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Correlation between caste-based female literacy and child sex ratio in Alipurduar District of West Bengal

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Abstract
The present paper examines the correlation between the caste-based female literacy rate and child sex ratio in the Alipurduar District of West Bengal in 2011. The study is secondary data based which is collected from the Census of India. The study aims to analyze the spatial pattern of female literacy rate and child sex ratio and to find out the correlation between the caste-based female literacy rate and child sex ratio in Alipurduar District. Pearson's correlation method is used to identify the correlation between female literacy rate and child sex ratio. The result of the study reveals that there is a wide disparity in the spatial distribution of caste-based female literacy rate and child sex ratio in the Alipurduar district. The study shows that the correlation between the caste-based female literacy rate and the child sex ratio is not equal. Correlation is positive in the case of General Caste but negative for both the Scheduled Caste and Scheduled Tribe in Alipurduar District. The study also highlights that the correlation between the Scheduled Caste female literacy rate and child sex ratio is significant at the 95 percent level.

Keywords: Female literacy rate, child sex ratio, spatial distribution, caste-based, correlation

1. Introduction
Literacy is the first step of learning and knowledge building. It is an important quality of civilization such as modernization, urbanization, and industrialization (Kumari, 2017) [4]. Female Literacy is probably the most enabling tool and weapon in the arsenal of democracy (Shetty & Shetty, 2014) [2]. Female literacy is one of the most important characteristics of any society as they improve social progress. According to the 2011 census report, India's female literacy rate is 65.5 percent. Female literacy is highest in Kerala and lowest in Rajasthan. There is a wide disparity in female literacy from state to state in India. Female literacy rate is higher in Kerala (92%), Mizoram (89.4%), Tripura (83.1%), Goa (81.8%), Himachal Pradesh (76.6%), Nagaland (76.7%) and Maharashtra (75.5%), while very low in Rajasthan (52.7%), Bihar (53.3%), Jharkhand (56.2%), Telangana (57.9%), Uttar Pradesh (59.3%), Arunachal Pradesh (59.6%) and Andhra Pradesh (60%). According to the 2011 census, the female literacy rate in West Bengal is 70.5%. The highest female literacy rate is found in Kolkata District (85%) and the lowest in Purulia District (51.3%).

Child sex ratio is an important aspect of population studies. The child sex ratio is defined as the number of female's population below six years of age per 1000 male's population below six years of age. According to the 2011 census report, India's child sex ratio is 919. The child sex ratio is highest in Arunachal Pradesh (972) and lowest in Haryana (834). There is a wide disparity in child sex ratio from state to state in India. Child sex ratio is higher in Arunachal Pradesh (972), Mizoram (970), Meghalaya (970), Chhattisgarh (969) and Kerala (964), while very low in Haryana (834), Punjab (846), Rajasthan (888) and Gujarat (890). As per the 2011 census, the child sex ratio in West Bengal is 956, which is much higher than the national average. The highest child sex ratio is found in Howrah District (964) and the lowest in Kolkata District (930).

Higher female literacy leads to increase consciousness and also contribute to improving social status. There is a correlation between female literacy and child sex ratio. Female literacy plays a crucial role in the upliftment of the child sex ratio. Therefore, the study of the correlation between female literacy and child sex ratio has become an important topic.

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Important research works on the relationship between female literacy and child sex ratio have been carried out by various scholars like Monu Kumar (Kumar, 2013) [1] did important research work on the correlation between female literacy and child sex ratio in Haryana by using census data 2011 based on Spearman's Rank Difference method. Anil Shetty and Shraddha Shetty (Shetty & Shetty, 2014) [2] conducted a study on the influence of female literacy on the sex ratio in Indian states by using the census data from 1981 to 2011. T. P. Shinde (Shinde, 2015) [3] examined the correlation between female literacy and child sex ratio in the Satara District of Maharashtra based on primary and secondary data. Bharat Parveen Kumari (Kumari, 2017) [4] conducted a study on the relationship between female literacy and child sex ratio in Haryana by using census data in 2011. Lalit Singh Jhala (Jhala, 2019) [5] also did research work on the impact of female literacy on the child sex ratio in Rajasthan by using Spearman's Rank Difference method. Surender Kumar and Amir Singh (Kumar & Singh, 2019) [6] investigated the correlation between female literacy rate and sex ratio through a case study of all districts of the state of Haryana based on census data in 2011. Shahid Imam (Imam, 2020) [7] analyzed the district level female literacy and changes in child sex ratio in Bihar, and T.V. Krishna, S. Rama Krishna and A. Raju (Krishna *et al*. 2020) [8] did research work on the changes and correlation between literacy rate and sex ratio of a backward region of Northern Vizianagaram District in Andhra Pradesh by using the Spearman's rank order method.

