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ETHNOMATHEMATICS: THE CULTURAL ASPECTS OF SECONDARY SCHOOL MATHEMATICS IN CAMEROON

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Abstract
The purpose of the study was to investigate the relationship between mathematics content on culture, culturally relevant curriculum and language in the South West Region of Cameroon. The study was an opinion survey delimited to 60 mathematics teachers in the region. The study revealed that there is a significant relationship between mathematical content and students' culture, the culturally relevant curriculum, and language in secondary schools in the South West Region of Cameroon. It was recommended that ethnomathematics concepts should be incorporated into the curriculum in all institutions including teacher-training colleges and Faculties of Education in all Universities in Cameroon. Authors and textbook writers should apply and provide proper illustration of ethnomathematics concepts in different areas of mathematics.

Key Words: Ethnomathematics, Mathematics, Culture, Curriculum, Language, and Achievement.

INTRODUCTION

An important change in mathematical instruction needs to take place in order to accommodate continuous and ongoing change in the minds of students in mathematics classrooms. Some scholars have developed a theory of culturally relevant pedagogy that examines the teaching-learning process within a critical paradigm and through explicit connections between students' culture and the school subject matter (D'Ambrosio, 1990; Gay, 2000; Rosa & Orey, 2003, 2010 & 2011). D'Ambrosio defined ethnomathematics in the following way:

The prefix *ethno* is today accepted as a very broad term that refers to the social cultural context and therefore includes language, jargon, and codes of behavior, myths, and symbols. The derivation of *mathema* is difficult, but tends to mean to explain, to know, to understand, and to do activities such as ciphering, measuring, classifying, inferring, and modeling. The suffix *tics* is derived from *techné*, and has the same root as technique (p. 81).

In other words, *ethno* refers to members of a group within a cultural environment identified by their cultural traditions, codes, symbols, myths, and specific ways used to reason and to infer (Rosa & Orey, 2007). *Mathema* means to explain and understand the world in order to transcend, manage and cope with reality so that the members of cultural groups can survive and thrive, and *tics* refer to techniques such as counting, ordering, sorting, measuring, weighing, ciphering, classifying, inferring, and modeling. Rosa and Orey (2003) stated that the *mathema* develops the *tics* within the context of *ethnos* because it consists of daily problems people face, larger problems of humanity, and endeavors of humans to create a meaningful world.

In D'Ambrosio's (1990) point of view, it is important to recognize that ethnomathematics is a research program that guides educational pedagogical practices. D'Ambrosio (1993) stated that the mission of the ethnomathematics program is to acknowledge that there are different ways of doing mathematics by considering the appropriation of the academic mathematical knowledge developed by different sectors of the society as well as by considering different modes in which different cultures negotiate their mathematical practices. Barton (1996) stated that in this conception, ethnomathematics is a program that investigates the ways in which different cultural groups comprehend, articulate, and apply concepts and practices that can be identified as mathematical practices. Mathematics is identified in cultural activities in traditional and non-traditional societies. This means that ethnomathematics refers to mathematical concepts embedded in cultural practices and recognizes that all cultures and all people develop unique methods and sophisticated explications to understand and to transform their own realities. It also recognizes that the accumulated methods of these cultures are engaged in a constant, dynamic, and natural process of evolution and growth (Orey, 2000; Rosa & Orey, 2007).

It is necessary to integrate a culturally relevant curriculum in the existing mathematics curriculum. According to Torres-Velasquez and Lobo (2004), this perspective is an essential component of culturally relevant education because it proposes that teachers contextualize mathematics learning by relating mathematical content to students' culture and real-life experiences. To Nasir and Cobb (2007), the contextualization of mathematics has been described as the identification of mathematical practices developed in different cultural groups. In this perspective, if mathematics is considered as a cultural construct, then it is a product of cultural development (Rios, 2000; Rosa & Orey, 2007). This claim of mathematics as a

cultural construct contradicts the claims that modern mathematics is universal, objective, and culturally neutral. This way of viewing mathematics validates and affirms all people's experience of mathematics because it demonstrates that mathematical thinking is inherent to their lives. Evidence of this assertion is given by Orey (2000), who stated that the tradition that diverse cultures use or work within evolves out of unique interactions between their language, culture and environment. Within this context, D'Ambrosio (2006) argued that in an ethnomathematical perspective, mathematical thinking is developed in different cultures in accordance to common problems that are encountered within a cultural context.

