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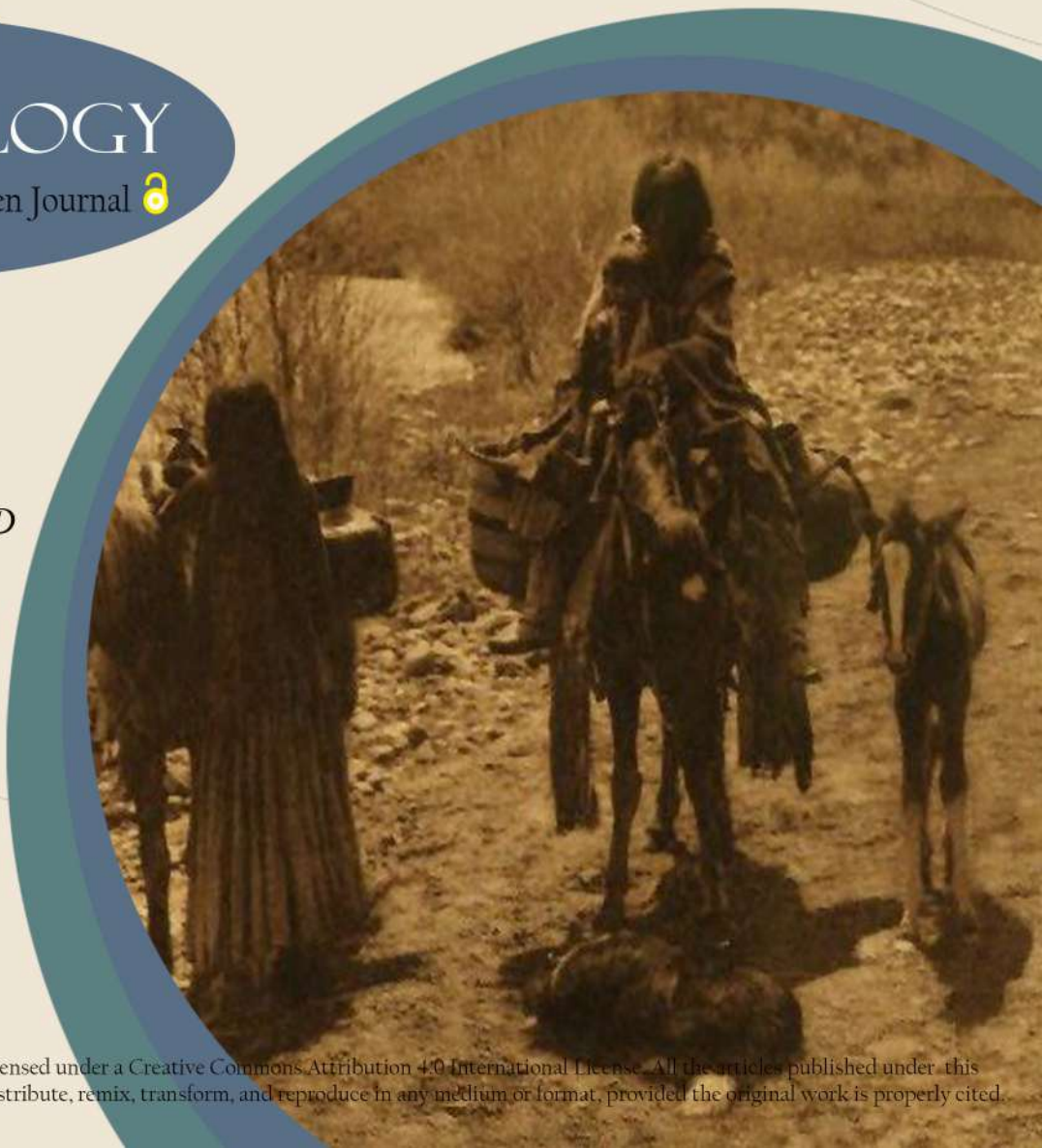

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Short Communication

Multi-Level Group Selection and its Connection to Empathetic, Community-Driven Pedagogy: A Research Study Framework Proposal

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ABSTRACT

Background
Multi-level group selection theory is a presently rejuvenated framework for explaining the empathic tendencies of group culture and behavior as means of beneficial natural selection utility.

Purpose
The purpose here is to simply articulate the ways in which the anthropological theory of multi-level group selection overlaps with the latest psychological research on child conceptualization of equity and empathy so that a focused line of thought can be followed in subsequent research on how childhood psychology interacts with classroom environs moving forward.

Conclusion
The impact these studies stand to have on the broader culture of education would be largely equitable, ensuring that all students from all demographics would be encouraged by like-minded teachers to further propagate their applied learning for mutual advantage and benefit while also exciting each other about what they learn by finding shared relevant experiences and desires to make relevant connections too.

Keywords
Multi-Level; Group selection; Kin selection; Empathy; Pedagogy; Pedagogical practice; Evolution; Natural selection; Classrooms; Education.

INTRODUCTION

Initially thought to be debunked decades past, recent research has suggested that multi-level group selection is the means of natural selection best supported by the evidence when aiming to understand the cultural aspects of empathetic group dynamics as a naturally occurring proclivity. This proposal sets up a workable set of research questions that could translate to applied studies. The proposal found here in fact briefly blueprints three potential study approaches: one survey-based report, one comparative qualitative study, and one longitudinal study focusing on the same group of learners and teachers over an extended period of time. Each of the potential forms the study could take connect to the main goal of the study, which is to determine if applying group selection principles to classroom environs improves the sense of comradery and testable academic achievement within the classroom. Gathering the report of the previous observational data, combined with the established prior literature on the validity of multi-level group selection as a viable theory for explaining human groups' natural proclivity for empathetic practice as a means of species well-being and propagation, this proposed framework is determined to be a meaningful and impactful project moving forward in applying anthropological data to the cultural and biological context of learning environments, in particular, K-12 classrooms. It stands to aid both applied practice for educators as well as more richly contextualized cultural data for researchers.

As someone with a background in anthropological study, as well as a background as a non-traditional student with very atypical learning approaches, this project seemed best approached in

a way that merged those two worlds, bringing the knowledge and experience the author has from both to bear on the question of emotionally-driven pedagogical practice and/or environments. Research in anthropology regarding the newfound understanding of utility for empathy-focused group interaction, even within the context of aiding individuals in a given goal, pertains first and directly to the question of how to inform more empirically-based rubrics for best practices for teachers in classrooms.

In the case of my specific research project, classroom limitations necessitate a refinement of focus so that the research questions (and the subsequent proposed research projects) can remain focused and manageable.

But what is this anthropological research, and how does it pertain to best pedagogical practices for empathy in classrooms? That information will be forthcoming. For now, let us precisely delineate the practical problem this proposed research project is meant to address.

Studies have shown time and again that one of the biggest contributing factors to lack of student performance in classrooms is a student's feeling isolated, or being invisible to the teacher.[1] This results in lack of engagement, which misapplies the process of transience (i.e. forgetting), which recent studies have shown actually is a useful process for clearing out clutter in the brain,[2] but can affect more immediate learned information when said process is applied broadly and lacks focus. Two key studies on the topic of classroom-learned information retention have helped us gain an insight into this process. In the first of these two studies, researcher Harry Bahrick examined how well Spanish language students remembered what they had learned after graduation.[3] He did this through a longitudinal study that examined the same group of students over a 50-year period to see if there were any common trends of forgetfulness of the material across all the individuals being examined.[3] This study resulted in a very interesting find: that contrary to popular belief, it is not simply repetition and application that guarantees long-term retention but rather in fact the way in which the information was first learned to begin with.[3] It was Bahrick who famously presented a pithy distillation of what was really going on by describing the common teaching process as pouring water into a "leaky vessel," and that only a more directly engaged form of instruction could shift the needed information into the part of the mind Bahrick called the "permastore," which his study demonstrated could retain complete information intact, even when unrecalled, for 50-years.[3]