Based on the literature review it can say that only a few research works have been done on the relationship between female literacy and child sex ratio in West Bengal. Still, the relationship between caste-based female literacy and child sex ratio has been not done. Thus, the present research work tries to study the relationship between caste-based female literacy and child sex ratio in the Alipurduar District of West Bengal.

2. Objectives
1.   To investigate the spatial pattern of caste-based female literacy rate and child sex ratio of Alipurduar District in 2011.
2.   To find out the correlation between caste-based female literacy rate and child sex ratio of Alipurduar District in 2011.

3. Study Area
Alipurduar District is a new district of the state of West Bengal in India. The district was formed on 25th June 2014 as the 20th district in West Bengal. The district lies between 89° to 89°54' East longitude and 26°24' to 26°49'48" North latitude. The total area of the district is about 3136 square kilometers and the elevation is 93 meters. On the North, the district shares an international border with Bhutan and on the east, it is bordered by Assam and Coochbihar in the south. The major rivers of the Alipurduare District are Torsa, Kaljani, Raidak, Jayanti and Sankosh. Presently the district has 6 Blocks, 9 census towns, and 22-gram panchayats. The blocks under the district are Madarihat, Kalchini, Kumargram, Alipurduar–I, Alipurduar–II and Falakata respectively. The district headquarter is Alipurduar. According to the 2011 Census, the total population of the district is 15,01,983 and the population density is 539 per sq. km. Alipurduar District contributed 1.6 percent of the total population of West Bengal and recorded a sex ratio of 948 females per thousand males and the literacy rate is 64.7 percent. Figure-1 shows the location and administrative division of the Alipurduar District in West Bengal.
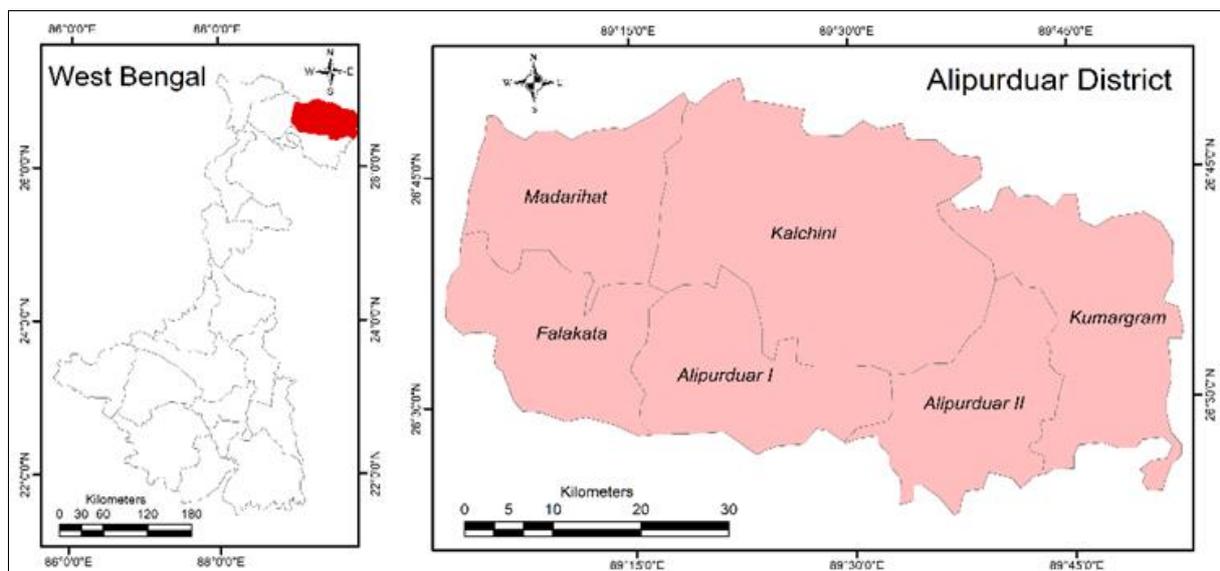

Fig 1: Location map of the study area

4. Database and Methodology
The study is mainly secondary data-based. The secondary data regarding caste-based female literacy rate and child sex ratio of Alipurduar District are collected from the Census of India. Simple statistical techniques by Microsoft Excel 2016 are used for data calculation. The caste-based female literacy rate and child sex ratio are calculated by using the following formulas

$$\text{Female literacy rate} = \left\{ \left(\frac{\text{Total no. of females literate population}}{\text{Total female population above 6 years of age}} \right) \times 100 \right\}$$

$$\text{Child sex ratio} = \left\{ \left(\frac{\text{Total no. females population below 6 years of age}}{\text{Total no. of males population below 6 years of age}} \right) \times 100 \right\}$$

