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Factors Affecting the Design and Application of Ergonomics Technology in Pumpkin Carving in Order to Inherit Thai Wisdom

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Abstract:

Thai wisdom is a body of knowledge that Thai people have continuously developed and trained from one generation to generation to be used to solve problems and improve the quality of life to suit each period of the changing society. It was considered as a cultural heritage that was invaluable to society. The purpose of this article is to study the factors affecting the design and application of Ergonomics Technology in pumpkin carving to inherit Thai wisdom. The study employed the qualitative research methodology as a case study. Data were collected using in-depth interviews in group with key informants including one expert, one specialist and one skillful craftsman, aiming to analyze the factors that affected the design and application of Ergonomics Technology in the final carving of pumpkins. The study indicated internal and external factors affecting the design and application of Ergonomics Technology in pumpkin carving. The internal factors were 1) personal interests, 2) individual aptitude, 3) creativity, 4) planning, 5) personal characteristics, and 6) leadership skills. Meanwhile, the external factors were 1) the necessity of living; 2) geographical condition and environment; 3) beliefs, doctrines, religious principles, and supernatural power; 4) technological progress from the west; and 5) studying willingness. The results of this study shed light on the design and application of modern technology in pumpkin carving to inherit Thai wisdom that emphasized process skills, and products produced from actual performance.

Keywords: *Thai Wisdom • Pumpkin Carving • Ergonomics Technology*

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I. INTRODUCTION

Thai wisdom has been a transfer of culture with deep meaning from the past until nowadays, showing intelligent understanding of creative events. Thai wisdom created in a certain period was a creativity of something neat and well-formed and was an accepted form

within the society to be beneficial for the living among people in the society. That is to contribute to the common life in that society. This also has an immense value in the form of art (Pornjaroenkun, & Neawheangtham, 2017). An example of this is "Pumpkin Carving". It is a Thai wisdom in the field of art and an invaluable heritage of the Thai heritage.

Pumpkin Carving can be seen at the banquets in hotels, at the arrangement of a dining table, and in various restaurants. The pumpkins were engraved to decorate the ta

bles or to be parts of the tableware. It encouraged a pleasant atmosphere for that meal as well. Pumpkin Carving required several essential skills when using a pumpkin carving knife to create each piece of works each time. Every single detail must be done confidently. The pumpkin that has been carved must have a fairly firm texture and a clear shape. Regarding this, it is important to study on how to conserve the Thai pumpkin carving.

Due to the changes of tastes and behavior of teenagers and people in the next generation, there is scary that Thai pumpkin carving would be sooner disappeared because there is certain belief that the next generation people would ignore in studying about Thai pumpkin carving skills, and are more willing to learn universal knowledge. Finally, it can result less transfer of Thai wisdom. In addition to the causes of Thai pumpkin carving concerns, the economic crisis in Thai society, politics reflected the society's weakness and lack of self-identity of Thai society can be included (Office of the Education Council, 2012).

To seek for the ways to help inherit the beautiful Thai wisdom, there are various academicians proposing state-of-the-art technology. For example, Guccio et al. (2016) applied the digital technology, information-communication technology, and public access such as website to drive the Italian to learn and experience with historical and cultural heritage. Another example, Li (2018) applied the virtual reality technology such as 3D, somatosensory technology, media, and so on in the inheritance of cultural heritage in Shanxi Datong Huayan Temple, which his study can contribute to the opportunity to conserve the cultural heritage. In the meantime, Džikić and Radin (2019) studied about the application of the digital technology in enhancing such activities that can document, present, and con

serve the heritage and its knowledge. In addition, there is another proposed technology

called ergonomics technology, which it is application of engineering concepts integrated with human factors to reduce human error and increase accurate human interaction study (Wickens, Lee, Liu, & Becker, 2009). Regarding this, the design and application of ergonomics technology in heritage conservation, such as pumpkin carving, can be one of methods to inherit Thai wisdom. Similarly, in 2018, Portalés et al. (2018) attempted to study interactive tools for the preservation, dissemination and study of silk heritage in the Silknow Project with the aim of designing automated digital modeling of its weaving techniques.

