TEACHERS’ PERCEPTIONS OF TEACHING CULTURALLY-BASED
MATHEMATICS CURRICULUM UNITS

A DISSERTATION SUBMITTED TO THE GRADUATE DIVISION OF THE
UNIVERSITY OF HAWAI’I AT MĀNOA IN PARTIAL FULFILLMENT OF THE
REQUIREMENTS FOR THE DEGREE OF

DOCTOR OF PHILOSOPHY

IN

EDUCATION

May 2014

By

Rhoda B. Velasquez

Dissertation Committee:

A. J. (Sandy) Dawson, Chairperson
   Neil Pateman
   Tom Craven
   Deborah Zuercher
   Beatriz D’Ambrosio
ACKNOWLEDGMENT

I would like to express my heartfelt gratitude and great appreciation to the following individuals who enabled me to successfully complete the dissertation study proposal:

Dr. A. J. (Sandy) Dawson, former Professor, College of Education, University of Hawai‘i at Mānoa (UHM), advisor and chair of the panel of Examiners, for sharing his valuable expertise in mathematics education, and his professional insights in educational research and for providing me with an enlightening outlook for my study;

Dr. Deborah Zuercher, Professor of Education at UH; for her thorough reviews, constructive criticisms and suggestions that contributed immensely to the improvement of the study;

Dr. Tom Craven, Professor of Mathematics and Dr. Neil Pateman, former Professor of Mathematics at UH for providing untiring guidance and encouragement throughout the course of the study;

Dr. Beatriz S. D’Ambrosio, Professor of Mathematics at the University of Ohio-Miami, for her critical analysis, suggestions and moral support for the improvement of the study;

The teacher-participants who patiently endure the challenges and difficulties of teaching the culturally based mathematics curriculum unit, and who willingly participated in my study. Without them, this study will not be accomplished.

My co-Macimisers, particularly Penina Tulensru, Tulensru Waguk, Danilo Mamangon, Epimachus Moses, Lucia Tabelual, Dora Miura, Bea Camacho, Jerry Fagolimol, Callistus Hachibmai, Miuty Nokar, Dionisialyn Bernard, Curtis Hayseck, Deeleeann Daniel, Stanley Etse, Tendy Liwy, Bobby Lomae, Sweeny Term, Alexander Langidrik, Andrea Aiona, Paul Tauiliili and Tauvela Fale, as well as my friends in
Kosrae, Yap, Federated States of Micronesia and in the Philippines for their unending moral and material support, understanding and enthusiasm;

My parents, Juan and Rosa, my brothers Josue and Jonathan, my sisters, Raquel, Ruby, and Rebecca and my best friend, Janice Manuel for their unconditional love, understanding and encouragement that served an inspiration to finish the study soonest, and

Finally, to the Almighty God in Heaven, goes my unceasing and deepest gratitude for the life, knowledge, strength and countless blessings bestowed on me.
ABSTRACT

This study was conducted to determine the teachers’ perceptions and views of teaching of culturally-based mathematics curriculum (CBMC) units in the 2 islands of Federated States of Micronesia, namely Kosrae and Yap, during the academic year 2012-2013. The Project MACIMISE funded by the National science Foundation inspired this study.

Specifically, this research study seeks to answer the following questions:

1. What are the teachers’ attitudes and opinions about the culturally-based mathematics curriculum?

2. How do teachers describe their experiences with teaching of mathematics using a culturally-based curriculum unit?

3. What do teachers think about the curriculum’s effectiveness and ineffectiveness in their teaching of mathematics?

4. How do teachers perceive students’ receptivity and attitudes towards the culturally-based mathematics curriculum?

The study used qualitative methods of research with 3 teachers in Kosrae and 2 in Yap, Federated States of Micronesia during the academic year 2012-2013.

Narrative stories of the teachers and interviews were the main instruments used to gather data for the study. These instruments were implemented after the teaching of culturally-based mathematics curriculum unit lessons.

In order to distinguish the different perceptions of the participants and understand its relationship, the data were typologically analyzed. Transcription, and organization of the data into categories, identification of emergent themes, relationships or patterns from the stories were conducted. Then, triangulation of these themes with the interview was made.
The study found out that teachers undoubtedly had positive attitude and students became interested and had positive attitudes toward CBMC. Teachers support the view that it is effective in the teaching and learning process and made a commitment to share it with others. They did note, however, that their lack of knowledge and experience with CBMC undermined their performance in teaching the unit.

The study encourages teachers and school administrators to try and implement the use of culturally-based curriculum (CBC) to supplement instruction. Further research in students’ achievement and attitudes, learning rate, retention and cost in using CBE should be conducted.
# TABLE OF CONTENTS

ABSTRACT .................................................................................................................................................. iv

LIST OF FIGURES ...................................................................................................................................... x

LIST OF TABLES ......................................................................................................................................... xi

Chapter One: INTRODUCTION ................................................................................................................ 1

Background .................................................................................................................................................. 1

The Research Site: Two Micronesian States ......................................................................................... 1

Characteristics of the Yap and Kosrae Educational Systems .............................................................. 2

Yap State Initiatives .................................................................................................................................. 4

Yap State Constitution .............................................................................................................................. 4

Title 16 of Yap State Code ....................................................................................................................... 4

Yap Department of Education .................................................................................................................. 4

Yap State Vision ......................................................................................................................................... 5

Yap State Mission Statement ................................................................................................................... 5

Kosrae State Initiatives .............................................................................................................................. 6

Kosrae State Constitution .......................................................................................................................... 6

Title 5 of Kosrae State Code of Laws ....................................................................................................... 7

Kosrae Department of Education Mission .............................................................................................. 7

Kosrae DOE Services for Gifted and Talented Students ....................................................................... 7

Teachers Perspective & Classroom Diversity ......................................................................................... 8

Culturally-based Mathematics Curriculum (CBMC) Units ................................................................... 11

Yap Grade 1 Unit ....................................................................................................................................... 11

Yap Grade 4 Unit ....................................................................................................................................... 12
<table>
<thead>
<tr>
<th>Chapter 2: REVIEW OF RELATED LITERATURE AND STUDIES</th>
<th>21</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics Literacy</td>
<td>21</td>
</tr>
<tr>
<td>Shifts in Mathematics and Science Education</td>
<td>24</td>
</tr>
<tr>
<td>Instructional Materials</td>
<td>24</td>
</tr>
<tr>
<td>Common Core Standards in Mathematics</td>
<td>25</td>
</tr>
<tr>
<td>Culture-based Education</td>
<td>26</td>
</tr>
<tr>
<td>Ethnomathematics</td>
<td>27</td>
</tr>
<tr>
<td>Impact of Culture-based Curriculum</td>
<td>29</td>
</tr>
<tr>
<td>Culturally-based vs. Culturally-responsive vs. Culturally-relevant</td>
<td>30</td>
</tr>
<tr>
<td>Indigenous Research Ethics</td>
<td>32</td>
</tr>
<tr>
<td>Theoretical and Conceptual Framework</td>
<td>35</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Chapter 3: METHODOLOGY</th>
<th>39</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research Method</td>
<td>39</td>
</tr>
<tr>
<td>Research Design</td>
<td>39</td>
</tr>
<tr>
<td>Respondents</td>
<td>40</td>
</tr>
<tr>
<td>Instruments</td>
<td>41</td>
</tr>
<tr>
<td>Figure</td>
<td>Description</td>
</tr>
<tr>
<td>----------</td>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td>Figure 1</td>
<td>Map of Yap and Kosrae, FSM</td>
</tr>
<tr>
<td>Figure 2</td>
<td>Research Paradigm of the Study</td>
</tr>
<tr>
<td>Figure 3</td>
<td>Conceptual Framework of the Study</td>
</tr>
</tbody>
</table>
LIST OF TABLE

Table 1: Cram's Translation of Smith's Cultural Values............................................... 32
Table 2: Categories and Descriptors........................................................................... 44
Chapter 1

INTRODUCTION

BACKGROUND

The Research Site: Two Micronesian State

The two islands featured in this study were chosen because of their nature, remoteness and richness in culture. This study involves exploring the site to gain as much information as possible, geographical, historical and cultural. In order to visualize the location of the two research sites, see the map below.

Figure 1: Map of Yap & Kosrae, FSM
Geographically, the two islands are located very close to the equator. The major part of the two islands is undisturbed and uninhabited. Forest, jungle, mountains, mangrove swamps and beaches appear to be their natural site. Most lands are privately owned. These two magical, remote islands, Yap and Kosrae, these paradise-like islands are known as the islands of stone money and the sleeping lady, respectively. It can be considered as the world’s best dive sites. (www.visityap.com and www.kosrae.com)

Historically, traders and whalers were early visitors to these islands from Europe. Missionaries were the next group that came to the islands in an attempt to instill a strong faith in God Almighty. With the outbreak of the two world wars the Japanese settled into the two islands. The arrival of the Japanese had a great influence into the islands’ lifestyles. The defeat of the Japanese was followed by the Americanization of the islands, which became part of the Trust Territory administered by the United States of America. In 1985, the Federated States of Micronesia gained their independence from the Trust Territory. In 1986 the Compact of Free Association was established between the FSM, and the US and it is still in effect. (www.visityap.com www.kosrae.com)

Culturally, traditional skills in woodcarving, canoe and house building, weaving from pandanus and coconut fronds, cooking, fishing and farming are commonly practiced. This is also the major way of earning a living on those two islands. Local customs and traditions must be observed, ranging from clothing, speaking, languages (there are four official languages on Yap), as well as other behaviors governed by the caste system on Yap, and religion on Kosrae. They are ‘quiet’ islands as there’s little disturbance or noise that is noticeable. These are the two islands where affectionate, gracious, bighearted and respectful people live.

*Characteristics of the Yap and Kosrae Educational Systems*

Learning is a continuous process, a popular adage that has been around since the beginning of time. Education is a cycle that evolves since the earliest times, wherein
knowledge and skills are passed on from generation to the next generation. The need for education is emphasized in the Federated States of Micronesia (FSM). Initiatives to improve education as indicated in Title 40 of the FSM Code: (Source: Education Strategic Plan of Yap State, FSM 2007-2012, [http://www.paddle.usp.ac.fj/cgi-bin/paddle?e=d-010off-paddle--00-1--0---0-10-TX--4------0-111--11-en-50---20-home---00-3-1-000--0-0-11-utfZz-8-00&a=file&d=yap001](http://www.paddle.usp.ac.fj/cgi-bin/paddle?e=d-010off-paddle--00-1--0---0-10-TX--4------0-111--11-en-50---20-home---00-3-1-000--0-0-11-utfZz-8-00&a=file&d=yap001))

TITLE 40 of the Federated States of Micronesia (FSM) Code, which contains the FSM Education Act of 1993, declares it to be the policy of the FSM to provide for a decentralized educational system in the country which shall enable its citizens to participate fully in the development of the islands as well as to become familiar with the Pacific community and the world. To this end, the purpose of education in the FSM shall include the following:

- To develop its citizens in order to prepare them for participation in self-government and economic and social development;
- To function as a unifying agent;
- To bring to the people a knowledge of their islands, the economy, the government, and the people who inhabit the islands;
- To preserve Micronesian culture and traditions;
- To convey essential information concerning health, safety, and protection of the island environment; and
- To provide its citizens with the social, political, professional and vocational skills required to develop the Nation.
It is also stated in the Title 40 Section 104-1, that, “Education shall be provided and shall be compulsory for all children, including children with disabilities, from first grade through graduation from the eighth grade, or until the age of 14 years”.

**YAP State Initiatives**

The state of Yap has developed several initiatives to improve its education system as described in the Yap State Constitution, Yap State Code, and the Yap State Department of Education (DOE) vision and mission statements, which are presented below. (Source: Education Strategic Plan of Yap State, FSM 2007-2012)

**Yap State Constitution**

Article XII, Section 2, of the Yap State Constitution, states that the Yap State Government shall provide for public education and schools, that public elementary education shall be free, and that traditions and customs of the people of the Yap State shall be taught in public schools as provided by law.

**Title 16 of Yap State Code**

As the Yap State Constitution calls for the teaching and learning of the traditions and customs of the people of the state, Title 16 of Yap State Code mandates creation of the position of culture teachers and hiring of culture teachers by the local school boards of elementary schools in Yap Proper to instruct students in various aspects of Yapese heritage and culture.

**Yap Department of Education**

Callistus Hachibmai, the Yap DOE Management and Support administrator, summarized the Yap educational setting as follows:

Yap DOE like the other FSM State DOE’s receives compact funding to operate its programs, which are consistent with the FSM National’s
Strategic Goals to improve and develop manpower, and build a sustainable economy. A major portion of the budget is allocated to providing quality education in the Early Childhood Education, elementary and secondary education. The on-going task to improve the quality of education and to make it relevant to the economic and social need for the State and the Federated States of Micronesia is training and upgrading of the schools’ teachers and principals.

(Personal Communication, January 2014)

In the public school system there are twenty-five Early Childhood Centers (ECE) and thirty-two public schools in Yap. Three of the thirty-two public schools are secondary schools, one on Yap proper and two on the neighbor islands, the Ulithi and Woleai atolls. The Public schools have a student enrollment of 2,741 and 299 teachers in the classrooms.

The geographical spread out of the schools extends eastward for approximately 540 miles from Yap proper. The school system is divided up to five school zones. They are Waqab Zone, Ulithi Zone, Woleai Zone, Ifalik Zone and Satawal Zone.

Yap State Vision: The Yap State Education believes that children are the center of education and education is the future of Yap. The Yap State Department of Education goal is to offer quality public education system that transforms schools into community centers that promote shared moral values, good governance and sustainable development.

Yap State Mission Statement: The Yap State Department of Education provides quality education for sustainable development through:
• Nurturing children’s sense of cultural identity, self-esteem, confidence, creativity, friendliness, high moral values and deep appreciation of life and its many challenges.

• Forming a cooperative enterprise with parents, community members, traditional leaders and other government and non-government agencies, which support schools and communities?

• Developing programs and policies, which reflect the changing needs of students, teachers, parents and communities through open communication, training and workshops, periodic re-examination of curriculum, collaborative decision-making and equitable funding.

• Valuing, respecting and supporting the local culture within each school.

• Creating public facilities, which are accessible to ALL students, including those with special needs.

**Kosrae State Initiatives**

The state of Kosrae also has developed several state initiatives to improve its education system as indicated in Kosrae State Constitution, Kosrae State Code of Laws, and the Kosrae State DOE vision and mission statements, as presented below. (Source: Management audit and functional analysis report Kosrae State Department of Education, (http://www.fsmed.fm/index.php/documents/category/18-audit-reports.html)

**Kosrae State Constitution**

Article XII, Section 1, of the Kosrae State Constitution, states that the Kosrae State Government shall promote education and health.
**Title 5 of Kosrae State Code of Laws**

As the Kosrae State Constitution calls for the promotion of education to the people of the state, Title 5 of Kosrae State Code of Laws mandates that the State DOE shall

- provide academic and vocational guidance for elementary and secondary education, giving special attention to handicapped minors;
- conduct teacher training and evaluation;
- develop relevant curriculum; and
- provide career counseling services to students
- administers youth, senior citizen and women’s affairs programs, preserves and promotes traditions and cultural heritage

**Kosrae Department of Education Mission**

The State Educational Mission is “to provide a student-centered education system that develops the skills, knowledge and values of the youth and young adults of Kosrae to become responsible, productive and life-long learners and be competitive locally and globally” (page 21).

Kosrae DOE is an organization with 182 teachers serving 2197 students SY 2009-2010. There are seven (7) facilities within the Department – 6 Elementary schools, 1 High School and Department Headquarters (located on the same grounds as the High school).

**Kosrae DOE Services for Gifted and Talented students**

The Kosrae DOE has adopted a program of placement of high achieving students into classes with advanced subject topics, such as calculus, physics, economics, Arabic,
US History and British History. Student performance data is available which guides placement into different levels within high school, for example, classes for each grade are broken up into “a”, “b”, ‘c’, or ‘d’. About 45 to 50 students have been identified as scholastically advanced and / or talented. Programs for gifted and talented children have been developed down to the grade 6 level. The students showing greater aptitude are placed in either ‘a’ or ‘b’ classes and then students with less abilities placed respective in other levels from “c” down. As mentioned above, ‘a’ and ‘b’ class students receive separate curriculum to other students. Determination for placement is made by a collective analysis of National Standardized Test (NST) 8th grade testing, High School entry tests for grade 9, 10th grade NST and teacher observations (page 47).

This program is the only one offered of its type in FSM as mentioned from the report.

As can be seen from the initiatives of these islands (Yap & Kosrae), teaching and learning developments are being implemented to ensure quality education is provided to the children and both state also emphasized the importance of traditions and culture in their classrooms.

*Teachers Perspective & Classroom Diversity*

Diversity has always been evident in classrooms, physically, socially or culturally. However, teachers need to take into consideration all these differences in order to provide quality education. If we want all students to have the opportunity of education that will enable them to make their dreams come true regardless of their social economic status, physical or cultural differences, then, teachers must develop lessons that motivate
all students to learn and create positive learning environments. (Teaching diverse
students, www.sagepub.com/upm-data/39272_2.pdf)

As for Yap classrooms, the student population, languages, gender, social status
and academic standing all create a rich diversity. The school population consists of
students who are Yapese (from the Yap Proper and outer islands of Yap, as well as
children of American, Filipino, Japanese, Chinese, Palauan, Chamorro descent as well as
and other Micronesians like Chuukese, Pohnpeians, and Kosraeans who migrated in this
island. Even though the outer islanders are considered Yapese, they also have their own
culture and languages, different in each of the outer islands. As can be seen, racial
differences and various languages are increasing and teachers should keep this in mind,
and be prepared for how to deal about it. Gender is also considered significant in
classroom diversity because of Yapese tradition and custom, some chores were
appropriate to girls and others were for the boys only. Social status is also important to
note since on Yap a caste system is prevalent. Academic achievement of students also
contributes to diversity since some students can finish the given task so fast that the
slower students will be missing out and have less opportunity to respond.

For Kosrae classrooms, diversity derives from the same variables as on Yap. Two
important differences, however, are that Kosrae doesn’t have outer islanders, and no caste
system.

Because of these academic, emotional, and cultural differences, it is most
important that teachers gain understanding of their students’ needs and develop ways to
get the interest of all the students to study.
To cater to these needs, educators have continuously presented many significant interventions, teaching methodologies and approaches. One recent development is teaching the curriculum based on culture practices and artifacts. Culture plays a significant role in the field of teaching and learning. Culture-based education is recommended in Pacific Resources for Education and Learning (PREL)’s document: Research into Practice (2010):

Slowly and steadily, new educational pathways are being founded on Pacific values, knowledge, and languages in the Pacific region—pathways that are working toward locally determined visions and goals within their own Pacific education systems. It is a momentum nurtured by the belief that indigenous peoples can and should reclaim and revalue their languages and cultures—their ways of knowing, doing, and saying—within the formal education system that educates their children.

Trends focused on culturally-based mathematics curriculum are intensifying and becoming popular. It is claimed that cultural knowledge plays an important role in many aspects of the teaching-learning process. As Lipka et al. (2006, p. 5) stated, “Issues of culture, power and creativity are weaved together to form a third space – the newly recontextualized content and the circumstances that surround learning that content – without losing sight of the critical importance of improving students' math learning.”

In order for the Pacific children to improve their mathematics education through culture, Project MACIMISE (Mathematics and Culture in Micronesia: Integrating Societal Experiences) was established and funded by the National Science Foundation. Project participants took on the task of uncovering mathematics that is within the cultural
practices and activities of the indigenous people in the Pacific region\textsuperscript{1} served by PREL, and to use these activities to develop curriculum units to teach mathematics to Pacific children.

\textit{Culturally-based Mathematics Curriculum (CBMC) Units}

A primary goal of the Project MACIMISE is the formulation of the CBMC units in Grade 1, 4 and 7. These units are the result of the extraordinary collaboration from the educators, Pacific elders, teachers and mathematicians. These units were produced to connect the local knowledge with the school mathematics, which also integrates the use of local materials. Although the Project MACIMISE had produced several units from the different islands of the Pacific, this paper will describe only the units taught by the participants of this study on Yap and Kosrae.

\textbf{Yap Grade 1 Unit}

This unit entitled: \textit{Indigenous Counting and Measuring Systems in the Outer Islands of Yap}, was developed by Godfrey Fagolimul, currently the Yap State Senator in charge of education, arts and health, and a former mathematics instructor at the College of Micronesia, Yap Campus.

In this unit, students learn how to use the indigenous counting system and measuring system in their culture and traditional settings. They will form their numerical understanding to expand and connect with the western counting system. They study the mathematical structure of the traditional Yapese number system, which is based on classifiers: \textit{fau} for counting round object and \textit{facho} for counting long objects. They also learn how to appreciate and preserve the cultural and traditional knowledge of numerical concepts of counting in their vernacular language as the basis of their identity and pride. For more details about this unit see Appendix E on page 74.

\footnote{\textsuperscript{1} The Republic of Palau, Guam, the Commonwealth of the Northern Mariana Islands (CNMI), the Republic of the Marshall Islands (RMI), American Samoa, and the Federated States of Micronesia (FSM) that includes the States of Yap, Chuuk, Pohnpei, and Kosrae.}
Yap Grade 4 Unit

Callistus Hachibmai, currently the management and support administrator at the Yap State Department of Education, and formerly a teacher trainer, developed this unit.

Building a local house, which is a common practice in Yap, is the main cultural activity integrated in the much larger, over arching unit. One activity that is central to this larger unit is the weaving of thatch roof, its construction and the tying techniques used to build the roof. However, in the sub-unit reported on here, students learn to group objects, decompose and compose using addition, subtraction, multiplication and division. They also study geometric patterns and shapes, measurement of length and algebraic thinking and reasoning. For more details about this unit see Appendix F on page 82.

Kosrae Grade 1 Unit

Tulensru Waguk, currently the Principal of the Utwe Elementary School in Kosrae, developed this unit.

Weaving puhlet sroacnu, which is a common practice in Kosrae whenever there’s an important occasion or gathering, is the central over-arching cultural activity in the unit. However, in the sub-unit students learn to count in Kosraean, and study the mathematical structure of the traditional Kosraean counting system. They also study how to group objects, compose and decompose using addition and subtraction. They also learn how to count in terms of number groupings, like counting by two’s, three’s or five’s. For more details about this unit see Appendix G on 96.

Kosrae Grade 4 Unit

Rhoda Velasquez, currently a mathematics instructor at the College of Micronesia – Yap Campus, but formerly a College instructor on Kosrae Campus of the College, developed this unit entitled Fraction in Mats.

---

2 Kosraean local plate made from weaved coconut leaves.
The basics of mat weaving, that is the intertwining of two leaves, is the primary cultural activity of the unit. Various groupings of seashells was another activity central to the activities with which the children were engaged. In this unit, students were introduced to number of rectangular shapes in the mat that provided opportunities for the exploration of concepts with respect to fractions. As well, the collection of seashells provides opportunities to explore the concept of ratio. The children also experienced how to decompose and compose using addition and subtraction. See Appendix H for further details on page 108.

**Kosrae Grade 7 Unit**

This unit entitled *Mathematical Relation in Epoweaving* was developed by Penina Tulensru, currently a teacher at Tafunsak Elementary School in Kosrae.

Weaving *epo*, which is the ball of the traditional Kosraean game, is the main cultural activity in this unit. Students learn the traditional ways of weaving *epo*, which is by constructing and folding to make a cube-like ball. Students were introduced to proving and disproving mathematical conjectures like the use of reasoning in making the connection between the number of folds for each layer of *epo*, whether it provides a linear relationship or not. They also studied how to display relationships using charts or tables, plotting ordered pairs, graphing and mapping and forming equations. See Appendix I for more details on page 125.

Fagolimul and Hachibmai from Yap, and Waguk and Tulensru from Kosrae are all participants in Project MACIMISE.

