Map Skills of Secondary Students in Relation to their Gender, Locality, and School type

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Abstract

The study of maps is an integral component of the West Bengal Board of Secondary Education syllabus (WBBSE). Study of maps is crucial as it stimulates students to expand their spatial understandings of physical and human landscapes on the earth's surface. This study investigated differences if any in the level of students' map skills in terms of their gender, locality, and school type. A descriptive research design was used, where data was collected using a self-developed testing tool from three hundred school students in Malda. Analysis techniques, such as frequency, mean, and an independent sample t-test were operated to test the constructed hypotheses using the IBM SPSS v22 software. Results of the study revealed that overall, students had a higher level of map skills. It showed a significant difference in map skills of male versus female, rural versus urban, and between government and private school students (p<.05). It was observed that male students (Mean = 25.07; SD = 3.95) had a higher level of map skills compared to female students (Mean = 19.78; SD = 5.17). Similarly, the students from urban schools (Mean = 23.76; SD = 4.46) and those from private schools (Mean = 26.19; SD = 3.140) had secured a higher level of map skills compared to rural school students (Mean = 20.88; SD = 5.86) and those from government schools (Mean = 18.97; SD = 4.415), respectively.

Keywords: *cartography, geography education, map reading, school management,*

Introduction

The concept of map is comprehensive, and etymologically, the term 'Map' is derived from the Latin word 'Mappa', which means 'Cloth'. It is a graphic representation of our earth as a whole or a segment of it on a plane surface, including paper, cloth, plastic, cardboard, etc., with definite scale, directions, signs, and symbols (NCERT, 2006). Teaching map skills at school levels is closely associated with the teaching of geography. It is said that geography is the only discipline of social studies that gives overwhelming emphasis on the study of map skills for school-going students (Harvey, 1969; Dikshit, 2004; Sarkar, 2009). The study of geography and map skills is so closely tied since time immemorial that no other discipline of social sciences does (Hartshorne, 1959; Husain, 2011). In the present study, the author has sought to determine map skills among school students in the state of West Bengal, where teaching maps is a part of the instructional curriculums of the West Bengal Board of Secondary Education syllabus (WBBSE). In the state, teaching map skills has a different status quo. At schools, students

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are being taught different skills with the parallel teaching of geography. There is no separate paper or subject for developing map reading abilities in the state of West Bengal; nevertheless, it is included as an inseparable part of the geography syllabus, and there is a separate class for teaching map skills under 'practical geography'. Teaching maps in schools of West Bengal aims to develop students' understanding of the physical as well as human landscapes on the earth's surface. It also aims to enhance students' spatial perception and helps them to learn socio-cultural and physical landscapes quickly. Students of the West Bengal Board of School Education (WBBSE) are taught maps in separate class, and they are empowered with different map skills, including, map reading, directions, map languages, etc. with topographic sheets and physical and political maps of India.

Maps represent layers of information about physical landscapes, such as reliefs, rivers, climate, and natural vegetation and human features, such as settlements, population distribution, transport networks, geo-political boundaries, economic zones, etc. (Khullar, 2011). Maps provide a geographic description that aids in the understanding of cause-and-effect links between various phenomena (Winn, 1991). Furthermore, it was evidenced that maps can be used by students to solve problems in their day-to-day life (Gökçe, 2015). It can also be utilised in social studies and sciences as a learning tool. Students can acquire spatial and rational thinking about the variable features and phenomena on the earth's surface by improving their map reading abilities. Students can utilise maps for a better understanding of geopolitical regions, boundaries, socio-cultural diversities, and historic events (Chiodo, 1997; Birbili, 2006; Liben, 2001; Kilinç, 2011; Atit et al., 2016; Gupta, 2018). Henceforth, the implications of maps in the learning-related text become essential for developing spatial perception and geographical understanding in school-going students (Verdi & Kulhavy, 2002). Furthermore, students' ability to use maps also affects their learning styles and academic achievements (van Dijk et al., 1994; Wiegand, 2006; Kilinç, 2011).