The Person correlation method by IBM SPSS Statistics 23 software is used for analyzes the correlation between caste-based female literacy rate and child sex ratio. Furthermore, ArcGIS 10.3 is used for preparing maps.
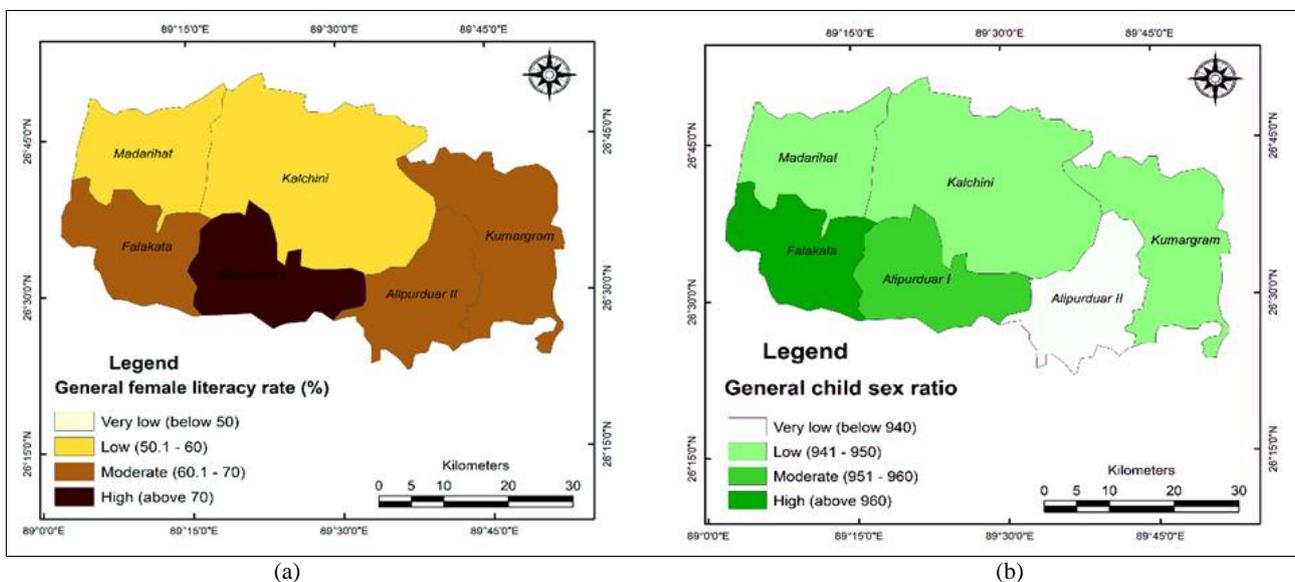
5. Result and Discussion
5.1 Spatial pattern of the General Caste female literacy rate and child sex ratio in Alipurduar District, 2011
The General Caste female literacy rate in Alipurduar District is 64 percent and the General Caste child sex ratio is 947 in the census year 2011. But the block level General Caste female literacy rate or General Caste child sex ratio differs from block to block. Table-1 and figure-2 show the block level distribution of the General Caste female literacy rate and General Caste child sex ratio in the Alipurduar District.

The highest General Caste female literacy rate is found in the Alipurduar-I block (72.7%) and the lowest in the Kalchini block (58.2%). In figure 2(a), Alipurduar District has been divided into four categories namely very low (below 50%), low (50.1%-60%), moderate (60.1%-70%) and high (above 70%) General Caste female literacy rate. There is no block fall in the very low General Caste female literacy rate category. Only two blocks are under the low General Caste female literacy rate category namely Madarihat (59.7%) and Kalchini (58.2%). The majority of blocks fall in the moderate General Caste female literacy rate category, these blocks are Kumargram (66.1%), Alipurduar – II (66.9%) and Falakata (65.4%). On the other hand, only one block like Alipurduar-I (72.7%) belongs to the high General Caste female literacy rate category.

Figure 2(b) represents the spatial pattern of the General Caste child sex ratio in Alipurduar District in 2011. The highest General Caste sex ratio is found in the Falakata block (965) and the lowest General Caste in the Alipurduar-II block (917). In figure 2(b), the General Caste child sex ratio of Alipurduar District has been divided into four categories namely very low (below 940), low (941-950), moderate (950-960) and high (above 960) General Caste child sex ratio. The very low General Caste child sex ratio is found in only one block such as Alipurduar-II (917). The majority of blocks are under the low General Caste child sex ratio category, which are Madarihat (946), Kalchini (947) and Kumargram block (946). The moderate General Caste child sex ratio is recorded only in the Alipurduar-I block (957) and the high General Caste child sex ratio is found in only the Falakata block (965).

| | (a) | (b) |

Fig 2: (a) Showing the spatial pattern of the General Caste female literacy rate and (b) showing General Caste child sex ratio in Alipurduar District, 2011

Table 1: Block level caste-based female literacy rate and sex ratio in Alipurduar District, 2011