However, in order to achieve the implementation of state-of-art technology, the prioritized activity is to study about people because they are the one who will implement this technology and factors that an influence effective technology implementation. The studied factors can be both internal and external dimensions covering personal factors such as age; gender; attitude; education; skills; knowledge; and others, and environmental factors such as technology, living conditions, geography, culture and religious principles, as well as related institutions (Pender, Murdaugh, & Parsons, 2002). Furthermore, Abras, Maloney-Krichmar and Preece (2004) also advocated that in adopting technology there should focus on studying and understanding users' physical characteristics and psychology of response as well as there should be a study of social conditions (Gould, & Lewis, 1985).

Therefore, this study aimed at studying and identifying the internal and external factors that can affect the use of ergonomics technology in conserving Thai heritage and wisdom such as pumpkin carving. The study analysis can present the related variables which are significant for technology users to take into account in order to create the effective technology implementation and maximize technology usability. In addition, the findings from this research can originally guide the opportunity future research on how people and its influential factors can help conserve Thai heritage and its beauty.

II. OBJECTIVES

Human factors are discussed over many decades since human elements are complicated and difficult to be learnt. In implementing technology, it cannot be avoided that internal and external factors related to human performance in learning and using technology must be taken well attention. Therefore, this research aimed at preliminarily identifying the internal and external factors that can affect design and application of ergonomics technology in pumpkin carving in order to inherit Thai wisdom

III. LITERATURE REVIEWS

Ergonomics technologies (or human factors) is the application to the engineering and design of products, procedures and structures of psychological and physiological concepts. The goal of human factors is to reduce human error, increase productivity and enhance safety and comfort, with a specific focus on interaction between human beings and things of interest (Wickens, Lee, Liu, & Becker, 2009). The field is a combination of numerous disciplines such as psychology, sociology, engineering, biomechanics, industrial design, physiology and anthropometry, interactive design and the visual design, and user experience. In research, human factors use a scientific method to study human behavior so that the resulting data can be applied to the four primary objectives. Essentially, it is the study of the design of devices, devices and processes that fit the human body and its cognitive abilities. In essence, the two terms "human factors" and "ergonomics" are synonymous (Lee, Wickens, Liu, & Boyle, 2017). There are three main fields of research in the ergonomics sector: physical, cognitive and organic ergonomics. Under those specific categories there are several specializations. Visual ergonomics specializations can involve visual ergonomics. Specializations within the field of cognitive ergonomics may include usability, human-computer interaction, and user experience engineering (Stanton, Salmon, & Rafferty, 2013). Domains of specialization within the discipline of ergonomics are broadly the following (Neuhaus et al., 2014). Physical ergonomics is concerned with the aspects of human anatomy, anthropometry, psychology and biomechanics as they relate to physical activity.

Cognitive ergonomics is concerned with mental processes, such as perception, memory, reasoning and motor response, as they affect interactions between humans and other system elements. Organizational ergonomics aims at optimizing socio-technical systems including its structures, policies and processes. In summary, ergonomics is a systematic study of workers aimed at changing the working environments, working practices and activities carried out. The focus is on the collection of relevant and reliable evidence to support the recommendation for changes in specific situations and the development of more general theories, concepts, guidelines, and procedures which contribute to the constant development of ergonomics expertise.

Regarding to the study of design and application of ergonomics technology in pumpkin carving in order to inherit Thai wisdom, it is very important to study about the internal factors because they can have significant impact on human behaviors. In respects of internal factors, there are various academicians identifying the related definitions as they consisted of two main domains encompassing with internal and external factors. The internal factors can encompass with three domains, which are biological aspect, psychological aspect, and sociological aspect (Pender, Murdaugh, & Parsons, 2002). According to the biological aspect, it refers to the factors that were originally born with human such as age, gender, race, nationality, and others. In the meantime, psychological factor refers to the attitudes, belief, emotion, value, perception, and others. Lastly, sociological factor means the lifestyles or behavior of the individuals respond to the surroundings such buying, working, travelling, eating and others. Similarly, Abras, Maloney-Krichmar and Preece (2004) also mentioned that internal factors such as physical characteristics and psychology of response can directly relate to technology usage. Related to technology acceptance, Davis, Bagozzi and Warshaw (1989) presented the technology acceptance model describing the people' acceptance to utilize the technology must be dependent on people perception and attitude towards the use and advantage of the technology. With the mode by Davis, Bagozzi and Warshaw (1989) implied that the internal factors can be very