According to Rosa and Orey (2003), this mathematical approach is presented as a cultural response to students' needs by making connections between their cultural background and mathematics. This approach supports the view that mathematics is conceived as a cultural product which has developed as a result of various activities (Rosa and Orey, 2011). The objective of this perspective is to make mathematics more relevant to students because every culture is assumed to have mathematical responses with valid content for a mathematics classroom. A classroom using this type of ethnomathematical curriculum would be full of examples that draw on the students' own experiences and on experiences that are common in their cultural environments. In so doing, ethnomathematics aims to draw from the students' cultural experiences and practices of the individual learners, the communities, and the society at large. Rosa and Orey (2008) affirmed that ethnomathematics uses these cultural experiences as vehicles to make mathematics learning more meaningful and to provide students with the insights of mathematical knowledge as embedded in their social and cultural environments.

The pedagogical work towards an ethnomathematics perspective allows for a broader analysis of the school context in which pedagogical practices transcend the classroom environment because these practices embrace the socio-cultural context of the students (Chieus, 2004). Damazio (2004) agreed by suggesting that pedagogical elements necessary to develop the mathematics curriculum are found in the school community. This means that the field of ethnomathematics presents some possibilities for educational initiatives that help to reach this goal. However, according to Monteiro, Orey, and Domite (2004), it is necessary to point out that the incorporation of the objectives of the ethnomathematics program as pedagogical practice in the school curricula and its operation and transmission in education is a recent field of study that is still developing its own identity in the pedagogical arena.

On the other hand, in the context of culturally relevant pedagogy, there is a need to examine the inclusion of mathematics in culture, drawing from a body of literature that takes on the cultural nature of knowledge production into the mathematics curriculum (Rogoff, 2003). Mathematics as part of the school curriculum must reinforce and value the cultural knowledge of students rather than ignore or negate it. A culturally relevant curriculum should fully integrate students' cultural mathematics knowledge through ethnomathematics. Rosa and Orey (2007) argued that this mathematics curriculum must be grounded in a constructivist approach to learning and seek to change the way mathematics teachers construct their learning environments. This can be done by producing teachers who are able to facilitate a mathematics learning environment grounded in real life experiences and to support students in the social construction of mathematical knowledge.

The trend towards ethnomathematical approaches to mathematics curriculum and pedagogy reflects a comprehensive development in mathematics education. Ethnomathematical approaches are intended to make school mathematics more relevant and meaningful to students and to promote the overall quality of education. Adam (2002) pleaded for a more culturally sensitive view of mathematics to be incorporated into the school curriculum. For example, Powell and Frankenstein (1997) proposed the elaboration of a mathematics curriculum that is based on students' knowledge, which allows teachers to have more freedom and creativity to choose academic mathematical topics to be covered in the lessons. They suggested that through dialogue with the students, teachers can apply mathematical themes that help them to elaborate the mathematics curriculum. In their point of view, teachers can engage students in the critical analysis of the dominant culture as well as the analysis of their own culture through an ethnomathematical perspective.

In this context, Ferreira (1997) stated that it is necessary to investigate the conceptions, traditions, and mathematical practices of a particular social group with the intention of incorporating these concepts into the mathematics curriculum. Knijnik (1993) also stated that the development of a mathematics curriculum that involves the relationship between academic mathematics and ethnomathematical knowledge contributes to the process of social change. Further, Adam, Alangui and Barton (2003) and Rosa (2010) stated that a culturally relevant mathematics curriculum based on an ethnomathematical perspective infuses the students' cultural backgrounds in the learning environment in a holistic manner. Rosa and Orey (2006) stated that one possibility for an ethnomathematical curriculum may be labeled as mathematics in a meaningful context in which students are given opportunities to relate their new learning experiences to knowledge and skills they have previously learned. In this regard, it is particularly important that the mathematical learning experiences of students acknowledge their cultural backgrounds, and experiences in the process of learning mathematics.