Block name	Female literacy rate (%)			Child sex ratio (%)		
	General Caste	Scheduled Caste (SC)	Scheduled Tribe (ST)	General Caste	Scheduled Caste (SC)	Scheduled Tribe (ST)
Madarihat	59.7	55.2	42.8	946	1022	994
Kalchini	58.2	51.7	46.8	947	1021	963
Kumargram	66.1	61.1	44.9	946	913	998
Alipurduar - I	72.7	59.4	47.8	957	964	928
Alipurduar - II	66.9	62.1	50.2	917	946	939
Falakata	65.4	57.5	40.2	965	928	934
District total	64.0	58.9	45.3	947	950	965

***Source*:** Authors' own calculation using census data 2011

5.2 Correlation between the General Caste female literacy rate and child sex ratio in Alipurduar District, 2011
Table-2 and figure-3 represent the correlation between the General Caste literacy rate and child sex ratio of the Alipurduar district in 2011. The Pearson correlation method is used to find the relationship between two variables. It is identified that the correlation (r) between the General Caste female literacy rate and sex ratio is 0.072 and the correlation is not significant. It is a low positive correlation. The positive relationship indicates that an increase in the General Caste female literacy rate leads to an increase in the
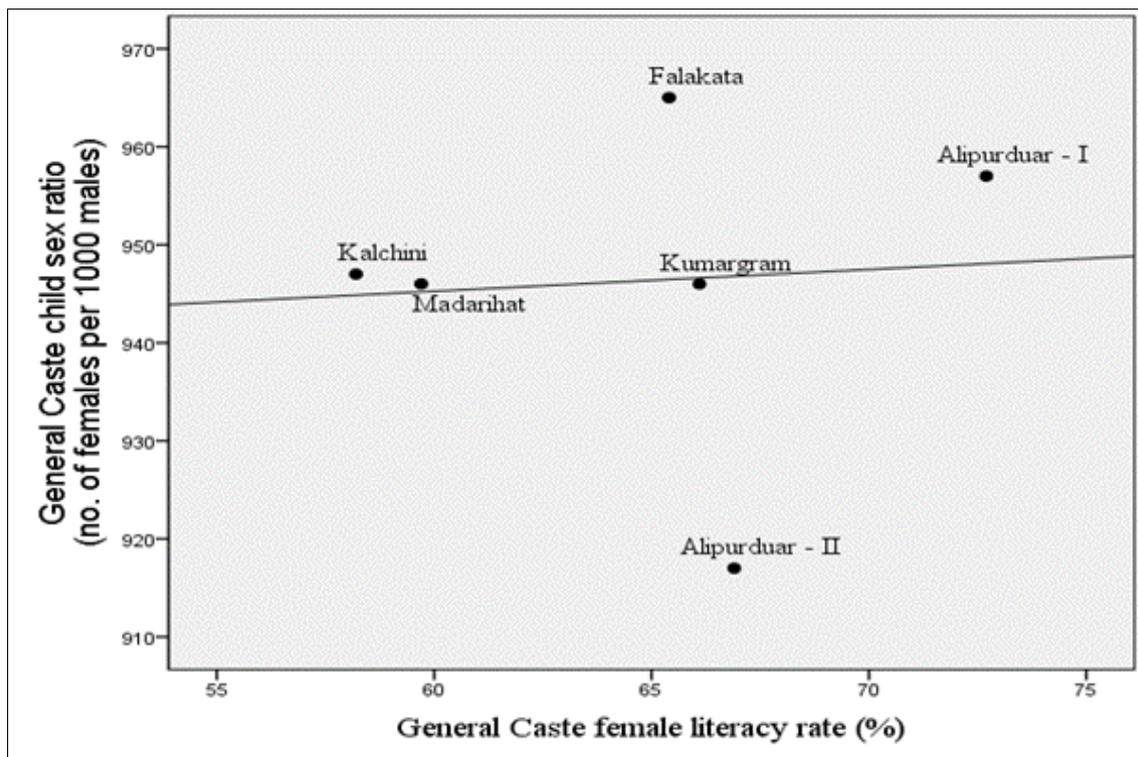
child sex ratio.

While comparing the General Caste female literacy rate and child sex ratio of Alipurduar District in 2011 (figure-2 and 3), it is observed that blocks with high General Caste female literacy rates have high child sex ratios, and blocks with low female literacy rates have low child sex ratios. For example, in the Alipurduar-I block, the General Caste female literacy rate is the highest (72.7%) and the child sex ratio is second highest (940). On the other hand, in the Kalchini block, the General Caste female literacy rate is the lowest (58.2%) and the child sex ratio is the second lowest (947).