much associated with technology usage performance. Meanwhile, Gifford and Nilsson (2014) advocated childhood experience, knowledge, personality, sense of self-control can influence people's behavioral performance. Khuong, and Duyen (2016) advocated the personal factors as the characteristics that are specific to a person, which they can include cognition, self-image, age, personal knowledge and practices. In addition, Pemani, & Massie, (2017) reviewed on the personal factors, which include age and life cycle stages reflecting the need and wants upon the time and trend changes, life styles referring the action responding the culture, tradition, tastes and so on, personality meaning about the person' distinct characteristics or traits.

External factors can also be taken into account since it can directly influence the behavior of human such as learning, buying, decision making or others (Jermsittiparsert, Siam, Issa, Ahmed, & Pahi, 2019; Jermsittiparsert, Thaiprayoon, Prianto, & Kurniasih, 2019). The term of external factors generally refers to the social and environmental surroundings that can affect human behavior and performance. The social perspective refers to the involvement of family, educational institutes, religions, governmental agency, and others that can form the norms for people in the community and society for their conformity. Meanwhile, environmental perspective includes geography, residing area, natural surroundings and building, man-made environment, technology, foreign culture, and others that can stimulate people perception and attitude. In addition, economic condition can also drive people behaviors (Pemani, & Massie, 2017). Regarding this, Davis, Bagozzi and Warshaw (1989) employed the external factors in terms of social factors to study about the technology acceptance in order to identify how people can positive react to the technology provision. Gifford and Nilsson (2014) mentioned that external factors such as religion, urban-rural differences, norms, social class, cultural and ethnic variations can influence people's behavioral performance.

IV. RESEARCH METHODOLOGY

Participants

Key informants were divided into the following three groups: Group 1 Expert - An expert refers to a person who has more than 5 years of carving experience and has won fruit and vegetable carving competition. The informant must have an important qualification as follows: Being a staff member of Rajamangala University of Technology Thanyaburi, who was awarded at least 1 prize from the fruit and vegetable carving competition. Group 2 Specialist - This refers to a person with less than 5 years of engraving experience. This informant must an important qualification as follows: Being a personnel of Rajamangala University of Technology Thanyaburi and has never been awarded any prizes from a fruit and vegetable carving competition. Group 3 Skilled - This refers to a person who has less than 2 years of carving experience and must have an important qualification as follows: Being a personnel of Rajamangala University of Technology Thanyaburi and has never been awarded any prizes from a fruit and vegetable carving competition.

Data collection

In this research, the researcher used the qualitative research method - case study, namely, instrumental cases which is the case study selection used to represent other cases and to reveal something more clearly through a case study or to support certain conclusions (Creswell, 1998). Data collection techniques were in-depth interview, observation, and group discussion. Moreover, Baxevanis, A. stated techniques for collecting data from users such as group conversations, inquiries or interviews, etc (Gill et al., 2008). The obtained data were then analyzed by using content analysis to gain the factors affecting the design and application of Ergonomics Technology in the final carving of pumpkins.

Initial data collection:

The researcher reviewed related documents and research in order to gain knowledge and understandings of the content of the current study. In addition, the study of concepts, related theories including concepts of learning and learning processes, concepts of socialization, theory of pluralism, Social Cognitive Theory,

and Symbolic Interaction. The researcher also understood the methods to be used in the study as a guidance to conduct the field research only, neither to be used as a framework nor to control ideas.