Another possibility sees an ethnomathematical curriculum as an integration of the mathematical concepts and practices originating in the students' culture with those of conventional and formal academic mathematics (Lipka, 2002). In this approach, the ethnomathematical curriculum takes students' culture and uses it explicitly to integrate these outside experiences into the conventional mathematics curriculum. In such a classroom environment, students build on what they know as well as on the experiences they have from their cultural environments (González, Moll, & Amanti, 2005). These experiences are then used neither as motivation nor as an introduction but instead as part of understanding how mathematical ideas are developed and how they are built into systems, formulated, and applied in various ways within the culture. This mathematical knowledge is related to conventional mathematics in such a way that the underlying mathematical ideas are fully understood and the power and utility of conventional methods are appreciated. Lipka (2002) stated that links are made to familiar practices and concepts by realizing and understanding the need for mathematical characteristics such as accuracy and formal reasoning in both academic mathematics and in real-life situations.

According to Bandeira and Lucena (2004), mathematical curriculum conceived in an ethnomathematical perspective helps to develop mathematical concepts and practices that originate in students culture by linking them to academic mathematics. It is assumed that a curriculum of this nature motivates students to recognize mathematics as part of their everyday life and enhances students' ability to make meaningful mathematical connections by deepening their understanding of all forms of mathematics. The objective of developing an ethnomathematical curriculum model for classrooms is to assist students to become aware of how people mathematize and think mathematically in their culture, to use this awareness to learn about formal mathematics, and to increase the ability to mathematize in any context in the future (Duarte, 2004; Rios, 2000, Rosa & Orey, 2006). This ethnomathematical curriculum leads to the development of a sequence of instructional cultural activities enabling students to become aware of potential practices in mathematics in their culture so that they are able to understand the nature, development, and origins of academic mathematics. Students also value and appreciate their own previous mathematical knowledge, which allows them to understand and experience cultural activities from a mathematical point of view, thereby allowing them to make the link between school mathematics and their real world and daily life (Knijnik, 1993; Rios, 2000; Rosa & Orey, 2007). According to Rosa and Orey (2003), students understand the nature of mathematics as they become aware of the mathematics in their culture. With awareness, students see mathematics as a human activity rather than just a set of symbols, numbers, and figures presented only at school.

On the other hand, cultural mathematical practices can be related to conventional mathematical systems and vice versa through mathematical thinking. In this regard, Monteiro, Orey, and Domite (2004) argued that mathematical thinking involves symbolizing, generalizing, abstracting, and making logical connections, which can be facilitated by seeing mathematics in various cultural contexts and learning mathematics through practical examples and investigations. According to Rosa & Orey (2006), one possible bridge is to know how the connections between academic mathematics and the real world are realized by both the teachers and students. This includes the examples teachers use in their instruction and the characteristics of informal and academic mathematics they choose to explore in classroom activities.

The field of ethnomathematics link students' diverse ways of knowing and learning through the use of culturally embedded knowledge along with academic mathematics curriculum. This approach into the mathematics curriculum explores academic and culturally rich ways to provide more inclusive developmental programs for the diverse populations served at educational institutions. In this regard, ethnomathematics is a program that includes curricular relevance and builds knowledge around the local interests, needs and culture of students. In other words, ethnomathematics as a teaching methodology is designed to fit the school culture of the students as the basis for helping them to understand themselves and their peers, develop and structure social interactions, and conceptualize mathematical knowledge (D'Ambrosio, 1990; Rosa & Orey, 2011).

In D'Ambrosio's (1993) perspective, in order to solve specific problems, solutions are created, generalized methods are developed from those solutions to solve similar problems, and theories are developed from these generalized methods. In the context of ethnomathematics, many cultural differentiated groups 'know' mathematics in ways that are quite different from academic mathematics as taught in schools. The tendency has been to consider these mathematical practices as non-systematic and non-theoretical. In contrast, the study of ethnomathematics underlies a structure of inquiry in mathematical practices by considering how these practices and problem-solving techniques can be developed into methods and theories. Since different types of problems are common in different cultures, the kinds of solutions, methods, and theories that are developed may differ from culture to culture. In this regard, what is recognized as a problem and a solution in one culture may have no meaning at all in another one.

D'Ambrosio (2001) stated that ethnomathematics has come to mean the study of how people within various cultural groups develop techniques to explain and understand their world in response to problems, struggles, and endeavors of human

survival. This includes material needs as well as art and spirituality through the use of the development of cultural artifacts; objects created by members of a specific cultural group that inherently give cultural clues about the culture of its creator and users. Rosa and Orey (2006:34) affirmed that "when practical or culturally-based problems are examined in a proper social context, the practical mathematics of social groups is not trivial because they reflect themes that are profoundly linked to the daily lives of students". Rosa and Orey (2008) further stated that this perspective provides an important opportunity for educators to link current events and the importance of these artifacts in the context of ethnomathematics, history, and culture. Culturally relevant mathematics curriculum should focus on the role of mathematics in a socio-cultural context that involves the ideas and concepts associated with ethnomathematics, using an ethnomathematical perspective for solving contextualized problems.