Table 2: Correlation matrix of the General female literacy rate and child sex ratio in Alipurduar District, 2011

Variables		General female literacy rate	General child sex ratio
General female literacy rate	Pearson Correlation	1	.072
	Sig. (1-tailed)		.446
	N	6	6
General child sex ratio	Pearson Correlation	.072	1
	Sig. (1-tailed)	.446	
	N	6	6

Source: Computed by the authors using SPSS software

Fig 3: Correlation between the General Caste female literacy rate and child sex ratio of Alipurduar District, 2011
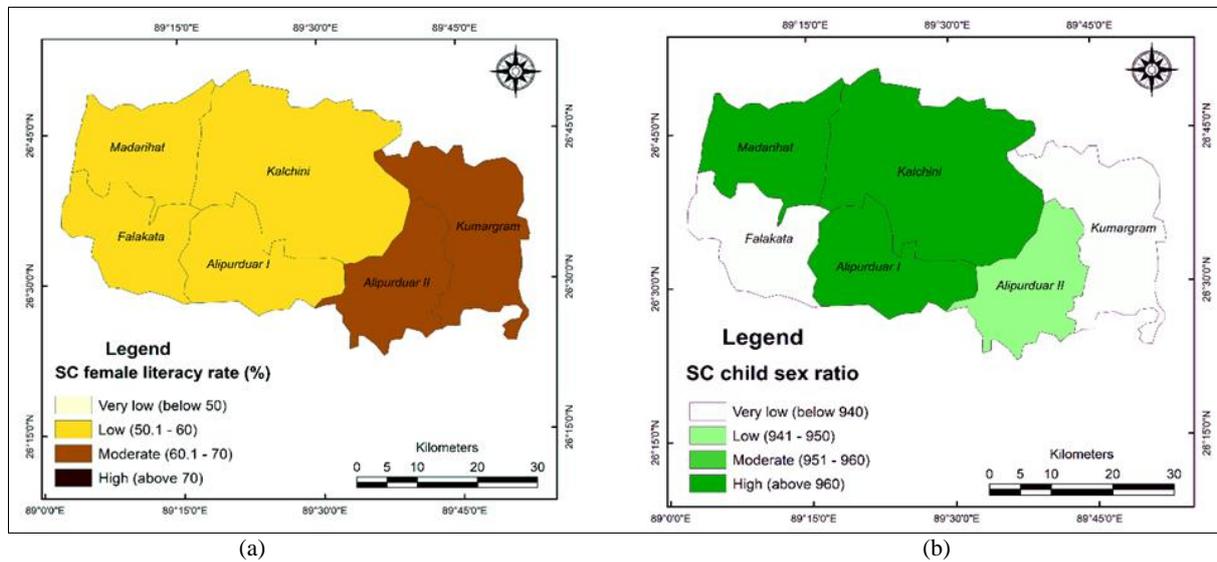
5.3 Spatial pattern of the Scheduled Caste (SC) female literacy rate and child sex ratio in Alipurduar District, 2011

The Scheduled Caste female literacy rate in Alipurduar District is 58.9 percent and the Scheduled Caste child sex ratio is 950 in the census year 2011. But the block level Scheduled Caste female literacy rate or Scheduled Caste child sex ratio differs from block to block. Table-1 and figure-3 show the block level distribution of Scheduled Caste female literacy rate and Scheduled Caste child sex ratio in Alipurduar District.

The highest Scheduled Caste female literacy rate is found in the Alipurduar-II block (61.1%) and the lowest in the Kalchini block (51.7%). In figure 4(a), Alipurduar District has been divided into four categories such as very low (below 50%), low (50.1%-60%), moderate (60.1%-70%) and high (above 70%) SC female literacy rate. There is no block fall in the very low and high SC female literacy rate category. The majority of blocks are under the low SC female literacy rate category namely Madarihat (55.2%), Kalchini (51.7%), Falakata (57.5%) and Alipurduar-I (59.4%). As opposed, two blocks Alipurduar-II (62.1%) and Kumargram (61.1%) belong to the moderate SC female literacy rate category.