Field data collection:

According to field data collection, the researcher gathered the data herself now that the researcher was the most important research instrument in qualitative research. Thus, the researcher was well-prepared with technical and the research processes for conducting qualitative research in order to be able to understand the phenomena from the case study and to collect data efficiently, get the most accurate information, to understand the meaning and learning processes, as well as understanding the carving experience by mainly using in depth-interview method, and made observations by summarizing and taking notes (Memo) about the content and the observations that were useful for the research data. The interview took approximately 1-2 hours. In addition, in this study, the researcher also used the method of data collection by observation method which was observations combined with interviews based on the following observation framework.

Data analysis

The data analysis in this qualitative research systematically took data from the research to identify the meaning, to differ the components, and to find relations between the data, taking into account the insider's perspective, which means that the experts interviewed draw conclusions from the analysis of the data. The researchers had therefore used the content analysis method to analyze the data (Creswell, 1998; Mayring, 2004). By interpreting, creating a conclusion or working hypothesis using data from the interview, several steps follow (LeCompte, 2000): 1) Transcribe the data obtained from the transcription of Interview without skipping certain sentences, as some information may be used for later review. 2) Providing a temporary conclusion and censorship is to try and write each interview conclusion and reduce the size of the data and to help remove unnecessary data. 3) Presentation of data for interpretation and presentation by constructing

mind maps, matrices and causal networks to connect the conclusions. And, 4) the process of summing up and summarizing facts is the connection between the principles, the concepts related to the findings. After data analysis, the study result as well as internal and external variables related design and application of ergonomics technology in pumpkin carving are explained in the next part.

V. RESULTS

Demographic data of informants

According to the demographic data, it was found that Group 1 Expert was male, aged 24 years, and worked as a general administrative officer in the Faculty of Home Economics Technology. He had 7 years of carving experience and won the fruit and vegetable carving competition organized by Office of Vocational Education Commission in 2014. Group 2 Specialist was male, aged 26 years old, and worked as an academic coordinator at an operational level in the Faculty of Home Economics Technology with three years of carving experience. He has never received any prize awarded in fruit and vegetable carving competition. Group 3: Skilled was female, aged 22 years old, and was a third-year student majoring in Hotel Management in the Faculty of Liberal Arts. She had one year of carving experience and have never received any prize awarded in fruit and vegetable carving competition.

Internal factors affecting design and application of ergonomics technology in pumpkin carving to inherit Thai wisdom

Internal factors were factors that arose from beliefs, thoughts, feelings, including the unique characteristics of each involved individual. They contributed to the design and application of Ergonomics Technology in pumpkin carving. In this study, there were five factors: 1) Personal interests - In the study, the interviewees usually started out with an interest in carving prior to their wants and then found their ways to learn carving. 2) Individual aptitude - It is another important condition that leads to the design and application of Ergonomics Technology in pumpkin carving. The interviewees were gifted in carving or

handicraft prior to learning how to craft. When having the opportunity to practice, they were able to learn and developed their skills quickly. They were proficient in carving various different patterns of which were varied depending on the individual skills of each person. For example, some were skillful in carving Thai patterns. Some were skillful in carving animals. Others were more skillful in square patterns than curved patterns. 3) Creativity - Apart from their fond and expertise, the person who performed pumpkin carving had to be creative in order to create various patterns meticulously, beautifully and differently. 4) Planning - Planning was another condition that led to the design and application of Ergonomics Technology in pumpkin carving. Crafters had to plan and prepare well. It could be seen from their basic skills in carving, and their love of arts which had an effect on their ability of carving and, in turn producing more difficult patterns beautifully. 5) Personal characteristics - Regarding the attitude of the interviewees, it was reflected that personal characteristics in terms of responsible people, interested in learning by themselves, determination, patience, and analytical thinking were of importance. Lastly, 6) leadership skills - Crafters should be aware of the benefits of change and support factors that promoted innovation in learning such as information technology, on-line learning resources, media, and equipment, etc. Although every person had the ability to develop himself to be leader of innovation, he ought not to forget Thai wisdom but try to find good things around himself because that was valuable knowledge that could be used to create pumpkin carving to inherit Thai wisdom.