In Micronesia, culturally-based instruction is becoming a fundamental part of education and will likely be more so in the future. Under Project MACIMISE, culturally-based mathematics curriculum units were developed and implemented in the Pacific region. A pilot study on teaching the culturally-based mathematics curriculum units was

---

3A cube-like ball made from *pandanus* leaves, which is use in a traditional ball game in Kosrae.
undertaken with children on several Pacific islands within the region that PREL serves. However, this paper will focus only on the pilot teachers in the state of Yap and Kosrae, FSM.

**Pilot Teachers Background**

Some background is provided below on the two pilot teachers in Yap and the three pilot teachers in Kosrae who were chosen to teach the Culturally-based Mathematics Curriculum (CBMC) Units and who willingly offered to participate in this study. Pseudonyms were used to ensure confidentiality and privacy of the individuals.

Nikko is the pilot teacher of the Yap Grade 1 CBMC Unit: *Indigenous Counting and Measuring Systems in the Outer Islands of Yap*. He is now a government official, but was once an instructor at the College of Micronesia. A master degree holder, he has been in the educational system for about 40 years in Yap. He is an outer islander and a non-native speaker of English. He has had different offices and taught different grades while in the department of education. He has also experience handling classes in the outer islands and in Yap proper with 10 up to 30 students. Aside from being the head of the family, he is also actively involved in the community activities.

Yacca is the pilot teacher of the Yap Grade 4 CBMC Unit on Local House building. She has been a public elementary school teacher for about 23 years now, an associate degree holder, who was nominated as a Teacher of the Year in recent years. She was born and raised on the Yap proper and also a non-native speaker of English. She teaches six or seven different subjects, like math, English, science etc., with an average of 20 students per class. She considered herself the head of the family since her husband passed away. She is also actively engaged in their community activities.

Sepe is the pilot teacher of the Kosrae Grade 1 CBMC Unit: *Counting and Adding with Native Plates*. She is a public elementary school teacher for 8 years. She is an associate degree holder, born and raised on Kosrae and a non-native speaker of
English. She teaches 3 different subjects with an average of 20 students per class. She is a mother of 4 children, and also actively involved in church and community activities.

Tolenna is the pilot teacher of the Kosrae Grade 4 CBMC Unit: *Fraction in Mats*. He is a public elementary school teacher for about 14 years, an associate degree holder, born and raised on Kosrae, and a non-native speaker of English. He teaches about 4 different subjects with an average of 20 students per class. He is the head of the family and also actively involved in church and community activities.

Sru is the pilot teacher of the Kosrae Grade 7 CBMC Unit: *Mathematical Relationship in Epo Weaving*. It was his first year of teaching at the public elementary school, an associate degree holder, born and raised on Kosrae, and a non-native speaker of English. He teaches about 4 different subjects with an average of 20 students per class. He is single, an active member of the youth club and also engages himself in church and community activities.

In order to provide quality mathematics education that is based on culture, teachers’ beliefs and attitude must be considered. As advocated on a featured article on Dr. Grable’s website ([http://ualr.edu/crgrable/id112.htm](http://ualr.edu/crgrable/id112.htm)), “… how educators think about linguistically and culturally diverse students and act on those beliefs is integral to the school reform…. …” (Camblin and Barlow, 2002).

In addition, James Beane (1995, p. 3), in the introduction to his article on what constitutes coherent curriculum, implies that for educators to invest their time and effort on a program, it is essential that it will produce an enduring transformation and not just a fleeting trend.

However, there is a lack of research into possible options for policies and strategies in using and teaching the culturally-based mathematics curriculum. There is also a lack of studies on the impact of the actions that are taken in teaching of the culturally-based mathematics curriculum or the effectiveness of its programs. Hence, this
study will not only assess the impact of the culturally-based units on the pilot teachers and children, but will also provide valuable data that can address policies and strategies for the teaching of culturally-based mathematics.

**Statement of the Problem**

This study aimed to determine the teachers’ perceptions and views of teaching CBMC units in Kosrae and Yap, two of the Federated States of Micronesia [FSM] during the academic year 2012-2013.

Specifically, this research study sought to answer the following questions:

1. What are the teachers’ attitudes and opinions about the culturally-based mathematics curriculum?
2. How do teachers describe their experiences with teaching of mathematics using a culturally-based curriculum unit?
3. What do teachers think about the curriculum’s effectiveness and ineffectiveness in their teaching of mathematics in terms of its use and completeness?
4. How do teachers perceive students’ receptivity and attitudes towards the culturally-based mathematics curriculum?

**Significance of the Study**

The researcher argues that it is necessary to know the teachers’ perception of teaching the culturally-based mathematics curriculum (CBMC) unit for the following reasons.

a. If teachers who pilot the CBMC units become highly motivated, gain positive attitudes and get high levels of support in teaching mathematics using CBMC, then more mathematics teachers will be convinced to include CBMC in their classes.

b. Teachers who have such experiences are
i. likely to make mathematics more interesting to students

ii. likely to discover that lesson preparation, presentation and assessment becomes easier.

c. Teachers’ attitudes and feelings to CBMC contribute to and foster the building the confidence and competence they need to teach mathematics.

This study is the first attempt by the Departments of Education on Kosrae and Yap, FSM, to determine the teachers’ perception of teaching CBMC in the classroom. The study has the potential of having a great impact on Kosraean and Yapese schools, particularly on administrators who have the authority to either fully implement the use of CBMC in all mathematics classrooms or upgrade its programs, or to discontinue its practice. This study will also give information to parents and the local Kosraean and Yapese communities that their departments of education are trying to look for teaching strategies as an alternative to the traditional lecture approach, and to thereby develop in children a greater interest in studying mathematics.

**My Personal Experience**

I was born, raised and educated in the Philippines. I also spent my early years of college teaching there, dealing with Filipino students with diverse cultures. Although, we are all called Filipinos in race, actually we have lots of differences in culture, languages or dialects, religion, socio-economic aspects, etc. In 2000, I was hired as a math instructor at the College of Micronesia (COM) at Kosrae Campus, Federated States of Micronesia. It is in another country, customs and traditions are also different from mine, but I was excited so I considered it as a challenge and an adventure in my life.

As a math educator, working at COM Kosrae campus provided me the opportunity to be affiliated with PREL’s Projects. Dr. Sandy Dawson, the director of the Project DELTA, MENTOR and now MACIMISE, invited me to participate in all three projects. I am so thankful and fortunate to be part of these three amazing projects. But of
course, I can’t be part of these projects without the support from our Campus Director, Kalwin Kephas. I spent ten years of my life in Kosrae. Kosraeans adopted me and considered me like a member of their family. That’s why Tulensru and Penina (both are MACIMISERS) are like my brother and sister, respectively.

In 2010, I went back to Philippines for medical reason and to take some rest. In 2012, two Yapese fathers, Jerry & Cal, encouraged me to be in their island and adopted me. So now, I am on Yap working at the same college (COM). I now have two Micronesian families, the Kosraeans and the Yapese. They are very kind, generous and respectful people.

These two islands are just dots in the map compared to other parts of the world, but I have chosen these two islands because of their nature and richness in culture. Although Europeans, Japanese, and Americans have settled in these two islands for some years, their traditional knowledge and skills were still being practice until today. Teaching and dealing with the Micronesian students for more than a decade gives me various challenges and difficulties. Sometimes there will be some moments that after a class period I would feel so lonely, as if I am not good enough in my teaching. Students’ absences, tardiness, inactive and quietness makes me feel uncomfortable and challenged. But as years have gone by, the training and professional development that I got from the two projects: DELTA and MENTOR gave me a new look into the situation. I have learned a lot of different activities and strategies that I can use in my classes, especially for those pre-service teacher-training students. I know that I can say that there was a difference, but I could feel that there’s still something that is missing. Then along came Project MACIMISE, which provides me with the opportunity to do research, to explore and discover the culture and environments of Kosrae. I have spent tremendous amount of time in dealing and in investigating indigenous cultural activities within a mathematical content. I have encountered different age groups and socio-economic groups of...
Kosraeans: students, co-instructors, co-workers, teachers, government officials, elders or cultural experts, parents and other people in the community. I can say that teaching with Kosraeans was very similar to Yapese students, as long as you understand and respect their customs, traditions and culture. My hard work in knowing and experiencing their culture has paid off. It seems like an eye opener to me not only in the mathematical aspect but also especially in cultural aspect. Knowing their culture makes me understand my students a lot better and I have to know and respect them. I know now why it is a great deal with them to be absent in class due to funeral and I could also understand why sometimes they are quiet. I realize that in every situation, they have the proper way of dealing with it and if ever that I am also in their situation, I would also do the same way. My heart widens and my understanding broadens that’s what makes me love the people and their culture. And sometimes, I cry for the thought that I am considered as an alien in their island, but they accepted and respected me as part of their family and that’s about their culture that I’m really proud of.

This study have had made a great impact on me being the sole researcher and an outsider. As an educator, learning the different cultures and experiences in culturally-based environment provides greater meaning and understanding in my methods and strategies in teaching mathematics. Being born and raised in a different culture and educated in the Philippines wherein conventional or traditional approaches were the main strategies in teaching made me realize that there was a more suitable method in dealing with the students in the Pacific, that is, the culturally-based mathematics teaching. The two islands, Kosrae and Yap, where collaboration, respect and trust were the integral qualities in their culture, are of great assistance in creating a positive learning environment for the students. This study strongly reinforced my belief that teaching mathematical concepts through an activity that is related to the students’ environment and culture fosters greater growth of understanding among the students. As a doctoral student
undertaking this research, the study has inspired and motivated me to engage in doing more research: to look further into different areas (home environments, ethnomathematics modules, learning styles, attitudes, academic preferences, etc.) that will further enhance of the learning environment of the students.
Chapter 2

REVIEW OF RELATED LITERATURE AND STUDIES

This chapter presents a discussion of theories, concepts and research studies that have a bearing on the focus of this study, and which hopefully will enrich the investigation.

Mathematics Literacy

Mathematical and scientific literacy is one of the fundamental goals of mathematics and science programs. PREL (1996) developed the *Pacific Standards for Excellence* to define global ideas important in a well-rounded educational program. These Standards describe regional goals towards which students, teachers and educational programs can strive.

The *Pacific Standards for Excellence in Mathematics and in Science* identifies a key set of important ideas that provide the foundation for understanding and applying mathematics and science. They are standards of excellence for all students and teachers to strive for in order to achieve PREL’s vision of mathematically and scientifically literate students who are knowledgeable, capable, and caring.

The American Association for the Advancement of Science (AAAS, 1989) Project 2061 definition of science literacy—which encompasses mathematics and technology as well as the natural and social sciences—has many facets. These include being familiar with the natural world and respecting its unity; being aware of some of the important ways in which mathematics, technology, and the sciences depend upon one another; understanding some of the key concepts and principles of science; having a capacity for scientific ways of thinking; knowing that science, mathematics, and technology are human enterprises, and knowing what that implies about their strengths and limitations; and being able to use scientific knowledge and ways of thinking for
personal and social purposes.

(http://www.project2061.org/publications/sfaa/online/intro.htm).

*The Pacific Standards for Excellence in Mathematics* represent PREL’s Pacific Mathematics Leadership Team’s response to the Curriculum and Evaluation Standards for School Mathematics National Council of Teachers of Mathematics, (NCTM). PREL’s team reviewed the NCTM document with the Pacific regions’ environment, cultures and needs in mind. Relevant recommendations were adapted from the NCTM document or new standards were created especially for the Pacific region. (PREL: PSE CD-ROM, 1996)

As the Leadership Team drew up the standards, they first looked at the needs of a demanding work force and society to determine the characteristics of a successful citizen. From there, they have identified three goals:

**Goal 1:** Mathematically literate workers can:
  - find multiple solutions to problems,
  - independently problem solve,
  - make new applications with their knowledge, and
  - retrain for a new job(s).

**Goal 2:** Lifelong learners can:
  - adapt to a changing workplace,
  - work independently or with a team,
  - make new applications with their knowledge,
  - have a well-rounded, fulfilling life,
  - use thinking tools that can help solve problems not now in existence, and
  - develop an attitude for learning beyond the classroom walls, beyond the school day.
Goal 3: Informed decisions are made by students who:

- are aware of government, religious, economic and other social
trends and beliefs,
- understand complex information,
- understand environmental changes and their associated
implications, and
- can apply mathematics to jobs, to everyday events, and to their
personal lives.

The Leadership Team was also aware that, for students to accomplish the three goals, all students must have access to important mathematics. Students should not be separated into groups that receive different content or for whom there are different expectations. As a consequence, they added a fourth goal to these standards.

Goal 4: Open mathematics to all students, so that they have opportunities to:

- learn and be intellectually challenged,
- achieve in mathematics with a belief that success does not depend on innate
talent, and
- develop mathematical power.

The idea of mathematical and scientific literacy has been around for many years. To achieve mathematical and scientific literacy among elementary and high school students, mathematics and science educators advocate a teaching and learning approach that starts with questions about nature, i.e., the world and its naturally occurring phenomena, together with all physical laws that govern them(The American Heritage Science Dictionary, 2002). This approach also engages students actively, concentrates on the collection of evidence, does not separate knowing from finding out, and de-emphasizes the memorization of technical vocabulary. In other words, teach math and
science in ways similar to the manner these areas are explored by mathematicians and scientists.

**Shifts in Mathematics and Science Education**

Mathematics and science are more than bodies of knowledge. They represent a way of looking at the world and ordering one’s experiences in it. The study of mathematics and science presents occasions to open young minds to new ideas and to equip students with the intellectual tools that will guide them as learners for the rest of their lives. Too often this is a missed opportunity. The following description is found in PREL (PSE CD-ROM, 1996):

Most schools today used a conventional approach to teaching these subjects. This approach presents science as a fixed body of facts, principles, and definitions, ordered sequentially, and divided into disciplines such as biology, chemistry, and physics. Mathematics instruction is usually lecture and practice. The approach to teaching described above does not work for most students. Somewhere in the middle grades students tend to lose interest, and by high school, many find mathematics and science difficult, boring, and irrelevant. Few take advanced courses. The result is that most adult citizens are not mathematically and scientifically literate.

**Instructional Materials**

The National Council of Teachers of Mathematics (NCTM, 1989) adopted certain standards for selecting instructional materials. These standards emphasize the value of periodic evaluation of the instructional materials based on the teachers’ and students’ reactions as well as an analysis of student achievement. The NCTM, to help ensure an updated curriculum and education to mold and prepare the students to acquire holistic knowledge and make the curriculum scientifically abreast with the contemporary society,
promoted the idea of continuous evaluation.
(http://www.fayar.net/east/teacher.web/math/standards/previous/CurrEvStds/index.htm)

Teacher-made instructional materials are the most common means of facilitating teaching-learning activities. Teacher-made instructional materials provide confidence in one’s ability to teach since one has the familiarity of the content, the objectives and presentation of the topic, and also the drills or exercise provided for the materials. In addition, teachers have the grasp on what specific topics need to be emphasized from those that are less important.

**Common Core States Standards in Mathematics**

The Common Core mathematical practices were created based on mathematical processes (problem solving, reasoning and proof, communication, representation and connections) and mathematical proficiencies (adaptive reasoning, strategic competence, conceptual understanding, procedural fluency and productive disposition. These practices are expected to be learned by the students at all levels (http://www.corestandards.org/Math).

1. Make sense of problems and persevere in solving them.

   This illustrates that when students were given a problem, they can explain the problem to themselves and can organize the given information, then after that they can create a plan on how to solve the unknown. The students will implement the plan, patiently and persistently. Then they need to verify and evaluate if their answer is correct. If not, then they should look for another way of solving the problem.

2. Reason abstractly and quantitatively.

   This means that the students should use the following habits: 1) create a representation of the given problem, 2) consider the units involved, 3) attend to
the meaning of quantities, and 4) use the properties of operations in order for them to contextualize and decontextualize problems.

3. Construct viable arguments and critique the reasoning of others
This states that the students can make conjectures, justify their conclusions and relate them to other students using drawings or diagrams and also they can listen and respond to other arguments of their classmates.

4. Model with mathematics
The students can use math to solve problems in real-life situations.

5. Use appropriate tools strategically
The student must know how to choose what tools to use in dealing with a problem. For example, if dealing with lengths, then the student can make use of ruler or tape measure; he should also know how to use these tools.

6. Attend to precision
The students must be accurate in solving a problem, they should check their solution if they use the appropriate symbols, math operations or units of measure.

7. Look for and make use of structure
The students can find and understand patterns and finally use these patterns in solving problems.

8. Look for and express regularity in repeated reasoning
The students can notice the repetition in the calculations, then, from there they can find a method or shortcut on how to compute it.

Teaching based on culture is noted in the Common Core State Standards (http://www.corestandards.org/Math/Practice) that mathematics educators must seek varieties of expertise that is described by the Standards for Mathematical Practices for them to develop in their students. One practice is “Model with Mathematics”, i.e.,
mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace.

**Culturally-Based Education**

According to Northwest Territories (NWT) Teachers Induction website, (http://www.newteachersnwt.ca/culture_based_education.html), culture may be defined as a people's traditions, history, values and language that make up the culture of a group and which contribute to their identity. Additionally, the website cited the following quotes about culture-based education.

1. Culturally-based education is intended to honor all forms of knowledge, ways of knowing and world views equally.

2. Culturally-based education will support aboriginal children as they define who they are as individuals and community members.

3. Culturally-based education is far more than the incorporation of cultural events and traditional skills into the curriculum. The goal of culturally-based education is to support all students through affirmation of their culture. When the school recognizes and validates the students' culture, it helps them to be aware of their heritage and to value the accomplishments of their family, their community and their ancestors. It builds a sense of pride and self-esteem, which is the best gift any teacher can give to his/her students.

The Kamehameha Schools, Research & Evaluation division (KSRED) produced a report (June 2007) in which they argue that culturally based education is the grounding of instruction and student learning in ways that include the values, norms, knowledge, beliefs, practices, experiences, and language that are the foundation of an indigenous culture.

(http://www.ksbe.edu/spi/PDFS/Reports/CBE/A_Brief_Overview_of_Culture-Based_Education_v3.pdf)

27
Ethnomathematics

D’Ambrosio, acknowledged as the father of ethnomathematics, uses the term ethnomathematics to articulate the connection between culture and mathematics (http://etnomatematica.org/articulos/Ambrosio1.pdf). My understanding about ethnomathematics is that it is a subject that was built on the ethnical/cultural background of the students such as beliefs, values, languages, food, dress, traditions and other cultural activities. Ethnomathematics includes lessons in mathematics that involve the student’s environment and culture, something that they can recognize and understand as their own. It integrates the local/indigenous practices or traditions into the school/academic mathematics. It may also refer to a process of learning mathematics using the student’s experiences and everyday living. It is also designed to give the students the information about the connections between the cultural heritage and the process of counting, measuring, comparing, calculating and other mathematical skills.

Ethnomathematics is very important to the teaching of mathematics. In order to better meet the mathematical needs of the students that belong to an ethnic community, ethnomathematics is formulated. The goal is to provide the students with ethnomathematical awareness and experiences in order for them to acquire better and deeper understanding of culture and especially mathematics. Ethnomathematics plays a significant role in the teaching and communicating of mathematics, since it is associated with the students’ ethnical and cultural background. When the teaching is based on their culture, it triggers the interest of the students and stimulates their thinking processes. Students feel as though they belong and are acknowledged.

Vega, Prieto and Carreon (2009, p.108) stated that culturally-based teaching acknowledges cultural diversity in the classroom. One is by recognizing and accepting student diversity; it communicates that all students are welcome and valued as human beings; it is particularly important for cultural and ethnical minorities who may feel some
form of alienation from school. This is amplified when teachers communicate that all students can learn and are expected to do so. Teaching mathematics that has connection to the student is also important. As D’Ambrosio (2001) noted, “Much of today’s curriculum is so disconnected from the child to be a full participant in it.” Therefore, a curriculum that alienates child’s identity eliminates full-participation of the child and will result in unwillingness and a lack of determination to study at all; how then will the child learn mathematics? That is why ethnomathematics comes into play, since it brings connection between the child’s self-identity and mathematics.

Teaching mathematics through ethnomathematics is an ideal process that clearly brings the academic mathematical knowledge to the learners in ways that make sense to them. In that case, they can gain comprehension and full understanding of mathematics and, at the same time, enhance their problem-solving skills, which will make them wise in decision-making and successful in this challenging world.

Impact of Culturally-based Curriculum

The following studies were taken from the June 2007 report published by KSRED. (http://www.ksbe.edu/spi/PDFS/Reports/CBE/A_Brief_Overview_of_Culture-Based_Education_v3.pdf)

Kawakami and Kanani (2001) investigated the perceptions of successful Hawaiian educators and found that educators of Hawaiian students identify authentic environment and experience-based learning as critical element in educational programs for Hawaiian students. According to McAlpine and Crago (1995), conflict between classroom culture and home culture may make it difficult for children to participate in class or force children to deny their family and heritage in order to succeed in a culturally alien school.

In a case study examined by Rickard (2005), a sixth-grade teacher and her students in an urban school district in Alaska, engaging in a module from the Math in a
*Cultural Context* (MCC) series, shows that the MCC module and the teacher’s support improved mathematics achievement through interwoven connections between content, pedagogy, and culture.

Another study conducted by Sternberg, Lipka, Newman, Wildfeuer and Grigorenkok (2005) on students taught by conventional curriculum (textbook-based instruction) and triarchic curriculum (involving analytical, creative and practical/culture-based instruction) in an area and perimeter unit for sixth grade Alaskan students from urban and rural communities, showed that the triarchic curriculum is superior to the conventional curriculum.

From the studies above, it is evident that using culturally-based activities is effective in teaching and learning process and that they also have positive effects and show better results in the mathematical achievement of the students. This also encourages teachers and school administrators to develop more culturally-based curricula and implement them.

**Culturally-Based vs. Culturally-Responsive vs. Culturally-Relevant**

These three terms are constantly being used in any educational research on culture. The following are some excerpts that hopefully provide brief description of each.

The Kamehameha Schools, Research & Evaluation division (KSRED) produced a report (June 2007) in which they argue that culturally-based education is the grounding of instruction and student learning in ways that include the values, norms, knowledge, beliefs, practices, experiences, and language that are the foundation of an indigenous culture.
On a study mentioned at Integrating New Technologies Into the Methods of Education website, (http://www.intime.uni.edu/multiculture/curriculum/culture/teaching.htm), culturally-responsive students can be described as follows:

Ladson-Billings (1994) studied actual instruction in elementary classrooms and observed these values being demonstrated. She saw that when students were part of a more collective effort designed to encourage academic and cultural excellence, expectations were clearly expressed, skills taught, and interpersonal relations were exhibited. Students behaved like members of an extended family assisting, supporting, and encouraging each other. Students were held accountable, as part of a larger group, and it was everyone's task to make certain that each individual member of the group was successful. By promoting this academic community of learners, teachers responded to the students' need for a sense of belonging, honored their human dignity, and promoted their individual self-concepts. (Gay, 2000)

Culturally-relevant teaching is a term created by Gloria Ladson-Billings (1994) to describe “a pedagogy that empowers students intellectually, socially, emotionally, and politically by using cultural referents to impart knowledge, skills, and attitudes.” Participating in culturally-relevant teaching essentially means that teachers create a bridge between students’ home and school lives, while still meeting the
expectations of the district and state curricular requirements. Culturally-relevant teaching utilizes the backgrounds, knowledge, and experiences of the students to inform the teacher’s lessons and methodology. (Source: Culturally-Relevant Teaching by Heather Coffey, [http://www.learnnc.org/lp/pages/4474](http://www.learnnc.org/lp/pages/4474))

Based on those descriptions above, my own understanding and differentiation among these three terms is that, culturally-based refers to the content of the lesson, while culturally-responsive and culturally-relevant have similarity, thus refer to the ways or methods of relating the lesson to the backgrounds of the students.

**Indigenous Research Ethics**

There are some norms or standards that need to be considered in undertaking research with an indigenous people.