In order to solve problems, students need to understand alternative mathematical systems. They also need to be able to understand more about the role that mathematics plays in a societal context (Orey, 2000; Rosa & Orey, 2007). This aspect promotes a better understanding of mathematical systems through the use of mathematical modeling, which is a process of translation and elaboration of problems and questions taken from systems that are part of the students' own reality. A system is part of reality, which is considered integrally. In this regard, a system is a set of items taken from students' reality, which studies of all its components and the relationship between them. Mathematical modeling is a pedagogical strategy used to motivate students to work on mathematics content and helps them to construct bridges between informal and academic mathematics (D'Ambrosio, 1993; Rosa & Orey, 2010).

The problem of fluency in the English language has been identified in mathematics problem-solving involving word problems. When English is not spoken in the home, or when the English that is spoken lacks the sophistication of mainstream English, classroom English is not reinforced outside the school. In mathematics this means that English language mathematics vocabulary may not be used outside the classroom, and further means that confusion occurs when certain terms such as 'factor' and 'product' have specialized meanings in the mathematics classroom different from their regular English language meanings. Garbe (1985) suggested that deliberate efforts must be made to overcome problems associated with sound as well as with the problems mentioned above. Students need more experience seeing, hearing, and using the English language mathematics terms in context. In predominantly native classrooms, it is critical that students hear, speak, and write much more English language mathematics. The application of native culture situations to the mathematics classroom represents one way of helping native students see relevance of mathematics in their culture, and to use this connection as a means of teaching more mathematics.

Borba (1990) suggested that ethnomathematics is mathematical knowledge expressed in the language code of a given socio-cultural group. Other researchers in this area have also made connections to language. D'Ambrosio who is considered by many as the 'father of ethnomathematics' described a research programme in ethnomathematics as the study of the generation, organisation, transmission, dissemination and the use of jargons, codes, styles of reasoning, practices, results and methods (Stillman & Balatti, 2000).

Given that ethnomathematics is concerned with the mathematical practices of particular cultural groups, it is not surprising that descriptions of it are linked to language. When an experience is described in language, meaning is added. However, this meaning is constrained by an individual's linguistic repertoire that developed from previous discussions with others. By describing an experience in words, aspects of it are highlighted whilst others are downplayed, often unintentionally (Meaney, 2005). Specific cultural practices such as ethnomathematical ones are embedded within the language of the culture. Wardhaugh (1998) stated that individuals from a particular culture come to use their language in ways that reflect what they value and what they do.

The mathematics register consists of the words and grammatical expressions that are used consistently to describe mathematical ideas (Roberts, 1998). Any group of people who regularly talk about mathematical ideas will have specific ways to succinctly convey their meanings. Halliday (1978) stated that we can refer to a "mathematics register", in the sense of the meanings that belong to the language of mathematics, and that a language must express if it is being used for mathematical purposes. It is only when the mathematical ideas within an ethnomathematical activity are valued by discussants that the mathematics register will be deployed. However, cultures that have not yet labeled a body of knowledge and skills as 'mathematics' may not have a developed mathematics register to describe their ethnomathematical practices in this way. When a new mathematics register is developed, the choice of terms and grammatical expressions will have an impact on the connotations that accompany the mathematical ideas.

Although the relationship between cultural practices and language has been recognized for some time, the use of ethnomathematics within the classroom has rarely been discussed in relationship to the language of instruction. Instead, discussions are more likely to be centered around the potential benefits to students of using ethnomathematical practices (Gerdes, 1996; Stillman & Balatti, 2000). Stillman and Balatti (2000) suggested that in recognizing the mathematics in real-life situations students would gain skills that would motivate them to learn about abstract concepts that could otherwise be considered as being devoid of meaning. These experiences could also support students to critique the assumptions on which these mathematical practices were based. The process of using ethnomathematics practices would also result in links being made between the students' community and the classroom. As was described by Meaney (2002), these benefits are seen as being particularly useful to indigenous students. The inclusion of ethnomathematical perspectives is believed to support indigenous students to gain better results because these students feel that their backgrounds and experiences were valued in the classroom and that mathematics can be developed by others outside of Western culture (Howard, 1995). The work by Lipka, Hogan, Webster, Yanez, Adams, Clark, and Lacy (2005) has shown that the use of culturally-based mathematics teaching with Yup'ik students in Alaska resulted in significant improvement in test results. Given that the incorporation of ethnomathematical practices into classrooms can only be done through language, any investigation of the benefits needs to include consideration of language issues.

