

Effect of Ethno-Mathematics Teaching on Mathematics: A Study on Primary Students of Tangkhul Tribe in Manipur, India

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ABSTRACT The present educational policy, National Education Policy 2020, highlighted the paradigm shift from content-based to experience-based learning that can make learning more meaningful and interesting. To make learning interesting and meaningful, a varied approach in learning where the researchers tried to incorporate the cultural context (ethno-mathematics) of students was used in learning to understand the mathematical concepts in the classroom. The objective of the study was to study the effect of ethno-mathematics teaching. A true experimental research design was carried out to 139 primary students with 63 students in the experimental group and 76 students in the control group among the Tangkhul tribe students of Manipur, India. A pre-test and post-test was taken on the Mathematical Achievement Test (MAT) prepared and standardised by the researchers. The experimental group was taught using ethno-mathematical teaching, and the control group using the conventional method. A statistical method t-test was used to test the null hypothesis. The t-test result shows that ethno-mathematics teaching was found more effective than conventional teaching. Again, after the treatment, an FGD (focus group discussion) was conducted to support the quantitative data. The qualitative data from the FGD showed positive responses from the experimental group confirming that learning was more interesting and joyful with the ethno-mathematical method, as compared to the conventional method.

INTRODUCTION

Mathematics is involved in all human activities, embedded in all cultures and is culturally dependent (Cimen 2014). It is the language of the world and a common tool of communication for all. Due to its significance in human life, even in schools it is considered as one of the most important as well as compulsory subjects in the curriculum. Despite its importance, the performance of students in Mathematics is not satisfactory. The ASER Report of 2014 showed how the learning level of students in Manipur had been decreasing in recent years. Data on rural Manipur had shown that in 2014 only 59.4 percent of class III students could do basic subtraction without borrowing as compared to 79.1 percent students in 2007. Also the ASER Report 2022 showed the trends of Mathematics that were not encouraging.

This deterioration in the learning level is disheartening and can raise questions towards the existing educational system. Learning of Mathematics is often associated with dull, lacking in innovative teaching practices. A study done by Emelda et al. (2024) highlighted that the poor performance in mathematics was linked with a

negative attitude towards mathematics and lack of teaching resources. The reason for the failure of the current educational system may dissociate to the learning context of students. In Rosa and Orey's (2016) study, it was discussed how learning can be meaningful when they tried to connect with students' context and culture. This application of knowledge deepens understanding.

The importance of culture and its influence was studied by Barton (1996), and this contextual knowledge is connected to ethno-mathematics that one uses every day without being aware of how important it is. Mesquita (2008) had worked on how ethno-mathematical tactics were used by the urban street children in robbery. The application of context may vary from culture to culture and to situations. However, it is evident that ethno-mathematics helped in construction of knowledge in their own context (Barton 1996). Contextual knowledge is essential for understanding the mathematical concept and implementation of ethno-mathematical in the curriculum as seen in Lipka and Andrew-Ihrke (2009). The concept of squares was taught using the ethnic measurement. Furthermore, importance of ethnomathematics was also men-

tioned in the work of Fouze and Amit (2023). They identify various mathematical concepts like square, isosceles triangle, rhombus in traditional Bedouin embroidery.

Importance of Ethno-mathematics in Learning Mathematics

The term ethno-mathematics is the combination of the two words that is 'ethno' and 'mathematics'. The word 'ethno' relates to the study of society and culture or cultural group and Mathematics. It is the field of study that examines mathematical ideas (Barton 1996) in their cultural context that is within the context of any group within which the ideas arise. The other term is called local culture (Danoebroto and Suyata 2024), which is the knowledge found practices among locals.

Ethno-mathematicians attempt to describe and understand the ways in which mathematical ideas are understood, articulated and used by different cultures and communities having different, unique knowledge of their own. Thus, in short it is the study of relationships between culture and mathematics and how mathematical knowledge is articulated in different cultural practices. Taking cognisance of the importance of contextual and ethno-mathematics in learning, this paper studied how Mathematics education can be effective by incorporating the knowledge of culture. Studies had shown how the cultural aspects of teaching allow culturally relevant content and challenge eurocentrism (Rosa and Orey 2011). It enables students to engage in solving problems independently and effectively by connecting with culture. Like for an instance, the E-module with integration of the cultural knowledge (Paramita et al. 2024) and digital cultural-based media (Sunzuma and Umbara 2025) help in learning mathematics. D'Ambrosio had contributed tremendously and mentioned how ethno-mathematical content showed better and meaningful learning in the classroom (D'Ambrosio 2001). Implementation of cultural components in the curriculum allows students to understand the mathematical concept and higher achievement (Jennifer 2016). Researches had proved this local knowledge (Jama 1999) has helped students in their achievement and improvement of skills in communication, coop-

