UNIVERSITI TEKNOLOGI MARA

A STUDY OF MATHEMATICAL THINKING IN *MENGKUANG* WEAVING

SYAHIRAH AFIQAH BINTI MOHD TAUFIK

Thesis submitted in fulfillment
of the requirements for the degree of
Master of Art

Faculty of Art & Design

December 2019

ABSTRACT

Ethnomathematics is the research that considers the interrelation both mathematics and culture. In Malaysia, ethnomathematics is applied in many fields such as weave (*mengkuang*, rattan, and *songket*), weapon making (*Keris*), dance (*Mak Yong*), pottery, woodcarving and others. Moreover, this research will only focus on the motifs of *mengkuang* weaving as the culture of ethnomathematics research which related to mathematical elements and aesthetic significance. As this is a qualitative research that explores *mengkuang* motifs element and mathematical element will mainly lead to the appreciation of the aesthetic significance. Purposive sampling was used in selecting the subject of this research which is three traditional *mengkuang* weavers. Participant observation, semi-structured and unstructured interviews were used to gather the data. Then, transcription was used to transcribe the interview sessions which later the data will analyze in different theme. The *mengkuang* weavers also do have mathematical thinking in their activities, but they are not aware of it. Their thinking has rarely discussed or appreciated. This research discusses the mathematical thinking and the mathematical elements embedded in the creative and artistic mind of the weavers in the process of *mengkuang* weaving. Their work involves a lot of applications of mathematical concepts such as measurement, accuracy, estimation, ratio, transformation (rotation, resizing, reflection and translation) and geometrical (symmetry and midpoint). The *mengkuang* motifs also can be categorized under the symmetry group, namely as Frieze Pattern, Wallpaper Pattern and Tessellation Pattern. Later, the mathematical elements that related to *mengkuang* motifs will interconnectedness to the aesthetic significance which is formalistic element by Clive Bell model and were analyzing them using the framework matrix and triangulation approach. Finding showed that *mengkuang* weavers did have mathematical thinking in their weaving activities such as estimation, ratio, reflection and repetition. Furthermore, the weavers were creative as the flora or fauna motif were transformation from the real object which came from their observation towards their surroundings. Besides, the motifs also can be classified into certain types of Frieze Pattern and Wallpaper Pattern that consist of transformation concept such as translation, reflection, rotation and glide reflection. Tessellation pattern also takes part to consider the arrangement of the motif which is no gap and no overlapping between the motifs. In addition, the framework matrix is used to find out the similarities between the terms used in mathematical transformation concepts and element of design that later will undergo the triangulation approach to meet the philosophy between them. As a conclusion, this research will help the young generation to preserve their heritage as *mengkuang* has been recognized for world. It also to give awareness that mathematics is not culture free studies which *mengkuang* motif can act as a tool in teaching. Besides, this research will relate the beauty of *mengkuang* motif and the process of weaving involve many mathematical elements and mathematical concepts.

Key words: Aesthetic Values, Ethnomathematics, Mengkuang Weaving Motif, Mathematical Thinking, Mathematical Transformation Concepts.

ACKNOWLEDGEMENT

TABLE OF CONTENTS

CHAPTER ONE
INTRODUCTION

1.1   Research Background

Ethnomathematics is the study that considers the interrelation both mathematics and culture (D'Ambrosio, 1999). D'Ambrosio & Ascher (1994) who are the etnomathematics founding fathers, describe ethnomathematics as the research of different type of mathematical forms that came out from various modes of insights. According to him, different cultures preserve the nature of mathematical knowledge that eventually led to the history of mathematics, philosophy and cognition. Specifically, ethnomathematics is one of the researches that have been specified in many ways by different peoples, depending on the context. It is also defined as the implementation of the mathematical thinking into the culture of a group of people staying in a specific country. Bishop (1988) claimed that there are six mathematical activities which are common to every culture such as counting, designing, explaining, locating, measuring and playing. This statement is defended by many researchers that go through etnomathematical research with various cultural groups throughout the world (Ascher, 2002 and Abdul Razak, 2013). Beyer (1988) and Siegel (1999) as cited in Nor Maizan (2016) and Hwa (2011), they concluded that the mathematical thinking into three major fields which include mathematical knowledge, mental operations and predisposition. Mathematical knowledge refers to mathematical concepts and ideas that one has obtained or learnt. Besides, mental operations can be considered as cognitive activities that need to be performed when thinking. Predisposition stands for the tendency to think in certain ways under certain circumstances which include being realistic, attentive, open minded and beliefs and affects.

In Malaysia, ethnomathematics is applied into various fields such as weaving *mengkuang, songket* and rattan, weapon making (*keris*), dance (*mak yong*), wooden craft, kite making (*wau*), food cover (*tudung saji*), top spin (*gasing*) and architecture (Wan Norliza et al., 2011 and Nor Maizan, 2016 and Marzita 2007). Producing those crafts needs special skills and knowledge. The beautiful art craft produced by the Malays has the existence of the mathematical thinking but rarely discussed or