Figure 4(b) represents the spatial pattern of the Scheduled Caste child sex ratio in Alipurduar District in 2011. The highest SC child sex ratio is found in the Madarihat block (1022) and the lowest in the Kumargram block (913). In figure 4(b), the SC child sex ratio of Alipurduar District has been divided into four categories namely very low (below 940), low (941-950), moderate (950-960) and high (above 960) SC child sex ratio. The very low SC child sex ratio is found in two blocks such as Falakata (928) and Kumargram (913). Only the Alipurduar-II block (946) falls under the low SC child sex ratio category. The majority of blocks are under the high SC child sex ratio category, which are Madarihat (1022), Kalchini (1021) and Alipurduar-I (964).
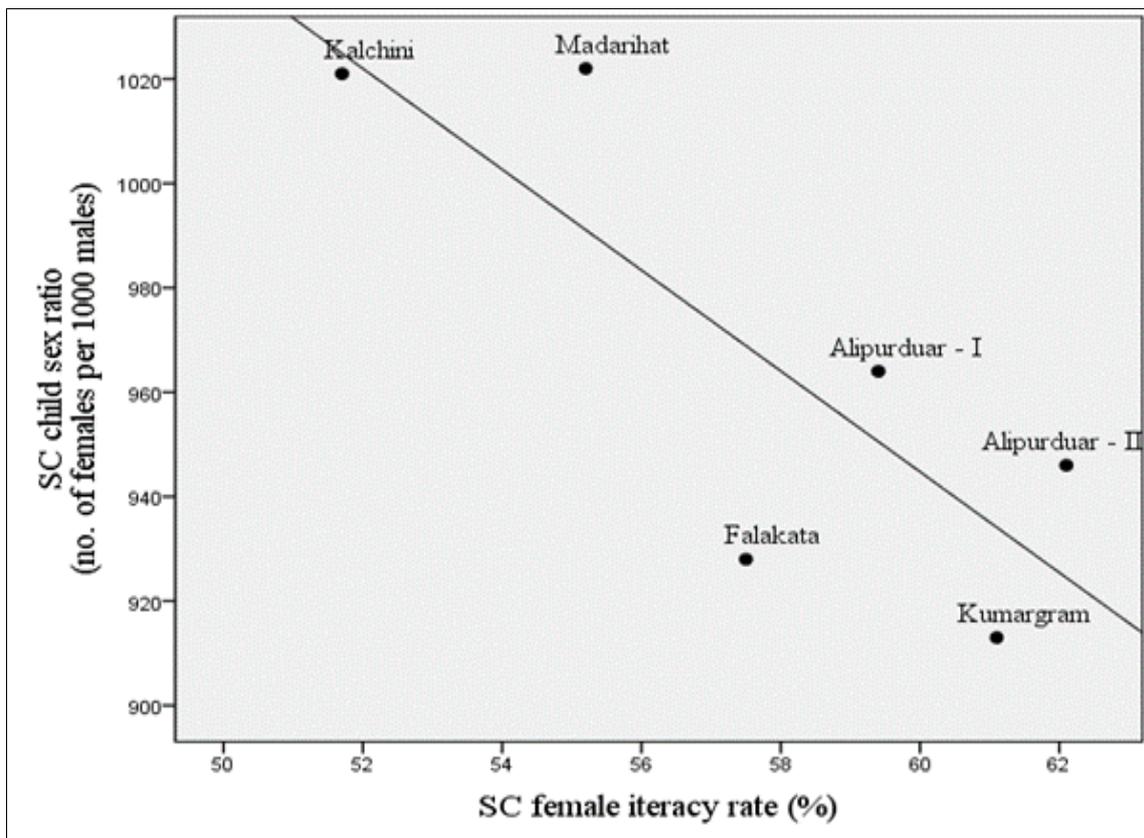
(a)   (b)

Fig 4: (a) Showing the spatial pattern of the SC female literacy rate and (b) showing SC child sex ratio in Alipurduar District, 2011

5.4 Correlation between the scheduled caste (SC) female literacy rate and child sex ratio in Alipurduar District, 2011

Table-3 and figure-5 demonstrate the correlation between the SC female literacy rate and the child sex ratio of the Alipurduar district in 2011. The Pearson correlation method is used to find out the relationship between two variables. It is identified that the correlation (r) between the SC female literacy rate and sex ratio is -0.809 and the correlation is significant at 95% level of confidence. It is a high negative correlation, which means that there is a high inverse relationship between the SC female literacy rate and SC child sex ratio of Alipurduar District in the census year 2011. The high negative relationship indicates that an increase in SC female literacy rate leads to a decrease in SC child sex ratio and a decrease in SC female literacy leads to an increase in SC child sex ratio.

While comparing the SC female literacy rate and SC child sex ratio of Alipurduar District in 2011 (figure-4 and 5), it is observed that blocks with high SC female literacy rates have lower child sex ratios, and blocks with low SC female literacy rates have higher child sex ratios. For example, in the Alipurduar-II block, SC female literacy rate is the highest (62.2%) but the sex ratio is the third lowest (946). On the other hand, in the Kalchini block, the SC female literacy rate is the lowest (48%) but the sex ratio is the second highest (1021).

Fig 5: Correlation between the SC female literacy rate and child sex ratio in Alipurduar District, 2011

Table 3: Correlation matrix of the SC female literacy rate and child sex ratio in Alipurduar District, 2011

Variables		SC female literacy rate	SC child sex ratio
SC female literacy rate	Pearson Correlation	1	-.809*
	Sig. (1-tailed)		.026
	N	6	6
SC child sex ratio	Pearson Correlation	-.809*	1
	Sig. (1-tailed)	.026	
	N	6	6