Notwithstanding, the review of literature showed a lack of substantial research efforts in India to understand map skills among school students and evidenced a discrepancy in students' levels of map skills in relation to their demographic characteristics, such as gender, locale, school types, family socio-economic status, school physical infrastructure (Gilmartin & Patton, 1984; Beatty & Tröster, 1987; Herman et al., 1988; Henrie et al., 1997; Bednarz et al., 2006; Moon et al., 2016). Further, it was found that students had limited opportunities to develop map-reading abilities at schools. The lack of instructional programs and physical infrastructures at schools has been restraining students from developing map skills (Bathurst, 1961; Muir, 1985; Bednarz et al., 2006; Gökçe, 2015; Bugdayci et al., 2017). Despite, few initiatives and steps taken by public and private schools, there are enormous inertias and handicaps resulted into disparities in performance outcomes, due to variation in provided physical facilities, teaching-learning process, teacher-student ratio, and institutional climate (Adika & Adika, 2013; Adeyemi, 2014; Okon & Archibong, 2015; Anandharaja et al., 2016; Aransi, 2018).

Furthermore, students' learning outcomes are also influenced by locality, i.e., rural vs. urban. The review of literature revealed that students in rural areas lack access to quality education, modern exposures, and a healthy learning environment while, on the flip side, students in urban schools have access to the required educational facilities, support, necessary exposures, and learning settings (Young, 1998; Igbo et al., 2015; Nnenna & Adukwu, 2018; Onoyase, 2015). Additionally, the problem like gender-based unequal treatments, including lack of socio-emotional support for girls' education still is a concerning issue among academics, which results in discrepancies in students' learning

performance (Adika, & Adika, 2013; Parveen et al., 2013; Anandharaja et al., 2016).

Thus, in the light of the aforesaid observations, where a dearth of substantial research studies was found and evidence the possible implications of students' demographic characteristics on their learning outcomes, that yet to be generalized to a large target population, a study of students' map skills accomplishments and determining if there is a difference in relation to their gender, locality, and school type would be a diligent effort towards map skills research. The present study, henceforth, will not only help stakeholders to understand the current status of students' map skills, but it will also provide empirical information that will help them understand the implications of students' demographics in their map skills acquisition at school levels.

Objectives of the Study

Following are the objectives of the study:

1. To study the levels of map skills among school students.
2. To examine the difference in map skills of male and female students.
3. To find out the difference in map skills of students in respect to their locality, i.e., rural and urban.
4. To identify the difference in map skills of students with respect to the type of school, i.e., government and private schools.

Key Terms Used in the Study

In this study, the author has focused on assessing the students' abilities in four different components of cartographic mappings, including map scale, direction, grid systems and spatial location, and map language, which includes convectional signs, symbols, and colors. A brief description of these components of map skills has been provided, such as –

Map Skills

Individuals' ability to read and interpret maps correctly with a proper understanding of scale, direction, grid systems, and map language; convectional signs, symbols, and colors, is referred to as map skills.

Map Scale

It is the proportion of the real distance on the ground to the corresponding distance on a map (Sarkar, 2009). In the absence of scale, a cartographical map resembles a sketch or rough drawing (Khullar, 2011). It provides readers a succinct description of the proportional area represented on a map in respect to the real area on the ground, as well as information about the linear relations amongst those objects depicted on the map.

Direction

On most maps, one arrow with the alphabet capital 'N' at the uppermost right corner represents cardinal direction North (North Line) and aids readers in reading maps correctly, which is why most cartographers consider it as one of the most important essential components of a good map. It is the point of orientation of a represented area or object on a given map. In the missing, especially in topographical maps, it is very difficult to understand the geographical as well as the socio-cultural landscapes of an area (Singh & Singh, 1991; Khullar, 2011). To comprehend a given map, there are usually four primary directions, such as, North, South, East, and West, and four minor directions, such as North-East, South-East, North-West, and South-West (NCERT, 2006).

Grid Systems and Spatial Location

This is the regular pattern of intersection space between horizontal and vertical lines that represent latitudes and longitudes, respectively. The term 'grid' simply refers to a system of the intersection of latitudes and longitudes (NCERT, 2006). Understanding

the latitude and longitude grid system is crucial for establishing the precise location and orientation of any object on the face of the earth depicted on a map. This is also important for determining a country's or region's standard time.