The second key study we will cite here is the more recent longitudinal study by Bacon and Stewart that examined the same task of coursework retention, but in their case pertaining to marketing class knowledge.[4] This study tracked 90 students' retention of the course material from 8 to 101 weeks after initially learning it, and used the Rasch measurement to place all the students on the same knowledge scale regardless of which iteration of the material they learned (some of the students tested had taken the class many years prior).[4] This study found the same basic result, that the more interactive and applied learning the students did, the less invisible they felt and the more information from the material ultimately got filed away into permastore.[4]

What this trend in the research means is that, in order for teachers to ensure their students are engaged and retain the material. They will always need to ensure their students feel directly connected to not just the material, but their peers, as well, for optimum participatory learning.[5]

An example of what this might look like in action comes from the author's own time as a teacher in the classroom, teaching 11th Grade English and requiring students to apply their writing and speaking skills to the task of performative speech for the purposes of learning how to persuade through formal argument formulation. In order to bring the students together in a sense of solidarity so as to impassion them all to this task, the author appealed to a sentiment that the students had already shared in prior class discussions: that their school administrators treated them more like prison inmates than high schoolers, and that the policies in place requiring students to be constantly chaperoned in hallways between classes and during bathroom breaks reflected a sense of antagonism or distrust toward students. It was therefore asked of the students who were willing to write and give a persuasive speech before the whole class with formulating an argument that could be presented to the school administrators and give thoughtful suggestions on alternative policies that would make the students feel heard. Approaching the task in this way helped all of my students in the classroom, even those who did not participate in the speeches themselves, to find common ground amongst themselves, support each other in sentiment, and build trust and a sense of community and culture.

This proposal aims to draw from the aforementioned anthropological knowledge solely in the arena that best points to a means of understanding empathic community practice from a groups-oriented standpoint, while also building upon the author's own experience as a classroom teacher taking steps to build true culture and community in the classroom. The application of our empirically demonstrable patterns of group behavior where empathy is concerned to the question of a more streamlined approach at empathetic pedagogical practice is a venture worthy of undertaking to this end.

GOALS AND PURPOSE

The goal of this research proposal is to cite and pull from both the anthropological data on group empathy behavior that best applies to classroom environments, as well as the psychological data on early childhood attitudes toward concepts such as altruism, empathy, and fairness, and bring both research worlds to bear on the question of what proposed research questions for a hypothetical project moving forward would prove useful.

The purpose of this research proposal is not to conceptualize a literal rubric, as that would be at a stage much later than what these initial research questions would directly address at the outset. Rather, the purpose here is to simply articulate the ways in which the anthropological theory of multi-level group selection overlaps with the latest psychological research on child conceptu-

alization of equity and empathy so that a focused line of thought can be followed in subsequent research on how childhood psychology interacts with classroom environs moving forward. From there, the pedagogical practice this proposal hopes to aid is not literal creation of curriculum or lesson plans but rather a more empirically-grounded rationale for how and why to run an elementary school classroom itself like a close-knit community though teacher mindfulness of this empirical grounding for social-emotional learning (SEL).

In summary, the author wants to propose research that will take the existing literature on empathetic benefits of group/social interaction and apply it to a narrower, more focused context of the elementary school classroom. Elementary age was chosen to be the focus of our research questions because it is that age range that the most current research suggests children solidify their understanding of social emotion and fairness of benefit,[11] and the classroom is the setting of choice for application of community philosophy because that setting brings with it special limitations in relationship dynamics, physical environment, and interaction time that requires a refinement of focus from the existing group selection theory models in order to successfully apply multi-level group selection theory to fair and empathetic pedagogical practice.

RATIONALE

"*Selfishness is almost the definition of vice … Virtue is, almost by definition, the greater good of the group*" - Science writer Matt Ridley.[7]

Multi-Level Group Selection Theory in anthropology has given great insight into how empathetic practice within social groups is advantageous to species propagation. The author submits that something demonstrated to be so naturally occurring and an evolutionary remnant that is innate to humans should also prove useful for building a foundation for further research aimed at helping inform empathetic and community-driven pedagogical practice in the classroom. The aim here is to help the teacher best communicate and collaborate with students, but the rationale is more student- and community-driven.

The anthropological work done already on the social applications of multi-level group selection theory as a means of explaining the more culturally anomalous elements of natural selection in humans shows promising insights into how to go about interaction practice in many realms where interpersonal communication is in play. For us, the classroom is an area yet underdeveloped with this lens in mind.

UNDERSTANDING GROUP SELECTION THEORY AND ITS HISTORY

To best understand what multi-level group selection is and how it connects to our question of empathy in the classroom, we need to start by clearly delineating the key terms we will be using in our description of the group selection process. There are two competing proposed mechanisms for how natural selection moves traits forward in groups:

1. Kin Selection: a proposed mechanism of natural selection in favor of behavior by individuals that may increase the survival of their own bloodline.[8]
2. Group Selection: a proposed mechanism of evolution in which natural selection acts at the level of the group, instead of at the more conventionally-assumed level of the individual.[9]

The 1960s and 1970s had brought the evolutionary biology community the work of biologists George Williams and William Hamilton that, at the time, had been considered the nail in the coffin of group selection theory.[8] However, in more recent years the theory's viability has been revisited and bolstered. While a hinderance at the individual level altruism is shown in the latest literature to actually advantageous at the level of groups.

THE DEBATE BETWEEN KIN AND GROUP SELECTION

If a giving and pacifistic person is pitted against another individual who is an aggressor, the aggressor is much more likely to win and therefore pass on his or her genes to subsequent generations.[8] Furthermore, if we graduate to the level of groups and the giving and pacifistic person exists within a community of selfish aggressors, then that person once again loses—taken advantage of and exploited by others.[8]

If we stay at the group level but flip that dynamic, and a selfish person is dropped into a group of altruists, then we still see selfishness win out (the free rider problem).[8] Group cooperation should hypothetically help human propagation especially, but that force is weaker than anticipated under these aforementioned conditions.[8]

THE NEW FORMULATION OF MULTI-LEVEL GROUP SELECTION THEORY

However, there is still yet one other dynamic that needs to be considered: homogeneous group comparison. What happens when an entire group of exclusively altruistic actors is compared against an entire group of exclusively aggressive and self-centered actors? This should hypothetically demonstrate the advantageous or disadvantageous qualities of self-interest vs. group cooperation in their purest and most innate forms when operating at the community level. Individuals interact within groups almost always, meaning communities and groups must be acknowledged as the most common backdrop upon which natural selection takes place. This fact must be taken into account in order to truly demonstrate which force, group selection or kin selection, truly gives the advantage for propagation.

Pitting homogeneously altruistic groups against clusters of homogeneously self-interested individuals, we see the following result: with no altruistic stragglers within the selfish group to feed off of, the selfish group eats its own in a dog-eat-dog existence and ultimately dwindles its numbers by adding stress, anxiety, cutthroat competition, and more violence into the mix.[10] Contrarywise, the purely altruistic groups induce more fertility, more happiness, less stress, and ultimately greater numbers of offspring.[10] And this occurs with or without the so-called free riders identified by Hamil-

ton and Williams being part of the mix. This suggests that even when selfish individuals take advantage of altruistic groups, said groups still provide the greater net benefit to everyone and are therefore the most effective for further propagation of the species. And of course, if everyone in the group is altruistic, it is much the same outcome. What evolution functioning more effectively at the level of groups would suggest, then, is that altruism is the more advantageous trait, and that the level of groups is indeed the more affecting level at which natural selection operates.

The Stanford Neuroendocrinology, Robert Sapolsky has laid it out as follows: yes, A>B, but also, AA<BB. While individual A might have a trait that dominates the trait of individual B, groups of people possessing the trait of A can be demonstrated as being dominated by the trait of B when B is also operating at the group level.[10] Since creatures interact with each other at the group and community level the vast majority of the time, it is that group level that ultimately ends up dictating a great deal of circumstances that affect the natural selection process. As leading group selection theory, David Sloan Wilson once stated, "*selfishness beats altruism within groups. Altruistic groups beat selfish groups. Everything else is commentary*".[9]

HOW MULTI-LEVEL GROUP SELECTION THEORY CONNECTS TO CLASSROOM EMPATHY

In order to better understand the interactions within the classroom from a multi-level group selection perspective, we need to better understand at what age a child's grasp and command of social emotions fully develops so that we can aim our further research questions at the proper age range and grade level.