PROBLEM STATEMENT

The use of ethnomathematical practices in mathematics classrooms warrants thoughtful consideration. This is because every activity is embedded within the language of the culture in which it arose. This language will highlight those features of the activity which the culture values. Changing the way an activity is discussed either by using the mathematics register or by changing the language will have implications for how the activity is perceived by the students. It may also change the actual practice itself by focusing on other ideas.

Cameroon is called "Africa in miniature" for its geological and cultural diversity. Natural features include beaches, deserts, mountains, rainforests, and savannas. The highest point is Mount Cameroon in the South West Region. Cameroon is home to over 200 different linguistic groups. The country is well known for its native styles of music, rich and diverse food types, cultural and religious believes, and English and French are the official languages. The problem of this study therefore posed as a question is; to what extent can mathematics content relate to culture, culturally relevant curriculum and language in the South West Region of Cameroon?.

Research Questions

The study was guided by the following research questions:

1. To what extent does secondary school mathematical content relate students' culture in the South West Region of Cameroon?
2. To what extent does secondary school mathematical content relate to culturally relevant curriculum in the South West Region of Cameroon?
3. To what extent does secondary school mathematical content relate to language in the South West Region of Cameroon?

SCOPE OF THE STUDY

The study was delimited to the opinion of mathematics teachers on the extent to which culture, culturally relevant curriculum and language affect students' achievement in mathematics in Fako Division in Cameroon. Fako division has the highest number of secondary schools in the South West Region.

DESIGN OF THE STUDY

This study used the survey design, precisely the sample survey was found appropriate in that it enabled the researcher to study a large population by making use of representatives of all the mathematics teachers in the division.

SAMPLE AND SAMPLING TECHNIQUES

A total of 60 mathematics teachers consisting of 50 males and 10 females were drawn from the target population by accidental sampling technique given that data were collected during the South West Association of Mathematics Teachers meeting.

INSTRUMENTS FOR THE STUDY

A questionnaire was constructed for data collection. The questionnaire was divided into four sections; gender, culture,

culturally relevant curriculum and language. The 4-point Likert scale was used with each item having four options (Strongly Agree SA = 4, Agree A = 3, Disagree D = 2 and Strongly Disagree SD = 1).

METHODS OF DATA ANALYSES

Mean scores and standard deviations were used for analyzing data to provide answers for the research questions. The hypotheses were tested at 0.05 level of significance using chi-square (χ^2) tests.

RESULTS AND DISCUSSION

1. To what extent does secondary school mathematical content relate to students' culture in the South West Region of Cameroon?

Ho$_1$: There is no significant relationship between secondary school mathematical content and students' culture in the South West Region of Cameroon.

Table 1: Mathematical content and students' culture

S/N	Item	SA	A	D	SD	$\bar{x}$	s	Dec.	x^2	df
1	Mathematics is identified in cultural activities in traditional and non-traditional societies.	29	27	4	0	3.42	.62	A	19.30	2
2	Mathematical concepts should be embedded in cultural practices since all cultures and all people develop unique methods and sophisticated explications to understand and to transform their own realities.	22	32	3	2	3.25	.71	A	44.12	3
3	Teachers should contextualize mathematics learning by relating mathematical content to students' culture and real-life experiences.	46	9	2	3	3.63	.78	A	87.33	3
4	Different cultural groups comprehend, articulate, and apply concepts and practices that can be identified as mathematical practices.	19	35	4	1	3.22	.65	A	49.68	3
5	There are different ways of doing mathematics by considering the appropriation of the academic mathematical knowledge developed by different sectors of the society.	21	34	4	1	3.25	.66	A	45.88	3
6	Mathematical thinking is developed in different cultures in accordance to common problems that are encountered within a cultural context.	19	36	4	1	3.22	.64	A	51.60	3
7	Many cultural differentiated groups know mathematics in ways that are quite different from academic mathematics as taught in schools.	21	23	11	5	3.00	.94	A	14.40	3
8	Cultural practices and problem-solving techniques can be developed into methods and theories.	21	31	4	4	3.15	.82	A	35.60	3
9	Since different types of problems are common in different cultures, the kinds of solutions, methods, and theories that are developed may differ from culture to culture.	18	25	8	9	2.87	1.02	A	12.93	3
10	What is recognized as a problem and a solution in one culture may have no meaning at all in another one.	16	13	19	12	2.55	1.10	A	2.00	3
11	The training of teachers who are able to facilitate a mathematics learning environment grounded in real life experiences and to support students in the social construction of mathematical knowledge is necessary in the contemporary society.	35	21	1	3	3.47	.77	A	51.73	3
TOTAL		**267**	**286**	**64**	**41**	**35.03**	**8.71**		**414.57**	**32**
MEAN						**3.18**	**0.79**	**A**		