*Correlation is significant at the 0.05 level (1-tailed)
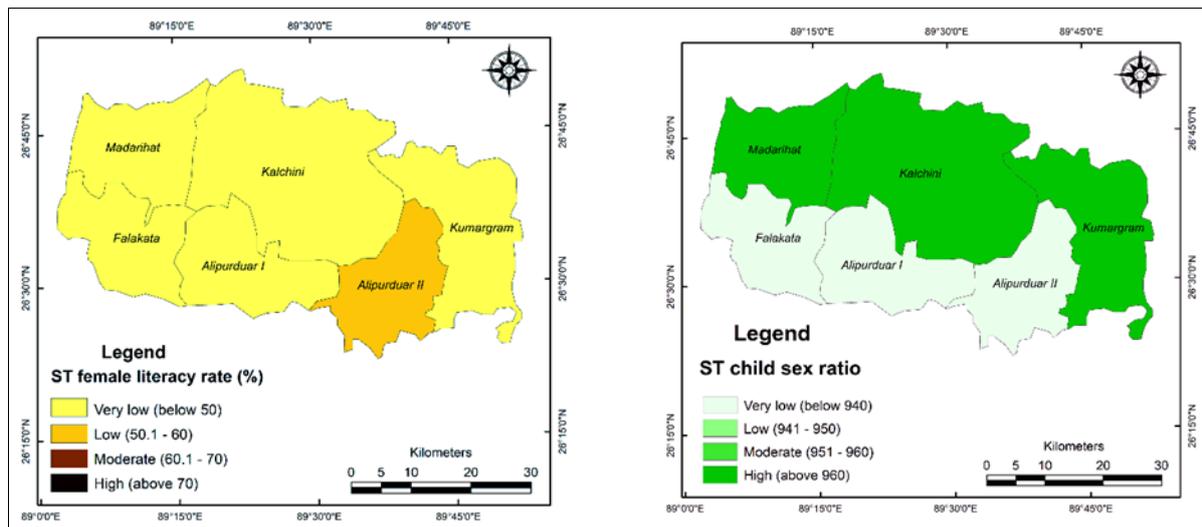*Source*: Computed by the authors using SPSS software

5.5 Spatial pattern of the Scheduled Tribe (ST) female literacy rate and child sex ratio in Alipurduar District, 2011

The Scheduled Tribe female literacy rate in Alipurduar District is 45.3 percent and the Scheduled Tribe child sex ratio is 965 in the census year 2011. But the block level Scheduled Tribe female literacy rate or Scheduled Tribe child sex ratio differs from block to block. Table-1 and figure-6 represent the block level distribution of Scheduled Tribe female literacy rate and Scheduled Tribe child sex ratio in Alipurduar District.

The highest Scheduled Tribe female literacy rate is found in the Alipurduar-II block (50.2%) and the lowest in the Falakata block (40.2%). In figure 6(a), Alipurduar District has been divided into four categories such as very low (below 50%), low (50.1%-60%), moderate (60.1%-70%) and high (above 70%) ST female literacy rate. There is no block fall in the moderate and high ST female literacy rate category. The majority of blocks are under the very low ST female literacy rate category namely Madarihat (42.8%), Kalchini (46.8%), Falakata (40.2%), Alipurduar-I (47.8%) and Kumargram (44.9%). On the other hand, only one block namely Alipurduar-II (50.2%) belongs to the low SC female literacy rate category.

Figure 6(b) shows the spatial pattern of the Scheduled Tribe child sex ratio in Alipurduar District in 2011. The highest ST Child sex ratio is found in Kumargram block (998) and the lowest in Alipurduar-I block (928). In figure 6(b), the ST Child sex ratio of Alipurduar District has been divided into four categories namely very low (below 940), low (941-950), moderate (950-960), and high (above 960) ST child sex ratio. There is no block fall in the low and moderate ST female child sex ratio category. Half of the total blocks are under the very low ST child sex ratio category, which are Falakata (934), Alipurduar-I (928) and Alipurduar-II block (939). In contrast, a high ST child sex ratio is observed in the remaining half of the total blocks, which are Madarihat (994), Kalchini (963) and Kumargram block (998).

Fig 6: (a) Showing the spatial pattern of the ST female literacy rate and (b) showing ST Child sex ratio in Alipurduar District, 2011