Work led by social development psychology, Dr. Peter Blake of Boston University has already helped lay these foundations by establishing that children begin applying social-emotional interaction between the ages of 4 and 9,[6] and that as early as age 6, these children are able to hold fast to a sense of equity—even outside of their own groups in which they could take more resources for themselves and disadvantage others in the outgroup.[11]

What this amounts to in application is that children of this age already demonstrate a knowledge of right and wrong, and even if and when they do something unjust or unfair to a fellow student, they realize what they've done is wrong and that they will be held accountable for the act if found out. This means that elementary school children, even from the earliest age, are primed to respond positively when practices like pro-social classroom structure and SEL are implemented. Despite SEL not yet being ubiquitous, the evidence of its successful adoption is plentiful.[12] The corroborating evidence that children are already at an age to be receptive to SEL at the beginning of elementary school is mounting..[11]

As a result, it is this paper's determination that the proposed research questions here should narrow their focus down to this same age group, and therefore focus on elementary school classrooms when contextualized in pedagogical SEL practice while taking into account what we know about the human need for empathy within groups on an evolutionary level.

HOW CHILD EMPATHY AND AN UNDERSTANDING OF MULTI-LEVEL GROUP SELECTION INFORM SEL

As we have seen through the information we have gathered thus far, the needs of the classroom are social, while SEL is a framework that aims to apply social and empathetic principles to day-to-day classroom learning. We also have seen that there is empirically grounded data that demonstrates an evolutionary aspect of our species' need to practice empathy within groups as a means of mutual benefit and propagation.

While pro-social teaching and SEL practices are continually proposed as the new norms in pedagogical practice and classroom culture, they often get pushback from parents and policy makers alike. Just as recently as February of 2020, an Idaho state education leaders hearing devolved into uproar and walk-outs when SEL was put forth as part of a new policy proposal for teacher training and best practices in the state.[13] Among the reasons often given by those opposed to SEL implementation are that they see SEL as some cult-like movement that is trying to force its way into classrooms,[13] or that the fact that it is gaining national support makes it "problematic".[13]

The elements of SEL, including self-awareness, responsibility, self-management, relationship building, and social awareness, all tether organically to those same needs as manifested in multi-level group selection theory's understanding of empathetic group practice for evolutionary advantage.[12] These elements are key components not just in social-emotional learning, but in advantageous interaction within groups of various types. The literature on the matter of empathic group selection thus far, however, has not brought the focus down to the classroom space, but it is my position that the classroom can itself be seen as a community, and that research aimed at considering a classroom to be a group, much like a kin group or a residential cluster, primed for natural selection to take place at the micro scale can help connect the evolutionary aspects of mutual aid and the more surface-level observations of the benefit of SEL practice in the classroom.

PROPOSAL

What further research to these aforementioned ends should materialize as, in this researcher's opinion, is a small collection of inter-related research projects focusing on different aspects of the project of tethering SEL practice to the empirical bedrock of multi-level group selection theory. By doing this, the naysays toward empathetic classroom practice will have a much harder time at succeeding on the policy implementation level. More white papers put forth in favor of empathetic classroom practice, grounded in empiricism from both the neuroscience and anthropological worlds, stand to further bolster the shift away from what Paulo Freire called the "banking model" of education and towards a more communal concept of what it means to be a learner and a teacher.[14]

For these handful of proposed projects to form, we need to determine what specific research questions could drive each of

them. We also need to make sure that these research questions will inform projects that will have tangible connectivity with practice, and not just theory. For the sake of succinct Ness, we shall limit the number of proposed research questions to three:

1. Are teachers who are predisposed to take a kin selective worldview in other aspects of their lives more or less likely to be receptive to SEL in their classroom practices?
2. Is a classroom organized like a social community for a period of one school year able to reap more positive results when it comes to classroom morale (teacher-student relationships and student-student relationships)?
3. Is a classroom organized like a social community for a period of one school year able to reap a measurable rise in class material retention on average?

In the case of the first research question, the resulting study would be straightforward enough. It would be likely comprised of survey elements on the teacher's end of things, whose results would then be compared against those same teachers' classroom practices, gathered as video data as well as performance reports, to see how many teachers with a more kin selection-aligned worldview also run classrooms more along the banking model than what we would describe as SEL.[14]

The second question would likely be a comparative study between two classes of the same subject and grade level, but with one maintaining the more traditional class structure and the other restructuring to make the classroom run more like a co-op in which mutual aid and more partner-oriented teacher-student interaction would guide the class days.[14] What the study would compare in this case would first be a self-reported final survey at year's end by students stating whether or not they felt a sense of trust and community with their fellow classmates and teacher. At that point, a subsequent comparison would be made between classes regarding average class subject retention *via* respective final exams.

For the third question, there would likely need to be more involved, as it could take one of two forms: 1) either a longitudinal study following the same classroom(s) over the course of two academic years—one year without classroom restructuring, and then a second year where the classroom environment would be remodeled to resemble more of a communal, mutual-benefit model, and then compare the academic retention (likely *via* a cumulative test result)of both years, and 2) as a comparative study much like study two where two classrooms of the same subject are structured differently and then their retention results are compared side-by-side at year's end.

The complications of the first model would come when not all of the same students would remain in the same class the following year, as well as whether or not a school would be willing to utilize the same teacher to teach the same subject two years in a row, one grade up. It's also arguable that the higher grade the following year would necessitate too drastic a class content shift for the longitudinal comparisons to be representative. This leads me to believe that if such a research question were to find funding, the study would likely take the form of the comparative model rather than the longitudinal, which still isn't perfect but stands to be more financially feasible and time-efficient. However, the main point is that whichever form it takes, this study (and the other studies along with it) feasibly could be conducted, which means that our proposed research questions are sound starting points for potential research projects to get off the ground.

The data gathered from these studies could then provide us with better insight on the benefits of applying communal practice and social-emotional learning to classrooms, not just from a standpoint of surface-level measurements of class performance but also from a deeper, more innate perspective of emotional well-being, with these studies backed by anthropological data and justified by the latest data on child psychological understanding of empathy and fairness, all coming back into the fold to further support SEL and pro-social classrooms as not only inevitable, but necessary.

CONCLUSION

The impact these studies stand to have on the broader culture of education would be largely equitable, ensuring that all students from all demographics would be encouraged by like-minded teachers to further propagate their applied learning for mutual advantage and benefit while also exciting each other about what they learn by finding shared relevant experiences and desires to make relevant connections to. The tasks in the classroom can be customized to the organic classroom culture that forms from these connections. This practice stands to become normalized and ubiquitous across locations and economic brackets when and if empirical studies like those suggested above demonstrate the soundness of its application.

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Original Research

Comparison of Body Composition between Pre-Menarche and Post-Menarche Sabar Girls of Purulia District, West Bengal, India

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ABSTRACT

Background
It was known that menarche plays a significant role to change body composition during adolescence. And there is a paucity of information on body composition in relation to pre- and post-menarcheal status on comparative manner among the tribal adolescence girls of West Bengal, India.

Objectives
To assess the body composition and compare the relative distribution of fat between the pre- and post-menarcheal girls and to explore the impact of body composition on menarcheal status among the Sabar tribal adolescence girls of the Purulia district, West Bengal, India.

Methods
The present cross-sectional study was conducted from three different blocks of Purulia district during June 2019 to December 2019. A total of 65 adolescence girls were randomly selected from the aged between 10 to 18-years. Among them, 34 girls were post-menarche stage and 31 girls were pre-menarche stage. Anthropometric measurements (height, weight, triceps and sub-scapular skinfolds) were measured. Spearman's rho correlation coefficient and Mann-Whitney *U*-test, Binary logistic regression were performed through SPSS version 25.