Map Language

There are different signs, symbols, and colors with their own function, which are used to depict different geographical features and socio-cultural and political landscapes of an area on a map. These signs, symbols, and colors are universally recognised and have the same meaning for everyone regardless of their regions or countries. For example, red denotes human settlements, blue denotes a water body, green denotes vegetation or forest, yellow denotes farmland, and so on (NCERT, 2006).

Hypotheses of the Study

1. **HO1:** There is no statistically significant mean difference in the map skills of male and female students.
2. **Ho2:** There is no statistically significant mean difference in the map skills between rural and urban school students.
3. **HO3:** There is no statistically significant mean difference in the map skills of government and private school students.

Methodology

In this study, a descriptive research design was adopted, with two different types of variables, such as an independent variable and dependent variable. Gender, locality, and school type were addressed as independent variables, while map skill was treated as a dependent variable.

Sampling

The author has adopted a stratified random sampling strategy. The district of Malda has a total of 17 blocks, five of which were randomly selected (keeping in mind the rural-urban dichotomy). Then, from each of the five selected blocks, two schools were chosen based on their co-education setup. Finally, a total of 300 ninth-grade students from each of the selected schools were selected for this study. The sample was dichotomized based on gender, locality, and school type, which included 158 male and 142 female students, 172 rural and 128 urban school students, and 150 students from both government and private schools.

Testing Tool

Data was collected using a self-developed testing tool, which has four components of cartographic mapping, such as map scale (7 items, e.g., what is scale, i. the ratio between the actual distance on the ground & the distance shown on the map, ii. the ratio between two places on a map, iii. the ratio between two places on the earth's surface), direction (8 items, e.g., which part of a map tells you direction (N, S, E, W) – i. Scale, ii. Title, iii. Map key, iv. Compass rose, & which among the following does not come under the cardinal direction – i. North, ii. South, iii. East, iv. North-west), spatial location (6 items, e.g., the imaginary that divided India into equal parts is called as i. Equator, ii. Tropic of Cancer, iii. Tropic of Capricorn, iv. Arctic Circle, & which state is located in the furthest north of India – i. Himachal Pradesh, ii. Punjab, iii. Jammu & Kashmir, iv. Rajasthan, & locate the following rivers, mountains and cities on the physical map of India; Ganga river, Mahanadi river, Aravalli mountain, Kolkata, and New Delhi) and map language (9 items, e.g., which colour is used for showing plains on a topographical map, i. Yellow, ii. Green, iii. Brown, iv. Blue). The test consists of 30 items of MCQs (Multiple Choice Questions) with three/four options each. No question holds any negative value for the wrong response. The range of the score was between 0 and 30. The scale's composite score was used to determine students' map skills.

Reliability and Validity of the Tool

For checking the validity of the self-prepared testing tool, the author has conducted a pilot study on 25 students, and three items were modified depending on students' responses and feedbacks. Then, the author has done content validity through experts' feedbacks. Finally, Cronbach's Alpha reliability was used to check the tool's reliability with 30 items. The test revealed a Cronbach's Alpha score of .762 (>.7.0), indicating that the developed tool has good internal consistency (Cronbach, 1951).

Statistical Tools

The collected data were analysed using both descriptive and differential statistics. Descriptive statistics, such as frequency, mean, standard deviation, and differential statistics, such as an independent sample t-test were operated to test the formulated hypotheses using the IBM SPSS v22 software.

Results of the Study

Status Quo of Students' Map Skills

To assess students' map skills, frequency and percentage were computed. It was observed in Table 1 that 35 per cent of the students scored in between 26 and 30 marks (88.66%-100%), while 32.4 per cent students who scored less than 70 per cent marks, out of which, 22.7 per cent students scored between 16 and 20 marks (53.33%-66.66%), 7.0 per cent students scored between 11 and 15 marks (36.66%-50.00%) and no one scored between 1 and 5 marks (3.33%-16.66%). Furthermore, it was found that 9.7 per cent of the students scored less than 50 per cent marks, indicating learning disparities in the attainment of map skills. Hence, it can be said that most of the students were good at map reading, while a few per cent of the students had performed poorly.