The table below was taken from an article, On Tricky Ground: Researching the Native in the Age of Uncertainty by Linda Tuhiwai Smith. ([http://web.uvic.ca/vv/stolo/L%20Smith%20On%20Tricky%20Ground%20Denzin_and_Lincoln_Chapter_4.pdf](http://web.uvic.ca/vv/stolo/L%20Smith%20On%20Tricky%20Ground%20Denzin_and_Lincoln_Chapter_4.pdf))

<table>
<thead>
<tr>
<th>Cultural Values (Smith, 1999)</th>
<th>Researcher Guideline (Cram, 2001)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aroha ki te tangata</td>
<td>A respect for people - allow people to define their own space and meet on their own terms.</td>
</tr>
<tr>
<td>He kanohi kitea</td>
<td>It is important to meet people face to face, especially when introducing the idea of the research, &quot;fronting up&quot; to the community before sending out long, complicated letters and materials.</td>
</tr>
<tr>
<td>Titiro, whakarongo...Kôrero</td>
<td>Looking and listening (and then maybe speaking). This value emphasizes the importance of looking/observing and listening in order to develop understandings and find a place from which to speak.</td>
</tr>
</tbody>
</table>
Manaaki ki te tangata | Sharing, hosting, being generous. This is a value that underpins a collaborative approach to research, one that enables knowledge to flow both ways and that acknowledges the researcher as a learner and not just a data gatherer or observer. It is also facilities that process of "giving back" of sharing results and of bringing closure if that is required for a project but not to a relationship.

Kia tupato | Be cautious. This suggests that researchers need to be politically astute, culturally safe, and reflective about their insider/outsider status. It is also a caution to insiders and outsiders that in community research, things can come undone without the researcher being aware or being told directly.

Kaua e takahia te mana o te tangata | Do not trample on the "mana" or dignity of a person. This is about informing people and guarding against being paternalistic or impatient because people do not know what the researcher may know. It is also about simple things like the way Westerners use wit, sarcasm, and irony as discursive strategies or where one sits down. For example, Māori people are offended when someone sits on a table designed and used for food.

Kaua e mahaki | Do not flaunt your knowledge. This is about finding ways to share knowledge, to be generous with knowledge without being a "show-off" or being arrogant. Sharing knowledge is about empowering a process, but the community has to empower itself.

Those are cultural values drawn from the book Decolonizing Methodologies that were then translated by Fiona Cram. The argument is that all researchers need to observe all these characteristics when doing their research with indigenous peoples. Indeed, in my view, they should be observed when doing all research with human subjects.

Additionally, in the first paragraph of the introduction of the Guidelines for Ethical Research in Australian Indigenous Studies, published in 2011 by Australian Institute of Aboriginal and Torres Strait Islander Studies (AIATSIS) states that, "Indigenous peoples have inherent rights, including the right to self-determination. The principles in these Guidelines for Ethical Research in Australian Indigenous Studies are
founded on respect for their rights. These include rights to full and fair participation in
any processes, projects and activities that impact on them, and the right to control and
maintain their culture and heritage. AIATSIS considers that these principles are not only
a matter of ethical research practice but of human rights.”

(http://www.aiatsis.gov.au/_files/research/ethics.pdf)

Below are the Principles of Ethical Research grouped into categories:

(www.aiatsis.gov.au/_files/research/ethics.pdf)

A. Rights, respect and recognition

Principle 1: Recognition of the diversity and uniqueness of peoples, as well as of
individuals, is essential.

Principle 2: The rights of Indigenous peoples to self-determination must be recognized.

Principle 3: The rights of Indigenous peoples to their intangible heritage must be
recognized.

Principle 4: Rights in the traditional knowledge and traditional cultural expressions of
Indigenous peoples must be respected, protected and maintained.

Principle 5: Indigenous knowledge, practices and innovations must be respected,
protected and maintained.

B. Negotiation, consultation, agreement and mutual understanding

• Principle 6: Consultation, negotiation and free, prior and informed consent are the
  foundations for research with or about Indigenous peoples.

• Principle 7: Responsibility for consultation and negotiation is ongoing.

• Principle 8: Consultation and negotiation should achieve mutual understanding
  about the proposed research.
• Principle 9: Negotiation should result in a formal agreement for the conduct of a research project.

C. Participation, collaboration and partnership
• Principle 10: Indigenous people have the right to full participation appropriate to their skills and experiences in research projects and processes.

D. Benefits, outcomes and giving back
• Principle 11: Indigenous people involved in research, or who maybe affected by research, should benefit from, and not be disadvantaged by, the research project.
• Principle 12: Research outcomes should include specific results that respond to the needs and interests of Indigenous people.

E. Managing research: use, storage and access
• Principle 13: Plans should be agreed for managing use of, and access to, research results.

F. Reporting and compliance
• Principle 14: Research projects should include appropriate mechanisms and procedures for reporting on ethical aspects of the research and complying with these guidelines.

From those cultural values and principles stated, it is clear that researchers must have greater understanding and knowledge of these values and principles in order for the indigenous community to accept and approve the conducted research projects in their community. These are the principles upon which this study was based.

Theoretical and Conceptual Framework
It has been known that culture affects learning. The effectiveness of these cultural activities used in instruction has been researched and tested. Building on the emphasis on experiential, hands-on, inquiry learning characterized by the educational philosophies of John Dewey and Jean Piaget, a new conception of learning has emerged that researchers call constructivism. In this view, learners build their own understandings that are complex, highly organized, and strongly tied to specific subject matter. Learning occurs when students construct their own knowledge by making connections between new information and their own existing knowledge (PREL CD-ROM, 1996). From this theory, arises the use of culturally-based curriculum in the teaching and learning process.

To enhance critical thinking and problem-solving skill in mathematics education, educators must become familiar with new approaches. In addition, teachers are encouraged to examine opportunities and challenges of these new strategies to enhance their work and teaching styles.

 Culturally-based curriculum instruction and a variety of indigenous resources are used in schools, colleges and universities all over the world. Educators must be aware of doable and credible teaching materials in order to be able to discover techniques and methods that will promote the main purpose of education. Learning is a continuous process. However, the way instructors teach and students learn must be constantly reevaluated and updated. Teachers should be aware of the importance of using visuals and hands-on activities to enhance learning and understanding.

 Culturally-based mathematics curriculum instruction can be successful if the teacher chooses to become a leader in the adoption of the use of cultural activities to enhance experiences of students and their engagement with mathematical ideas
embedded in cultural contexts. The potential of culture-based curriculum is the ability of all students to learn at the highest levels with the greatest resources in order to have the promise of a future of real opportunity.

To find out the teachers’ perceptions of teaching of CBMC unit lessons, a number of steps were necessary in order to establish the validity and reliability of the results of the study.

The steps carried out in this study were: 1) ask permission from authorities, 2) implementation of the CBMC unit, 3) participants write their narrative stories, 4) conduct interview, and 5) data collection analysis and triangulation.

The conceptualization of the study is presented through a research paradigm and conceptual framework on the next page.
Figure 2: Research Paradigm of the Study

**Goals**

- **Intellectual Goal**: To understand the perceptions and impact of CBMC and to add to the literature about the curriculum in grades 1, 4 & 7 of Korea and Yap 2011.
- **Practical Goal**: To gain insight on teachers’ perception on CBMC and its impact on their teaching.
- **Existing Research Literature in Mathematics Literacy, Common Core Standards, Ethnomathematics, Teachers’ Beliefs, Culturally Based Mathematics Curriculum and its impact**

**Research Questions**

What are the teachers’ perceptions and views of the culturally-based mathematics curriculum?

1. What are teachers’ attitudes and opinions on CBMC?
2. How do teachers describe their experiences with teaching the CBMC?
3. What do teachers think about the effectiveness in their teaching of the CBMC?
4. How do teachers perceive students’ receptivity and attitudes toward CBMC?

**Methods**

- **Strategies of Inquiry**: Exploratory case study bounded by:
  - Setting: Korea & Yap Elementary School
  - Participants: Elementary school teachers
  - Data collected from written stories, interviews

- **Purposeful Selection**: Kosrae and Yap Elementary Math teachers were selected based on their experiences with curriculum

**Validity**

- **Data Collection**
  1. Written stories to provide background & context
  2. Interviews to acquire further data, solicit feedback and for confirmation

- **Data Analysis**: Takes place as data is being collected

- **Triangulation**: Multiple participants (purposefully selected teachers) multiple data sources

- **Partial transcripts and detailed description of the methods**

- **Coding themes**: to make comparisons within the same organizational and substantive categories (Maxwell, 2005) cited by Burns, 2009

**Experiential Knowledge**

As math teachers, different ways of teaching the lesson must be utilized to meet individual needs of the students to learn mathematics. Proper motivation and interest-catching activities could also help to enhance a conducive learning environment.

**Research Paradigm**

- **Constructivist Theory**

**Research Design**

- Qualitative case study using written stories and interviews
Chapter 3

METHODOLOGY

This chapter presents the research method, research design, research subjects, data gathering tools and analysis used in the study.

Research Method

Multiple qualitative case studies were used in my research study. According to Linda Morra Imas (2009), case study is a method of learning about a complex instance, based on a comprehensive understanding of that instance obtained through extensive description and analysis of that instance taken as a whole, and in its context. In my case, this instance refers to the teachers’ perception of teaching of culturally-based mathematics curriculum (CBMC) unit lessons in Yap and Kosrae FSM.

By recognizing the perceptions of the teachers from these two islands in teaching the CBMC unit lessons, educators and community leaders will have a better understanding of the impact of the CBMC on the teacher’s perception of using cultural activities to teach mathematics.

Research Design

This study uses an exploratory design. The main key in exploratory design is to gain ideas and insights (Brown & Suter, 2011) (http://www.monroecollege.edu/AcademicResources/ebooks/9781111532406_lores_p01_ch03.pdf).

This study also employs the constructivist theory. On page 19 of an e-book entitled An Introduction to Research, a methodology under constructivist paradigm states that the interactive approach between and among the investigator and the respondents is sometimes described as hermeneutical and dialectical in that efforts are made to obtain multiple perspectives that yield better interpretations of meanings that are compared and
contrasted though a dialectical interchange... (http://www.sagepub.com/upm-data/29985_Chapter1.pdf)

Respondents

The participants of this study were determined by convenience sampling. The three selected teachers on Kosrae and two teachers on Yap, FSM, who were chosen to teach the culturally-based mathematics curriculum unit lessons in grade 1, 4 and 7 and who volunteered to take part in my study, were the subjects of this study. The participants’ sample as described in the first chapter were diverse with respect to ethnicity, age, gender, past educational experiences, socioeconomic status, and social roles. All of the participants were nonnative speakers of English, teaching in their vernacular language or English, and sometimes both because some students were not from their island. Participants consisted of novice and experienced teachers. All of them were certified Micronesian teachers, born and raised on the islands. Four of them have Basic Certificate [teachers who posses Associate of Arts/Associate of Science degree and passed the FSM National Standardized Tests for Teachers (NSTT) Content Competency Component and Teaching Competency Component], and one had an Advance Certificate [teachers who possess Bachelor of Arts/Bachelor of Science degree and passed the FSM National Standardized Tests for Teachers (NSTT) Content Competency Component and Teaching Competency Component] (Source: FSM teacher Certification Policy, 2012 at http://www.fsmed.fm/index.php/teacher-certification-policy.html). Four of the participants were teachers from a public elementary school who actually teach one of 1st, 4th or 7th grade level and one was a former teacher (currently a government official) who willingly piloted the unit. They were asked to be part of this project for approximately 4 – 12 weeks. Identification of the participants was done during the first semester of the school year 2012-2013.
Instruments

This research focuses on teachers’ perceptions about teaching CBMC. One form of data collected was narrative stories that the teachers were asked to write. Excerpts from the abstract and executive summary of the document published in 2003 by Defence Science and Technology Organisation, Systems Sciences Laboratory (Mitchell and Egudo) states the following:

Narrative is an interpretive approach in the social sciences and involves using storytelling methodology. The story becomes an object of study, focusing on how individuals or groups make sense of events and actions in their lives. (Abstract, p.1)

The approach is said to enable the capture of social representation processes such as feelings, images, and time. It offers the potential to address ambiguity, complexity, and dynamism of individual, group, and organizational phenomena. (Executive Summary, paragraph 5)

The stories were designed to understand and established a contextual basis for understanding and interpreting the interviews. The participants' stories provided me with substantial information about their perceptions of teaching of the CBMC lessons. The guide for teacher-participants in writing their stories is in Appendix B (see page 68). This guide was sent electronically in Kosrae and personally in Yap to teacher-participants before teaching the CBMC unit and was collected after the unit had been taught.

In-depth, individualized interviews were scheduled for Kosrae and Yap. The interviews were another source of data used to understand teacher-participants’ perceptions about teaching and learning and their interactions with students when teaching the CBMC. Teachers were interviewed to collect information about past and
present experiences as a means to assist the researcher in making sense of the participating teachers’ beliefs and philosophies about teaching of the CBMC unit. In addition, teachers reflected on their instructional practices and defined their beliefs about teaching CBMC. The interviews were scheduled, and the time and location were identified, about a week after the CBMC units were taught. The interviews were intended to draw explanations about teachers’ instructional delivery based on their stories. Each individualized interview last about thirty minutes. All the narrative stories and interviews were undertaken and collected during the school year 2012-2013.

Procedure

Permission to conduct the study was sought from the school administrators of the participating elementary schools or the Director of the Department of Education (DOE). Copies of the narrative story guide (Appendix B, p. 68) and the interview guide (Appendix C, p.71) were shown to the directors of DOE. Upon approval, I contacted the selected teachers who were chosen to teach the CBMC units so that I could discuss and explain my research study and seek their willingness to participate. I distributed the narrative story guide to them if they agreed to participate. I collected their stories after a few weeks. I knew four of the participants for several years. With the other one, introduced to me by associates from the DOE, I got acquainted quickly, and had little difficulty asking them all to write a story. The only challenge I encountered was time: the time needed to allow them to write, considering their job, their family and social responsibilities. Although my participants were all non-native English speakers, I let each teacher write in his or her first language. I even had someone available to translate the story guide in Kosraean and Yapese, but they all agreed to write in English. As indicated in their consent form, I explained to them that only my University of Hawai‘i advisor, teachers in the project and I would have access to the data, although legally authorized agencies, including the UH Human Studies Program, can review research records.
After analyzing their stories, individual interviews were scheduled. All the data gathered from their stories and interviews was analyzed and securely kept.

In order to preserve the confidentiality of the participants, codenames have been used throughout this study whenever a subject is mentioned.

**Data Analysis**

In order to distinguish the different perceptions of the participants in Yap and in Kosrae and understand relationships, the data were typologically analyzed. It means that the investigator started by separating the data set into categories based on predetermined typologies generated from assumption, common sense, or research objectives (Hatch, p. 152, 2002). Stories and interviews were transcribed and searched for patterns of behavior and outcomes that emerged which generated a list of categories. After categories were identified, the data were manually coded to visually denote the patterns and the contradictions. Categories were constructed and themes were assigned. Frequency counts of the number of responses were tallied and tabulated. Furthermore, verbatim examples from teachers’ stories and interview responses for each theme were quoted. The purpose of engaging in document analysis was to examine the triangulation of Yap and Kosrae teachers’ responses from the interviews and their stories. Triangulation of data sources allows the interpretation of data to make sense of the case, and establish trustworthiness of relationships between the two data sources. Triangulation is a way of assuring the validity of research results through the use of a variety of research methods and approaches. It is a means of overcoming the weaknesses and biases which can arise from the use of only one of the methods we have described, such as observation, questionnaires, etc. (http://www.bolton.ac.uk/bissto/Writing-a-Dissertation/Methodology/Triangulation.aspx)
Chapter 4

FINDINGS AND RESULTS

This chapter presents the results, discussion of the findings and conclusions from this research study and recommendations for further study.

Findings

The focus of this research was on the perceptions of teachers teaching the CBMC lessons. The participants in Yap and Kosrae expressed their perceptions either as statements from their stories or responses from the interview. The coding “-S” after each teacher’s pseudonym before the quotation refers to the statement from the stories written by teachers, while the coding “-I” after the pseudonym were responses from the interview.

In the Table 1 below, categories of responses were tabulated with their corresponding descriptors. The following sections will analyze and synthesize the data categories, and incorporate relevant related literature in the next chapter as it pertains to the findings on the perceptions of teachers on teaching CBMC unit lessons.

Table 2

Categories and Descriptors

<table>
<thead>
<tr>
<th>No.</th>
<th>Categories</th>
<th>Descriptors</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>On Teachers’</td>
<td></td>
</tr>
<tr>
<td></td>
<td>a. Skills and knowledge</td>
<td>Preparedness or professional development on teaching CBMC lessons;</td>
</tr>
<tr>
<td></td>
<td>b. Attitudes and dispositions on CBMC</td>
<td>Positive attitudes, effectiveness, enthusiasm, interest, challenged, promised to share to others and continue using it.</td>
</tr>
<tr>
<td></td>
<td>c. Teaching experiences on CBMC</td>
<td>Enjoyable, remarkable, challenged, untimely, appropriate, inappropriate, prerequisite lessons, connection of math &amp; culture, not enough time, inexpensive materials and easily available</td>
</tr>
<tr>
<td></td>
<td>d. Used of local materials</td>
<td></td>
</tr>
</tbody>
</table>
Students’ Reaction
Positive attitudes, enthusiasm, interest, active, energetic, challenged

Teachers’ Knowledge and Skills

This theme emerged from the analysis of the written stories and interview transcripts, that professional development or training is necessary in teaching the culturally based mathematics curriculum in order to teach the unit better. This perception is important because none of the participants from Yap and Kosrae had taught or experienced a culturally based mathematics curriculum before. The following statements were excerpts from the stories and interviews of the teachers.

Yap Pilot Teachers:

Yacca-S: “I did not receive any training on the culturally based mathematics unit; I was not prepared to teach this lesson. I agreed to participate because the project was appropriate for the fourth grade and I am a fourth grade teacher.”

Yacca-I: “No, no [training], we only have a meeting with the principal and … talk about how important for the student to come to know to build a house… [They think] that as a teacher, if I read [the CBMC unit plan] I understand what I had to do from this plan, of course… so I ask them, we have to fully understand and think it through… so I [just] share what I know, like weaving but constructing the house, oh no… I’m not a man!...”

Nikko-S: “Even if I don’t have such training in the teaching of culturally-based mathematics [unit], I feel that with the experience I have in teaching, I can easily manage to teach with comfort and confidence.”

Nikko-I: “No training, in our [Macimise] class we talked about some concepts but no training, I actually teach them the CBMC… I just
use my own way, activity and knowledge and try to get the students [to be] interested and be successful in teaching [the CBMC unit].”

**Kosrae Pilot Teachers:**

Sru-S: “One of the most obvious challenges about teaching the unit was the lack of training beforehand. I agreed to participate in this project because… my curiosity was aroused to see the connection between any mathematical concepts to a cultural aspect.”

Sru-I: “No [training]… I think it would produce a different outcome… the outcome will be fully better… [if there’s] a training that ties both cultural aspect and mathematics before actually teaching it…”

Tolenna-S: “I have heard many times and been repeatedly told that culturally based teaching is one of the best ways to promote learning. However, I didn’t bother to implement it in class just because I thought it is difficult or impossible. Throughout the whole week of piloting this CBMC project, I realized that a culturally-based lesson is simply effective, attractive and inexpensive.”

Sepe-S: “I was given a very great opportunity to carry out a unit that is a part of Macimise Education project which was mainly on culturally-based mathematics. I receive no training on it, but I did get a lot of tutoring from … who has helped me lot in this unit lesson.”

As evidenced by these teachers’ comments, the teachers from both Yap and Kosrae had not undergone any training on teaching the culturally-based mathematics curriculum unit; however, by just reading the CBMC unit and with a little support from the unit developer, they tried their best to teach it using their current knowledge and skills. Their inquisitiveness on the connections between math and culture enticed them to
participate in the project, and accept the challenges of teaching it, believing that this will have great reward in the end.

**Teachers’ Attitude and Disposition on CBMC**

The second theme that emerged was about the teacher’s attitude and disposition toward the culturally-based mathematics curriculum. The excerpts below demonstrate the teachers’ positive attitude toward culturally-based mathematics curriculum, though the teachers noted concerns and questions.

**Yap Pilot Teachers:**

Yacca-S: I felt that the [CBMC] project could surely improve the students learning in mathematics and an expert can do an excellent job on it.

Yacca-I: “I look at it, that plan just really, really help the students to become more better in math… you help the students’ mind to explore, to think more… I like all the part[s]. Each of the part… in the [CBMC] lessons… It’s easy, it’s easy, materials are there, you just have to collect… but you noticed… I think if there’s someone who [can] understand English, the curriculum was… maybe someone… I think…no, not to lead the lesson alone… you know… if someone…who really like teaching, if he or she teach this lesson, I know he or she will do like it and I think he or she maybe do better than me…[I like to share the plan to other teacher also but] I’m not that kind of teacher who likes to say, ‘I know [this], I know [that]’… If someone have to teach the plan and if they need help, we could share…The CBMC is more fun, it’s more easy, challenging, interesting for the students for them to sit in.”

Nikko-S: “I believe that teaching culturally based mathematics is the way to effectively build the foundation of mathematics learning for the
children in the islands … Based on my personal experiences I feel that cultural mathematics is always an integral part of the living and culture of the islands in Micronesia.”

Nikko-I: “For me, [teaching] culturally-based mathematics [curriculum] is that, at first, it’s a challenge because I’m trained in a western education so I am more familiar with western teaching but when this ethnomathematics comes up, it’s interesting but when I get into the flow of it and then I can relate into my own culture and it becomes… natural for me to teach.”

Kosrae Pilot Teachers:

Sru-S: Overall, I think the CBMC project’s success depends on the students’ readiness.

Sru-I: “I think with them knowing math and tying it to a cultural aspect I think… it will be more effective than just giving it straight up to textbook… If the culturally base activities are adequately in line with the math like there is no disruption… if it goes smoothly, you can really show the connection, the real connection with the culturally-based. If there is one then I think it’s gonna be effective… Share the lesson to other teachers? I don’t know… If it went smoothly then I would… without the troubles when you squeeze those prerequisites… but if they [students] master the prerequisites [the mathematical concepts required for the activity] and without any trouble I think I should be able repeat it [re-teach it]”

Tolenna-S: I strongly believe that culturally based teaching is very effective because … Students could easily learn the concepts to be taught in a lesson if they use things they’re familiar with. They tend to engage
themselves to the lesson if it connects to their work in the community or at home as well. In my opinion and observation, culturally-based teaching approach is useful to students in this region especially to English [as a] second [language] learners.”

Tolenna-I: “Wow, there’s a great changes… when I used this kind of materials or ah when I used this kind of lesson or a I mean when I, when I was trying to use this kind of techniques to carry out my lesson, I’ve seen how easy it is, not to me alone but also for the students and also save time.”

Sepe-S: All in all, I really enjoyed learning and executing the unit lesson, not only because it was culturally-based, but because it was a remarkable experience. I learned a lot and it did help me a lot in my work and most importantly the kids enjoyed…

Sepe-I: “I really like the culturally base because it helps me, even it is integrated… the math and the culture thing…. The materials that we were using it’s like in here... which is... I observed... students…. were very excited. At first I thought it’s gonna be hard for them to weave but then as we were weaving it was like it’s okay, if you compare to regular classes I like the cultural-based one.”

From the comments above, teachers from Yap and Kosrae now have positive perception towards culturally-based mathematics curriculum, found it to be effective and enjoyable, and that it can be used to enhance the learning of the students in mathematics. **Teachers’ challenging experiences in teaching the CBMC units**

Another theme that emerged is about the teachers’ different challenging experiences while teaching the CBMC unit. See following declarations.
Yap Pilot Teachers:

Yacca-S: “… because this research project was new to me. I wasn’t really sure on what I was doing. The content was too broad and the time was limited. The truth of the matter is that both the students and I were learning at the same time during my instructions on this culturally-based mathematics curriculum unit.”