eration, understanding differences. Kabanga et al. (2024) how mentioned the how local wisdom called Tengko Situru model was incorporated at elementary students learning. A concept based on ethno-mathematical programs helped in teaching mathematics in the classroom and this approach has become a contemporary pedagogical trend in education that allows school mathematics to connect with students' culture for better learning.

Connecting school mathematics and learners' culture can bridge the gap of learners' understanding and application. However, students find it difficult to connect the knowledge that they have learnt in the schools to daily transactions. Despite its relation between culture and Mathematics, there is a lack of ethno-mathematical knowledge as pointed out in Sunzuma and Maharaja's study (2019). A study conducted by Weldeana (2016) had similar findings that teachers and professionals lack the use of ethno-mathematical knowledge. This piece of innovative strategy can help teachers, students and all the stakeholders make aware that students' background is one of the key factors in understanding the concepts and interesting as learning needs holistic approach by enrichment of curriculum considering the socio-cultural background.

Objective of the Study

Knowing the fact that there are elements of mathematical concepts embedded in the cultural practices, the researchers tried to bring these cultural resources into the classroom learning process. A varied application in learning of mathematics was also recommended in National Education Policy 2020 to make learners enjoy the learning of mathematics subjects. There is a phobia in mathematics that "*mathematics is a difficult subject*". This perception one has had even from our parents and elders can be eliminated only when the child enjoys the learning by making learning more interesting. Therefore, the researcher intends to work on students' backgrounds and ancestral knowledge to make learning joyful and interesting. The term Lokvidya also focused on 'indigenous knowledge', which is highly regarded in the New Educational Policy 2020. Thus, the present study tried to har-

ness the indigenous knowledge of the Tangkhul tribe handed down by their forefathers in learning mathematics effectively. Besides, there have been a few studies in India especially in the north-eastern region to address this issue to enhance learning.

METHODOLOGY

Procedures of Conducting the Experimental Study

For investigating the cause and effect, a true experimental research design was used. A true experimental design requires manipulation of independent variables. Therefore, the researchers tried to manipulate the variables like age, SES (socioeconomic status), intelligence and the pre-test scores (Mathematical Achievement Test). Both the groups were given treatment for two weeks, ethno-mathematical teaching to the experimental group and conventional teaching to the control group. After the treatment, a post-test was conducted. Table 1 shows the design of true experimental research employed in the study.

Population of the Study

The population of the study was grade 3 students of Ukhrul district, in Manipur, India.

Sample and Sampling Technique

Samples of grade 3 students in two sections (A and B) were selected for the study. The two groups were assigned into the control group and experimental group randomly and hence comprising 63 students in the experimental group and 76 in the control group.

Tools Used

For matching the control group and the experimental group, the researchers used tools such

as, the Standard Progressive Matrix (1996 edition), SES (socioeconomic status) developed by the researchers for assessing the socioeconomic status of students, age and Mathematical Achievement Test scores, prepared and standardised by the researchers to assess the achievement in mathematics. The reliability of mathematical achievement was calculated through the split-half method, which was found to be .84, which is highly reliable. The content validity of the tool was established by consultation with experts and construct validity of the tool was established by calculating internal consistency. A focus group discussion was conducted after the ethno-mathematical teaching in the experimental group. The ethno-mathematical teaching prepared by the researchers had been given in appendix.

RESULTS AND DISCUSSION

After teaching the experimental group for two weeks through ethno-mathematical teaching (refer appendix) and the control group with conventional teaching, post-test were taken in both the control group and the experimental group. The results were statistically analysed and had been presented in Table 2, which shows that there was no significant difference, which means that the groups were identical.