Table 1: Students' Scoring in Map Skills

Scores in Map Skills	Frequency (No. of Students)	Percentage (%)
26-30	105	35.0
21-25	98	32.6
16-20	68	22.7
11-15	21	7.0
6- 10	8	2.7
1-5	0.0	0.0
Total	300	100

Levels of Students' Map Skills

Table 2 showed that students had a mean score of 22.65 in map skills, with a standard deviation of 5.3. The scale had a Mdn value of 15. Students' mean map skills score was found to be greater than the scale Mdn value (22.66>15). Henceforth, it may be concluded that students' level of map skills was high.

Table 2 : Students' Level of Performance in Map Skills

N	Mean	S.D.	Mdn-Value
300	22.65	5.3	15

Map Skills among Male and Female Students

The analysis of Table 3 revealed the outcome of 158 male and 141 female students' scores in map skills, out of the total number of 300 participants. It was observed that male students' mean score (Mean=25.07; SD=3.95) was higher than that of female students' mean score (Mean=19.78; SD=5.17). The calculated t-value of 9.99 was statistically significant at a sig value of 0.012 (two-tailed, p<.05). The computed Cohen's d was 1.16 (t×2/√df), indicating that the difference in map skills between male and female students had a substantial effect size. Henceforth, the constructed null hypothesis "HO1: there is no statistically significant mean difference in map skills of male and female students" was rejected at 0.012 level (p <.05), while the alternative hypothesis "there is a statistically significant mean difference in map skills of male and female students" was accepted. By implication, it is signified that the male students had a higher level of map skills compared to their counterpart female students.

Table 3 : Mean and t-test of Map Skills of Male and Female Students

Gender	N	Mean	S.D.	SEM	SED	t- value	df	Sig. level
Male	158	25.07	3.95	.314	.529	9.99	297	0.012
Female	141	19.78	5.17	.436				

Map Skills among Students of Rural and Urban Schools

Table 4 indicated the results of 123 rural and 177 urban school students' scores in map skills out of 300 samples. The mean score for rural school students was found to be lower (Mean=20.88; SD=5.86) than the mean score for urban school students (Mean=23.76; SD=4.46). It was observed the computed t-value of 4.831 was statistically significant at a p-value of 0.03 level (p <.05). The computed Cohen's d was .56 (t×2/√df), indicating that the difference in map skills between the groups had a substantial effect size. As a result, the null hypothesis "Ho2: there is no statistically significant mean difference in map skills between rural and urban school students" was rejected at 0.03 level, while the research hypothesis "there is a statistically significant mean difference in map skills between rural and urban school students" was accepted. By implication, it is inferred that the students of urban schools had a higher level of map skills compared to their counterpart rural school students.

Table 4 : Mean and t-test of Map Skills of Rural and Urban School Students

Locality	N	Mean	S.D.	SEM	SED	t- value	df	Sig. level
Rural	123	20.88	5.86	.528	.596	4.831	298	0.03
Urban	177	23.76	4.46	.335				

Map Skills of Students of Private and Government Schools

Table 5 showed the results of 150 private and 150 government school students' map skills tests. The mean score for private school students (Mean=26.19; SD=3.14) was higher than the mean score for government school students (Mean=18.97; SD=4.41). The calculated t-value of 16.321 was significant at 0.01 level (two-tailed, $p<.05$). The computed Cohen's d was 1.89 ($t\times2/\sqrt{df}$), indicating that the difference in map skills between private and government school students had a large effect size. Hence, the stated null hypothesis "HO3: there is no statistically significant mean difference in map skills of government and private school students" was rejected, while the alternative hypothesis "there is a statistically significant mean difference in map skills of government and private school students" was accepted. By implication, it is signified that the students of private schools had a higher level of map skills compared to their counterpart students of government schools.