5.6 Correlation between the Scheduled Tribe (ST) female literacy rate and sex ratio in Alipurduar District, 2011

Table-4 and figure-7 represent the correlation between the ST female literacy rate and ST Child sex ratio of the Alipurduar district in 2011. The Pearson correlation method is used to detect the relationship between two variables. It is identified that the correlation (r) between the ST female literacy rate and ST Child sex ratio is -0.262 and the correlation is not significant. It is a low negative correlation, which means that there is an inverse relationship between ST female literacy rate and ST Child sex ratio of Alipurduar District in the census year 2011. The low negative relationship i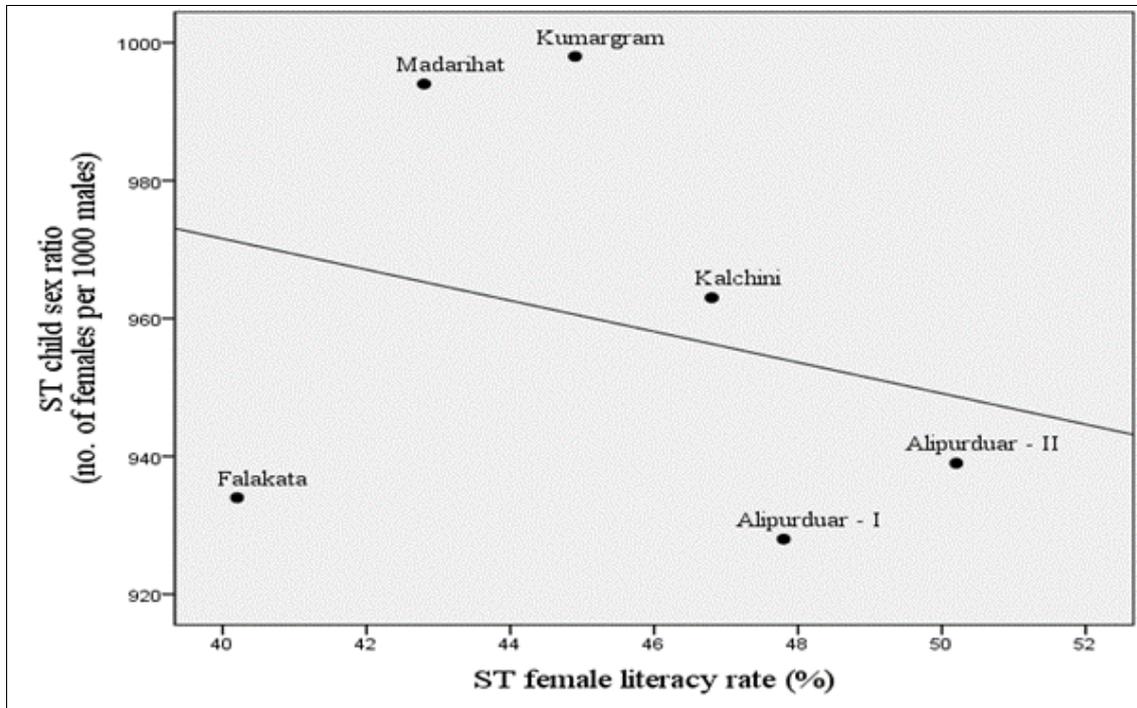ndicates that an increase in ST female literacy rate leads to a decrease in ST Child sex ratio and a decrease in ST female literacy rate leads to an increase in ST Child sex ratio.

While comparing the ST female literacy rate and ST child sex ratio of Alipurduar District in 2011 (figures-6 and 7), it is noticed that the blocks with high ST female literacy rates have lower ST child sex ratios and blocks with low ST female literacy rates have higher ST child sex ratios. For example, the Alipurduar-II block has the highest (50.2%) ST female literacy rate but the second lowest in the ST Child sex ratio (939). On the other hand, the literacy rate of the Madarihat block is the second lowest (42.8%) but the ST Child sex ratio of the block is the second highest (994).

Table 4: Correlation matrix of the ST female literacy rate and child sex ratio in Alipurduar District in 2011

Variables		ST female literacy rate	ST child sex ratio
ST female literacy rate	Pearson Correlation	1	-.262
	Sig. (1-tailed)		.308
	N	6	6
ST child sex ratio	Pearson Correlation	-.262	1
	Sig. (1-tailed)	.308	
	N	6	6

Source: Computed by the authors using SPSS software

Fig 7: Correlation between the ST female literacy rate and child sex ratio in Alipurduar District, 2011

Major findings
- Block level caste-wise female literacy rate and child sex ratio of Alipurduar District are unequally distributed in 2011.
- Female literacy rate of each of the caste groups is highest in the Alipurduar-II block of the Alipurduar District in 2011.
- Child sex ratio of each of the caste groups is high in the Madarihat block of the Alipurduar District in 2011.
- General Caste female literacy rate and child sex ratio of Alipurduar District is low positively correlated in 2011.
- There is a significant negative correlation between the Scheduled Caste female literacy rate and child sex ratio of Alipurduar District in 2011.
- There is a low negative correlation between the Scheduled Tribe female literacy rate and child sex ratio of Alipurduar District in 2011.

Conclusion
Literacy rate and sex ratio are one of the most considerable components of social development. The study is mainly focused on investigating the spatial pattern of caste-based female literacy rate and child sex ratio and identifying the caste-based correlation between female literacy rate and child sex ratio in Alipurduar District by using the census data of 2011. The study shows that the block level caste-based female literacy rate and child sex ratio is irregularly distributed in Alipurduar District. The study represents that

General Caste female literacy and child sex ratio are low positively correlated. The study also highlights that there is a significant negative correlation between the Schedule Caste female literacy rate and child sex ratio, but not significant in the case of Schedule Tribe in Alipurduar District. In conclusion, it can be said that equal opportunity is needed for improving our society irrespective of every caste and class to establish social equality as well as eradication of gender discrimination.

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