Results
It was depicted that significant differences were found in all anthropometric and body composition characteristics between the pre and post menarche state. The mean values of percent body fat (PBF), fat mass (FM), fat free mass (FFM), fat mass index (FMI) and fat free mass index (FFMI) in pre-menarche girls were 14.61%, 4.45 kg, 24.35 kg, 2.33 kg/m^2 and 13.08 kg/m^2, respectively. Similarly, the mean values of PBF, FM, FFM, FMI and FFMI in post-menarche girls were 20.37%, 8.07 kg, 31.00 kg, 3.70 kg/m^2 and 14.29 kg/m^2, respectively. The results of Spearman correlation coefficients (r) showed that the body composition measures were significantly correlated with the anthropometric variables except FFM and FFMI among the post-menarche girls. Menarcheal status of the Sabar tribal adolescent girls of Purulia district was pretentious of PBF and FFM.

Conclusion
The body composition characteristics were significantly different between pre- and post-menarche-state. So, further study in larger augmentation is required to validate the present findings.

Keywords
India; Tribes; Sabar girls; Menarche; Body composition.

INTRODUCTION

Menarche is a state that is started after the first occurrence of menstruation. It's major role on the development of both physical and sexual health.[1,2] In general, menarche is started after significant skeletal maturity,[3] and occurs during 6-months to 1-year after reaching the maximum growth spurt or peak height velocity.[4] The onset of menstruation impacts to physiological and psychological[3] changes in a woman's reproductive life.[5] Many studies reported age at menarche is influenced by nutrition, body composition, socio-economic and physical factors.[6,7] Earlier studies mentioned that onset of menarche tended to occur later in girls who consumed vegetarian diet.[8-10] In contrast, another study found socio-economic factor such as occupation, education, and household income of the parents were not related to the age at menarche.[11] More importantly, menarche is influenced by genetic, environmental and socio-economic factors, which produce significant variation between population.[4,12,13] There was a vast variation of affecting factors on age at menarche. Menarcheal age was associated with nutritional factors, which influence the age at menarche mainly through their effects on accumulation of adipose tissue.[14] It is recognized that body size and body composition are strong predictors of the initiation of menarche.[15] It was documented that mean age at menarche has been decreasing 4-months per decade and menarcheal age stabilized at 12.8-years by the mid 20th Century.[16] Age at menarche is lower in developed countries than the developing countries. This difference is generally happened due to differences of socio-economic condition, particularly nutrition.[17] While adolescent girls decrease their physical activity during puberty, their weight is increases and its impact on fatness and menarche occurs due to leptin secreation.[18] The process of biological maturation influences the anthropometric characteristics.[19,20] The adolescent period, including puberty is a unique period of hormonal, psychological, cognitive and physical changes and these changes have to face with emotional, social and behavioral dimensions.[21,22] Puberty become faster and reach menarche at an earlier age among overweight girls.[23,24] Among the thin girls, if menarche is started earlier then there is a trend to gain weight rapidly.[25] Earlier age at menarche had also related with higher body mass index (BMI), waist circumference, blood pressure, glycated hemoglobin and a worse lipid profile during adulthood.[26]

According to census 2011, the tribal population was 8.6% of the total population of India. The Sabar is one of the primitive Mundari speaking tribe widely spread over hill regions of Orissa, Madhya Pradesh, Andhra Pradesh, Jharkhand, and West Bengal. A total of 40 tribal groups are found in West Bengal and Sabar is one of the major tribe in this state. They are mainly concentrated in Purulia, Bankura and Midnapur distract and adjoining areas.[27] According to the census 2011, the total population of Sabar in West Bengal and Purulia district were 40374 and 6914, respectively.[27]

Different studies had been shown that the significant difference in body composition between pre- and post-menarcheal girls and these differences vary from racial to racial group.[28-30] It is evident that the amount of body fat in post menarcheal Bengali girls had greater than their counterpart.[31,32] It is well established that anthropometric measurement like skinfold thickness is an useful indicator to assess body composition in all age groups.[33] An earlier study reported that the anthropometric and body composition characteristics had significantly higher mean values in menarcheal group than pre-menarcheal group.[32] In view the above facts, the present study was undertaken to compare the body composition characteristics between pre-menarcheal and post-menarcheal girls and to find out the impact of body composition on menarcheal status of the adolescence girls of the Sabar tribe of Purulia district, West Bengal, India.

MATERIALS AND METHODS

The Setting

This cross-sectional study was carried out during June 2019 to December 2019 on the Sabars community at three different blocks (Barabazar, Banwan and Manbazar-II) under the Purulia district of West Bengal, India. These blocks are highly Sabar concentrated area of the district. The study area is situated at the border of area of Jharkhand and West Bengal. All three blocks are situated approximately 225-255 km away from Kolkata, the provincial capital of West Bengal.

Samples

The data were collected from three different blocks of Purulia district, West Bengal. The participants were selected from all girls above the age of 10-years-old for the present study. Mean age at menarche was almost 13-years age (12.87-year). During analyzing the data, we eliminated the data from above 15-years age and before 11-years age and also there were another reason that we were selected before and after two years from mean age at menarche. This short age range was designed to minimize the effect of age on anthropometric traits. The final sample size included in the analysis is 65 individuals. The estimated sample size (26 from each group) was computed by standard formula: $n_i = 2\left(\frac{z\sigma}{ES}\right)^2$ Where, n_i is the sample size required in each group, value of z at 97% confidence interval is 2.17. Standard deviation (σ) is 5 of PBF, and E is the margin of error (3). Age of the girls were ascertained from the birth certificate. The study protocol was approved by the Institutional ethical committee of SKB University prior to conduct the survey.

Anthropometric Measurement

All are anthropometric measurements were taken by a trained girl. Height was taken using Martins anthropometric rod to the nearest 0.1 cm. Weight was taken using spring balance weighing machine to the nearest 0.5 kg. Skinfold measurement such as Triceps (TRISKF), Biceps (BISKF) and sub-scapular skinfold (SUBSSKF) thickness were measured to the nearest 0.2 mm using Holtain skinfold calliper.

Assessment of body composition: Percent body fat (PDF) were calculated with two skinfold thickness i.e. Triceps skinfold (TRISKF), sub-scapular skinfold (SUBSSKF). PBF derive using standard Formulae developed by Slaughter et al.[34] These equations were:

Girls: PBF=1.33 (TRISKF+SUBSSKF)-0.013 (TRISKF+SUBSS-

KF)-2-2.5

The fat mass (FM) was calculated following the standard equation:

FM=(PBF/100)×body weight (kg).[35]

FFM=Body weight (kg)-FM (kg).[35]

The FM and fat free mass (FFM) were then divided by height-squared in meter to assess the fat mass index (FMI) and fat-free mass index (FFMI), respectively.

Statistically analysis: Mean age at menarche was calculated through descriptive study. Due to small sample size and non-normal distribution non-parametric test were employed. Independent sample Mann-Whitney *U*-test was performed to test significance difference between pre- and post-menarche state. Spearman's rho correlation coefficients were used to evaluate the relationship between anthropometric and body composition variables and binary logistic regression were used to identify the variables which were impacts on menarcheal status. All statistical analyses were performed using the statistical package for social sciences (IBM® SPSS, version-25).

RESULTS

The mean (SD) age at menarche was 12.87 (±0.92) years among the Sabar adolescence girls of Purulia districts. Out of 65 girls, 34 girls were pre-menarche stage and 31 girls were post-menarche stage. The mean values of anthropometric and body composition measurers were higher among post menarche girls compare to pre-menarche girls. The mean difference between pre-menarche and post-menarche girls of the height, weight, BMI, TRISKF, SUBSSKF were 10.26 kg, 11.22 cm, 2.56 kg/m^2, 3.19 mm and 3.60 mm respectively (Table 1).