External factors affecting design and application of ergonomics technology in pumpkin carving to inherit Thai wisdom

External factors were factors that arose directly from the individual person. They were caused by surrounding environment involved and had an influence on the creative of pumpkin carving to inherit Thai wisdom. Regarding this study, the findings revealed six factors which consisted of 1) The necessity of living Even though, the interviewees had different

ways of life, and different traditions, they all felt bound and dependent on nature and learnt from nature. This made them gain knowledge about how to make a living and have a lifestyle that is consistent with nature. From various problems, it was necessary for them to adjust themselves and be creative in carving pumpkin to inherit Thai wisdom suitably in accordance with the natural environment by means of inventing or developing for use. 2) Geographical condition and environment - Conditions in which the interviewees lived were varied resulting in the creation of pumpkin carving to inherit Thai wisdom differently. 3) Beliefs, doctrines, religious principles, and supernatural power - According to the study, the interviewees were Buddhists. There were Buddhism and supernatural power. Religious doctrines were employed as their ways of life and also spiritual anchor which brought about creativity in pumpkin carving. 4) Technological progress from the West - The interviewees viewed this progress caused better development and communication of Thai society. But we should consider that adopting Western technological advancement to make us creative in carving pumpkin to inherit Thai wisdom had both advantages and disadvantages of various aspects of technology before using it. This was due to the fact that some types of technology could indirectly hurt us and we did not even realize it or become aware of it. 5) Studying to gain more knowledge from experiences - Crafters had to constantly seek for knowledge and study for more knowledge by experimenting, ask knowledgeable people, consistently produce their carving production, and continuously improve their carved work for more quality to benefit both themselves and society and eventually enable to transfer their knowledge to others.

The results of this study shed light on the design and application of modern technology in pumpkin carving to inherit Thai wisdom that emphasized process skills, and products produced from actual performance. This research can be summarized as a conceptual framework of factors affecting the design and application of ergonomics technology in pumpkin carving to inherit Thai wisdom, as seen in

Figure 1.

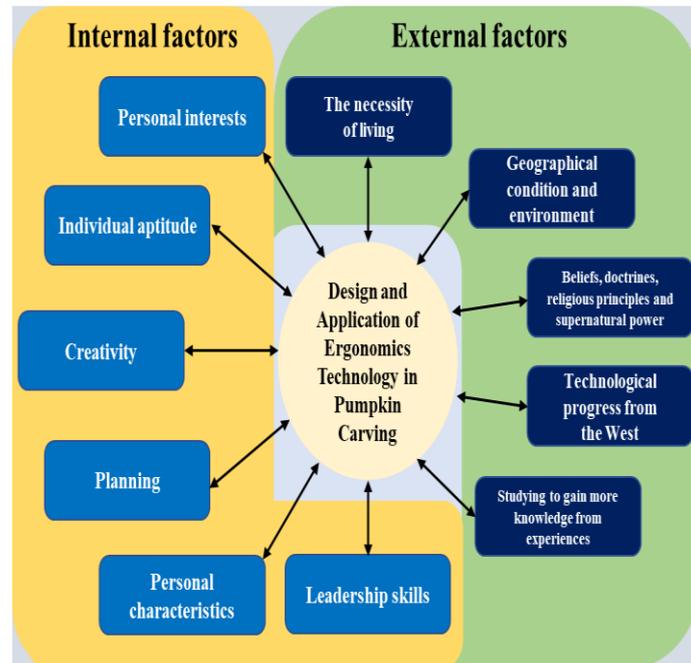


Fig. 1. Conceptual framework of factors affecting the design and application of ergonomics technology in pumpkin carving to inherit Thai wisdom