Table 5 : Mean and t-test of Map Skills among Students of Government and Private Schools

School Type	N	Mean	S.D.	SEM	SED	t-value	df	Sig. level
Government school	150	18.97	4.41	.361	.442	16.32	298	0.01
Private school	150	26.19	3.14	.256				

Discussions

The current study found that school students had a high level of map skills, nevertheless, a discrepancy was recorded in scoring patterns (Table 1). Furthermore, the study identified a significant mean difference in students' map skills based on their gender, locality, and school type, wherein, male students and students of urban schools and those from private schools had higher levels of map skills compared to their counterparts female students, rural school students, and the students of government schools, respectively (Table 3, 4, 5). The findings of this study were supported by a study undertaken by Henrie, et al. (1997), which found a gender gap in the acquisition of map skills among students, with male students outperforming their female counterparts. Gilmartin and Patton (1984) found that gender played a significant role in map-use activities, such as symbol identification, route map planning, visual search, and orientation among young students, with boys outperforming their female counterparts. Herman, et al. (1988) also reported a substantial difference in the location map skill component between male and female students. Male students' ability to locate places on maps was more accurate than female students, according to Beatty and Tröster (1987). Moon, et al. (2016) found that males outperformed females in cognitive spatial orientation map skills, although there was no statistically significant difference between them.

Notwithstanding, no supportive research on the disparities in map reading abilities between rural and urban students, or between government and private school students, has been discovered. However, the field observation suggested that a lack of teacher engagement for 'slow learners' may have contributed to the disparity in map skills acquisition across school-going students. In terms of the gender gap, it can be claimed that traditional society places less value on girls' education, causing them to get involved in household chores and caring for siblings at home. In this regard, Rahaman and Rahaman (2018) reported similar finding from a study conducted in the same district,

Malda, indicating that girls' performance is harmed by household pressure and uncertain future. The current study concluded that the availability of modern exposures might have caused a difference in map skills among rural and urban students. This finding from the field observation was supported by Anwaruzzaman and Kasemi (2019) who conducted a study in the same district, revealed that the underdeveloped socio-economic conditions in rural areas are the causes of the rural-urban discrepancy in learning. Further, the current study identified from the field observation, that the disparity in map skills between government and private school students was caused by a lack of required staff, infrastructures, pupil-teacher ratio, exposures, and management efficiency, and these findings are consistent with earlier studies, Goyal and Pandey (2009) and Rasool and Bhat (2018) conducted in different parts of India.

Delimitations and Suggestions

This study was delimited to investigate map skills acquired by secondary school students in the Malda district of West Bengal. It was a descriptive study that looked at how students' map skills differ depending on their gender, location, and school type. However, based on the findings, it was suggested that a study be conducted to explore the factors that contribute to better performance as well as the causes for learning disparities in map skills among school students in terms of their demographics, specifically, gender; male and female, locale; rural and urban, and school type; government and private school.

Conclusions

Overall, it is fair to conclude that the teaching of map skills is an important aspect of school education in West Bengal. The factors related to individual, family, and schools potentially affect students' ability to acquire map skills. In light of this, the current study has provided empirical evidence on students' status quo on map skills and learning gaps in terms of gender, locality, and school type. The findings of the current study, henceforth, are worthwhile to stakeholders in comprehending the status of student" map abilities, and in comprehending the implications of students' demographics in the acquisition of map skills at the school level.

In the present study, though the overall level of map skills amongst students was found to be high, but around 10 per cent of students were identified to be less capable of map reading skills. Henceforth, the study suggests, teachers bestow equal importance to all students and direct their special attention to those who were less capable or slow learners. Female students had performed less on map reading skills than male students, which is due to a traditional society that places less importance on girls' education, and the lack of socio-emotional support for girls' education. So, parents and teachers must play a critical role in dispelling the traditional mindset and providing moral supports to young girl students, both at home and school.

Furthermore, the study found that rural school students were less proficient in map skills than urban school students, owing to a lack of modern exposures and educative parental supports for their education. In this case, school authorities should facilitate parent guidance programmes, as well as take steps to ensure required modern equipment in the schools. Students from government schools had performed less on the map skills test compared to private school students. It was found that learning disparities in map skills between the groups were caused by the lack of infrastructure and good management at government schools. Henceforth, government school authorities and teachers should focus their attention on these issues and take the required initiatives to improve map skills among students.

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