Table 2 indicates body composition characteristics i.e. PBF, FM, FFM, FMI and FFMI among the studied girls. It was noticed that the post menarche girls had significantly higher mean values of body composition measurers than pre-menarche girls. The mean difference between pre- and post-menarcheal girls of PBF, FM, FFM, FMI and FFMI were 5.75%, 3.62 kg, 6.65 kg, 1.37 kg/m^2 and 1.21 kg/m^2 respectively. All body composition measurers showed significant differences between pre-menarche and post-menarche girls (*p* value<0.001).

Table 3 represents the Spearman's rho correlation coef-

Table 1. *Anthropometric Characteristics Among the Pre Menarcheal and Post-Menarcheal Sabar Girls*

Anthropometric Variable	Pre-Menarche (n=34)	Post-Menarche (n=31)	Difference (+)	Mann-Whitney U
Weight (kg)	28.30 (6.34)	39.07 (4.96)	10.26	117.0***
Height (cm)	135.90 (7.70)	147.13 (4.97)	11.22	124.0***
BMI (kg/m^2)	15.43 (1.96)	17.99 (1.56)	2.56	164.0***
TRISKF (mm)	7.65 (3.03)	10.84 (2.91)	3.19	192.0***
SUBSSKF (mm)	7.92 (3.10)	11.53 (4.10)	3.60	243.0***

*Level of significance ***=p<0.001*

Table 2. *Descriptive Statistics on Body Composition Measurer Among Pre and Post-Menarcheal Sabar Girls*

Body Composition Parameter	Pre-Menarche (n=34)	Post-Menarche (n=34)	Difference (+)	Mann-Whitney U
PBF (%)	14.61 (4.86)	20.37 (4.04)	5.75	182.0***
FM (kg)	4.45 (2.52)	8.07 (2.30)	3.62	138.0***
FFM (kg)	24.35 (4.10)	31.00 (3.33)	6.65	117.0***
FMI (kg/m^2)	2.33 (1.76)	3.70 (1.53)	1.37	166.5***
FFMI (kg/m^2)	13.08 (1.07)	14.29 (1.09)	1.21	234.5***

*Level of significance ***=p<0.001*

Table 3. *Spearman's Rho Correlation Coefficient between Anthropometric Measurements and Body Composition Variables of the Pre-Menarche and Post-Menarche Girls*

Anthropometric Parameter	Pre-Menarche					Post-Menarche				
	PBF	FM	FFM	FMI	FFMI	PBF	FM	FFM	FMI	FFMI
Weight	0.688**	0.889**	0.983**	0.796**	0.832**	0.458**	0.750**	0.885**	0.690**	0.667**
Height	0.602**	0.793**	0.900**	0.639**	0.594**	0.425*	0.589**	0.522**	0.465**	0.051
BMI	0.644**	0.800**	0.875**	0.808**	0.945**	0.396*	0.643**	0.809**	0.658**	0.855**
TRISKF	0.918**	0.814**	0.476**	0.843**	0.333	0.665**	0.627**	0.211	0.605**	-0.001
SUBSSKF	0.931**	0.913**	0.623**	0.943**	0.565**	0.891**	0.839**	0.066	0.865**	-0.048

*Statistically significant level=*p<0.05, **p<0.001.*

ficients between anthropometric measurements and body composition characteristics. Among the pre-menarche girls, all body composition measurers were significantly correlated with anthropometric characteristics except TRISKF with FFMI. But among post menarche girls, FFM and FFMI were not significantly correlated with TRISKF and SUBSSKF. On the other hand, height was also not correlated with FFMI.

Binary logistic regression has been performed to assess the impact of body composition measurers on their menarcheal status. The model is contained four body composition variable (PBF, FM, FFM and FMI). We have excluded FFMI by step forward. Though sample size is small. The model as a whole explained between 47.5% (Cox and Snell R square) and 63.3 % (Nagelkerke R squared) of the variance in menarcheal status, and overall correctly classified 83.1% of cases (Table 4). In the Table 5, only two variables made a statistically significant contribution to the model (PBF and FFM) (p value<0.001) and most predictors variable was PBF (OR 3.677) followed by FFM (2.018).

DISCUSSION

In the present study it was found that the all body composition measurers and anthropometric characteristics were significantly different between pre- and post-menarche girls. Similar results reported by earlier studies.[32,36] Majority of anthropometric characteristics were positively correlated with body composition characteristics among pre-menarcheal girls. In post menarcheal girls, height with FFMI and TRISKF and SUBSKF were not correlated. BMI has a high correlation with total body fat and percentage of body fat in children and adults.[37] Increase in fat mass and body weight was the main fact behind these differences.[36] Moreover, FFM had greater impact on menarcheal status other than all body composition characteristics as found in the present study. Silimarly, PBF also had an impacts on menarcheal status but early menarche, longer reproductive years, and menopause were significantly associated with increased body fatness, which was assessed by BMI, waist circumference, PBF and abdominal fat.[38] More importantly, weight, height, abdominal and suprailiac skinfolds were associated with the onset of menstruation. But after controlling for age and body weight, timing of menarche were not associated with total dietary energy, protein, lipid, and carbohydrate intakes.[8] FFM and fat mass were significantly greater mean value in the pubertal group than pre-pubertal group.[39]

In the present study, the mean age at menarche was 12.87-years which is similar with other studies[15,40] but greater than a another report.[41] It was well documented that there is significant difference in body composition and onset of menarcheal age between low and high socio-economic class. In high economic class, both values are higher in compared to low socio-economic class.[42] The initiation of puberty with menarche is directly related with BMI, fat mass, and leptin and only as a partial modifier of menarche in terms of a discrete acceleration of menarche in overweight and obese girls.[40] Many studies were reported the association of body size menarcheal age and of body fat as measured by BMI.[11,14,17] There is tend to occur first menstruation is related to the fat deposition in both lower and upper body region. While changes in lower body part (hips circumference and pelvis breadth) tended to peak preceding first menstruation and changes in upper body part (triceps and subscapular skinfold thickness) is reached peaked in the year following first menstruation.[43] Leptin works as a regulator of body weight and serum level which are strongly associated with both BMI and fat mass. Higher BMI and PBF in girls were more advanced in their maturation status compared to girls with low BMI and PBF.[44] Peak mass or BMI of pre-menarche girls are increased during onset of menarche which are not affected as much compared to the post-menarche groups' BMI.[45] Body

Table 4. *Classification Table of the Cases*

Observed		Predicted		
		Menarche Status		Percentage Correct
		Pre-Menarche	Post-Menarche	
Menarche status	Pre-menarche	28	6	82.4
	Post-menarche	5	26	83.9
	Overall percentage			83.1

The cut value is 0.500

Table 5. *Results of Logistic Regression Analysis Between Dependent and Independent Variables*

Body Composition	B	SE	Wald	DF	Sig.	OR	95% CI for OR	
							Lower	Upper
PBF	1.302	0.632	4.252	1	0.039	3.677	1.067	12.679
FM	-0.611	1.269	0.232	1	0.630	0.543	0.045	6.525
FFM	0.702	0.278	6.373	1	0.012	2.018	1.170	3.481
FMI	-4.503	2.875	2.452	1	0.117	0.011	0.000	3.105
Constant	-25.383	9.870	6.614	1	0.010	0.000		

**Dependent variable-menarcheal status; Predictor variable: PBF, FM, FFM, FMI*
B: Regression coefficient, SE: Standard error of B, DF: Degree of freedom, OR: Odds ratio

fat was not related with menarche independently. Whenever body weight was taken into account, the relationship between skinfold and menarche disappears but body weight and menarche is associated with each other[17] but in the present study PBF was related with menarche independently. Although, BMI and body composition parameter (PBF, FM, and FMI) are related each other, as assessment of body fat from skinfolds thickness gives a more direct result of body fat mass.[46] All body composition characteristics were significantly higher in post menarcheal girls compared to pre-menarcheal girls in both Japanese and Caucasian groups.[30]

CONCLUSION

In conclusion, body composition characteristics were significantly different between pre- and post-menarcheal status among the Sabars tribal girls. Present study found that BMI was highly correlated with PBF and FM. More importantly, FFM and PBF of the body composition characteristics had a significant impact to menarcheal status of the Sabar tribe. Therefore, similar study should be conducted among the girls of the other population in varied setting to understand the pattern of body composition characteristics on pre- and post-menarcheal state.