$\bar{x}$ = mean score, **s =** standard deviation, **Dec. =** Decision, x^2 = Chi square, **df** = degree of freedom

The respondents strongly accepted that mathematics is identified in cultural activities, in traditional and non-traditional societies and that mathematical concepts should be embedded in cultural practices since all cultures and all people develop unique methods and sophisticated explications to understand and to transform their own realities. Teachers should contextualize mathematics learning by relating mathematical content to students' culture and real-life experiences; different cultural groups comprehend, articulate, and apply concepts and practices that can be identified as mathematical practices. There are different ways of doing mathematics by considering the appropriation of the academic mathematical knowledge developed by different sectors of the society. Mathematical thinking is developed in different cultures in accordance to common problems that are encountered within a cultural context. Many cultural differentiated groups know mathematics in ways that are quite different from academic mathematics as taught in schools, and that cultural practices and problem-solving techniques can be developed into methods and theories. It was moderately agreed that since different types of problems are common in different cultures, the kinds of solutions, methods, and theories that are developed may differ from culture to culture; and what is recognized as a problem and a solution in one culture may have no meaning at all in another one. They opined to a very high extent that the training of teachers who are able to facilitate a mathematics learning environment grounded in real life experiences, and the support of students in the social construction of mathematical knowledge is necessary in the contemporary society.

Conclusively, secondary school mathematical content relate to a very great extent to students' culture in the South West Region of Cameroon ($\bar{x} = 3.18 \pm 0.79$). Since the calculated value ($\chi^2 = 414.57$) is greater than the table value ($\chi^2 = 43.77$) with df = 32 at $p \leq 0.05$ level of significance, we reject Ho_1 and state that there is significant relationship between mathematical content and students' culture in Cameroon secondary schools.

2. To what extent does secondary school mathematical content relate to culturally relevant curriculum in the South West Region of Cameroon?

Ho_2: There is no significant relationship between secondary school mathematical content and culturally relevant curriculum in the South West Region of Cameroon.

Table 2: Mathematical content and culturally relevant curriculum

S/N	Item	SA	A	D	SD	$\bar{x}$	s	Dec.	x^2	df
1	The use of cultural artifacts; objects created by members of a specific cultural group that inherently give cultural clues about the teaching of mathematics can improve performance.	25	29	5	1	3.30	.70	A	39.47	3
2	A mathematical approach may be presented as a cultural response to students' needs by making connections between their cultural background and mathematics.	17	33	7	3	3.07	.78	A	35.73	3
3	There is the need to make mathematics more relevant to students because every culture is assumed to have mathematical responses with valid content for a mathematics classroom.	35	20	4	1	3.48	.70	A	49.47	3
4	A classroom using this type of ethnomathematical curriculum would be full of examples that draw on the students' own experiences and on experiences that are common in their cultural environments.	36	18	3	2	3.49	.75	A	51.71	3
5	The use of cultural experiences can function as vehicles to make mathematics learning more meaningful and to provide students with the insights of mathematical knowledge as embedded in their social and cultural environments.	27	26	4	4	3.28	.80	A	35.33	3
6	Pedagogical elements necessary to develop the mathematics curriculum like geometrical shapes and objects (huts, farm ridges, windows, tiles, conics etc) are found in the school community.	13	21	16	9	2.64	1.00	A	5.20	3
7	In order to solve problems, students need to understand alternative mathematical systems and they also need to be able to understand more about the role that mathematics plays in a societal context.	31	20	6	2	3.36	.804	A	35.98	3
8	To solve specific mathematical problems, solutions are created, generalized methods are developed from	26	27	3	3	3.29	.79	A	37.48	3