However, the post-test results indicate that there was a significant difference in both control group and experimental group, which was found to be 2.08 greater than the table t value that is 1.98 (Table 2). Though the mean scores of both the experimental and control group had increased in the post-test results, the mean scores in the pre-test post-test on the mathematical achievement test in the experimental group were higher than that of the control group (Table 3). Thus, it can be concluded that the group taught with the ethno-mathematical teaching was higher, which was more effective as compared to conventional teaching. In the post-test results, the

Table 1: Experimental research design

<i>Experimental Group</i>	(Controlled Variables)	Pre-test	Ethno-mathematical teaching	Post-test
<i>Control Group</i>	Age, SES, Intelligence test, Pre-test score	Pre-test	Conventional teaching	Post-test

Source: Author

Table 2: t-test results of control group and experimental group

	Mean	SD	Df.	Calculated t value	Table t value	Result
Control pre-test and Experimental pre-test on mathematical achievement test	13 14	4.76 6.93	137	1.04	1.98	Not significant
Control post-test and Experimental post-test on mathematical achievement test	23 26	9.17 9.13	137	2.08	1.98	Significant
Control pre-test post-test on mathematical achievement test	13 23	9.17	150	8.16	1.98	Significant
Experimental pre-test post-test on mathematical achievement test	14 26	9.13	124	9.22	1.98	Significant

Note: P-value is at .05 level of significance

Source: Author

experimental group had gained 11.88 and the control group had gained 9.67. The study suggests that incorporating culture in teaching aids had a positive impact and enhanced achievement. This result was similar with the studies by Babbitt et al. (2015), and Paramita et al. (2024) who found that students performed better when compared with the group without cultural content in the curriculum and the E-module containing ethnomathematics had the skills in problem solving abilities serve as pedagogical tools in understanding the concept of mathematics (Umbara et al. 2021) Thus, it is evident that incorporating culture can help in solving mathematical problems and mathematical skills (Danoebroto and Suyata 2024; Näslund-Hadley et al. 2025). Studies suggest that integrating ethnomathematics in teaching enhance understanding (Acharya et al. 2021; Sunzuma and Maharaj 2020; Sunzuma and Umbara 2025). Table 3 shows the mean achievement scores and standard deviation of the experimental and the control group.

As observed in Table 3, it is evident that group taught with the ethno-mathematical teaching strategy performed better than the conventional teaching. The mean scores in mathematics were higher indicated that students' performance is better when taught with ethno-mathematical teaching rather than the teaching without any cultural examples. The same type of result was found by Salihu et al. (2024) opined how performance in geometry was higher when taught through ethno-mathematical strategy. Research has been done on the influence of culture like the concept of ethno-modelling (Rosa and Orey 2016), a widely known concept, which

Table 3: Mean achievement scores and standard deviation of the experimental and the control group

Teaching method	Type of test	N	Mean	SD
Ethno-mathematics	Pre-Test	63	14.44	6.93
	Post-Test	63	26.32	9.13
Conventional	Pre-Test	76	13.41	4.76
	Post-Test	76	23.08	9.17

Source: Author

has become a teaching tool using the cultural context for better learning. Similar studies (Abiam et al. 2016; Omere and Ogedengbe 2022; Pratama et al. 2024; Magdalena Dhema et al. 2025; Accra-Jaja et al. 2023) revealed that the ethno-mathematical based instructional approach was superior to the conventional method and enhanced pupils' achievement in learning mathematical concepts. In the present study, students were able to identify the shapes drawn on traditional houses of the Tangkhul tribe and are able to retain them as compared to the control groups. Using this approach in the classroom allows students to understand the concept of geometrical concepts and retain, as pointed out in Adamu's study (2024). This retention of concepts when cultural elements were presented in teaching geometry and arithmetic was evident from (Sunzuma et al. 2021). The findings of the study pointed out that students in the experimental group are more willing to take initiative and participated as the students were asked to make holes to play the game (cultural games called '*lung-yarva*'), students in the experimental group replied, "*Miss, we will make the hole (hastily)*". The findings clearly indicated that they are interested and motivated to participate when asked

to play the cultural game which was known to them. This finding were consistent with the studies by Salihu et al. (2024), Arvianto et al. (2025) and Winardi and Jupri (2025) who found the association of the cultural games, found learning a realistic and meaning experiences that enhances performance and fosters deeper understanding of the mathematical concepts.