Yacca-I: “… with the lesson plan, I did that [weaving] part twice because on the first time I didn’t really understand, I was thinking just to weave the thatch roof so went ahead and finish weaving all the coconut leaves and then I came and look at the plans, oh there was this kind of weaving that was so much more to follow so I went back… and we have to undo and repeat the weaving… It could be because it was our first time to teach that plan so we need more time for this [weaving activity].”

Nikko-S: “Teaching cultural mathematics of counting and measuring is easy for me in the vernacular language as all of the students can understand and relate to the activities undertaken for each lesson… The challenge is time management that can allow completion of applicable activities after starting as the sequence needs to be completed within the time period. One has to plan the lesson and rehearse the time for that period or make a sequence of events for that period or make a sequence of events to continue [on to the] next class… Classroom management can be a challenge but if one can anticipate and deal with students’ behavior in the classroom; everything can fall into place according to your expectation.”

Nikko-I: “I think the challenging part is to instill into the kids interest to learn their own counting system and measuring system…”
because they seem to lack interest… they’re more tune into western world… when I did this cultural [unit] they [students] asked me questions ‘why, why are we learning this? Wherein we’re learning western, you know, education and maybe we’re going away in different world’. Actually I told them, ‘No, you have to start in the classroom your own culture before we go on and learn other people’s culture…’ I think the most important part is to get the interest going and also to relate to what applications the counting system because it relates the everything that they do or we do in the culture or in the islands… the measurement part at first it’s hard to relate the counting system but when they see that the measurement is also basically counting while measuring length, they can relate that… Timing is a challenge also because you have to teach a certain objectives within that time… when it comes to activity that’s the challenging part because students are really in to what they are doing and they don’t want to stop, but I have to stop them because they have to go to another class…”

Kosrae Pilot Teachers:

Sru-S: “From what I observed, I think the [CBMC] project was implemented at an inconvenient time of the school year as most of the math concepts used was yet to be introduced to the participating students... I find myself lengthening the project’s time frame to accommodate their lack of experience in working with the concepts… Another challenge was making the connection between the two [culture and math] without any prior experience in the math concepts… At the end of the project after barely mastering the main concepts being taught, they [the students]
finally make the connection between the two and were utterly surprised at their findings.”

Sru-I: “…when they give me the materials, the plans, I couldn’t make the ties between the two, the cultural aspects and mathematics. Put it on this way, some things met, some aspects did not met, so it came out 50/50 success in some areas and failure on others. So I still, I don’t know maybe, a better cultural aspect that will really show its relationship to math and not just any cultural aspect. I don’t know it was kind of confusing at times… another thing, the students’ performing levels, more like the prerequisite for the aspects that we covered in the plan… the mathematical concepts that we’re solving in the culture thing, the whole thing they [students] were really shock to it, not expose to it. So they're gonna take it slow at the beginning and after I started to put it in my own prerequisite to fill in for the missing areas… decided to understand a bet.”

Tolenna-S: “It seems to me that role playing a lesson really help to make learning a success. [However] For example, if the role play dialogue has been translated to fit students’ vernacular, I believe they [my students] will learn much faster… Instead of using the weaving mat proposed in the lesson, I used oranges, bananas, apples and shells. I also asked students to create fractions based on the color of shirt each individual was wearing, gender and place where each individual lives.

Tolenna-I: “I feel comfortable when I see the lesson, especially the role play dialogue. My second thought when I carry out the pilot, it’s kind of hard for the students to understand or comprehend on what they have read… Anyway, I feel comfortable when I carry out the lesson, even though the kids couldn’t understand when I’m in English but when I try to
translate it in our own language I’ve seen that the interest in their look and the role of the story really spark their interest so they start to focus more on the flow of the story…

Sepe-S: “… the most challenging is for them [the students] to actually weave a local puhlet sroacnu. From my experience, kids at this age can hardly weave a puhlet sroacnu … but that was only my experience and that was my thought before actually executing the unit. Most rewarding of the unit lesson was each of them actually did their best to weave a puhlet sroacnu, and to my surprise most of them can actually weave on their own.”

Sepe-I: “ At first when I introduce the topic we were like, we spent about 10 minutes more, the next thing, we were trying to adjust [the time]…. Practicing with the weaving, that’s only but not much a challenge… when I introduce the weaving, it’s like they are struggling in weaving but on the second and third… when we were engaging it is so easy so they didn’t mind.”

As noted by the statements above, diverse challenges and experiences were encountered by the teachers from both Yap and Kosrae in teaching the CBMC unit, beginning from the confusion about the connection of math concepts to the culture, being worried if students can do the cultural activity, and also bothered about the time allotment of the activity for the lesson, up to classroom management, but to their astonishment, everything went relatively well.

**Materials used in teaching the CBMC units**

One more theme that arose from the data was about the materials used in teaching the CBMC lessons. The materials were the local artifacts and objects that were readily available on the islands. Following are some of the declarations made by the teachers.
**Yap Pilot Teachers:**

Yacca-S: “Local materials are everywhere. They are easy to gather and they don’t cost a penny.”

Yacca-I: “It’s easy, materials are there, you just have to collect them.”

**Kosrae Pilot Teachers:**

Tolenna-S: “Culturally based curriculum is attractive because students and teachers could use as many local, colorful and fancy materials/arts available on the island. The most important thing about the culturally based curriculum is its expenses, which cost less money and less time… It’s about time for us to teach and look into ways that we could spend our money and time wisely… in the lesson plan, I used oranges, bananas, apples, and shells, shirt of each individual were wearing… All that I mentioned above didn’t cost a penny.

Tolenna-I: “I’ve been teaching math especially meant for maybe about 5 or 6 years from now, and I, I haven’t used local ah materials or cultural-based materials in my lesson but now when I used it, I really see that, it is very useful in many ways. First, we have the materials available on the island, there are many, many local materials that we can use for that kind of lesson and it cost less, you don’t need to spend or make a pick budget for those materials unit. And second, I feel that or I’ve seen that student when they are working with their own materials just like they could easily learn because they have seen it, they get used to it, and maybe they have seen it every day, and they feel comfortable when they used their own or cultural base materials.”

Sepe-S: “Materials used were the leaflets of our coconut trees…”
Sepe-I: “The materials that we were using, it’s like in here... which is... I observed... students…. were very excited. At first I thought it’s gonna be hard for them to weave but then as we were weaving it was like it’s okay…”

It is evident from the above declarations, one teacher from Yap and the two teachers from Kosrae, is that when teaching the CBMC unit, teachers can use local materials that were readily acquired, inexpensive and helpful in the teaching-learning process of the students.

**Students’ reactions to CBMC units**

An additional theme that came out is about the various reactions of students during the instruction of the CBMC unit. The testimony regarding this theme follows:

**Yap Pilot Teachers:**

Yacca-S: “The students liked the lesson very much that most of them did fully participate… but I don’t think that they seemed to understand the main idea of the lesson very well due to my fault… Another good thing I saw during this plan was that lots of students came to learn faster through using concrete materials.”

Yacca-I: “Weaving, first time, I was thinking some of the girls are better in weaving, only few of them cannot, but most of them… we finish… They were very excited especially the boys who were leading up their model houses… they really wanted their model house to finish… there were times, I told them to stop what they’re doing, we have to talk about this, maybe two of the groups stop and pay attention but the other 3 groups keep on working… Yah, most of them, really, really happy… they always look forward to that time… Only few are not so good in math so they show no interest in math but those who like math and whenever I ask
question like if nine leaves is on this side (half of the house) they said, ‘Maaaammmmmmm’ [shouting in unison]…. They are very happy…yeah… they like math.”

Nikko-S: “When I presented my lesson to the first graders, the children were curious as to what new lessons I would teach them. When they found out it was in our vernacular counting and measuring, they seemed to view the lessons as old and for the past generation. Most of them preferred the American counting system, but when I explained the need to preserve our own knowledge and skills, they were receptive and became interested. The students were challenged… It is rewarding to observe students become interested and involved by applying their cultural knowledge and skills as part of their education in the classroom.”

Nikko-I: “when I did this cultural [unit] they [students] asked me questions ‘why, why are we learning this? Wherein we’re learning western, you know, education and maybe we’re going away in different world’. Actually I told them, ‘No, you have to start in the classroom your own culture before we go on and learn other people’s culture… I think they should understand that’s how things should be to reverse their thinking… Now, they are more interested to it, the activity is hard that makes them interested because they actually applied their knowledge to real life and that’s the best part of teaching… They become interested because they can understand, they can see, they can relate to it… the culture in the island setting, they can relate to it so it’s easy.

**Kosrae Pilot Teachers:**

Sru-S: “In the beginning of the project, the participating students were highly interested to see or make the connection between the two:
Math & Culture, but overtime, due to their lack of understanding on the prerequisite math concepts used, their attitude toward the project deviated. At the end of the project, after they barely mastering the main concepts being taught… they were actually surprised that cultural aspect does have a relationship/connection to the math concepts…”

Sru-I: “Well there were at times from the beginning actually they were really interested in that, you know, with the fact that, who can weave the prettiest, the biggest, the cutest, and they were really aware of how many folds each leave should have to make the prettiest or the biggest part… When I introduce the math, they were like ah ‘what?’… they weren’t so excited… but when we try to tied with mathematical concept they were like got confused. At first they were only introduce only about the weaving then somewhere in the middle they were like, they were starting to make the connection and then that was like the arousing part of their ah excitement. And at the end when they were really figure it out when they really understood why, how the weaving activity connected to the mathematical concept.”

Tolenna-S: “Students could easily learn the concepts to be taught in a lesson if they use things they’re familiar with. They tend to engage themselves to the lesson if it connects to their work in the community or at home as well… Students or learners might prefer learning from their cultural values and that’s how attractive the cultural-based curriculum is.”

Tolenna-I: “I feel comfortable when I carry out the lesson, even though the kids couldn’t understand when I’m in English but when I try to translate it in our own language I’ve seen that the interest, new look and the role of the story really start their interest so they start to focus more on
the flow of the story… Surprisingly enough, I found that the students really ah their activity is really motivate them in a way that they are really actively participate and at the same time they’ve been fully participate I see that they really chat and get into the point that a fraction is a way whereby you ah take out pieces from a whole.”

Sepe-S: “The children were the highlights of the unit. They were enjoying every day of the unit lesson, and seem eager to go on to the next day’s event… Arithmetically, the concepts of number, shapes, patterns, and problem solving in basic addition can be understood among most of the kids. Traditionally, they seem to know the purpose of the puhlet sroacnu… and I guarantee that you’ll [be] rewarded just to see your kids enjoy learning.”

Sepe-I: “… students especially the first graders… they were very excited… From my observation they were not in a regular setting of an everyday class they were happy at it and they’re interested to go on to the next day lesson, and even among them, they were competing which of them can weave the fastest puhlet sroacnu… For the cultural base ah most of them I would say they maybe all of them know how to weave the puhlet sroacnu. But I think that in mathematics, I would say 80% of the students catch the fun while we are teaching. So I could say that it is very helpful… I gave them a written statement using simple addition, even mentally using flash card and they were fast to make the sum…”

Based on this testimony, students in both Yap and Kosrae really enjoyed their cultural experiences during the teaching of the CBMC unit. They got fascinated and surprised to see the relationship in learning mathematics, even though they encountered some difficulties and challenges during the lessons.
Discussion

All people are entitled to have quality education. The importance of providing quality education was also emphasized by the FSM public school system. As can be seen from the initiatives of these islands (Yap & Kosrae), teaching and learning developments are being implemented to ensure quality education is provided to the children and both states also emphasized the importance of traditions and culture in their classrooms.

Educational institutions need to strengthen the methodologies and approaches in the teaching of mathematics. In the United States, as cited by Daugherty & Wicklein in their study: Mathematics, Science, and Technology Teachers’ Perceptions of Technology Education, Stern (1991), Deputy Assistant Secretary of Vocational and Adult Education of the U.S. Department of Education, reported that, “If we are serious about improving mathematics and science achievement, and indeed, the overall educational performance of our students, we must explore different ways of teaching and organizing curricula…” (http://scholar.lib.vt.edu/ejournals/JTE/v4n2/wicklein.pdf)

To provide quality mathematics education through culture, Project MACIMISE participants developed culturally-based mathematics curriculum units and these were piloted in the Pacific Region. However, this study only dealt with the pilot teachers in Yap and Kosrae. These two islands are underdeveloped, remote but very rich in culture. Although many foreign colonizers, traders and missionaries have settled in these two islands, their traditional knowledge and skills in wood carving, canoe and local house building, weaving using pandanus and coconut fronds are still being practiced until today.

Teachers on these two islands have diverse students so they must consider their cultural, social and academic differences. They need to create and implement lessons that
motivate all students to learn and maximize their learning abilities. In order to reach these goals, pilot teachers taught the CBMC units created by the Macimisers in Kosrae and Yap. The study embarked on the task of exploring the teachers’ perceptions of teaching of the CBMC unit. The findings in this qualitative case study present us with a glance into educational approaches and instructional strategies when teachers attempt to cater to the needs of culturally responsive students. However, these findings are broad statements and may not be applied to all contexts.

From the results drawn in Chapter 5, it is clear that teachers were not given professional development training on CBMC prior to teaching the CBMC unit, but that they think that having such training would make their teaching of the units improve. Parrish and Linder-VanBerschot (2010) cited Gunawardena & LaPointe (2007) that in order to improve their teaching instructional providers, including instructors and instructional designers, especially those working in online environments and struggling to maintain sufficient presence and student engagement, should develop skills to deliver culturally sensitive and culturally adaptive instruction. Furthermore, Singh (2010) states that successful pedagogy requires teachers to be culturally literate. The results found in this study support these contentions.

Another finding is that teachers undoubtedly had positive attitude toward CBMC, that they support the view that it is effective in the teaching and learning process because of the relationship between the cultural activity and mathematics, and made a commitment to share it with others and to continue using the approach themselves. They did note, however, that their lack of knowledge and experience with CBMC undermined their performance in teaching the unit. Teachers’ various difficulties and challenging experiences in teaching the CBMC unit were also indicated in the findings. Such challenges are noted in the introduction to the Organisation for Economic Co-operation...
and Development (OECD) 2009 document states that:
(www.oecd.org/berlin/43541655.pdf)

Teachers’ beliefs, practices and attitudes are important for understanding and improving educational processes. They are closely linked to teachers’ strategies for coping with challenges in their daily professional life and to their general well being, and they shape students’ learning environment and influence student motivation and achievement (p.89).

The other finding of this study is that students became interested and had positive attitudes toward CBMC lessons, something that Kaiwi and Kahumoku (2006) noted in their work when they found that the introduction of a Native Hawaiian approach to analyze literature by acknowledging and validating students’ perspectives empowered them (cited by Singh, 2010). They concluded that students showed a sustained connection to ancestors, greater appreciation for parents and grandparents, and an increased desire to learn. This result is supported by the current study.

**Recommendations**

Based on the conclusions of this study, the following recommendations are found worthy of consideration.

1. School administrators should encourage the implementation of the use of culturally-based curriculum (CBC) to supplement the instruction in mathematics courses. They should also encourage their teachers to undergo training in using culturally-based curriculum not only in mathematics but also in other courses.

2. Teachers who are currently using CBMC should encourage other teachers to try CBMC in their classrooms and assess students’ achievement and attitudes in their respective courses.
3. Teachers in all levels should be encouraged to develop culturally-based lessons to correspond with the level of the students. They should also need to check that the topics and the cultural activity are appropriate, timely and precise.

4. Further research in students’ achievement and attitudes, learning rate, retention and cost in using CBE should be conducted.

Limitations of the Study

As a bounded case study, the results of this project cannot be generalized and the results are also non-transferable. The intent of the study was simply to investigate and describe (in their own words) the perceptions of teachers in teaching of CBMC unit. The paper strived to provide a thick description of varied factors that influenced the participants’ decision to share the unit to others and promised to continue using culturally based curriculum. Other limitations exist within the methodology of this project. As I am the only interpreter of the data for the study, and by choosing to employ qualitative methods such as written stories and interviews (with researcher designed questions), then for the construction of meanings, my own personal biases were certainly incorporated into the findings.

Also, it was possible that in writing the stories and in the interviewing of the teacher-participants that they would not be willing to give accurate information about their perceptions in teaching of CBMC lessons in order to maintain an acceptable level of social dignity. This provided a certain level of awkwardness and uncertainty as they worried about how they would be judged from their responses.

My own experiences with CBMC and the teacher-participants also influenced my interpretations of their statements. Moreover, an inescapable degree of subjectivity exists in the specific themes discussed because of my own ability to decide what to highlight. However, because I was transparent throughout the project and worked hard to keep out
any personal opinions, I believe that said subjectivity does not negate the value of the project. I hope that my study provides the reader with additional understanding into the importance of the findings and the need to further study this phenomenon.

***************

This study was the realization of one of the goal of the Project in which it provides great insights and indisputable reasons to continue its objective of discovering indigenous activities in the Pacific that will be used in enhancing the teaching and learning process in mathematics. This study, being part of the Project MACIMISE provides excellent evidence in the vision of the project when it was just beginning.
APPENDICES

Appendix A: LETTER OF PERMISSION TO CONDUCT THE STUDY

March ___, 2013

MR. __________________
Director
Department of Education

Dear Sir:

I am Rhoda Velasquez, a doctoral student at the University of Hawaii at Manoa (UH) in the School of Education, Curriculum Studies. As one of my duties and part of the requirements for earning my graduate degree, I am doing a research project on topics concerning mathematics teaching and learning.

As a teacher of mathematics, working with students and the Micronesian community, I am interested in learning about the effects of culturally-based mathematics curriculum. This is in connection with my dissertation study proposal entitled “TEACHERS’ PERCEPTIONS OF TEACHING OF CULTURALLY-BASED MATHEMATICS CURRICULUM UNITS”. I am interested in those stories of teachers about their experiences after teaching the pilot-study of the culturally-based mathematics units in Grade 1, 4 & 7. I believe that teacher's stories and experiences are useful in the teaching and learning process and very much important in the development of their commitment in teaching the Pacific children.

This letter is to ask permission from you to conduct the study and also to request assistance in gathering the data necessary to complete my study. The story guide and interview questions that will be used are attached. If interested, a copy of my report will be sent to you upon completion of the study.

If you have any questions about this research project, you can contact me at (691) 952 4910 or rhodv@yahoo.com or my Supervising Professor, Dr. Alexander (Sandy) Dawson at dawsona@hawaii.edu.

Your approval on this request is very much appreciated.

Very truly yours,

RHODA B. VELASQUEZ
Researcher

APPROVED: __________________
DIRECTOR OF EDUCATION DATE: ________________
Appendix B: STORY GUIDE

Dear Mr./Ms. ______ Teacher__,

A heartfelt thanks to you for taking part in my education research project! At this time, I want to you to write about your experiences in the teaching of culturally-based mathematics curriculum unit lessons. I know you might find it easier to ‘talk’ about your experiences, but would you please try to write about these experiences (in your own language if you wish). Your story may tackle some of the questions below but please feel free to write your own ideas about the culturally-based mathematics curriculum. The information you share is strictly confidential, and I will not identify anyone in my reports. You will have the opportunity to see how I use the information you share before sharing my report with anyone else.

1. Why did you agree to participate in this education research project?
2. Describe your observations of students’ response to the culturally-based mathematics unit. Did the students like the lessons? Did they fully participate? Did they seem to understand the main idea?
3. What was challenging about teaching the culturally-based mathematics unit?
4. What was rewarding about teaching the culturally-based mathematics unit?
5. Can you provide examples of how the unit was successful?
6. How did you feel while teaching the unit? Were you comfortable or were you stressed? Please explain your feelings.
7. Did you receive any training or professional development on the culturally-based mathematics curriculum unit? Did the professional development prepare you to teach the unit? If yes, describe ways that the training was helpful.

Again, thank you very much for sharing your experiences with me through your stories. In the future, I will be personally talking to you and chat about your experiences. Have a great day!

Sincerely yours,

Rhoda Velasquez
Researcher
Appendix C: Story Guide Translated into Kosraean

Paing kom Mr./Mrs. ________________

Tarilacna ke nuhnak wowo lom in kahsreyuc ke study se luhkinge. Ke pacl se inge, nga ke ngihsre kom in sruhmuhnu kuhlutuh ke puhla lom ke ahkfahsryeyacen lessons suc ma sramteyuckyak ke ohiyacmahtuh fin acn sum sifacna. Ngaakihlenlah e fihsracsr kom in sruhmuhn ke puhsremmuhkenatuhsruhkngacngihsre kom in sruhmuhn ke ma suhmuhslah-ke aten story soko, ke pahiymnalakahs Kosrae kuh ke kahspaclahng. Ngafinsraksramsram lom an in tohpohkakhewakihsensiucktahklac ten inge, ac nuhnak muhnahtiac tahfuh luo in tahfelah ke oana sie nuhnak lom sahyac. Ma nuhkewamuh kom e sruhmuhn an ac tuhfahkarihngihnyuck ac orekmakinyucknuhkesrihpacluhn study luhk uh muhkena. Inem ac fahtiacnaahhkahlemyeyuckpackac. Kanon study luhk uh ac tuhfahhkahhlemyeyuckpacluhn sum met likingaoruh report luhkuhnsinmwtfelangngan report nuh se.

1. Efuh kom insese kom in wikahsruh program in study se inge?


3. Meac kom lie tuhupac ke kom ahkfahsrye lessons ingacn uh?

4. Meac kom lie tuhwo ke kom ahkfahsrye lessons ingacn uh?

5. Fin kom muhorekma lessons ingacnsum sin tuhlihklutlutan, komkuh in ahkuhteyaclah ke srihpac fuhkah?


Kulohlacna,
Rhoda Velasquez
Appendix D: Story Guide Translated into Yapese

Mogethin Mr./Ms. _________________.

Siro’ ma kamagarko time rom nigabepii e ayuwko re education research project rogney. Botufrognigunangrogonlanininumnge tin bonannikam experience nag u napan e um sensei nag e matheagnimuuunbochharogon e yalen nu Waab nay (culturally based mathematics curriculum). Tin bonannigaraweliy u maragaenlanininumara experience rom komitiney e sensei komatheag e bo confidential, aradary bee ngabiyangnikug ra weliyngak. Ma umonninug report nag moragaen e re research ney, ma gurapiingom, nge tin e girdiini ke pii e ayuwnog, ngakumpiedlaninumedriy.

In i duwer e baaraynirayogningeipiiboch e awuyngom u rogonnigomang e namweliylanininumnge experience rom komitiney e sensei komatheag. Rayogninamweliysalpem nu WaabaraNgalish.

1. Mangfannikamdugliyninam un ko re education research project ney?
2. Mu weliyrogon e sap rom u rogonnin i sap e bitirkomitey e filmatheagniyibeunegbochrogonyaldadngay. Gabe lam nag ma baadag e bitir e mitey e filmatheag? Urunedkopiinni i yog sensei ninganrin? Yadbonaakopinaenniyibefil?
3. Mangbochbonanni um piregnimomawngom u napan e um sensei nag e matheagkobiney e kanawoo?
4. Mangbochbonanni um piregni gam moomriy, aragaffalfalngay, u napan e um sensei nag e rimit e matheagney?
5. Mu weliyboch e naennibuchnigabe lam nag nipowriynimangil/arabotagan e mitey e filmatheag.
6. Bayuwrogonlanininumnapan e um sensei nag e mitey e matheag? Bo gel e alngengriy, famoom rom?
7. Baa e training araskulni um taa u monninam un i sensei nag e mathaegkobiney e kanawoo? R baa e training faskulni um un ngay mag weliyrogonnipii e ayuwngom.

Boyay, kamagarko time ngeayuw rom ko re research project rogney. Ra tuf ma bay ug non ngom.

Kamagar,

Rhoda Velasquez
Appendix E: Interview Guides for Teachers

At this time, I want to talk about your experiences in the teaching of culturally-based mathematics curriculum unit lessons. The information you share is confidential, and I will not identify anyone in my reports. You will have the opportunity to see how I use the information you share before sharing my report with anyone else. I will record the interview to assist me with my notes.