VI. DISCUSSION AND RECOMMENDATIONS

From the study about the internal factors, it was found that 1) personal interests, 2) individual aptitude, 3) creativity, 4) planning, 5) personal characteristics, and 6) leadership skills can affect design and application of ergonomics technology in pumpkin carving to inherit Thai wisdom. Provided that crafters personal characteristics, and attitude of crafters were essential since these things made them discover their own aptitude by learning and practicing hard (Oupananchai, & Onputtha, 2018). Hence, aptitude was important in terms of learning goals that focused on those who were interested in carving as a center, which led to the design and application of Ergonomics Technology in pumpkin carving (Pender, Murdaugh, & Parsons, 2002; Maloney-Krichmar & Preece, 2004; Gifford & Nilsson, 2014). This is in line with the study conducted by Somapa (2016) who have analyzed the factors and best practices of the royal institutions. The result showed that it was of high importance to build a relationship with learners and the focus was to encourage learners to

know their own aptitude. This reflected that personal characteristics had a great influence on the creation of pumpkin carving. The most obvious personal characteristics were responsibility, patience and determination. However, in order to design and apply Ergonomics Technology in pumpkin carving, creative thinking was often needed in tandem with self-learning, aiming to be utilized in the process of thinking, analyzing, and improving regularly, such as art-related websites, design of a variety of different patterns, and carving experiments. Similar, Somdee, (2012) who have studied the application of the sufficiency economy initiative, and inherited local knowledge in handicrafts. She pointed out that learning methods with emphasis on the training of learners' skills by experimenting with actual practice would lead to skills, knowledge and aesthetic experiences. Later on, these were subsequently applied to further generate their own work.

Regarding the study of external factors, it was found that external factors 1) the necessity of living; 2) geographical condition and environment; 3) beliefs,

doctrines, religious principles, and supernatural power; 4) technological progress from the west; and 5) studying willingness can affect design and application of ergonomics technology in pumpkin carving to inherit Thai wisdom. This can reflect that, before crafting, the interviewees have learned how to carve from various learning materials such as books, texts, and media from the Internet and so on in order to practice carving prior to the process of applying various patterns to their work. This could be comparable with Bandura, Freeman and Lightsey (1999) studying about intellectual-social learning concept and stating that human behaviors emerged mostly from learning by observing or imitating the actions of others. Their study divided the models into four main types, namely 1) Behavioral modeling - the way that shows behavior for people, 2) Verbal modeling - having a model that speaks, writes or tells what to do because humans can do things by listening to others' voices or from reading from other people's writing such as cooking from books or texts, 3) Symbolic modeling - having a picture or sound model that is transmitted through various media, such as radio, television, computers, and finally 4) kinesthetic modeling - having a touch-based model, for example, deaf and blind children while studying may have to touch the mouth of the teacher. This can also be supported by Oupananchai, and Onputtha (2018) advocated that knowledge learning can be obtained from various sources, which can be beneficial towards the skills creating effective human performance. The study result derived from the interview in this study also corresponds with the study done by Gifford and Nilsson (2014) who found that living condition, cultural and ethnic variations as well as religion can influence people's behavioral performance. Therefore, it is very important to consider the related environment and social atmosphere.

As a result, the study can contribute the original knowledge related to the internal and external factors for any organizations and involved persons that are aiming at utilizing ergonomics technologies inheriting Thai's pumpkin carving wisdom. They should prepare themselves to find participates with self-interest and good

attitude on pumpkin carving because pumpkin carving requires more times and more self-consciousness. In addition, the persons who are participating in having pumpkin carving should be creative and plannable because they must delicate themselves in creating the exquisite pattern on the pumpkin. In addition, the associated organizations and involved persons should learn and understand more about the availability of technology from the west in the area as well as the living condition, beliefs, doctrines, religious principles, and supernatural power.

However, the study has some limitations. The limitation in this research was the data collection under the outbreak of COVID-19, which is a qualitative research, must have specific characteristics or qualifications that are consistent with the research objectives. The researcher must study in depth with key informants who only have the skills, experience and expertise in pumpkin carving. Therefore, if a researcher uses random sampling, that's not an appropriate method of obtaining sufficient information for research purposes. In this regard, the findings obtained from the selection of key informants provide clear, accurate conclusions, and data saturation can be used to describe the results of this study. Therefore, further research in the field should focus on the use of a wider range of research methods, both in the field of action research combines appropriate methods or other forms of research in order to produce more practical results by giving importance to those involved in all sectors, in particular the art and culture of pumpkin carving, which will continue to inherit Thai wisdom.

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