Besides the above statistical results, positive responses from FGD were much encouraging. Students in the experimental group had less fear as compared to the control group when students in the experimental group boldly asked the researchers, “*Miss, what shall we do with these corn seeds?*”, while the others started to smile and began to talk among themselves. The students’ gesture (joyful responses) and responsive atmosphere in the classroom implies that they began to be friendlier when they saw the corn seed and started using the local dialect while teaching. The joy in their face (smile) showed that they are fearless in learning. Students at first do not understand that it was meant for learning mathematics, as they question the researchers what they would do with the corn seeds. The general perception of students in mathematics is the fear or phobia in mathematics, which had already been pointed out in the above discussion. However, this research study showed that the students had less fear when they saw the corn seeds, which were connected to their culture or everyday life. This was further confirmed by D’Ambrosio (2001) that how learning was greatly affected by its cultural background of the students and enhance achievement in Mathematics (Achor et al. 2009; Jeyam et al. 2024; Näslund-Hadley 2025). It was also found that the experimental group students had less fear and were friendlier towards the researchers when local dialect and materials were shown to students while teaching. The familiar things that are found in the culture like for an instance the corn seeds, the drawings and paintings on the walls, these materials made students more interested to learn and fearless attitude towards mathematics could be the reason for higher in the mean score in the post-test results in the experimental group which was higher as compared to the conventional group. Similar results were seen in Adamu’s study (2024) which found significant difference in the mean interest

ratings, achievement and retention when taught using ethno-mathematics approach.

Moreover, it was seen that students enjoyed and were ready to learn the ethno-mathematical learning method more than the conventional teaching, which is closely associated with their culture, as a student said, “*We like this type of teaching more. We like your teaching (shouting in a loud voice)*”.

The students also responded, “*yours...yours Miss*”, when questioned about their preferences of learning that they are more interested in learning Mathematics when local examples were used rather than textbook examples.

CONCLUSION

The results of the study found that ethno-mathematical teaching was more effective in enhancing the students’ achievement in mathematics than the conventional teaching. Students’ attitude towards mathematics changed when students’ cultural materials were used in the classroom. They began to participate and engaged themselves to learn more. The interests in learning were seen while using the ethno-mathematical content. Thus, it can be concluded that students who were exposed to ethno-mathematical teaching perform better and help to reduce fear in mathematics. It increased students’ interest and involvement in the mathematics lesson.

RECOMMENDATIONS

The study recommends that ethno-mathematical teaching needs to be implemented in the school curriculum as students across cultures found it helpful. The pedagogical aspects can be addressed by relating to a student’s culture. This should be introduced in teacher training programmes, both in pre-service and in-service training. Workshops and seminars should be organised for better content knowledge in ethno-mathematics. Adequate information about the innovative practices in teaching need to be introduced in teacher training programmes and proper implementations of the programme even at the grass root level is needed. Overall, the study can serve as an encouragement to the community and teachers as they seek to incorporate local resources in school curricula.

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APPENDIX

ETHNO-MATHEMATICAL TEACHING STRATEGY

The ethno-mathematical teaching strategy was prepared appropriate to the grade 3 syllabus math. The topics contained in the ethno-mathematical teaching strategy were as follows.

1. Concept of Arithmetic: Addition, Subtraction and Division

Ethno-mathematical approach: Corn was used as a method of counting in the culture. Thus, for understanding the concepts of addition and subtraction, corn counting was used. Students were distributed 20 corn seeds and had to use these for solving the mathematical problems. The concept of division was taught with the help of the cultural games “lungyarva”. Students were made to play the games in groups where the players distribute the stones one by one, which embedded the concept of division.

2. Concept of Measurement: The local measurement system was used for understanding the concept

of measurement, such as millimetre, centimetre and kilometre.

Local examples of measurement, such as Lam (stretched arms), Mathik-akai (half-chest), Seira (end of middle finger to elbow), were taught ethno-mathematically from smaller to large forms of measurement.

3. Simple Geometrical Shape Concept: Drawings printed on the traditional shawl and houses were taken to teach the concept of shapes.

Students were shown pictures of various geometrical shapes drawn on the Tangkhul traditional attire. The shapes drawn on traditional houses were shown for better understanding and to be more interesting.

Besides the above mathematical concepts, the medium of instruction, which is the local (Tangkhul) dialect used by the researchers helped in understanding the concepts better.