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CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

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Opinion

Why Denisova Cave is Important for Paleolithic Culture?

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The first discovery of Denisovans in 2008, a partial finger bone, provided scant evidence of their skeletal characteristics. Subsequent deoxyribonucleic acid (DNA) analyses, however, offered a wealth of information on this hominin population. The DNA sequencing demonstrated that Denisovans coexisted with other hominins such as Neanderthals or *Homo Sapiens* in the Middle Pleistocene. Genetic information demonstrates that Denisovans was a sister group to the Neanderthals and interbred with modern humans, explaining why the people living in Melanesian islands carry five per cent of Denisovan genes.[1] In the past few years, key artefacts supporting the genetics have surfaced stone tools, bone points, tooth pendants, and the like. However, one class of objects is the most significant, the knapped stone tools of the Denisovans. The manufacturing of these tools clearly demonstrates that the Denisovans had been close enough to both Neanderthals and Modern Humans for intercultural communications.

To study the diversity of middle Pleistocene transition (MPT) and the culture of the earliest *H. sapiens*, recent discoveries of the presence of early *H. sapiens* in Asia, paleoanthropologists and bioarchaeologists focused mainly on hominin fossils of the European continent ignoring Asia and specifically the area of north of Himalayas, the Barents Sea.[2] However, extensive archaeological excavations in Siberia led by Anatole Derevianko et al3 suggest that there are continuous sequences of tool industries from Middle-to-Upper Paleolithic.[2] Moreover, new geochronological methods at Denisova Cave supported the evidence of continuous lithic culture without interruption between homo species is certain in this massive expanse.[3]

Although the Mousterian industry was prominent among Middle Pleistocene hominids, no trace of Neanderthal's Mousterian lithic culture was recovered from Denisova Cave until now, despite the unquestionable hybridization between the two hominin populations.[3] Considering layer 11 and its boundaries, especially in the east chamber of the cave, an intriguing question is whether the Denisovans utilized both the Middle and the Upper Paleolithic industry simultaneously.

Furthermore, this techno-complex is unusually ordered through time. Besides, in addition to stone tools, bone materials and more fitting tooth pendants in the cave demonstrates the presence of early Upper Paleolithic Culture. We have this complete dating thanks to optically stimulated luminescence (OSL)-method—optically stimulated luminescence—by Centre for Archeological Science at University of Wollongong, Wollongong, Australia.[3]

At other North Asian sites such as Malaya Sya and Kara Bom, Laminar Levallois appears to have been the dominant technique of lithic production[2] shown to have developed over a period of 100,000-years in Denisova.[3] Even farther south in Obi-Rahmat, Uzbekistan, in an independent way, the Levallois technique persisted for 80,000-years.[2] Additionally, aesthetic attempts related to bone industry and decorative pendants date to 45,000-years ago in Kazakhstan as well as Denisova, which suggests that Northern and Central Asia populations communicated during their coevolution.

The oldest Paleolithic Specimens in Denisova Cave are associated with the unifacial and bifacial big flake cores of archaic laminar tendencies, dating back to between 195,000 and 122,700-years ago in the Middle Pleistocene.[3] Toward the Upper Paleolithic sequences around 45,000 and 40,000-years ago, there appears to be a perpetual development to the thinner blades connected to knapping the cobbles, especially on ventral faces. Regional sites with cultural continuity independently indicate that Denisovans not only interbred with Neanderthals and modern humans, but they were also close enough for cultural communications.

Regional evolution of *H. sapiens* and industrial continuity from Middle-to-Upper Paleolithic has been shown in numerous sites in the North and East Asia,[2] given the transition between Dali and Liujiang crania in Shuidonggou, "*and Denisova alongside a cultural convergence -- from the Levallois technique to the blades — dating back to 50,000 and 40,000-years ago*".

Northern Asia from Urals to the Barents Sea, Central Asia encompassing Uzbekistan and Kazakhstan, and the far East including China and Mongolia all indicate uninterrupted, independent evolution of hominin species. Therefore, to thoroughly apprehend the origins of *H. sapiens* and their Upper Paleolithic Techno Complex, it is necessary to carry out more excavation research and post-excavation analyses therein.

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Obituary

The Life of One Patient - Memories of Dr. Paul Farmer (1959-2022)

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"*It always seems impossible until it's done*".
- Nelson Mandela

"*Christians have not done enough in this area of conversion to the neighbor, to social justice, to history. They have not perceived clearly enough yet that to know God is to do justice. They have yet to tread the path that will lead them to seek effectively the peace of the Lord in the heart of social struggle*".
- Gustavo Gutierrez

Doctor Paul Edward Farmer passed away on 21 February, 2022 of an acute cardiac event in his sleep at University of Global Health Equity (UGHE) in Butaro, Rwanda, an institution which he helped found. Launched in September 2015, UGHE is a new kind of university focused on delivering the highest quality of health care by addressing the critical social and systemic forces causing inequities and inefficiencies in health care delivery. That week, Paul had been teaching and treating sick patients, one of which passed away from complications of late-stage acquired immune deficiency syndrome (AIDS), a young man in his mid-thirty's whom Paul had cancelled a trip to Sierra Leone for. He was devastated when he lost the patient, after trying out different life-saving therapies, interventions, and possible hospital transfers to save the life of one patient. A few days later, exhausted and in bed to rest for only a few hours, the man who had the world's biggest heart, himself died away of a cardiac event. Part of me thinks that Paul internalized the pain his one patient was suffering.

Despite the life of prodigious, accomplished achievements - a MacArthur "genius" award in 1993, member of the Academy of Arts and Sciences and the Institute of Medicine of

the National Academy of Sciences, from which he was the recipient of the 2018 Public Welfare Award, co-founder and self-described "chief strategist" (he gleefully commented) of Partners In Health (PIH), Kolokotrones University professor at Harvard Medical School, comfortably wrestling between the foundations of power and the "*poorest of the poor*", Paul lived his life in contrast.

Here are just a few metrics from PIH and what the nonprofit has accomplished since its inception in 1987: 2.8 million outpatient visits in supported clinics, 2.1 million women's health checkups around the world and over 2.1 million home visits conducted by community health workers.

Paul and I were so close. I imagine part of it was his trying to grapple with being a medical anthropologist and a practicing physician, having left his family so many times to be in the field with his patients. He understood that I myself was a child who grew up as a third culture kid in the field of anthropology, and during my childhood and adolescent years, I was left with my sisters in Northeast Brazilian pharmacies hearing about the maladies of poor peasants while my mother conducted social epidemiological research for her masterpiece "*Death Without Weeping*", a book Paul often told me was one of his favorite ethnographies and which had an immense influence on his own writing in Haiti, and later Rwanda.

Another aspect of our over 30-year friendship was that I knew Paul since he was a medical student. I saw him develop his own brand of activism, and I while my mom had mentored him at a critical juncture in his life, so had he played that role for me in my own development, which ultimately led me to the field of global public health.

He wanted to know that he was a good father and was it OK that his priority was to the poor, the life of one patient. His daughter, Katherine, during a ceremony at Trinity Church in Boston on March 12th, 2022, described perhaps my favorite story (and there are so many) of Paul. During the last couple of years amid the coronavirus disease (COVID) pandemic, Paul spent more time in Miami with his three children and wife Didi Bertrand and had an abundant garden outside which he spent several hours working on. At one point working in the garden, he turned to Katherine with tears welled up in his eyes, and almost apologetically said, "*I had to do this work. I had to do it. And if I had the chance to do it all over again, I would have done the same thing*". Kathrine embraced her father. She understood, and she was OK with it. He always led with love, he led with compassion.

