the whole thing that can detrimentally influence any industry from the outer, such as supply chain difficulties, swings in marketplace constraints, or a deficiency of employees. It's important to foretell hazards and to act versus them prior to converting them into victim and compressed the growing shops. (https://www.mindtools.com/pages/article/newTMC_05.htm).

Design thinking is frequently recognized as an analytical and groundbreaking procedure that relates an entity in prospects to experimentation, construct, and pattern simulations, collect response, and reshuffle. Some attributes (e.g., imagining, ingenuity) that a respectable layout intellectual must have been identified. Design thinking started to get intensified interest in corporate situations. The reason is the design of goods and service sector is a leading aspect of commercial effectiveness, to the level that innumerable prominent corporations have dedicated themselves to transforming into design bosses (Dunne & Martin, 2006). And even if design thinking has developed into an indispensable fragment of the project and engineering disciplines along with commerce, it can be a productive impression on 21st century education throughout disciplines because it incorporates creative thinking in engendering determinations for complications. That is, in educational situations, learners are compelled to understand analytically, sense and reason reasonably, and work out intricate quandaries (Rotherham & Willingham, 2009). Consequently, to assist learners thrive in this interrelated, arithmetical sphere where people reside in, educationalists should prepare for students by acquiring and perfecting the 21st-century talents (e.g., design thinking, methods thinking, and cooperation talents) that enrich their conundrum resolving skills and manage them for organization and profession (Razzouk & Shute, 2012).

Next famed thinking tool is Six Thinking Hats by Edward de Bono. He fosters this skill as more efficient artistic reasoning and determination make up. The 6 Thinking Hats is one such method. The dressed in the hat is allegorical. Anytime, everybody will wear down the identical pigment, in other words, watch at the conundrum at hand from one and only standpoint, the viewpoint hinted by the hat colour. White Hat Thinking solicits for data well-known or necessary. When request for white hat thinking imply demanding what knowledge is required, what is comprehensible, and how it can be obtained. Yellow Hat Thinking uncovers the positives and quest for advantage and gain. The yellow hat title part is for merely analysing the optimistic image of tasks and solution expectations. As dissented to yellow, Black Hat Thinking is judgment such as the evil spirit supporter or why somewhat might not be successful. Point the hurdles and perils. Perhaps the greatest daunting and beneficial of the Hats but it is a trouble if overworked. Once ponder of black denotes think of damaging, or watchfulness. The black hat is for critical assessment. It points out what cannot be completed. The anticipation is that the black hat title part will thwart people from getting errors. Red Hat Thinking means feelings, impulses, and instinct. When make use of this hat, folks can convey feelings and sentiments and apportion concerns, be fond of, loathes, passions, and detests. People don't have to justify their declarations. The red hat allows feelings to be expressed. Once they are contended, people can go on to a further fruitful tactic. Green Hat Thinking is an opening to deliver fresh ideas and new perceptions. Blue Hat Thinking is the monitor tool that make sure the Six Thinking Hats® specifications are seen. The blue hat is the hardest one to grasp. It deals with controlling the thinking process. The blue hat is normally "handed" to one individual, who commands what hat will be "worn", consequently managing the sort of thinking being exploited. The blue hat amplifications on the thinking being utilized, requests for opinions, choices, etc. The blue hat can go from individual to individual or can be a presiding officer (Hamilton & Bowkett, 2015).

3.0 DATA ANALYSIS

Descriptive analytics is a statistical approach that is employed to explore and encapsulate chronological data to discover patterns or connotation. This is a reflective assessment of novice figures and to deliver comprehension into historical forms of behaviours and accomplishment in online learning settings.

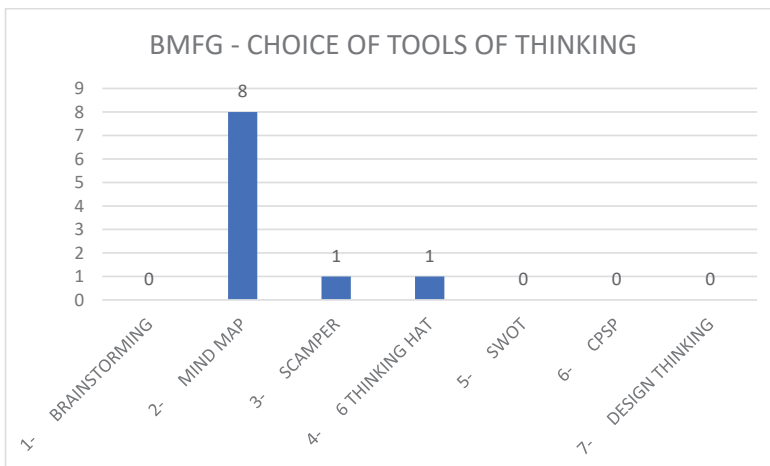
One of the most important pluses of descriptive assessment is its superior level of neutrality and independence of the scholar (Lans & Van Der Voordt, 2002). Evocative evaluation is deemed to be wide-ranging than other quantitative approaches and it presents a larger image of an incident or occurrence. Descriptive Analysis can utilize considerable number of variable quantity or even a specific number of variables to carry out a descriptive assessment.

This research involved one faculty programs which is BMFG from the Engineering Faculty of Manufacturing. This program contains 10 groups that each group need to choose one thinking tool out of seven as their choice of group assignment topic. This research aims to find what is their selections and try to figure out the reason of their preference.

- Faculty/Program Data Analysis Bases

Table 1 Program from Faculty of Manufacturing

BMFG	
Types of Thinking Tools	The Choice of Tools of Thinking
1- BRAINSTORMING	0
2- MIND MAP	8
3- SCAMPER	1
4- 6 THINKING HAT	1
5- SWOT	0
6- CPSP	0
7- DESIGN THINKING	0



Graph 1 Choice of tools of thinking

In this program, majority of groups which is 8 opted mind maps. The other two groups, each of it chose SCAMPER and 6 Thinking Hat. Other thinking tools not taken at all. It might show that mind map is the best tool for this faculty for teaching and learning. It is amazing to see that there are seven choices of thinking tools and yet only three were their preferences. The majority of group preferred mind map and their choices could be due various factors; firstly, mind map is an easy and interesting tool to use since mind map encourage student to play with colors and drawing. Mind maps also could be the suitable tools which match with their characteristic of learning style. The statements taken from the assignments will show why they prefer mind map compared to the rest.

Only one group took SCAMPER as their preference and it could be its complicated tool to use since this acronym involves S for switch, C for combine, A for alter or acclimate, M for modify or lessen or amplify, P as placed to other uses, E as eradicate and finally is R as reorganize or overturn. However, this group do find this tool a very beneficial thinking tools that can be used by anyone in any level of an individual either as student or more.

One last group chose 6 Thinking Hats, and this tool is a fascinating tool because it can make student understand of their own strength and dominance of thinking. Yet only one group prefer it. However, this group do understand the greatness of this tool as stated in the assignment.

4.0 CONCLUSION

Critical thinking is the method of analyzing, examining, interrogating, and confronting conditions, problems, and evidence of all forms. Critical thinking is an essential tool in solving society difficulties and in expanding interferences or initiatives in wellbeing, human public services, and neighborhood growth. There are thousand thinking tools available in the world and each student has freedom to select what is the best option for them to use because each tool aims to enhance their critical and creative thinking that they can use in their learning time or during their career world. The most important thing is that they have learned these seven tools of thinking and they may use it when the time is applicable to apply.

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