	those solutions to solve similar problems, and theories are developed from these generalized methods.									
9	An ethnomathematical curriculum would promote a better understanding of mathematical systems through the use of mathematical modeling, which is a process of translation and elaboration of problems and questions taken from systems that are part of the students' own reality.	19	32	6	1	3.19	.69	A	40.07	3
10	Mathematics as part of the school curriculum must reinforce and value the cultural knowledge of students rather than ignore or negate it.	24	26	3	4	3.23	.85	A	32.61	3
11	Mathematics curriculum must be grounded in a constructivist approach to learning and seek to change the way mathematics teachers construct their learning environments.	21	30	4	3	3.19	.78	A	36.21	3
12	There is the need for a mathematics curriculum that is based on students' knowledge, which allows teachers to have more freedom and creativity to choose academic mathematical topics to be covered in the lessons.	12	27	12	8	2.73	.94	A	14.29	3
TOTAL		**286**	**309**	**73**	**41**	**38.25**	**9.58**		**413.55**	**36**
MEAN						**3.188**	**0.798**	**A**		

$\bar{x}$ = mean score, **s =** standard deviation, **Dec. =** Decision, x^2 = Chi square, **df** = degree of freedom.

The respondents agreed that the use of cultural artifacts (objects created by members of a specific cultural group that inherently give cultural clues about the teaching of mathematics) can improve performance, and that a mathematical approach may be presented as a cultural response to students' needs by making connections between their cultural background and mathematics. There is the need to make mathematics more relevant to students because every culture is assumed to have mathematical responses with valid content for a mathematics classroom. A classroom using this type of ethnomathematical curriculum would be full of examples that draw on the students' own experiences and on experiences that are common in their cultural environments. The use of cultural experiences can function as vehicles to make mathematics learning more meaningful and to provide students with the insights of mathematical knowledge as embedded in their social and cultural environments. Pedagogical elements necessary to develop the mathematics curriculum like geometrical shapes and objects (huts, farm ridges, windows, tiles, conics etc) are found in the school community. In order to solve problems, students need to understand alternative mathematical systems and they also need to be able to understand more about the role that mathematics plays in a societal context. To solve specific mathematical problems, solutions are created, generalized methods are developed from those solutions to solve similar problems, and theories are developed from these generalized methods. An ethnomathematical curriculum would promote a better understanding of mathematical systems through the use of mathematical modeling, which is a process of translation and elaboration of problems and questions taken from systems that are part of the students' own reality. Mathematics as part of the school curriculum must reinforce and value the cultural knowledge of students rather than ignore or negate it. Mathematics curriculum must be grounded in a constructivist approach to learning and seek to change the way mathematics teachers construct their learning environments. There is the need for a mathematics curriculum that is based on students' knowledge, which allows teachers to have more freedom and creativity to choose academic mathematical topics to be covered in the lessons.

To conclude, secondary school mathematical content relate to a very great extent to the culturally relevant curriculum in the South West Region of Cameroon ($\bar{x}$ =3.188 ± 0.798). Since the calculated value (χ^2 = 413.55) is greater than the table value (χ^2 = 43.77) with df = 36 at $p \leq 0.05$ level of significance, we reject Ho_2 and state that there is a significant relationship between mathematical content and the culturally relevant curriculum in Cameroon secondary schools.

3. To what extent does secondary schools mathematical content relate to language in the South West Region of Cameroon?

Ho_3: There is no significant relationship between secondary schools mathematical content and language in the South West Region of Cameroon.