1. We would like to know your feelings, opinions and views about the culturally-based mathematics curriculum?
2. Tell us about the content, strategies and timing, what has it been like using culturally-based mathematics curriculum? (What has been the most challenging – what have you like best about this curriculum?)
3. How does using the culturally-based mathematics curriculum compare with your other teaching experiences?
4. Are there any content in the curriculum that stand out for you—and if so, for what reasons?
5. Have you been able to apply any skills or knowledge you have in the teaching of the culturally-based mathematics curriculum unit lessons? (Examples)
6. Are there any challenges you are facing in teaching the indigenous mathematics units?
7. Did you understand the mathematics in the lesson? If not, what part was difficult to understand?
8. In your experience, how do students react to your teaching of mathematics that is based on their own community, its culture, practices and traditions?
9. After teaching the unit, was there some part of it that you would like to change? What are those parts and why would you change them?
10. Do you think you will teach the unit again in the future? Do you think you will recommend and share the lessons with other teachers for them to use in their classes?
11. Finally, how would you describe success of this culturally-based mathematics curriculum unit – what would that look like for you?
12. Is there anything else you would like to tell me about the culturally-based mathematics curriculum unit that you have just taught or about teaching of these lessons?
Appendix F: Letter of Consent of Teacher-Participant

University of Hawai'i

Consent to Participate in Research Project:

Teacher's Perceptions of Teaching of Culturally based Mathematics Curriculum Unit

My name is Rhoda Velasquez. I am a doctoral student at the University of Hawaii at Manoa (UH) in the School of Education, Curriculum Studies. As one of my duties and part of the requirements for earning my graduate degree, I am doing a research project on topics concerning mathematics teaching and learning. The purpose of my project is to try to understand the perceptions of teachers of using culturally-based mathematics curriculum (CBMC) in their teaching. I am asking you to participate because you teach the CBMC unit in one of the grade levels: 1st, 4th or 7th grade.

Activities and Time Commitment: If you participate in this project, I will ask you to:

1. Collaborate with me on adapting the CBMC unit lessons as part of your regular teaching position.
2. Implement the lessons and reflect on the teaching and learning that occurs when you teach each of the CBMC unit lessons.
3. Write your experiences in teaching the CBMC unit and meet with me for an interview at a location and time convenient to you. The interview will consist of 10-15 open ended questions, and will take 30 – 45 minutes. Interview questions will include questions like, “How did you feel while teaching the unit? Were you comfortable or were you stressed? Please explain your feelings.” “Do you think you will teach the unit again in the future? Do you think you will recommend and share the lessons with other teachers for them to use in their classes?” Only you and I will be present during the interview. I will audio-record the interview so that I can later transcribe the interview and analyze the responses. You will be one of about 6 people whom I will interview for this study.

Timeline: The plan is to begin collaboration and implementation in February 2013. The duration of the project is approximately 4 to 12 weeks.

Benefits and Risks: This collaboration process may be helpful as you think about how you teach mathematics to your students and reflect on ways to improve your teaching. The results of this project will help me and the mathematics education community to learn more about CBMC for the benefit of future students.

I believe there is little or no risk to you in participating in this research project. If however, you become stressed or uncomfortable in participating, including the answering any of the interview questions or discussing topics with me during the interview, we can
skip the question, or take a break, or stop the interview, or you can feel free to withdraw from some or all the project activities.

**Privacy and Confidentiality:** During this research project, I will keep all data from the recordings, stories and interviews in a secure location. Only my University of Hawaii advisor, teachers in the project and I will have access to the data, although legally authorized agencies, including the UH Human Studies Program, can review research records. After I transcribe the stories and interviews, I will destroy the recordings. When I type and report the results of my research project, I will not use your name or any other personally identifying information unless you have specifically requested and granted permission for me to do so. Rather I will use pseudonyms (fake names) referring to you, your school and your student. If you would like a summary of the findings from my final report, please contact me at the number listed near the end of this consent form.

**Voluntary Participation:** Your participation in this project is completely voluntary. You can choose freely to participate or not to participate. In addition, at any point during this project, you can withdraw your permission.

If you have any questions about this research project, please call me at (691) 952-4910 or email me at rhodv@yahoo.com. If you have any questions regarding your rights as a research participant, please contact the UH Human Studies Program, by phone at (808) 956-5007, or by email at uhirb@hawaii.edu.

Please keep a copy of this consent form for your records. I will scan and e-mail you a copy for your records.

If you agree to participate in this project, please sign the following signature portion of this consent form and return it to me.

**Signature(s) for Consent:**

I agree to participate in the research project entitled, “Teacher's Perceptions of Teaching of Culturally based Mathematics Curriculum Unit”. I understand that I can change my mind about participating in this project, at any time, by notifying the researcher.

Your Name (Print): __________________________________________
Your Signature: ____________________________________________
Date: _______________________________________________
Appendix G: Grade 1 Unit Plan (YAP)

Yap State, Federated States of Micronesia

<table>
<thead>
<tr>
<th><strong>Unit Title:</strong> Indigenous Counting and Measuring Systems in the Outer Islands of Yap, Federated States of Micronesia</th>
</tr>
</thead>
</table>

**Rationale:** The knowledge and applications of the indigenous counting system and measurement system are essential for the daily living and survival in the remote outer atolls and islands of Yap State in the Federated States of Micronesia. Culture and traditions still form the basic essential living patterns of the people in Yap and its neighboring islands. As the Yap State Constitution calls for the teaching and learning of the traditions and customs of the people of the State, the Yap State Code mandates creation of the position of culture teachers and hiring of culture teachers by the local school boards of elementary schools in the State of Yap. The focus of this unit is to preserve the indigenous knowledge of counting and measuring in the islands by fostering the understandings and learning at the younger age of the children. The unit would create a sequence of activities that will culminate with the children the teaching, learning, and applications of counting and measuring using the vernacular language of the remote outer islands.

<table>
<thead>
<tr>
<th><strong>Stage 1—Desired Results</strong></th>
</tr>
</thead>
</table>

**Goals:** This unit focuses on the indigenous counting system and the measurement system used in the Caroline Islands, particularly in the outer islands and atolls of Yap State. At the end of the unit the students will be able to master the use of the counting and measurement system in the vernacular language and use them in their daily activities at home and in the communities as well as at schools. At the end of the unit, the students will learn to appreciate their own knowledge and skills and their applications in the island settings as well as forming the foundation of their knowledge expansion and exploration into the 21st century.

<table>
<thead>
<tr>
<th><strong>Enduring Understandings</strong></th>
<th><strong>Essential Questions</strong></th>
</tr>
</thead>
</table>
| 1. Learn and use indigenous counting system and measuring system in their cultural and traditional settings to form their numerical understanding to expand upon and to connect with the western counting system.  
2. Appreciate and preserve the cultural and traditional knowledge of numerical concept of counting in their vernacular language as the basis of their identity and pride. | 1. What are the values of the indigenous counting system in the island environment setting?  
2. How can the children learn and appreciate this knowledge in their modern living today without losing their interest in their own culture and their sense of identity?  
3. How can the knowledge and skills of using the counting system and |
measuring system be preserved today and tomorrow for the next generation?

<table>
<thead>
<tr>
<th>Knowledge</th>
<th>Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Indigenous counting and measuring systems</td>
<td>1. General counting</td>
</tr>
<tr>
<td>2. Cultural values and applications of the systems in the islands</td>
<td>2. Counting by classification</td>
</tr>
<tr>
<td>3. Foundational knowledge of number patterns and relationships</td>
<td>3. Playing game of counting</td>
</tr>
<tr>
<td>4. Appreciation and preservation of cultural knowledge and values</td>
<td>4. Cooperation and participation</td>
</tr>
<tr>
<td>5. Understand patterns and relationships</td>
<td>5. Measuring using body parts</td>
</tr>
<tr>
<td>6. Concept of cooperation and participation</td>
<td>6. Measuring long objects</td>
</tr>
</tbody>
</table>

Stage 2—Assessment Evidence (attach copies of everything you will use)

<table>
<thead>
<tr>
<th>Lesson 1:</th>
<th>Lesson 2:</th>
<th>Lesson 3:</th>
<th>Lesson 4 &amp; 5:</th>
</tr>
</thead>
<tbody>
<tr>
<td>To introduce and/or review the basic concept of indigenous general</td>
<td>To introduce the concept of counting by descriptive classification</td>
<td>To introduce the second classifier ‘facho’ for counting long objects</td>
<td>To introduce Indigenous Measurement System Using Body Parts</td>
</tr>
<tr>
<td>counting system (0 and 1 to 50.)</td>
<td>(using classifiers or word endings): ‘fau’ for round object</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Macimise Project Unit Plan Lessons - Grade 1**

**Lesson Plan 1**

Objective(s): Students will be able to count up to twenty in the vernacular language using the general counting system and demonstrate understanding of numerical quantity by matching numbers with quantity of objects.
Formative Assessment(s): Students will enter class with varying degrees of prior knowledge. During the introduction activity, teacher observes students to see which students struggle with counting.

Primary Learning Strategies:

Materials: small rocks, shells, pennies, small sticks, etc.

Time – 30 minutes X 2 periods

Introduction: Today we will learn about numbers and counting. Teacher asks students…which would you rather have…one piece of candy or two pieces of candy or nothing? Why? Do we have more boys in our class or more girls? How can we find out? How can we find out how many chairs we have in our classroom? Let’s count them. Let’s learn more about counting.

<table>
<thead>
<tr>
<th>Period 1</th>
<th>Teacher Activities</th>
<th>Student Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>On one side of the board draw 5 marks on the board, ask students to count the</td>
<td>Students count marks together</td>
</tr>
<tr>
<td></td>
<td>marks with you. Add 5 more marks on the board. Ask students to count marks</td>
<td></td>
</tr>
<tr>
<td></td>
<td>together with you.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>On opposite side of board, draw…10 different marks. Ask the students to count</td>
<td>Students count marks together</td>
</tr>
<tr>
<td></td>
<td>the marks.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Explain that although the marks are different, they show the same amount of</td>
<td>Students listen to explanation</td>
</tr>
<tr>
<td></td>
<td>‘stuff’. Explain that we have numbers that show us quantity (or how much)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Write numbers 1-10 across the top of the board (leave space for students to make</td>
<td>Students listen to teacher, say</td>
</tr>
<tr>
<td></td>
<td>marks under the numbers). Ask students to say number as you point to it and draw</td>
<td>numbers out loud, and draw marks to</td>
</tr>
<tr>
<td></td>
<td>a mark to show how many under the number. Do the first few numbers together. Ask</td>
<td>represent numbers on the board.</td>
</tr>
<tr>
<td></td>
<td>for student volunteers to draw marks for remaining numbers.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Students form pairs, count objects together</td>
<td></td>
</tr>
<tr>
<td>Pair up students. Give each pair a set of 10 objects (rocks, shells, etc.) Ask student pairs to count objects together. Allow time for students to practice counting the objects. One student places few objects on the desk while other student counts them...then reverse roles. During that time teacher moves around the room checking individual students counting.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>then practices counting objects their partner places on table.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Game ‘Naming Numbers with Rhythm’ Ask students to form a circle. (not more than 10 in a circle). Start the rhythm...both hands pat legs two times, then clap 2 times, then snap right fingers then left fingers. Have students practice the rhythm slowly at first (can be speeded up as they get the hang of the steps). Then ask them to count off starting with 1 and to remember their individual number. The game is played by everyone following the rhythm, but adding...saying their individual number on the right snap and calling the next number on their left. After a few round, switch the order of the students so they are a new number, after several rounds you can switch them again. |
| Students play game, practices naming numbers and recognizing the order of the numbers |

Conclusion:

Lesson Plan 2

Objective(s): Students will be able to identify and count round objects in the environment that are counted using the classifier of ‘fau’ – round stone.

Formative Assessment(s): Teacher observes students as they count orally and identify round objects to be counted.

Primary Learning Strategies: Discussion, group work, observations

Materials: rocks, seashells, or other round objects in different quantities
**Introduction: Time – 30 minutes**

We have counted in class a general way to count objects in our previous lessons…but our language is special in that we have special ways to count things that are different. For example, today we will learn about counting round objects.

<table>
<thead>
<tr>
<th>Teacher Activities</th>
<th>Student Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduces concept of counting objects by classifiers- start with round… draw circle on board…explain that when we count round objects, we use different words to show the classification of the object. Draw 10 circles on the board. Count with students the 10 round objects using the correct classifier (example…one is <em>sew</em>, but one round object is <em>sefau</em>, two is <em>ruwou</em>, but two round objects are <em>ruwefau</em>…in classifiers, the ending is changed to show the kind of object being counted. The ending of circular objects is ‘fau’ (meaning round stone)</td>
<td>Students listen, count with teacher</td>
</tr>
<tr>
<td>Have students count round objects in the classroom (rocks)</td>
<td>Students count rocks using correct classifier.</td>
</tr>
<tr>
<td>Group students into partner groups. Give each group a set number of rocks to count…different amounts for each pair. Students practice counting rocks with one another orally. Teacher walks around room to observe whether students are counting correctly. Once pairs count correctly, exchange rock sets with other pair groups to count.</td>
<td>Pairs take turns counting rocks.</td>
</tr>
<tr>
<td>Have students form rhythm circle, play rhythm counting game using round classifiers.</td>
<td>Students play game.</td>
</tr>
<tr>
<td>Class discussion on kinds of round objects in the environments that are counted with round objects in the classroom (rocks)</td>
<td>Students discuss common items in their environment that are counted with round objects</td>
</tr>
</tbody>
</table>
counted with the ‘round stone’ classifier. Ask students what are other round things they have seen in the environment (breadfruit, copra, apples, coins, balls, etc.)

Take students outside classroom…to observe and count round objects on campus.

Conclusion: Bring students back to class and orally debrief the lesson’s activities.

Lesson Plan 3

Objective(s): Students will be able to identify and count long objects in the environment that are counted using the classifier of ‘facho’ – long ones.

Formative Assessment(s): Teacher observes and tests students as they count long objects orally and identify long objects to be counted.

Primary Learning Strategies: Discussion, group work, observations, matching counts of long objects on sheets of papers and on the board.

Materials: pencils, sticks, tall trees such as coconut trees and banana trees, and other long objects in different quantities.

Time – 30 minutes

Introduction: We have learned to count in class the general way to count objects in our previous lessons. Because our language is special in that we have special ways to count things that are different, we have also learned to count round objects using classifiers of word endings that describe objects counted. For example, yesterday we have learned about counting round objects. Today, we will learn to count objects that are long in dimensions using the classifier ‘facho’ – long ones.

<table>
<thead>
<tr>
<th>Teacher Activities</th>
<th>Student Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduces concept of counting objects by classifiers- start with round… draw circle on board…explain that when we count round objects, we use different words to show the classification of the object. Draw 10 circles on the board.</td>
<td>Students listen, count with teacher</td>
</tr>
</tbody>
</table>
- Count with students the 10 round objects using the correct classifier (example...one is *sew*, but one round object is *sefau*, two is *ruwou*, but two round objects are *ruwefau*...in classifiers, the ending is changed to show the kind of object being counted. The ending of circular objects is *fau* (meaning round stone).

- Have students count round objects in the classroom (rocks).

- Students count rocks using correct classifier.

- Group students into partner groups. Give each group a set number of rocks to count...different amounts for each pair. Students practice counting rocks with one another orally. Teacher walks around room to observe whether students are counting correctly. Once pairs count correctly, exchange rock sets with other pair groups to count.

- Pairs take turns counting rocks.

- Have students form rhythm circle, play rhythm counting game using round classifiers.

- Students play game.

- Class discussion on kinds of round objects in the environments that are counted with the 'round stone' classifier. Ask students what are other round things they have seen in the environment (breadfruit, copra, apples, coins, balls, etc.).

- Students discuss common items in their environment that are counted with round classifiers.

**Conclusion:** Bring students back to class and orally debrief the lesson’s activities.

---

**Lesson Plan 4 and 5**

**Objective(s):** Students will be able to measure using body parts. (finger, palm of hand, half arm length, whole arm length, fingertip to breastbone, fingertip to shoulder of opposite arm, fingertip to elbow of opposite arm, and fingertip to fingertip) Each has specific name.
Formative Assessment(s):

Primary Learning Strategies:

Materials:

Time – 30 minutes X 2

Introduction:

<table>
<thead>
<tr>
<th>Teacher Activities</th>
<th>Student Activities</th>
</tr>
</thead>
</table>

Conclusion:
Appendix H: Grade 4 Unit Plan (Yap)

**Unit Title:** 4th Grade Unit for Yap State  
by Cal Hachibmai

**Rational:** The focus of the unit is house building. House building is as the focus for this unit because it is one of the most essential knowledge in the Outer Islands of Yap. This region is prone to bad weather and frequent storms so in order to be able to rebuild the house in case of storms and other natural disaster; the children need to learn the knowledge and skills.

<table>
<thead>
<tr>
<th>Stage 1 – Desire Results</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Goals</strong></td>
</tr>
<tr>
<td>The goal of the unit is that by the end of the five lessons, the students will be able to create house models that are correctly put together with the right part in the right place and are tied securely together. Securely means can hold together without falling apart when moving it around. At the same time the students will learn some math concepts that are stated in each lesson objectives.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Enduring Understandings</strong></th>
<th><strong>Essential Questions</strong></th>
</tr>
</thead>
</table>
| 1. Basic knowledge of building a house. (weaving thatch roof, construction, tying techniques)  
2. Basic knowledge of patterns.  
3. Proportional measurements.  
4. Algebraic thinking | 1. Why do we need to learn about house building? |

<table>
<thead>
<tr>
<th><strong>Knowledge</strong></th>
<th><strong>Skills</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>House construction by building models</td>
<td>Extending and predictions skill,</td>
</tr>
</tbody>
</table>

**Common Core Standards Addressed**

<table>
<thead>
<tr>
<th><strong>Summative Assessments Tasks</strong></th>
<th><strong>Other Evidence</strong></th>
</tr>
</thead>
</table>
| 1. Observation of the model and judging it to the pre-stated criteria created in lesson 1.  
2. Pencil and paper test on extending and predicting patterns (test prepared/see unit 4 resources)  

**Stage – 3 Macimise Learning Plans**

<table>
<thead>
<tr>
<th>Lesson 1</th>
<th>Lesson 2</th>
<th>Lesson 3</th>
<th>Lesson 4</th>
<th>Lesson 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thatch roof Weaving</td>
<td>Tying Techniques</td>
<td>Constructing the Basic Parts of the Model</td>
<td>Completing the House Model</td>
<td>Field Trip and linking all the lessons together</td>
</tr>
</tbody>
</table>
## Macimise Daily Plan

<table>
<thead>
<tr>
<th>Title: Thatch roof weaving</th>
<th>Focus: House Building</th>
<th># 1</th>
</tr>
</thead>
</table>

### Objective:
The students will be able to weave thatch roof and at the same time be able to learn the proportional measurements as well as identifying, creating, and working with tables to use predictions skills for the patterns created.

### Formative Assessments:
Teacher Observation = (students weaving thatch roof correctly, students can identify patterns from the thatch weaving, students able to transfer weaving patterns onto their tables, student extending the pattern in their tables correctly, student using prediction skills, students will also be able to apply their knowledge of proportional measurements.) Questions and Answers=(Teacher will ask individual student questions and student able to answer.)

### Learning Strategies:
Pure-learning and group participation, modeling and observations, exploring and discovering.

### Materials Needed:
coconut palm leaves, (depending on the number of students in the class), knives to cut the leaves, pencils, notebooks, and a completed model of a house.

### Introduction
Tell the students a short story the importance of knowing the knowledge of house building. The teacher either will use the prepared story in the resources folder or make up one.

<table>
<thead>
<tr>
<th>Time</th>
<th>Teacher Activities</th>
<th>Students Activates</th>
<th>Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 mins.</td>
<td>1.1. The teacher tells the students the story of why it is important to learn the knowledge of building a house.</td>
<td>1.1. Listen and ask question if necessary and taking notes.</td>
<td>Pencils and notebook for taking notes.</td>
</tr>
<tr>
<td>5 mins.</td>
<td>1.2. Connect the story to the lessons that will follow by telling them the importance of houses and learning how to build them. Also let them know that at the end of the unit, they will build a house model and at the same time learn mathematics concepts.</td>
<td>1.2. Listen and ask question.</td>
<td>Pencils and notebook for taking notes.</td>
</tr>
<tr>
<td>5 mins.</td>
<td>1.3. Teacher and students create the criteria for what is a “good house model”.</td>
<td>1.3. Discuss and share their ideas of a good house model, from their own prior knowledge and from what they learn of the model shown to them.</td>
<td>Pencils and notebooks for keeping notes.</td>
</tr>
<tr>
<td>10 mins.</td>
<td>1.4. If teacher does not know how to weave thatch roof, invite in an expert to show the students how to weave thatch roof, or utilize the culture teacher at the</td>
<td>1.4. Use local measurement to measure the length of the thatch they will</td>
<td>Strings, knifes, palm leaves</td>
</tr>
</tbody>
</table>
1.4. Steps for the teacher.
   A. Pass to each student a complete coconut palm leave.
   B. Model to the student the different types of local measurement that can be use to measure thatch roof. Example: sepaiu, stelobe, sengaf and etc.
   C. Tell the students to practice the measurements using their leaf. After practice measuring, tell the students to use the three measurements in the example above and mark them. The teacher cut each student’s leaves into three parts according to their marks.
   D. Using the sepaiu length, the teacher split the leaf part through the mid rib then model the simplest form of thatch weaving (one over, the next under, one over and the next under pattern) to the students while they observe. Encourage them to pay close attention to the patterns of the weaving. Example: leave, over, underneath, over, underneath and etc.
   E. Model the next complex weaving process for the students then have them practice. Show at least two types of weaving thatch roof. Have students pay close attention to the patterns in the weaving.

| 1.4A-D. Place the leave face down on either the floor or on the lap and start the weaving process. Watch the teacher and/or expert modeling and practice the process. The students then practice the weaving the simplest form of weaving the thatch roof. Observe then practice the next type of weaving. Ask questions. Pay attention to the patterns in the weaving process. |

1.5. Have the students find and talk about the patterns they find on the weaving. Example: The way the leaves are woven on top and underneath each other. Encourage them to use their own words in explaining to each other the pattern each of them find. For example: This leaf goes over and under, over and under and so forth.

| 1.5. Identify the patterns use on each type of weaving and talk about them. |

10 mins.

| 1.6A. Make sure the students link the weaving patterns to the numbers. Example: One leaf over, one leaf under, one leaf over and etc. can be translated into 1, 2, 1, 2, 1, 2, where the 1 represent |

| 1.6. Translate the patterns they find in to numbers. |

| Coconut leaves |

| Pencils and notebooks |
the over and 2 representing the under etc. One leaf over, two leaves under, one leaf over, two leaves under can be translated to 1, 2, 2, 1, 2, 2, 1, 2, 2, and so forth.

1.6B. Have the students find and translate different patterns.
6C. Have the student talk to each other about the patterns and their translations.

1.6. Have the students find and translate different patterns.
6C. Have the student talk to each other about the patterns and their translations.

<table>
<thead>
<tr>
<th>Term</th>
<th>1st</th>
<th>2nd</th>
<th>3rd</th>
<th>4th</th>
<th>5th</th>
<th>6th</th>
<th>10th</th>
<th>15th</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patterns</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>?</td>
<td>?</td>
<td>?</td>
<td>?</td>
</tr>
</tbody>
</table>

1.7A. Using the patterns they find, the students will create tables like the one above that will show the number of leaves as terms and the patterns as the next set of numbers.

1.7B. Encourage students to observe the patterns and create tables that tell about their patterns.

1.7C. Have the students create tables and extent up to three term then answer questions such as what number of pattern comes in the 10th, 15th, 20th term then compare their predictions to the weaving.

1.7. Extend and Predict: Using a table, the students will extend the patterns they identify and predict what will come in the 10th, 15th, 20th term then compare their predictions to the weaving.