I wanted to make sure that I sent some memories from Paul's teachers, mentors, and friends, to capture who he was – and how he will be remembered. All of us agree, that we must do the work to bring good trouble in medicine and medical anthropology to light.

"*Dear Arachu and friends,*

We must all have so many memories of Paul. I first met Paul when he was an eager undergraduate at Duke University and then much later as anthropologist-physician at Harvard. (All Duke flags on campus will be lowered through Wednesday in his honor.) Then of course Paul went to Haiti. One day in Berkeley Paul showed up to my crowded house asking for a couch to sleep on. The next morning Paul was in the kitchen washing dishes with our former Gov. Jerry Brown, then Mayor of Oakland. At one point we bumped into each other during the end of Cuba's human immunodeficiency virus (HIV)/AIDS sanatorium.

Paul inspired so many people and organizations to fight epidemics, social and political injustice, and the basic needs of the world's sick-poor. He argued for a political economy of death counts (à la German anthropologist, Rudolf Virchow). As a physician-theologian, Farmer had a unique ability to capture the embodiment of institutionalized violence and suffering. In addition to fighting the bureaucratic global international health regime Paul carved out time to heal the sick. His double consciousness as a physician-anthropologist, a policy maker and a healer, an activist and a theologian, Paul was able to work between his philosophical critical thinking and his feet-on-the-ground 'being there' anthropologist. At times there was a certain world-weariness as he made his back through capitalist foundations and the everyday sickness of needy bodies, just as he was impatient with medical anthropologists. He wanted more, much more from us. I remember Paul saying that he refused to listen to one more Haitian story of 'sorcery-sent' illness when it was 'for-profit medicine' that was to blame for the dead.

With tears and love",
Nancy

Nancy Scheper-Hughes, Chancellor's Professor Emerita
Department of Anthropology, University of California Berkeley

"Dear Nancy and all,

Thank you for sharing these wonderful words...My own friendship with Paul happened around our mutual admiration for Cuban public health and one of my other heroes and dear friend, Jorge Pérez, copied here too. Paul was so gracious that when we decided to make the film SALUD! he was eager to share his thoughts on film and was a major influence in turning the documentary from a feature on Cuba's international health teams into a much deeper look at the reasons why poor people the world over don't have access to what makes them healthy, including decent public health systems. As you all know, Paul slept very little--his work, his patients, his writing, and activism all-consuming. But when he arrived in Cuba, as Tracy Kidder described in his book: "When we got to our hotel, Farmer said, 'I can sleep here. Everyone here has a doctor. ´ He lay down on his bed and within a few minutes he was asleep...."

Rest in power, dear Paul. We need to do so much more to live up to your legacy.

Warm regards to everyone and un abrazo",

Gail Reed, International Director of Medical Education Cooperation with Cuba (MEDICC)

"He was so admirable a human being in so many ways. And the outpouring of emotion for him almost everywhere speaks to his true place at the moral core of humanitarianism, global health, social medicine. medical anthropology, infectious disease research and practice and more. As he said in a message two days before he died, he was my symbolic son, and the tragic irony of history is that he pre- deceased his mentors. He influenced me so very much and I loved him. it was a 40-year relationship, and I had the full measure of Paul, so extraordinary were his virtues, his vision, his down to earth humanity, and the lightness of being he animated. Paul is irreplaceable, but we will all struggle to pick up the burden and continue his work and your work to repair the world. Because you, Nancy Scheper-Hughes, modeled for him productive ways of destabilizing the status quo and reframing the future to privilege the wretched of the earth. Blessings in his memory on all of us who care".

-Arthur Kleinman, PhD advisor, and Professor of Medical Anthropology, Department of Global Health and Social Medicine, Harvard University

"Paul gave everything - everything - to others. Life was not about what he could do for himself. It was about what he could do for others, and in that, life's successes were measured. When I told him I was writing about trade unions for my undergraduate honors thesis at University of California (UC), Berkeley, USA he chided me for thinking so linearly about institutions and how they relate to the very worst off in society (reminding me of the veil of ignorance theory by late Harvard philosopher John Rawls). He said, "Trade unions represent trade union interests. Never forget the poorest of the poor" he quipped. Paul Farmer described himself as a "cracker from Florida"".

He used to come up to University of North Carolina (UNC) from neighboring Duke and fell in love with the field of medical anthropology while auditing my mom's classes. He also fell in love with Haiti then and decided to go down there and volunteer. If Paul were not a physician-medical anthropologist, perhaps he would have been a missionary, a saint, maybe even a Chief Executive Officer (CEO) in a boardroom. He certainly had the gravitas and focus for that. Quiet in a room, you could always feel his presence, his power.

When I saw him this past November 2021, I was lucky enough to joke about the old times in North Carolina (NC), agree to an imminent trip to West Africa, talk about his upbringing, and keep it light in the face of global epidemics (and a pandemic). I told him I had lost my iPhone in a Harvard cab, and he smiled, "*Isn't that great though, to be without it?*" The last meeting, I reminded him what our family likes to call him, "Saint Paul". He beamed. His smile was infectious.

When I was at a low point in my life in 2010, I went out to Boston to spend time at PIH and seek solace, a quiet guidance from him since I have known him since I was a kid in North Carolina. Lost, I found my way, since he recommended an Master of Public Health (MPH) program and set up a fortuitous meeting with his PhD advisor, Dr. Arthur Kleinman at the Asian Center at Harvard.

One time in 2017, I had asked his assistant, Katherine, to set up a meeting in downtown Boston. "*Paul is running late and had to see patients in Haiti. But he is on the next flight to see you*". I met Paul in a downtown restaurant, where he plotted down with a bag full of stethoscopes and was in route later to Amsterdam and then West Africa, where we had been discussing a possible trip together to see patients. He wanted to know how my nascent engagement was going at the time. He often quoted Gustavo Gutierrez, the liberation theologian. Paul and I talked fondly of our mutual friend, Tolbert Nyenswah, who was Liberia's deputy minister of health for disease surveillance and epidemic control from 2015-2017, during the Ebola crisis.

In 2021, when another colleague asked if Paul could speak for United States Agency for International Development (USAID) in Washington, D.C., he cleared his schedule and made it happen.

More than anyone, he reminded me that social justice is in my family's deoxyribonucleic acid (DNA). "*You can't avoid it*" he would say. He made you feel like the most important person in the room and often stared through you - directly and without distraction (a technique he invariably picked up from Bill Clinton). Paul was wickedly funny, engaging storyteller, genuine, kind, humble, warm, irreverent, perennially optimistic in the face of an unfair world, vivacious, raw, attentive, thoughtful, and decent. Moreover, a decent soul who walked this earth dedicated to a less crooked world, never losing that faith, a faith rooted in humanitarian ethics. "*The idea that some lives matter less is the root of all that is wrong with this world*". Like Tracy Kidder, the author of Paul's biography, "*Mountains Beyond Mountains*", I also like to think that he died happy, although I know he also carried the pain of the life his one patient he could not save to bed. Again, in his world of contradictions, he was straddling the world of suffering and the world of hope. Rest in Peace, dear brother.

-Nate Hughes, Senior Director, Business Development at Peachtree Bioresearch Solutions

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Short Communication

A Short Enquiry on Social Anthropology in Mathematics

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ABSTRACT

Mathematical anthropology is a well-known subject of anthropology research nowadays. Mathematical anthropology solves intriguing and significant difficulties in anthropological theory. Several publications and books have published articles or scientific papers by notable scientists on this topic. The mathematical anthropology analysis fast and improvised that particular field exclusively in the framework of kinship. Several scientists have studied mathematical analysis of genealogy, kinship terminology, and culture theory, among other topics, but "*Social Anthropology in Mathematics*" is a new field of social anthropology, not a replacement for mathematical anthropology. It uses some simple mathematical formulas to explain any social anthropological investigation. The study of social anthropology in mathematics requires the use of simple mathematical formulas. This is the subject of the current brief communication.

Keywords
Mathematics; Anthropology; Lineage; Clan, SET theory; Culture.