Table 3: Mathematical content and language

S/N	Item	SA	A	D	SD	$\bar{x}$	s	Dec.	x^2	df
1	Through dialogue with the students, teachers can apply mathematical themes that help them to elaborate the mathematics curriculum.	28	27	3	1	3.38	.67	A	45.20	3
2	A language deficit automatically leads to a mathematics deficit.	19	19	12	8	2.84	1.04	A	6.14	3
3	English language mathematics vocabulary may not be used outside the classroom.	3	10	27	17	1.98	.83	R	22.09	3
4	Students need more experience seeing, hearing, and using the English language mathematics terms in context.	20	32	7	0	3.22	.65	A	15.90	2
5	Ethnomathematics is mathematical knowledge expressed in the language code of a given socio-cultural group.	10	37	3	6	2.91	.82	A	52.14	3
6	A research program in ethnomathematics is the study of the generation, organization, transmission, dissemination and the use of jargons, codes, and styles of reasoning, practices, results and methods.	12	32	7	6	2.88	.87	A	30.93	3
7	Specific cultural practices such as ethnomathematical ones are embedded within the language of the culture.	10	37	8	4	2.90	.76	A	46.02	3
8	The mathematics register consists of the words and grammatical expressions that are used consistently to describe mathematical ideas.	13	34	8	2	3.02	.72	A	40.75	3
9	The use of ethnomathematics within the classroom has rarely been discussed in relationship to the language of instruction.	13	31	7	8	2.83	.93	A	25.27	3
10	In recognizing the mathematics in real-life situations students would gain skills that would motivate them to learn about abstract concepts that could otherwise be considered as being devoid of meaning.	31	25	0	3	3.42	.75	A	22.10	2
11	The use of ethnomathematical practices in mathematics classrooms warrants thoughtful consideration. This is because every activity is embedded within the language of the culture in which it arose.	22	30	6	1	3.24	.70	A	37.34	3
TOTAL		**181**	**314**	**88**	**56**	**32.62**	**8.74**		**343.88**	**31**
MEAN						**2.965**	**0.794**	**A**		

$\bar{x}$ = mean score, **s =** standard deviation, **Dec. =** Decision, x^2 = Chi square, **df** = degree of freedom.

The respondents opined that through dialogue with the students, teachers can apply mathematical themes that help them to elaborate the mathematics curriculum, and that a language deficit automatically leads to a mathematics deficit. English language mathematics vocabulary may be used outside the classroom and students need more experience seeing, hearing, and using the English language mathematics terms in context. Ethnomathematics is mathematical knowledge expressed in the language code of a given socio-cultural group. A research program in ethnomathematics is the study of the generation, organization, transmission, dissemination and the use of jargons, codes, and styles of reasoning, practices, results and methods. Specific cultural practices such as ethnomathematical ones are embedded within the language of the culture. The mathematics register consists of the words and grammatical expressions that are used consistently to describe mathematical ideas. The use of ethnomathematics within the classroom has rarely been discussed in relationship to the language of instruction. In recognizing the mathematics in real-life situations students would gain skills that would motivate them to learn about abstract concepts that could otherwise be considered as being devoid of meaning. The use of ethnomathematical practices in mathematics classrooms warrants thoughtful consideration. This is because every activity is embedded within the language of the culture in which it arose.

To wrap up, secondary school mathematical content relate to a high extent to language in the South West Region of Cameroon ($\bar{x}$ =2.965 ± 0.794). Since the calculated value (χ^2 = 343.88) is greater than the table value (χ^2 = 43.77) with df = 31 at $p \leq 0.05$ level of significance, we reject Ho_3 and state that there is a significant relationship between mathematical content and language in Cameroon secondary schools.

CONCLUSION

There is significant relationship between mathematical content and students' culture, the culturally relevant curriculum, and language in secondary schools in the South West Region of Cameroon. The use of cultural experiences can function as approaches to make mathematics learning more meaningful and to provide students with the insights of mathematical knowledge as embedded in their social and cultural environments. There is therefore the need for a mathematics curriculum that is based on students' knowledge, which allows teachers to have more freedom and creativity to choose academic mathematical topics to be covered in the lessons.

RECOMMENDATIONS

1. Ethnomathematics concepts should be incorporated into the curriculum in all institutions including teacher-training colleges and Faculties of Education in all Universities in Cameroon. Authors and textbook writers should apply and provide proper illustration of ethnomathematics concepts in different areas of mathematics.
2. Seminars and in-service programs should be organized by all mathematics associations, examination boards, and delegations of education and the pedagogic offices for teachers in the field to be acquainted with the teaching of mathematics using cultural artifacts, languages and culturally relevant approaches.
3. More research programs in ethnomathematics on the study of the generation, organization, transmission, dissemination and the use of jargons, codes, and styles of reasoning, practices, results and methods should be carried out in Cameroon.

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