1.8A. Have the students share and talk about their tables with each other in their groups.

1.8B. Have them choose a table with three terms that they will present it to the whole class.

1.8C. Each group will take turn and show the whole class their tables, the thatch roof pattern at which they created the table and have the whole class predict the next term, the 10th term, 20th term and the 25th term.
Encourage students to discover ways to explain their ideas so the other students can understand. There is no right or wrong answers so encourage students share their ideas. Encourage them to also ask each other’s questions.

1.8. In groups of 3-4, students will share and discuss their tables with each other and if needed create more tables identify, extend and predict patterns or terms. Choose a table and prepare to present it to the whole class.

Pencils and notebooks and/or graph papers.
**Title: Tying Techniques Focus: House Building#2**

**Objective:** In this lesson, the students will learn techniques on how to tie two or three pieces of sticks together securely. At the end of the lesson they will be able to: Observe then create their own tying pattern; create math and solve math problems out of the patterns; talk about the patterns in their own words.

**Formative Assessments:** Teacher Observation = (students weaving thatch roof correctly, students can identify patterns from the thatch weaving, students able to transfer weaving patterns onto their tables, student extending the pattern in their tables correctly, student using prediction skills, students will also be able to apply their knowledge of proportional measurements.) Questions and Answers=(Teacher will ask individual student questions and student able to answer.)

**Learning Strategies:** Pure-learning and group participation, modeling and observations.

**Materials Needed:** twine strings, and sticks, pictures of different tying

### Introduction

If the teacher has limited knowledge of house building, an expert or elder should be invited into the classroom to do the modeling.

<table>
<thead>
<tr>
<th>Time</th>
<th>Teacher Step</th>
<th>Student Activities</th>
<th>Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 mins.</td>
<td>2.1A. Introduce the lesson with connections to the previous lesson. Let the students know that in this lesson they will learn different tying techniques and at the same time practice on some math concepts. 2.1B. Pass the materials out to the kid the materials needed for the activity. Each kid should have some pieces of sticks and one roll of string.</td>
<td>2.1. Building connections and getting ready for the lesson.</td>
<td>Pencils and notebook for keeping notes.</td>
</tr>
<tr>
<td>5 mins</td>
<td>2.2. If the teacher does not know how to do the tying, bring in an expert to demonstrate the tying techniques. 2.2A. Show the students the pictures of different tying.</td>
<td>2. Student looks at different kinds of tying techniques and asks questions and/or takes notes.</td>
<td>Pictures showing different tying styles, strings,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>2.2B.</td>
<td>Explain to the students the importance to know how to tie things securely so the house will not fall apart easily.</td>
<td>sticks</td>
<td></td>
</tr>
<tr>
<td>2.3A.</td>
<td>Teacher or Expert: Demonstrate the simplest form of tying two pieces of stick securely. Can be done 2x or 3x while students observe.</td>
<td>Strings and sticks</td>
<td></td>
</tr>
<tr>
<td>2.3B.</td>
<td>Encourage the students to observe the different patterns shown in the knots. Some knots will form a diamonds, triangles and/or squares.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.3C.</td>
<td>With the teacher or expert, the students will practice how to tie the sticks together.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.4.</td>
<td>See if they can come up the pattern of the diamond, triangle or square. Encourage them to create their own patterns.</td>
<td>Strings and sticks</td>
<td></td>
</tr>
<tr>
<td>2.5.</td>
<td>If they roll diagonally from left to right three times and right to left five time, what would be the total roll of the string around the sticks? And if they did that same pattern with two other connections, what would be the total? What would happen if the change the pattern? What would happen if they have even number connections? Etc. Encourage them come up with their own math problems and solutions.</td>
<td>Pencils and notebooks</td>
<td></td>
</tr>
<tr>
<td>2.6.</td>
<td>Encourage the other students to ask questions.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.6.</td>
<td>Choosing one of their patterns the students show and tell the whole class why they chose that pattern, and how they create the pattern. They can also talk about the math problems they can create out of that pattern and how they solve them.</td>
<td>Pencils and notebooks</td>
<td></td>
</tr>
</tbody>
</table>
Objective: In this lesson, the students will learn techniques on how to tie things together securely. At the end of the lesson they will be able to: identify patterns and shapes; create appropriate names of shapes and patterns; practice how to estimate and/or predict.

Formative Assessments: Teacher Observation = (students weaving thatch roof correctly, students can identify patterns from the thatch weaving, students able to transfer weaving patterns onto their tables, student extending the pattern in their tables correctly, student using prediction skills, students will also be able to apply their knowledge of proportional measurements.) Questions and Answers=(Teacher will ask individual student questions and student able to answer.)

Learning Strategies: Pure-learning and group participation, modeling and observations.

Materials Needed: twine strings, and sticks

| Introduction |
|--------------|-----------------|-----------------|
| 3 mins.      | 3.1. Introduce the lesson by connecting it to the previous lesson. Tell the students that what they learned in the previous lessons was preparation for the next activates in this lesson. | 3.1. Listen and ask questions. |
| 5 – 7 mins.  | 3.2A. With the expert or teacher guiding, the students assemble the major parts of the house. Encourage the students to pay special attention to the shapes and pattern when working on the model. 3.2B. Encourage them use the different type of measurements learned in lesson 1. 3.2C. When they completed the general structure of the model move to the activities below in students step 3. | 3.2. Using their tying skills from the previous lesson, the student will tie together the major parts of the house models: columns, major beams and rafters. |
| 10 mins.     | 3.3A. Get the students in to groups of 2-4 and let them observe the structure they've just completed. 3.3B. Have them look for shapes | 3.3. In-group of 2 – 4, students look for shapes they find on the model talk about them and create names for |

Pencils and notebook

Strings and sticks

Pencils and notebook
from the structure and draw them down on a piece of paper.
3.3C. Have them create names for the shapes they draw using their own words. It can be one word name or combination of words but making sure the names are meaningful to them, preferably names that only describe the shape.

<table>
<thead>
<tr>
<th>10 mins</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.4A. Teacher ask the groups a question and the first group to answer the question correctly will be the first group begin the game by telling the other groups the name of one of their shape then the first group that draw the correct shape take the turn to say the name of one of their shape while the other groups draw the shape. If none of the groups draw the correct shape, the same group either adds some more hints to their name or says another name. 3.4B. After the game the students move to the next activity.</td>
</tr>
<tr>
<td>3.4. Game: In the same groups, each group take turn to tell the other group the name of their shape and the other group figure out the shape by drawing it. (Play the game)</td>
</tr>
<tr>
<td>Pencils and notebooks</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>15 mins</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.5A. Group the student in the same group or using different groups of 2-4. 3.5B. Teacher explain to the students the rules of the game as written under students step 5, then write the bonus questions on the board. 3.5C. Each group either discuss their answer to the bonus questions first or observe the model and create math problems that they will use in the game. 3.5D. The teacher facilitates and encourages creating sensible math problems. The following are few examples of the bonus questions that the teacher may use. 3.5a. If the double the length of the model, how many rafters would they need? 3.5b. Or what would happen to the</td>
</tr>
<tr>
<td>3.5. Looking at the model, the students create and solve math problems. Game rules: 1. Other group correcting other group = 5 points 2. Answering bonus question sensibly and with completeness. Each bonus question = 4 points 3. Sensible problems = 3 points 4. Partly sensible problem = 2 points 5. Most problems = 1 points</td>
</tr>
<tr>
<td><em>The game is played in students step 6.</em></td>
</tr>
<tr>
<td>Pencils and notebooks</td>
</tr>
</tbody>
</table>
width? Why?
3.5c. If they want to double the length of the model but they don't have any extra rafters, what would they do and why? …Etc.
3.5d. Teacher will come up with more guiding questions for the students.
3.5E. Each group solves their problems and is ready for the next activity that they will share to the other groups.

3.6A. Teacher or selected member from each group will be the judge and point keeper.
6B. Each group take turn to share their first problem then solve it for the other. Encourage the other group members to ask questions.
3.6C. After all the groups share their first problem, they move to their second problem.
3.6D. When a group runs out of problem, they are out of the game but they can still win the game through points.

3.6. **Game:** Each group takes turns and shares their problems with the other groups. Explain to the other groups how they come to the problem, then show and explain how to solve the problem.

**Macimise Daily Plan**

**Title:** Completing the House Model  
**Focus:** House Building  

**Objective:** In this lesson, the students will complete the house model. At the end of the lesson they will be able to: create, solve and share problems with fractions; generate math ideas from the structure.

**Formative Assessments:** Teacher Observation = (students weaving thatch roof correctly, students can identify patterns from the thatch weaving, students able to transfer weaving patterns onto their tables, student extending the pattern in their tables correctly, student using prediction skills, students will also be able to apply their knowledge of proportional measurements.) Questions and Answers=(Teacher will ask individual student questions and student able to answer.)

**Learning Strategies:** Pure-learning and group participation, modeling and observations.

**Materials Needed:** twine strings, and sticks
<table>
<thead>
<tr>
<th><strong>Introduction</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>An expert of elder should be invited into the classroom to assist the teacher in modeling the techniques and skills if the teacher does not know how to build houses or house models.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 mins.</td>
<td>4.1. Introduce the lesson and make connections to the previous lessons.</td>
</tr>
</tbody>
</table>
| 7 mins. | 4.2A. With the teacher or expert, the students continue working to complete the structure of the model. Encourage the students to use the measurement types and the tying techniques they learned from previous lessons.  
4.2B. Encourage them to pay attention to additional pattern and shapes. |
| 10 mins. | 4.2. The students work to complete the house model. They should add all the purlins and the thatches if necessary. |
| 4.3. Teacher walks around and facilitates group questions and concerns. |
| 4.3. In groups of 2 – 4, students observe the completed model and talk about any mathematical ideas they find. Examples: additional pattern and shapes, additions, subtractions, etc. |
| 5 mins | 4.4. Facilitate and answer and questions from the groups. |
| 4.4. In the groups, the students present to the whole class what each discuss in their groups. |
| 15 mins. | 4.5A. Refer back to the activity in Lesson 3, students step 5 and 6. Use the same game but this time encourages the students to include fractions and measurements problems.  
4.5B. Teacher will create bonus questions, which will include fractions and measurements problem.  
4.5B.a. Encourage the students to also use fractions, example the number of rafter vs. the number of purlins...etc.  
4.5B.b. Encourage them to also create problems from the measurements. Example. How does |
| 4.5. Use the same activity used in lesson 3 steps 5 & 6. This time the activity will extend to include the purlins thatches. |
| the measurement of the rafters or the king post affect the whole building? Or the main beams vs. the secondary beams. 4.5B.c. Teacher will create more guiding questions. |
|---|---|---|
| 10 mins. | 4.6. Encourage the other group members to ask questions. | 4.6. Each group take turn to share their ideas to the other groups. |

### Macimise Daily Plan

**Title:** Field Trip and linking all the lessons together

**Focus:** House Building

### Objective:
In this lesson, the students will go on a field trip to observe a real house. At the end of the lesson they will be able to:

**Formative Assessments:** Teacher Observation = (students weaving thatch roof correctly, students can identify patterns from the thatch weaving, students able to transfer weaving patterns onto their tables, student extending the pattern in their tables correctly, student using prediction skills, students will also be able to apply their knowledge of proportional measurements.) Questions and Answers=(Teacher will ask individual student questions and student able to answer.)

**Learning Strategies:** Pure-learning and group participation, modeling and observations.

**Materials Needed:** twine strings, and sticks

### Introduction
An expert of elder should be invited into the classroom to assist the teacher in modeling the techniques and skills if the teacher does not know how to build houses or house models.

<table>
<thead>
<tr>
<th>5 – 10 mins.</th>
<th>5.1A. Invite an expert to talk and answer student’s questions during the fieldtrip. 5.1B. Introduce and connect the lesson to previous lessons. Tell the students the purpose of the field trip and what to look for when they reach the men's house.</th>
<th>1. Listen and ask questions if needed.</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 mins.</td>
<td>5.2A. Encourage students to apply their knowledge of the model to the actual house observed. Encourage them to compare and contract their model to the actual house. Make sure they write down their observations because they will talk</td>
<td>2. Students will take a field trip to the closest men's house or canoe house to compare what they see on the actual house to their model.</td>
</tr>
</tbody>
</table>
about them when they return to the classroom.
5.2B. Lay down some field trip rules for the safety of students during the trip. All the students should understand these rules.
5.2C. Make sure the students have either their notebooks or pencils to write down things that they observe during the field trip. (Encourage them to think and observe mathematically and also write down questions that they may have)
5.2D. Tell the students that when they returned from the field trip they will discuss whatever they have in their notes in the classroom and create math problem from what they observed.
5.2E. Teacher facilitate and entertain questions making sure students ask questions during the fieldtrip.

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 mins.</td>
<td>5.3. Encourage the students to discuss whatever they think is important because it will be necessary in winning the game that will be played in step 3 below.</td>
</tr>
<tr>
<td>15 mins.</td>
<td>5.4A. Each question is worth 2 points. The teacher will ask a team to answer a questions and a member from that team</td>
</tr>
<tr>
<td></td>
<td>5.4. In the same group created above, the</td>
</tr>
</tbody>
</table>

5.3. (After the Field trip in the classroom)
In groups, the students will discuss the result of their field trip. (Differences and Similarities) What if the thatches on the house needed change and the men ask them to figure out the number of thatches the house would need. How would they figure it out? What if they were asked to build another house with an additional half measurement in length, how many materials would they need? Why?

Pencils and notebooks
will answer the question and if answer correctly, they got the 2 points and if partially then only one point. If that member answer is not correct, the question goes to the next team and next team until the question comes back to the first team again but this time another member will attempt to answer the question.

5.4B. The questions will be created by the teacher but below are some examples of the questions.

<table>
<thead>
<tr>
<th>5.4B.a. Questions:</th>
<th>5.B.a. Questions:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triangle</td>
<td>1. What is a three sided figure that can be found when you stand in the front or back of the house?</td>
</tr>
<tr>
<td>7</td>
<td>2. If you find 7 rafters on one side of the building, how many would you think would be on the other side?</td>
</tr>
<tr>
<td>15 mins.</td>
<td>* 6 X 2 = 12 thatches for one side and approx. 24 for both sides. * Because I calculated the area and even if I did not mention the width of the thatches, it is understood that most thatches in Yap OI are about 1 foot width. The roof is approximate because the actual shape of the side of the house is not a square.</td>
</tr>
<tr>
<td>10 mins.</td>
<td>Unit Summative Assessment</td>
</tr>
</tbody>
</table>

students will answer questions from the teacher and prepare to defend and explain their answer.
Appendix I: Grade 1 Unit Plan (Kosrae)

Tulensru Waguk

Unit Title: Counting and Adding with Native Plates (Plet Sracnu)

Rationale: Teaching and learning of mathematics in school has been to follow a set of scope and sequence derived from the Kosrae State Mathematics Curriculum. Counting and adding in first grade mathematics also follow procedures as indicated in the mathematics scope and sequence. Geometry in 1st grade is basically identifying attributes of circles, triangles, squares, and rectangles. This unit takes into account the importance of using culturally relevant lessons in counting and adding and in identifying defining attributes and non-defining attributes of common basic geometric shapes (squares and rectangles).

<table>
<thead>
<tr>
<th>Desired Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goals</td>
</tr>
<tr>
<td>To use the commonly used local counting system to count, read, write and compare whole numbers</td>
</tr>
<tr>
<td>1. To add with single-digit numbers and in pairs.</td>
</tr>
<tr>
<td>2. To weave a plet sracnu with five coconut leaflets.</td>
</tr>
<tr>
<td>3. To recognize, classify, identify, and draw common shapes in weaving using local language terms.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Essential Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>What does a weaver have to think about when making Plet Sracnu?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Enduring Understandings</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. To understand the idea of counting in pairs (skip-counting by 2’s).</td>
</tr>
<tr>
<td>2. To understand defining and non-defining attributes of squares and rectangles.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Knowledge</th>
<th>Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Know counting number words.</td>
<td>1. Count with local counting words up to twenty.</td>
</tr>
<tr>
<td>2. Know similarities and differences between squares and rectangles</td>
<td>2. Identify basic attributes of square and rectangle in the weaving of plet sracnu.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Common Core Standards Addressed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.OA.5 Relate counting to addition and subtraction (e.g. by counting on 2 to add 2)</td>
</tr>
<tr>
<td>1.OA.6 Add and subtract within 20 demonstrating fluency for addition and subtraction within 10.</td>
</tr>
<tr>
<td>1.G.1 Distinguish between defining attribute (e.g. triangles are closed and three-sided) versus non-defining attributes (e.g. color, orientation, overall sizes).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Assessment Evidence</th>
</tr>
</thead>
</table>

92
### Summative Assessment Task
1. Worksheets
2. Woven *plet sracnu*.

### Other Evidence
1. Teacher Observation
2. Students Responses to Teacher’s oral questions

### Lesson Titles
| Day 1: Counting with Local Counting System | Day 2: Making *Plet sracnu* | Day 3: Defining and Non-defining Attributes of Squares and Rectangles | Day 4: Pairing and skip-counting by two’s | Day 5: Adding with Coconut leaflets and Native Plates |

### MACIMISE Daily Lesson Plan

#### Lesson # 1  [Counting with Local Counting System]

### Lesson Objectives
Objective 1: By the end of the lesson, 90% of the students will be able to use the commonly used local counting system to count, read, write and compare whole numbers to 20 correctly.

### Formative assessments for learning
Observation Worksheet Oral Questioning

### Learning strategies

#### Introduction

<table>
<thead>
<tr>
<th>Time</th>
<th>Teacher Activities</th>
<th>Student Activities</th>
<th>Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 min.</td>
<td>Motivations: 1. Tell students that they will learn to count coconut leaves and leaflets used in making native plate sat the end of the lesson. Tapping on Students’ Prior Knowledge 2. Teacher poses questions for discussion and</td>
<td>1. Students orally respond to teacher’s questions. 2. Students share experiences in Birthday parties</td>
<td>Numerals Chart (1-20)</td>
</tr>
</tbody>
</table>
sharing:
1. Can you name and count the various kinds of food served in birthday parties?
2. How many people are in your family?
3. How many people usually attend birthday parties?
4. Who prepared the local food containers?

<table>
<thead>
<tr>
<th>Time</th>
<th>Teacher Activities</th>
<th>Student Activities</th>
<th>Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 min.</td>
<td>1. Put the students in 4 mixed gender groups of 4 or 5</td>
<td>Count up to 20 coconut trees inside the school campus, and then count those around the school campus.</td>
<td>Coconut leaves</td>
</tr>
<tr>
<td></td>
<td>2. Prepare recording sheets</td>
<td>Count leaves on two coconut trees</td>
<td>Recording sheets.</td>
</tr>
<tr>
<td></td>
<td>3. Prepare coconut leaves for groups</td>
<td>Count leaflets of a cut coconut frond.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4. Assess student understanding</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>5. Evaluate lesson</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Conclusion (review: what did we learn today and why does it matter to us)

<table>
<thead>
<tr>
<th>Time</th>
<th>Teacher Activities</th>
<th>Student Activities</th>
<th>Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 min.</td>
<td>1. Prepare review questions and materials</td>
<td>Students demonstrate knowledge and skills acquired.</td>
<td>Coconut leaves</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Orally count to 20.</td>
<td></td>
</tr>
</tbody>
</table>
Lesson Objectives
Objective 1: By the end of the week, 90% of the students will be able to weave a *plet sracnu*.

Formative assessments for learning
Observation
Worksheet
Oral Questioning

Learning strategies
Introduction

<table>
<thead>
<tr>
<th>Time</th>
<th>Teacher Activities</th>
<th>Student Activities</th>
<th>Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 min.</td>
<td>Motivations</td>
<td>Students’ responses to teacher’s questions</td>
<td>A woven plet sracnu (for display)</td>
</tr>
<tr>
<td></td>
<td>1. Tell students that they will learn to weave <em>plet sracnu</em> at the end of the lesson.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tapping on Students’ Prior Knowledge</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. Teacher’s Questions:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. Have you ever tried to weave a plet sracnu?</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. Who weave native plates (plet sracnu) used in birthday parties.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. How many native plates (plet sracnu) were used in the last birthday party at your home (estimate).</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Activities (step by step details and organization enough for someone else to follow.)

<table>
<thead>
<tr>
<th>Time</th>
<th>Teacher Activities</th>
<th>Student Activities</th>
<th>Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 min.</td>
<td>1. Provide coconut leaves for weaving.</td>
<td>4. Weaving a <em>plet sracnu</em> (food container)</td>
<td>Coconut leaves</td>
</tr>
<tr>
<td></td>
<td>2. Demonstrate how to weave a native plate.</td>
<td></td>
<td>Ropes</td>
</tr>
<tr>
<td></td>
<td>3. Assist students in weaving native plates</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
1. Count leaflets on two cut off parts of a coconut leaf (one with 6 leaflets, and the other with 10 leaflets)
2. Describe pairs
3. Split each cut sections of the coconut frond at the center of the bark (coconut leaflets are attached to the barks one across or opposite the other).
4. Compare and contrast: Which has more leaflets? Which is bigger? (6 or 10)
5. Weave a native plate with 3 pairs and then 5 pairs
6. Estimate number of plates that could be produced from one leaf (3 and 5 pairs) and compare with the actual number.
7. Count the actual numbers of plates woven from one leaf.
8. Figure out number of leaves needed for a certain number of people in a first-year birthday party

### Conclusion (review: what did we learn today and why does it matter to us)

<table>
<thead>
<tr>
<th>Time</th>
<th>Teacher Activities</th>
<th>Student Activities</th>
<th>Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 min.</td>
<td>Prepare review questions and materials</td>
<td>Students demonstrate knowledge and skills acquired</td>
<td>1. Coconut leaves</td>
</tr>
</tbody>
</table>

### MACIMISE Daily Lesson Plan

**Lesson # 3**  [Defining and Non-defining Attributes of Squares and Rectangles]

**Lesson Objectives**

Objective 1: By the end of the week, 90% of the students will be able to describe defining and non-defining attributes of square and rectangle.

**Formative assessments for learning**

Observation
Worksheet
Oral Questioning
# Learning strategies

## Introduction

<table>
<thead>
<tr>
<th>Time</th>
<th>Teacher Activities</th>
<th>Student Activities</th>
<th>Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 min.</td>
<td><strong>Motivations</strong></td>
<td>Students identify geometric figures</td>
<td>Squares, rectangles,</td>
</tr>
<tr>
<td></td>
<td>1. Tell students that they will weave</td>
<td></td>
<td>circles, triangles</td>
</tr>
<tr>
<td></td>
<td>plet sracnu again and identify</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>patterns of squares and rectangles in</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>plet sracnu at the end of the lesson.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Tapping on Students’ Prior Knowledge</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. Teacher’s Questions:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>a. Can you tell three things that</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>have square or rectangular shapes.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>b. Assist students in weaving native</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>plates (plet sracnu)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Activities (step by step details and organization enough for someone else to follow.)

<table>
<thead>
<tr>
<th>Time</th>
<th>Teacher Activities</th>
<th>Student Activities</th>
<th>Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 min.</td>
<td><strong>Prepare materials</strong> (plet sracnu)</td>
<td>Identify geometric figures and patterns in</td>
<td>Coconut leaves</td>
</tr>
<tr>
<td></td>
<td>Teacher’s Questions:</td>
<td>a native plate (plet sracnu)</td>
<td>Woven plet sracnu</td>
</tr>
<tr>
<td></td>
<td>a. Questions should be posed for the</td>
<td>count the number of squares, rectangles,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>purpose of assessing student</td>
<td>triangles, and etc.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>understanding and assessing</td>
<td>Estimate sizes of geometric figures as</td>
<td></td>
</tr>
<tr>
<td></td>
<td>instruction:</td>
<td>coconut leaflets are added.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Possible Questions:</td>
<td>Describe defining and non-defining</td>
<td></td>
</tr>
<tr>
<td></td>
<td>a. How many sides does a square have?</td>
<td>attributes of geometric figures identified.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b. How many squares, rectangles,</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
and triangles have you found on your native plate?