ANTHROPOLOGY IN MATHEMATICS

In mathematics, there has long been a divide between mathematical snthropology and social anthropology. Mathematical Anthropology is a distinct branch of applied mathematics in which mathematicians and anthropologists work together to address many forms of anthropological concepts and hypotheses. Mathematical anthropology is a pure and fundamental field of study. Expert mathematicians and anthropologists with a good understanding of higher mathematics are probably the best candidates for this job. Students with an anthropology background have almost certainly tried to pique their interest in this field by incorporating the concept of anthropology into mathematics. Indeed, social anthropology in mathematics does not cover the entire field of pure mathematical anthropology. This course or lance, though, could be compensated for the scholar's mathematical curiosity by the practice of simple mathematical creation of social and cultural anthropology ideas. The central means of the concept of social Anthropology in mathematics could be a few simple principles, symbols, and equations from elementary mathematics. The goals of both thinking are distinct from one another. Mathematical anthropology entails determining the reality in society, implying that anthropology theory cannot exist without mathematics to some level. "*Mathematics is the mother of science—while social science theories have their roots in this discipline, it has gloried and endured for all*". Higher mathematics is not required for outstanding anthropology study. In this case, anthropology in mathematics is required.

The concept of 'Genealogical mathematics has appeared fundamental to work several in fields. In social anthropology, genealogies as such are the primary method for fieldwork.[1] Consequently, a recent study has occurred on clan and lineage. The lineage has been experimented with by the directed line of the segment of vector and scalar properties. Properties of vector and scalar theorem applied analogically. The study tried to enlighten on a relation between lineage and directed line segment and has existed or not in the perception of the analogical approach. Simple to know-two positions have determined their origin and the other latest point. Origin is not an actual locus, so it may be termed as 'Apical ancestors' because origin could not be able to calculate certainly for its long backward direction. The terminal position signifies the locus that presents the latest generation, and it will be going in the future. So, therefore one thing has cleared that lineage has a direction, and draw a straight line between these two positions in genealogy, and we have usually found a straight line that contains several loci of persons. This straight line has characterized by its magnitude and having a direction. The study shows that apical ancestors and their latest generation made the straight line due to the transmission of clan taboos on genealogy. At that moment, we know that every lineage has two dimensions meaning "*Maximum and Minimum lineage*" according to the theory of kinship. Every successive parental

stalk in time and space - is carried out by a substantial number of directed line segments. These line segments are discussed or proved by the triangle and parallelogram or *p*-system graph theory. The study had intended to exercise the overview of male or female line inheritance patterns by using analogically directed line segments of vector and scalar quantities. Though, the investigation does not mention the other properties of the vector. Genealogy has categorically acted as a catalyst has seen, and in this approach-the 'Genealogy' method is essential in the domain of the study of analogical magnitude fields where time and space have been seen.[2] Biswas et al[3] have also shown the following diagram for their study.

Diagram 1: Lineage Straight Line with Direction

Imagine you are drawing a hypothetical genealogy from the first generation to generation six. Then you will get a straight line under the dimension of patrilineal (male to male) or matrilineal (female to female).

Gen-I ⟶ Gen-VII

[that straight line is drawn based on kinship, and it could be considered as the line which has a unique direction from ancient to present and future]

Diagram 2: Initial and Terminal Position

Now you think this a way that on the straight-line Gen-I represents as an initial and Gen-VII as terminal position then we find;

A (initial point) ⟶ B (terminal Position

[A=Gen-I and B=Gen-VII]

Some scholars have described culture as energy in an anthropological context - the components of culture are two types: one is its material form, known as material traits, and another is social traits. Hence, we have considered that fact through the analogical concept that culture has two major components: which would likely to describe as its material and energy level. The material traits are the state of potential energy. It has mass, weight, and volume. Let's look at a book as an example of 'material traits that hold the mass, energy, and volume (length, breadth, and height), and 'song' is sound energy that is structured' by step-by-step musical tunes. These are social traits as well as possess energy. Therefore, it would like to express analogically' that 'energy is a form of culture'.

The study intends to draw a relation between time, space, and genealogy: and where genealogy somewhat looks like a 'space' where individuals presented concerning the time. The 'time and space' have controlled the genealogical existence of human groups and the continuity of human society. Therefore, social anthropological research can be a more meaningful or enlightening mission with the help of these two lenses. The study has also reported that genealogy is influenced by three components; these are marriage, death, and birth. These three components have a value of negative and positive nature. The positive value i.e., birth always increases and the negative charge decreases the numerical strength of a genealogy. And a major; institution like 'marriage' confirms the role of birth.

[Biswas[4] prescribed a figure which is cited here for understanding the piece.]

Marriage='+' and '–' charge (Male/Female)

Birth='0' or '+' charge (x^1, x^2, x^3,……, x^N)=0/one and more

Death=only negative value ($-x^1$, $-x^2$, $-x^3$,…., x^N)=Less than '0' (Death is the only character that possessed a negative charge but birth is a typical character that possesses two values i. e. "0" and more than 'Zero'. 'Zero' is not a character of Negative because after birth offspring's can be dead-hence negative value suggests death, not for birth. So, the theorem is that "*birth always positive occurrence or factor and greater than zero in respect to the time and space in a genealogy*" (Birth>0).

This paper discusses the festivals of 'Urban Oroan' tribes in the district of West Bengal. Urban tribes mean the migrated people who had been coming to the city or semi-urban areas for hundreds of years back. Particularly they were hired by money-lenders, landlords, different companies' supervisors for the labor of railway construction work, jungle cutting, river dam works, etc. Afterward, they had not returned to their cradle house. They live here permanently. Therefore, slowly foreign urban traits have been entered their way of living. As a result, they breed a new cultural stage where traditional cultural traits would not yet be hampered or be lost but modified and merge into modern cultural activities. Now urban Oraon celebrates two types of festivals –which are mentioned by the author as "Ideal" and "Modern" types. "Ideal" type has referred to the traditional ritual and festivals of the Oraon tribe, and Modern festivals mean the festivals which are usually celebrated by upper caste people. These two facts are the main components of a 'set' as the author explained and denoted as Ideal (x), and Modern (y). The author pointed out those functionally three types of festivals i.e. family (A), clan (B), and community (C) is celebrated by them. With that festival thus two elements have been blended. Another one element also mentioned by author i.e., invitation of neighbor (z), and three festivals are represented as three sets i.e. {A}=family festival, {C}=clan festival, and {B}=community festivals. Therefore it can be represented that Set-A {x,y,z}, Set B {x,y,z}, and Set –C {x,y,}. The clan festival (C) possesses only two elements; element 'c' does not exist. Two set A and B are equal (A=B) if they consist of the same elements. In the end, the author has tried to explain that Set A and B are the proper subsets of C because in Set C the element 'y' is usually not found. The study exerts that Oroan people in past no clan festivals celebrated but in case urban Oroan people have been practicing the clan festival that is the new form of Urban Oroan people behavior pattern. No null set is detected, and a community festival can be called a superset festival or a family festival. So, it is mentioned that the festivals of urban Oroan people are governed by set theory analogically.[5]

Therefore, I have focused some examples on the concept

of social anthropology in mathematics, which is far away from mathematical anthropology indeed. In the present situation, social anthropology in mathematics is essential for the study of anthropology. Social anthropology in mathematics could be a substitute for the theory of anthropology explanation. It is the primary stage of mathematical anthropology that begins. The students of anthropology' sometimes get an opportunity to study anthropological mathematics-especially those who are not well-trained in higher mathematics. Simple mathematical formulas are the study tools of anthropological mathematics. Anthropological mathematics is the new language of anthropology theories. The present essay is a brief communication that deals with the study of social anthropology in mathematics. Social anthropology in mathematics or anthropological mathematics is not an equipped distinct sub-division of anthropology at this moment. It is now a premature condition. More effective studies should be work done for its development. It is better to call that particular approach the very beginning stage of mathematical anthropology. Therefore, it has value for developing the research of anthropology, and it is a new dimension of anthropology research and also applied research.

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