Conclusion (review: what did we learn today and why does it matter to us)

<table>
<thead>
<tr>
<th>Time</th>
<th>Teacher Activities</th>
<th>Student Activities</th>
<th>Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 min.</td>
<td>Prepare review questions and materials</td>
<td>I. Students demonstrate knowledge and skills acquired</td>
<td>1. Coconut leaves</td>
</tr>
</tbody>
</table>

MACIMISE Daily Lesson Plan
Lesson # 4  [Pairs and Skip-Counting by Two’s]

Lesson Objectives
Objective 1: By the end of the lesson 90% of the students will be able to count numbers in pairs and skip-count by two’s to 20 correctly.

Formative assessments for learning
Observation
Worksheet
Oral Questioning

Learning strategies
Introduction

<table>
<thead>
<tr>
<th>Time</th>
<th>Teacher Activities</th>
<th>Student Activities</th>
<th>Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 min.</td>
<td>Motivations</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. Tell students that they will learn to count with pairs and skip-count by two’s at the end of the lesson.</td>
<td>Orally respond to teacher’s question</td>
<td>Coconut leaves</td>
</tr>
<tr>
<td></td>
<td>Tapping on Students’ Prior Knowledge</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. Teacher’s Questions:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. Have you ever heard people skip-count?</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. When and why do you think people use skip counting?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Activities (step by step details and organization enough for someone else to follow.)

<table>
<thead>
<tr>
<th>Time</th>
<th>Teacher Activities</th>
<th>Student Activities</th>
<th>Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 min.</td>
<td>Tell the story (legend) of the Giant Gecko</td>
<td>Listen to the story of the Giant Gecko. Describe characters and tell the different pairs in the story.</td>
<td>Coconut leaves</td>
</tr>
</tbody>
</table>
### Conclusion (review: what did we learn today and why does it matter to us)

<table>
<thead>
<tr>
<th>Time</th>
<th>Teacher Activities</th>
<th>Student Activities</th>
<th>Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 min.</td>
<td>Prepare review questions and materials</td>
<td>Students demonstrate knowledge and skills acquired</td>
<td>1. Coconut leaves</td>
</tr>
</tbody>
</table>

### Lesson Objectives

Objective 1: By the end of the lesson, 90% of the students will be able to solve addition problems involving order of numbers.

### Formative assessments for learning

- Observation
- Worksheet
- Oral Questioning

### Learning strategies

#### Introduction

<table>
<thead>
<tr>
<th>Time</th>
<th>Teacher Activities</th>
<th>Student Activities</th>
<th>Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 min.</td>
<td>Motivations</td>
<td></td>
<td>1. Discuss ways used for adding native plates.</td>
</tr>
<tr>
<td></td>
<td>1. Tell students that they will learn to add with coconut leaflets and native plates</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. Tapping on Prior Knowledge:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. What are some ways people use to add native plates?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Activities (step by step details and organization enough for someone else to follow.)

<table>
<thead>
<tr>
<th>Time</th>
<th>Teacher Activities</th>
<th>Student Activities</th>
<th>Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 min.</td>
<td>1. Prepare leaflets</td>
<td>4. Add number of leaflets given.</td>
<td>Coconut leaflets</td>
</tr>
<tr>
<td></td>
<td>2. Prepare native plates</td>
<td>5. Add number of native plates (plet sracnu) given.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. Prepare problem solving activities</td>
<td>6. Add number of leaflets and plates given to make ten and</td>
<td>Native plates</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 1. Counting Systems

<table>
<thead>
<tr>
<th>English</th>
<th>Counting System One</th>
</tr>
</thead>
<tbody>
<tr>
<td>One</td>
<td>Sie</td>
</tr>
<tr>
<td>Two</td>
<td>Luo</td>
</tr>
<tr>
<td>Three</td>
<td>Tolu</td>
</tr>
<tr>
<td>Four</td>
<td>Ahkosr</td>
</tr>
<tr>
<td>Five</td>
<td>Limekohsr</td>
</tr>
<tr>
<td>Six</td>
<td>Ohnkohsr</td>
</tr>
<tr>
<td>Seven</td>
<td>Itkohsr</td>
</tr>
<tr>
<td>Eight</td>
<td>Oalkosr</td>
</tr>
<tr>
<td>Nine</td>
<td>Yuc</td>
</tr>
<tr>
<td>Ten</td>
<td>Singucul</td>
</tr>
<tr>
<td>Eleven</td>
<td>Singucul sie</td>
</tr>
<tr>
<td>Twelve</td>
<td>Singucul luo</td>
</tr>
<tr>
<td>Thirteen</td>
<td>Singucul tolu</td>
</tr>
<tr>
<td>Fourteen</td>
<td>Singucul ahkosr</td>
</tr>
<tr>
<td>Fifteen</td>
<td>Singucul limekohsr</td>
</tr>
<tr>
<td>Sixteen</td>
<td>Singucul ohnkohsr</td>
</tr>
<tr>
<td>Seventeen</td>
<td>Singucul itkohsr</td>
</tr>
<tr>
<td>Eighteen</td>
<td>Singucul alkosr</td>
</tr>
<tr>
<td>Nineteen</td>
<td>Singucul yuc</td>
</tr>
<tr>
<td>Twenty</td>
<td>Longoul</td>
</tr>
</tbody>
</table>

7. Add number of plates given to make ten and twenty
8. Add leaflets or plates given to make certain numbers

Conclusion (review: what did we learn today and why does it matter to us)
Recording Sheet

Date: _______________          Group No. ________________

Tally the numbers of coconut trees, coconut leaves, and coconut leaflets

<table>
<thead>
<tr>
<th>No. of Coconut Trees</th>
<th>No. of Coconut Leaves</th>
<th>No. of Coconut Leaflets</th>
<th>Drawings or Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Sramsram Kacl Srohsrohk (The Legend of The Giant Gecko)
Narrator: Sie pacl ah tuhoa srohsrohknal uhpsokumuhtaOkat. Mwet ah sahngweng sel oruuheltahl ac kais luo(2), ahkosr(4), ohnkohsr(6), oalkosr(8), ac singucul (10) kal.
Oak sokoesmet ah kalma
Srohsrohk :Mwetekahsringan?
Mwet ke oak ah :Mwetluo
Srohsrohk :siemuhta, sie kaloht

Narrator: Na srohsrohk el kanglacmwet sac. Oak sokoaklukoac ah kalma
Srohsrohk :Mwetekahsringan?
Mwet ke oak ah :Mwetahkosr
Srohsrohk :luomuhta, luo kaloht

Narrator: Na srohsrohk el kanglacmwet luo ah. Oak sokahtolkoe ah kalma
Srohsrohk :Mwetekahsringan?
Mwet ke oak ah :Mwetonkohsr
Srohsrohk :tolu muhta, tolu kaloht

Narrator: Na srohsrohk el kanglacmwet tolu ah. Oak sokoakahkosr ah kalma
Srohsrohk :Mwetekahsringan?
Mwet ke oak ah :Mwetoalkosr
Srohsrohk :ahkosrmuhta, ahkosrkaloht

Narrator: Na srohsrohk el kanglacmwet ahkosr ah. Oak sokoaklimekohsr ah kalma us tah ac puhnak.
Srohsrohk :Mwetekahsringan?
Mwet ke oak ah :Mwetsingucul
Srohsrohk :limekohsr muhta, limekohsr kaloht

Narrator: Na mwetsingucul ac kalkahingnuhmeoa. Srohsrohk el ukoaclahnalaelahl sang tah ah puokilyacna sang puhnak ah sipikilyacna el misa. Na ik ac tuhkuhkanguhllahsrohsrohk. Luhflalsrohsrohk ah oarsnaOkat, Tafunsak ne misenge.
Problem Solving: Addition

**Direction:** Orekmakihnsroalkuh sracnu napwacye in sang konacack top nuhkekuhsensiyuck ten inge.

1. Suculalpahpah Kun ah som nuhkelwenlalTulpe ah. Mukul tolu ac muhtwacn tolu. Mwetekahsroohnfohn?

2. Eltahlenenuh in sifacna us plet sracnu laltahl som nuhkeparty sac. Muhtwacn tolu ac oraclihk in fal sracnu ac naeltahlotwelah plet sracnu ohnkohsr(6). Plet sracnu ekahasr kais sie muhtwacnotwelah?

3. Ke falfaluh sracnu ah. Oasrsra sracnu limekohsr(5) ke la ac limekohsr(5) ke la. Sra sracnu ekahsrenenuh is sang oraclah plet sracnu luo(2)?

4. Fwinmuhtwacn tolu ac sracknaluhngseotwot plet sracnu na kais sie otwela ma luo in weang ma ohnkohsr eltalhlotwelahtari ac, nap let sracnu ekahsroohnfohnheltahl ac otwelah.
Appendix J: Grade 4 Unit Plan (Kosrae)

Rhoda Velasquez

Unit: Fraction in Mats

Rationale: This plan will provide the students an opportunity to make paper mats and to learn fractions using the designs on the weaved-paper mats. Weaving is a common activity in Kosrae, Federated States of Micronesia.

<table>
<thead>
<tr>
<th>Desired Results</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Learning Objectives</strong></td>
</tr>
<tr>
<td>1. Describe the meaning of fraction from a set or a whole.</td>
</tr>
<tr>
<td>2. Define and identify the numerator and denominator.</td>
</tr>
<tr>
<td>3. Read and write the fraction of a given part of a set or a whole.</td>
</tr>
<tr>
<td>5. Draw picture of common fractions and draw pictures that represent equal fraction.</td>
</tr>
<tr>
<td>6. Use weaved mats models to show whole number, and fractions.</td>
</tr>
<tr>
<td>7. Given mixed fractions, round to the nearest whole number</td>
</tr>
<tr>
<td>8. Add and subtract like fraction.</td>
</tr>
<tr>
<td>9. Identify key words in a given problem to decide on the operation needed to solve problems involving fractions.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Enduring Understandings</th>
<th>Essential Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>The students will acquire understanding about fraction and perform operations on fraction</td>
<td>How weavers think of design to make subdivisions on the mat?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Knowledge</th>
<th>Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Traditional patterns in weaving</td>
<td>Make simple design mats</td>
</tr>
<tr>
<td>2. Fraction components, its numerical representations and doing basic operations</td>
<td>Compare fraction mats</td>
</tr>
<tr>
<td></td>
<td>Adding fraction mats</td>
</tr>
<tr>
<td></td>
<td>Subtracting fraction mats</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>A. Common Core Standards addressed</th>
<th>B. FSM Standards for fraction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Extend understanding of fraction equivalence and ordering.</td>
<td>1. Demonstrate the ability to read, write and compare simple fractions in English and the local counting system.</td>
</tr>
<tr>
<td>2. Build fractions from unit fractions by applying and extending previous understandings of operations on whole numbers</td>
<td>2. Represent fractions in a variety of ways using physical models, diagrams and number expressions.</td>
</tr>
<tr>
<td>3. Use a variety of methods and ways to round and estimate fractions.</td>
<td>3. Use a variety of strategies including the understanding of fractions to solve problems and explain the reasoning used to reach the solution.</td>
</tr>
</tbody>
</table>

Assessment Evidence (attach copies of everything you will use)
<table>
<thead>
<tr>
<th>Summative Assessment Task</th>
<th>Other Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Learning Plan</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 1: Weaving Activity to Introduce Fraction</td>
<td>Day 2: Comparing Fraction</td>
</tr>
<tr>
<td>Day 3: Equivalent Fraction</td>
<td>Day 4: Addition of Fraction with Like Denominator</td>
</tr>
<tr>
<td>Day 5: Subtraction of Fraction with Like Denominator</td>
<td></td>
</tr>
</tbody>
</table>
Title: Introduction to Fraction  Lesson #  1

**Today’s objectives**

Learning Objectives:
1. Describe the meaning of fraction from a set or a whole.
2. Define and identify the numerator and denominator.
3. Determine the fraction of a given part of a set or a whole.

Cultural Objective:
To make simple design mats applying their skill in weaving other objects.

**Formative assessments for learning**

1. Observe group participation (Look at how students collaborate to create the design)
2. Group work’s results (Write fractions represented by the design on the weaved-paper mats and identifying its components)
3. Group presentation (Discuss and explain in front of the class how they get those fractions)

**Learning strategies (attach copies of all materials you use)**

**Introduction**

<table>
<thead>
<tr>
<th>Time</th>
<th>Teacher Activities</th>
<th>Student Activities</th>
<th>Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 min</td>
<td>The teacher tells a story about Sru (see attached story) then asks students to write notes about fractions in the story.</td>
<td>The students listen attentively and take notes about fractions in the story.</td>
<td></td>
</tr>
</tbody>
</table>

**Activities (step by step details and organization enough for someone else to follow.)**

<table>
<thead>
<tr>
<th>Time</th>
<th>Teacher Activities</th>
<th>Student Activities</th>
<th>Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 min</td>
<td>1. The teacher will facilitate the weaving activity. The teacher will form groups of 3 students in each group. Through draw lots, each group will pick a design for the mat making activity. The teacher will ask the students to copy the design by weaving strips of paper. (See attached weaving activity) 2. Teacher will ask students to determine the fraction/s represented by the design on their weaved-paper mats. Let them identify numerator and denominator of the fraction then ask how they got it.</td>
<td>1. Students group themselves into 3 members then weave by copying the given design. 2. Students discuss among group members while they write the fraction/s represented by the design on the weaved-paper mats.</td>
<td>Colored paper strips of equal length and width, &amp; scotch tape</td>
</tr>
</tbody>
</table>

**Conclusion**

<table>
<thead>
<tr>
<th>Time</th>
<th>Teacher Activities</th>
<th>Student Activities</th>
<th>Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 min</td>
<td>Teacher will asks students to present their group’s work in class and asks what did they learn and why does it matter.</td>
<td>Groups are presenting their work in front of the class.</td>
<td></td>
</tr>
</tbody>
</table>
### Today’s objectives

**Learning Objectives:**

1. Read and write the fraction of a given part of a set or a whole.
2. Compare fractions represented by the design on the weaved-paper mats using less than, more than and, equal symbols.

**Cultural Objective:**

To use the design on the weaved-paper mats.

### Formative assessments for learning

1. Observe group’s participation in the activity (Looking at how students compare the patterns on the mats)
2. Group work’s results (Looking at fractions on the given weaved-paper mats and compare)
3. Group presentation (Discuss and explain in front of the class how they arrive at their conclusions)

### Learning strategies (attach copies of all materials you use)

#### Introduction

<table>
<thead>
<tr>
<th>Time</th>
<th>Teacher Activities</th>
<th>Student Activities</th>
<th>Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 min</td>
<td>Teacher will flash the mats and ask the students to recall the fractions represented by the designs on the weaved-paper mats.</td>
<td>Students will simultaneously tell the fractions.</td>
<td>Weaved-paper mats from lesson 1</td>
</tr>
</tbody>
</table>

#### Activities (step by step details and organization enough for someone else to follow.)

<table>
<thead>
<tr>
<th>Time</th>
<th>Teacher Activities</th>
<th>Student Activities</th>
<th>Materials</th>
</tr>
</thead>
</table>
| 25 min| 1. Teacher will show two weaved-paper mats. S/he will ask the fraction represented by the dark-colored design on the weaved-paper mats and let the students compare the two fractions using less than, greater or equal symbols. Ask the students how they arrived at their conclusion.  
2. Teacher will group students with 4 members in each group. S/he will give each group 5 pieces of weaved-paper mats and let them list as many fraction inequalities that they can find from those fractions represented by the dark-colored design on the weaved-paper mats. | 1. Students read aloud the fractions on mats and tell the comparison and their reasons.  
2. Students discuss among group members while they write the fractions inequalities they have found on the weaved-paper mats. | Weaved-paper mats from lesson 1 |

#### Conclusion

<table>
<thead>
<tr>
<th>Time</th>
<th>Teacher Activities</th>
<th>Student Activities</th>
<th>Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 min</td>
<td>Teacher will asks students to present</td>
<td>Groups are presenting</td>
<td></td>
</tr>
</tbody>
</table>
Title: Equivalent Fraction Lesson # 3

Today’s objectives

Learning Objectives:
1. Read and write the fraction of a given part of a set or a whole.
2. Determine fractions that are equivalent and use the equal symbols.
3. Draw picture of common fractions and draw pictures that represent equal fraction.
4. Express fractions with the same denominator.

Cultural Objective:
To used the design on the weaved-paper mats.

Formative assessments for learning
1. Observe group’s participation in the activity (Looking at how students take part in the group)
2. Group work’s results (Determine whether fractions are equivalent on the given weaved-paper mats and draw pictures represent equal fractions)
3. Group presentation (Discuss and explain in front of the class how they got their conclusions)

Learning strategies (attach copies of all materials you use)

<table>
<thead>
<tr>
<th>Time</th>
<th>Teacher Activities</th>
<th>Student Activities</th>
<th>Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 min</td>
<td>Teacher will flash the mats and ask the students to recall the fractions represented by the designs on the weaved-paper mats.</td>
<td>Students will simultaneously tell the fractions.</td>
<td>Weaved-paper mats</td>
</tr>
</tbody>
</table>

Activities (step by step details and organization enough for someone else to follow.)

<table>
<thead>
<tr>
<th>Time</th>
<th>Teacher Activities</th>
<th>Student Activities</th>
<th>Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>25 min</td>
<td>1. Teacher will post those weaved paper mats on the 4 walls of the room. Divide the class into 4 groups. Ask each group to choose which wall they want and let them move and stand on that wall and let them look at those posted paper mats. 2. Teacher will ask each group to identify fractions that are equal represented by the dark-colored design on the weaved-paper mats on their wall and write them on the big blank sheet of paper on their wall within 5 minutes. Teacher will then give</td>
<td>1. Students group themselves into 4 groups. 2. Each group has their own big blank paper on the wall and markers. Students write the equal fractions they have found on the weaved-paper mats.</td>
<td>Weaved-paper mats. Loose sheet of big blank paper posted on the wall, markers</td>
</tr>
</tbody>
</table>
a pair of equal fractions and let the students draw the model of that pair of equal fractions.

3. After 10 minutes, ask each group to walk around and move counter clockwise and visit other groups’ work. Let each group spend a minute to analyze, check or critique that group’s work and then, let them move to the next, and then to the next until they reach their own wall.

3. Students visit, analyze, check or critique other group’s work. When they reach their own work, they would see what other’s group have commented on their work.

Conclusion

<table>
<thead>
<tr>
<th>Time</th>
<th>Teacher Activities</th>
<th>Student Activities</th>
<th>Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 min</td>
<td>Teacher will asks students to present their group's work in class and asks what did they learn and why does it matter.</td>
<td>Groups are presenting their work in front of the class.</td>
<td></td>
</tr>
</tbody>
</table>

Title:  Adding Fractions with Like Denominators  Lesson #  4

Today’s objectives

Learning Objectives:

1. Read and write the fraction of a given part of a set or a whole.
2. Use weaved mats models to show whole number, and fractions.
3. Given mixed fractions, round to the nearest whole number
4. Add fractions using the weaved-paper mats.

Cultural Objective:

To used the design on the weaved-paper mats.

Formative assessments for learning

1. Observe pair activity (Looking at how students take part in their work)
2. Pair worksheet (Looking at fractions on the given weaved-paper mats and add)
3. Pair presentation (Discuss and explain in front of the class how they arrive at their conclusions)

Learning strategies (attach copies of all materials you use)

Introduction

<table>
<thead>
<tr>
<th>Time</th>
<th>Teacher Activities</th>
<th>Student Activities</th>
<th>Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 min</td>
<td>Teacher will flash the mats and ask the students to recall the equivalent fractions represented by the designs on the weaved-paper mats.</td>
<td>Students will simultaneously tell the equivalent fractions.</td>
<td>Weaved-paper mats</td>
</tr>
</tbody>
</table>

Activities (step by step details and organization enough for someone else to follow.)

<table>
<thead>
<tr>
<th>Time</th>
<th>Teacher Activities</th>
<th>Student Activities</th>
<th>Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 min</td>
<td>1. Teacher will show a mat made with all-white paper strips, a mat made with</td>
<td>1. Students listen and actively respond to</td>
<td>Weaved-paper</td>
</tr>
</tbody>
</table>

109
all-brown paper strips and some mats made with both white and brown paper strips. Teacher will ask students what they think the fractions represented by each mat.

2. Teacher will demonstrate how to add fractions with like denominators using the weaved-paper mats. Example:
   Q: What is the fraction represented by the colored-brown part of these two paper mat?
   Q: If I will combine these colored-brown part of these two mats, then what will I have?
   Q: How you got your answer?
   3. Teacher will give more examples to further elaborate how to add fractions by drawing mat models. Teacher will discuss that if the answer is a mixed number then they can round their answer to the nearest whole number. Example:
   Q: If these mats, 7/12 and 11/12 will be added then what we got?
   Q: Correct, so 18/12 means what? Do we have more than a whole mat?
   Q: Correct. Our answer 1 and 6/12 or 1½. Now, if we want to round the answer to the nearest whole number then what would it be? Why is it 2?
   4. Teacher will give their exercise worksheet and let students work in pairs.

---

**Conclusion**

<table>
<thead>
<tr>
<th>Time</th>
<th>Teacher Activities</th>
<th>Student Activities</th>
<th>Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 min</td>
<td>Teacher will asks some pair of students to present their work in class and asks what did they learn and why does it matter.</td>
<td>Pairs are presenting their work in front of the class.</td>
<td>mats from lesson 1</td>
</tr>
</tbody>
</table>

---

**Title:**  Subtracting Fraction with Like Denominators  
**Lesson #**  5

Today’s objectives

**Learning Objectives:**

1. Read and write the fraction of a given part of a set or a whole.
2. Subtract fractions using the paper mats.

Cultural Objective:

To used the design on the weaved-paper mats.

Formative assessments for learning

1. Observe pair activity (Looking at how students take part in their work)
2. Pair worksheet (Looking at fractions on the given paper mats and subtract)
3. Pair presentation (Discuss and explain in front of the class how they arrive at their conclusions)

Learning strategies (attach copies of all materials you use)

<table>
<thead>
<tr>
<th>Introduction</th>
<th>Time</th>
<th>Teacher Activities</th>
<th>Student Activities</th>
<th>Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5 min</td>
<td>The teacher will show mats and recall how to add fractions or may pick an exercise on the worksheet yesterday and discuss.</td>
<td>The students listen and respond accurately.</td>
<td>Weaved-paper mats from lesson 1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Activities (step by step details and organization enough for someone else to follow.)</th>
<th>Time</th>
<th>Teacher Activities</th>
<th>Student Activities</th>
<th>Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>30mi n</td>
<td>1. Teacher will illustrate that subtracting fractions with like denominators is just like taking away the brown-colored part of the mat and determining what was left is the answer.</td>
<td>1. The students listen and respond accurately. 2. Students discuss with their partner while they add the fractions.</td>
<td>Weaved-paper mats from lesson 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Teacher will give their exercise worksheet and let students work in pairs.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Conclusion</th>
<th>Time</th>
<th>Teacher Activities</th>
<th>Student Activities</th>
<th>Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10mi n</td>
<td>Teacher will asks some pair of students to present their work in class and asks what did they learn and why does it matter.</td>
<td>Pairs are presenting their work in front of the class.</td>
<td></td>
</tr>
</tbody>
</table>

FRACTION STORY FOR LESSON 1

Narration: The bell rung and the teacher said “Look for the meaning of fraction, as your assignments”. All students went out of the room and other headed to their home. After school hours, Ninac Sepe brought her son Sru to the craft shop. They went inside and talked to the manager of the shop.
Sepe: Lenwo Ninac Mary, kom fuhkah?
Mary: Wona, kom pe?
Sepe: Wona, pe. I am here to make a proposal with you, can we talked for a second.
   (Sepe attended to his son and whisper)
Sepe: Sru behave, just sit down here and wait for me, okay.
   (Sru nodded and his mother went to the manager’s office. But after few seconds, Sru got curious and looked around.)

Sru: (Talking to the Sales lady) Ninac, would you mind if I look around your shop.
Sales Lady: It’s okay.

Sru got interested on the plate of colored seashells and started counting. “Oh different colored shells, orange, yellow and white”, Sru said. He wonders, as he pin pointed each color while silently counting. “Three yellow, 2 orange and 5 white colored shells, ten sea shells!, he whispered. Then his focus went to the weaved wrist band. He started prying on it and mumbling as he determines the total number of little squares on it. 20 shaded and 20 unshaded ones, a total of 40. While Sru is busy determining the total number of little square in the wristband, his older cousin Penina came and watching.
Penina: Oh, nice counting!
Sru: Older cousin Penina, there you are, it’s nice to see you.
Penina: Nice to see you, too.
Sru: I heard that you are a math person and you even win on some math quiz bees.
Penina: (smiled) Hmm, I just got lucky sometimes. What about you how are you now in your math class. I could hear you mumbling some numbers.
Sru: I, I’m fairly average I think, but tomorrow we’ll going to study fraction, and I’m quite afraid of it.
Penina: Why, it is not a ghost that you have to be afraid of.
Sru: They say fraction is confusing and totally different.
Penina: Hmm. Okay. What are you looking at awhile ago?
Sru: (Pointed at those shells and the wristband.)
Penina: Okay here it is, (she took the shells) Fraction is used to name parts of a set of objects/things so this is a collection of seashells, so it can be considered a set.
Sru nodded
Penina: Now, how many seashells are there all in all?
Sru: 10 seashells
Penina: Then how many of it are colored yellow.
Sru: 3
Penina: So it was 3 out of 10 seashells are colored yellow and that is a fraction.
Sru: really….is that so.
Penina: Yep, just don’t forget the word “out of”, okay, since it refers to the part of the set.
Sru: Therefore, the white colored seashells would be 5 out of 10, is it correct?
Penina: Correct. It is always in fraction form.

Here’s how it is written: 3/10, 5/10
3/10 is the fraction or part of the set of seashells which are yellow.
5/10 is the fraction or part of the set which are white.

Sru: So the top number tells you how many colored shells are there.
Penina: Yes
Sru: But why is it, the bottom number the same?
Penina: Hmm, so where do you think that 10 came from?
Sru: Ten is the total number of shells in the jar.
Penina: You got it. Always remember, fraction has 2 main parts. The top number, which is called numerator, always tells you the number of object taken/being considered in the set. The bottom number, which is called denominator, always tells you the total objects in the set.
Sru: (Nodding and happy) Now, I got it. Yeah I’ll remember that. Kuloh Ninac Pen
Sru: (Smiling) Kuft fahl som pe.

Then Nena Sepe came out of the manager’s office and they both walked home.
Ninac Sepe: Hey Sru, I saw you and Pen are talking.
Sru: Yep we talked about fraction.
Ninac Sepe: Really.
Sru: Yeah, it is part of a set of object (Sru show the wristband that he bought) See, there are 40 little squares in this wristband and 20 are shaded so the fraction 20/40 is the part of wristband that are shaded.

Ninac Sepe: Very good. I think you really understood. There’s more about fraction. I’ll tell you if you’ll come to help me prepare for dinner.
Sru: (Wondering) There’s more on fraction, really? Okay, I’ll help.
Ninac Sepe: Okay, so when we arrive home, tell your father to gather some breadfruit and bring them to me.
(At home, his father came then Sru run to his father and very excited.)
Sru: Father, father at last you came, I’ve been waiting for you for so long.
Father: (Wondering) Hmmm interesting, why is it so?
Sru: Father, change your clothes first and let’s go get some breadfruit. Ninac Sepe wants breadfruit for dinner.
(His Father is smiling, change his clothes and they both went. After 20minutes, Sru came with a bundle of breadfruits.)
Sru: Ninac Sepe, we’re here.
Ninac Sepe: Come Sru and bring those at the table.
(While at the table, Ninac Sepe is paring the breadfruit, and Sru is watching.)
Ninac Sepe: So, do you want to know more about fraction? Let’s use this breadfruit. Fraction is also used to name parts of an object. The whole object should be divided into equal parts. Do you see this breadfruit, now I’m going to cut it into 2. So, what is this?

Sru: Tahfuh. (Kosraean word for half)
Ninac Sepe: Samat (Kosraean expression for smart). What you said “tahfuh” is \( \frac{1}{2} \), and that is the fraction. The whole breadfruit is divided into 2 parts. \( \frac{1}{2} \) is one out of 2 parts. (Shrew is wondering, so Ninac Sepe took another breadfruit). Now if I cut the whole breadfruit into 4 equal parts, then one part will be ____?

Sru: koto (Kosraean word for \( \frac{1}{4} \), said slowly and unsure).

Ninac Sepe: (She nodded and placed the 3 quartered breadfruit together)

What about this what fraction does it represent?

Sru: (Shrugged as he wonders what to say)

Ninac Sepe: So how many do I have?

Sru: tolo koto? (3 pieces of 1/4)

Ninac Sepe: yes, correct or you may say… 3 out of? How many did I cut the whole breadfruit?

Sru: four

Ninac Sepe: So, it is…..3 out of____? Is it 3 out of 4?

Sru: 3/4, oh yes I got it

Sru is so excited that he got a tangerine and open it. Talking to himself:

Sru: Therefore, this tangerine is a whole, then see, it is divided into 9 parts. So, if I choose 2, then it is 2/9. Eheheheh…

_The end of story._

_Worksheet on Lesson 4:_

**Adding Fraction with the Same Denominator (without simplifying but with rounding to the nearest whole number**

A. From the paper mats below, write the corresponding fraction of the shaded part then add.
1. \[
\begin{array}{c}
\begin{array}{c}
\vdots
\end{array}
\end{array}
\]

2. \[
\begin{array}{c}
\begin{array}{c}
\vdots
\end{array}
\end{array}
\]

Answer is rounded to ___

3. \[
\begin{array}{c}
\begin{array}{c}
\vdots
\end{array}
\end{array}
\]

Answer is rounded to ___
4. +

5. +

Answer is rounded to ___

Answer is rounded to ___
Lesson 5 Worksheet

Subtracting Fractions with the Same Denominator (without simplifying)

A. From the following paper mats below, write the fraction that correspond to the shaded part, then subtract.
B. Given the following fractions, draw by shading the paper mats that correspond to the fraction and then subtract.

1. \(\frac{3}{8} - \frac{2}{8} = \) 

\[
\begin{array}{c}
\begin{array}{cccc}
\blacksquare & \blacksquare & \blacksquare & \blacksquare \\
\blacksquare & \blacksquare & \blacksquare & \blacksquare \\
\end{array}
\end{array}
\quad - \\
\begin{array}{c}
\begin{array}{cccc}
\blacksquare & \blacksquare & \blacksquare & \blacksquare \\
\blacksquare & \blacksquare & \blacksquare & \blacksquare \\
\end{array}
\end{array}
\quad = \\
\begin{array}{c}
\begin{array}{cccc}
\blacksquare & \blacksquare & \blacksquare & \blacksquare \\
\blacksquare & \blacksquare & \blacksquare & \blacksquare \\
\end{array}
\end{array}
\]

2. \(\frac{9}{12} - \frac{5}{12} = \) 

\[
\begin{array}{c}
\begin{array}{cccc}
\blacksquare & \blacksquare & \blacksquare & \blacksquare \\
\blacksquare & \blacksquare & \blacksquare & \blacksquare \\
\end{array}
\end{array}
\quad - \\
\begin{array}{c}
\begin{array}{cccc}
\blacksquare & \blacksquare & \blacksquare & \blacksquare \\
\blacksquare & \blacksquare & \blacksquare & \blacksquare \\
\end{array}
\end{array}
\quad = \\
\begin{array}{c}
\begin{array}{cccc}
\blacksquare & \blacksquare & \blacksquare & \blacksquare \\
\blacksquare & \blacksquare & \blacksquare & \blacksquare \\
\end{array}
\end{array}
\]

Appendix K: Grade 7 Unit Plan (Kosrae)

Penina Tulensru

**Unit Title:** Mathematical Relation in Epo Weaving  
**Rationale:** Teaching mathematical concepts through Epo weaving is not only an opportunity for students to learn math but also a chance to learn and value their own culture. This unit of lessons will promote how culture and mathematics work together in building students understanding and skills in mathematical learning.

**Desired Results**

<table>
<thead>
<tr>
<th>Goals</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Able to weave an Epo and understand the value of Epo within Kosrae culture.</td>
</tr>
<tr>
<td>2. Using the weaving sequence in Epo to introduce Mathematical Relations to students.</td>
</tr>
<tr>
<td>3. Note the mathematics within epo weaving and extend to other weavings.</td>
</tr>
<tr>
<td>4. Understand how mathematical concepts can be learnt from activities within our culture.</td>
</tr>
</tbody>
</table>

**Essential Questions:**  
What skills do an epo weaver has that I don’t. What do mathematical relations has to do in epo weaving?

**Enduring Understandings**  
Understanding a Mathematical Relation.  
Displaying mathematical relation using Chart, Ordered Pairs, Graphing and Mapping.  
Describing Relation in words and by equation.

<table>
<thead>
<tr>
<th>Knowledge</th>
<th>Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generalizing number patterns.</td>
<td></td>
</tr>
<tr>
<td>Creating formulas.</td>
<td></td>
</tr>
<tr>
<td>Graphing functions and relations.</td>
<td></td>
</tr>
<tr>
<td>Creating Ordered pairs.</td>
<td></td>
</tr>
<tr>
<td>Creating or writing mathematical relations.</td>
<td></td>
</tr>
<tr>
<td>Weaving epo, Graphing, Organizing data Reasoning</td>
<td></td>
</tr>
</tbody>
</table>

**Common Core Standards addressed**  
Patterns and Algebra  
3.7.1 Describe relationships and functions using word and symbols.  
3.7.2 Write and solve one-step equation  
3.7.3 Locate points on the coordinate plane
**Assessment Evidence**

<table>
<thead>
<tr>
<th>Summative Assessment Task</th>
<th>Other Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Survey</td>
<td>Students work</td>
</tr>
<tr>
<td>Questionnaires</td>
<td>Observation notes on each lesson activities</td>
</tr>
<tr>
<td>Videos</td>
<td>Students feedback on required tasks</td>
</tr>
<tr>
<td>Pre and Post Testing</td>
<td>Pilot teachers comments or journals</td>
</tr>
</tbody>
</table>

**Lesson Titles**

|--------------------|---------------------------------------------|---------------------------------------------------------------------|-----------------------------------------------------|--------------------------------------------------|

**MACIMISE Daily Lesson Plan**

**Lesson # 1 [Weaving Epo]**

**Lesson Objectives**

Students will be able to:
1. Explain what an epo is, who plays it and who weaves it.
2. Weave an epo with the help of the teacher.

**Formative assessments for learning**

1. A concrete product (epo) from each student.
2. Written summary about epo in the Kosrae culture.

**Learning strategies**

**Introduction: Playing an Epo game.**

<table>
<thead>
<tr>
<th>Time</th>
<th>Teacher Activities</th>
<th>Student Activities</th>
<th>Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 min.</td>
<td>Instruct students to get into a circle. Join the epo game. Lead the game telling who leaves and who stays.</td>
<td>Boys: Play Epo Girls: Clap for the game</td>
<td>Epo</td>
</tr>
</tbody>
</table>

**Activities (step by step details and organization enough for someone else to follow.)**

<table>
<thead>
<tr>
<th>Time</th>
<th>Teacher Activities</th>
<th>Student Activities</th>
<th>Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 min.</td>
<td>Lead a circle talk about the epo game. Why is it played only by men? What makes it a manly game? How do we relate the game rules to</td>
<td>Taking turns sharing their ideas and thoughts about the game.</td>
<td></td>
</tr>
</tbody>
</table>
### 25 min.

- **Teacher Activities:**
  - what we know about the Kosraean men in the past?
  - Distribute coconut leaves for each student. Each student with 3 pieces of equal size and length leaves.
  - Model each step of weaving a epo.
  - Tie the three leaves together by one end.
  - Put something circular and wrap it with the knot.
  - (Continue on each step and wait for every student to follow. Walk around and check each students’ work so you’ll correct them immediately or acknowledge them with their good works.)
  - When modeling and first trial of practice is done, let each student to unfold his or hers and start over again to recall and do on his or her own.
  - Instruct students to apply what they did with the coconut leave to the real type of leave - pandanus leave.

- **Student Activities:**
  - Get into groups of four. Each student with their own three leaves.
  - Follow each step the teacher models.
  - Work in groups of four with each person having their own share of leaves and weaving.
  - Peer learning will be among the group.
  - Whoever gets each step will be required to help those in their groups.
  - Unfold and try to weave it again. Recall each step and still could ask for help from the group mates.
  - When weaving is approved by the teacher as good, weave a real epo using the real type of leave.

- **Materials:**
  - Coconut leaves
  - Pandanus leaves

### Conclusion (review: what did we learn today and why does it matter to us)

<table>
<thead>
<tr>
<th>Time</th>
<th>Teacher Activities</th>
<th>Student Activities</th>
<th>Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 min.</td>
<td>Orally ask students the following questions: Did you learn anything</td>
<td>Each student will write up short answers in response to the teacher’s questions and submit</td>
<td>Paper and pencils</td>
</tr>
</tbody>
</table>
What did you enjoy the most?
What did you dislike about today’s learning?
Why do you think it is important for us to learn how to weave an epo in a math class?

MACIMISE Daily Lesson Plan
Lesson # 2
Title: Discovering Weaving Sequence/Pattern

Lesson Objectives
Students will be able to:
Retell how to weave an epo starting from first to last step.
Identify the pattern in weaving epo.

Formative assessments for learning
Group presentation
Worksheet of questionnaires

Learning strategies
Introduction: Observing/Discussion of students’ assignment from home.

<table>
<thead>
<tr>
<th>Time</th>
<th>Teacher Activities</th>
<th>Student Activities</th>
<th>Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 min.</td>
<td>Lead conversation to talk about students work brought from home.</td>
<td>Show their work, observe and compare each other’s products.</td>
<td>Brought in epo from home. (assignment from previous lesson)</td>
</tr>
</tbody>
</table>

Activities (step by step details and organization enough for someone else to follow.)

<table>
<thead>
<tr>
<th>Time</th>
<th>Teacher Activities</th>
<th>Student Activities</th>
<th>Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 min.</td>
<td>Group students into groups of three.Roles in each group; 1. Writer 2. Weaver 3. Reporter Prepare or give out</td>
<td>Work in groups of three to answer the guiding questions. Study the epo either way from the start or could be backward by unfolding each layer. Discuss among the groups and decide how</td>
<td>Epo Lined papers pencils</td>
</tr>
</tbody>
</table>
worksheet with leading questions as they study their work.

Walk around to each group and direct them just to make sure they are doing the right task.

**Questions will include:**
- How many strands of leaves were used in a epo?
- What does it take to make the smallest size epo?
- How many folds needed in each layer?
- How many folds each strand get in order to make a regular size epo?

Each student will be responsible for each role. Weaver should be holding the epo and unfolding each cube so the whole group could see what was done. Writer – is in charge of noting their findings and organize it. Reporter- will be the speaker for the group as it comes to presenting time.

| Conclusion (review: what did we learn today and why does it matter to us) |
|---|---|---|
| **Time** | **Teacher Activities** | **Student Activities** | **Materials** |
| 10 min. | Lead sharing and asking guiding questions | Group Sharing Still in groups, the student with the role of a reporter will share what they discover. | Easel pad Markers Rulers |

MACIMISE Daily Lesson Plan
Lesson #3
Title: Creating Mathematical Relation from weaving sequence of an Epo.

**Lesson Objectives**

**Students will be able to:**
- Describe what a mathematical relation is.
- Define domain, range.
- Display relations using ordered pairs.
- Display a relation using a Chart.

Formative assessments for learning
Students work (data in ordered pairs and chart)

Students’ participation in class discussions.

Responses in discussing new vocabularies

**Learning strategies**

*Introduction: Review of group sharing from previous lesson.*

<table>
<thead>
<tr>
<th>Time</th>
<th>Teacher Activities</th>
<th>Student Activities</th>
<th>Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 min.</td>
<td>Still in the same groupings, review the findings shared from previous lesson.</td>
<td></td>
<td>Group findings</td>
</tr>
</tbody>
</table>

**Activities (step by step details and organization enough for someone else to follow.)*

<table>
<thead>
<tr>
<th>Time</th>
<th>Teacher Activities</th>
<th>Student Activities</th>
<th>Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 min.</td>
<td>Introduce a relation using students’ findings from previous sharing. Explain that a mathematical relation is a set of ordered pairs showing how numbers are related. Domain is the set of all first coordinates or first numbers of an ordered pairs. Range is the set of all second coordinates or second numbers of an ordered pair. Work with whole group, to put data collected from previous lesson to create a mathematical relation. Let the number of cube as Domain and number of folds as Range. Display in ordered pairs.</td>
<td>Think of something else that can be put into a relation. Ex: 1. Polygons with number of sides. 2. Students with their birthdates. Students will work individually following the teacher to display their findings in ordered pairs. Show work to teacher to check if the ordered pair is correct. If the teacher approves work, reorder using a chart. Ordered pairs should look like this: (1,6)(2,12)(3,18)(4,24)(5,30) Students will then use the ordered pairs to answer the following questions. 1. What are the two variables in the relations?</td>
<td>Data collected from observation of epo weaving. Papers Pencils Rulers Graphing papers</td>
</tr>
<tr>
<td>25 min.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Check on students’ works. If students’ work with ordered pair is good, let them display the same relation using a **chart**. Lets students observe that organizers are different but the data or relation is the same.

2. What are the domains?
3. What are the ranges?

**Conclusion (review: what did we learn today and why does it matter to us)**

<table>
<thead>
<tr>
<th>Time</th>
<th>Teacher Activities</th>
<th>Student Activities</th>
<th>Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 min.</td>
<td>Lead closing discussion.</td>
<td>Exchange papers with peers and observe each other’s works.</td>
<td>Notes</td>
</tr>
<tr>
<td></td>
<td>Ask students where the data was collected.</td>
<td>Discuss and agreed upon the correct answers. Share ideas about the new vocabularies learned from the lesson.</td>
<td>Student’s Works</td>
</tr>
</tbody>
</table>

MACIMISE Daily Lesson Plan

Lesson #4   Displaying Relations in Mapping and Graph

**Lesson Objectives**

Students will be able to:
Display relations using Mapping.
Display relations using Graph.

**Formative assessments for learning**

Students’ graphs and mappings.

Students’ participation in class activities and discussions.

**Learning strategies**

**Introduction:**

<table>
<thead>
<tr>
<th>Time</th>
<th>Teacher Activities</th>
<th>Student Activities</th>
<th>Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 min.</td>
<td>Review students’ work from previous lesson.</td>
<td>Look at their chart and Ordered pairs. Explain the domain and range. Domain is the number of cube while Range is the</td>
<td>Chart and ordered pairs created from previous lesson.</td>
</tr>
<tr>
<td>Time</td>
<td>Teacher Activities</td>
<td>Student Activities</td>
<td>Materials</td>
</tr>
<tr>
<td>-------</td>
<td>------------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>--------------------------------</td>
</tr>
<tr>
<td>30 min.</td>
<td>Show how a graph looks. Label the coordinates in a graph as labeled in the Chart. Domain as number of cubes. (C) Range as number of folds. (F) Work with students to graph the first two sets of number then let them graph the others on their own. Check students’ work individually.</td>
<td>Follow the teacher’s instruction in drawing your own graph. Label each coordinate. X axis as C and Y axis as F. Graph the first two sets of numbers with the help of the teacher. Graph the other numbers on your own. Have the teacher check your work. Point to each coordinate or axis to tell the teacher what each stands for or what variable they represent. If the teacher passes graphing, display the same relation using Mapping.</td>
<td>Graphing papers</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Pencils</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Bland papers for mapping</td>
</tr>
</tbody>
</table>

**Conclusion (review: what did we learn today and why does it matter to us)**

<table>
<thead>
<tr>
<th>Time</th>
<th>Teacher Activities</th>
<th>Student Activities</th>
<th>Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 min.</td>
<td>Review lessons by asking guiding questions for students to think about. Do a gallery walk so students will have the chance to observe each other’s work.</td>
<td>List all four ways of displaying Mathematical Relations. Put all four papers of each on your table and do a gallery walk so everybody can look at each other’s work.</td>
<td>Students’ work of Ordered pairs, Charts, Mapping and Graphs.</td>
</tr>
</tbody>
</table>
### Lesson Objectives

Students will be able to:
- Describe mathematical relation in words.
- Describe mathematical relation in patterns and equation.
- Use observation to predict new information in a relation.
- Generalizing number patterns.
- Solving one step equation.

### Formative assessments for learning

- Students’ participation through observations.
- Students’ responses in activities, explaining patterns in words and equations.
- Students’ feedback in writings.

### Learning strategies

**Introduction:**

<table>
<thead>
<tr>
<th>Time</th>
<th>Teacher Activities</th>
<th>Student Activities</th>
<th>Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 min.</td>
<td>Lead students to look at the relations displayed in all four ways. Notice that they will use the same relations to create patterns and equations.</td>
<td>Study their works from previous lessons: ordered pairs, chart, mapping and graphs.</td>
<td>Students’ works, Pencils, Charts, papers</td>
</tr>
</tbody>
</table>

**Activities (step by step details and organization enough for someone else to follow.**)

<table>
<thead>
<tr>
<th>Time</th>
<th>Teacher Activities</th>
<th>Student Activities</th>
<th>Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 min.</td>
<td>Guide students to study the relations and be able to come up with the expected responses, (colored red) and more.</td>
<td>Study each display and note what is visible from each. Graph: all points are on the 1st quadrant. All points are positive integers. We cannot connect the dots because not all numbers will work.</td>
<td>Graph, ordered pairs, mapping and chart.</td>
</tr>
</tbody>
</table>

Guide students to study the chart and see the number relationship in order to come up with a rule or equation. Ask leading questions to guide students’ works.

Guide students to study the chart and see the number relationship in order to come up with a rule or equation. Ask leading questions to guide students’ works.

Describe the relation by patterns. Chart: the number of folds (F) is 6 times the number of cubes (C). F= 6C Using the equation found to predict new

<table>
<thead>
<tr>
<th>(number of cubes)</th>
<th>(number of folds in each cube)</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>F</td>
</tr>
<tr>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>12</td>
</tr>
<tr>
<td>3</td>
<td>18</td>
</tr>
<tr>
<td>4</td>
<td>20</td>
</tr>
<tr>
<td>5</td>
<td>25</td>
</tr>
</tbody>
</table>
information. If C is 6, what will be the F? If C is 25, what will be the F? Substitute and solve.

**Conclusion (review: what did we learn today and why does it matter to us)**

<table>
<thead>
<tr>
<th>Time</th>
<th>Teacher Activities</th>
<th>Student Activities</th>
<th>Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 min.</td>
<td>Lead students to generalize the number pattern. Give more examples so they’ll use the equation to solve more problems. Extend the activity by having students create their own examples.</td>
<td>After solving the equation students will explain on a paper what it means. If C=6, then what is F? Substitute c with 6. F= 6 (6) F=36. This means that if there are 6 cubes there need to be 36 folds.</td>
<td>Pencils Papers Charts</td>
</tr>
</tbody>
</table>
BIBLIOGRAPHY

A. Books


B. CD-ROM


C. Periodicals/Journals/Magazines


D. Online Resources


Kosrae (n.d.) http://www.kosrae.com


*Qualitative Research* (n. d.) An online lecture notes [PowerPoint slides]. Retrieved from cepd7152.wiki.westga.edu/file/view/Hatch_Chapter4.pptx


Yap Department of Education (2007) *Yap Education Strategic Plan.* Retrieved from http://www.paddle.usp.ac.fj/cgi-bin/paddle?e=d-010off-paddle--00-1--0---0-10-TX--4-------0-111--11-en-50---20-home---00-3-1-000--0-0-11-utfZz-8-00&a=file&d=yap001