

THE IMPACT OF HUMAN FACTORS ON THE RETRIEVAL OF INFORMATION PRESENTED WITH CULTURAL SYMBOLS ON NIGERIAN TOPOGRAPHICAL MAPS.

DR R. O. OLOMO

Department of Geography And Regional Planning,
Faculty Of Environmental Studies,
Ambrose Alli University,
P.M.B. 14, Ekpoma,
Edo state, Nigeria.

INTRODUCTION:

Maps are effective communication devices when they convey information efficiently and accurately. The cartographic communication theory, describes the process whereby information is selected, symbolized on a map and subsequently perceived, recognized and interpreted (Wood, 1972). An important concern for cartographers is how map effectiveness can be increased by actions that will result in more accurate and more efficient map communication (Olson, 1975).

According to Olson (1975), being traditionally associated most strongly with the making of maps; cartographers generally try to improve map effectiveness during the design process. Maps are simplified to show only the relevant material, symbols are chosen in such a way that spontaneous reactions to them are coincident with the desired response, and sometime symbols are adjusted so that at least the average judgments among many map users are correct. Such action according to him involves a modification or adjustment of the map itself, but another possible approach to improving map communication is to attempt to improve readers' skills. With this approach, the reader is trained to deal with the symbols on the map in a more efficient and accurate manner.

Cartographers are constantly striving to produce better maps, through more carefully composed "messages" and more easily decipherable symbolism (Wood, 1972). Wood (1972) believes that many maps already fulfill most of the requirements of functional efficiency, making them "good" in a communication sense, but a breakdown in communication often occurs. According to him, map user misuse, misunderstand and mistake the reliability of maps, and therefore, frequently responsible for this breakdown. The techniques of consumers' research and human factor analysis that are currently being employed to provide for improved maps were adopted in this research. Thus, the study examined the impact of human factors on the interpretation of cultural symbols on Nigerian topographical maps. Several factors that affect the retrieval of information from maps were analysed.

Here the Cartographic Information Transferal (CIT) model of Balogun (1978a) becomes very relevant. The Cartographic Information Transferal (CIT) concentrates on the amount of and factors affecting, Cartographic information at each stage of communication. The more relevant aspect of the model to the issue under discussion is the Retrieved Cartographic Information (RCI), which is the maximum information extracted from the map by the map user. The amount and quality of information obtained by the map user are influenced by a number of factors, which led Balogun (1978a) to derive a functional relationship:

$$RCI = f(P, Eg, AE, C, M, O)$$

Where

RCI = Retrieved Cartographic Information

P. = Visual perception of symbols which is a function of
(colour, shape, form, size, orientation etc)

Eg = general experience in map interpretation.

AE = age and education of the user.

C = cultural background.

M = imaginative ability.

O = other factors e.g. interest, temperament etc.

He then came up with the second law of cartographic information transferal, which states that information is distorted in the process of retrieving the latent cartographic information of the map. Distortion according to him means inequality of any kind, amount, quality, form and so on. However, since the model also points out the factors influencing the cartographic information at each stage, the cartographer can recognize the area where adjustment or improvement is desired (Balogun, 1978a). The ideal situation is for cartographic input to be equal to cartographic output but the attainment is very difficult. Thus Cartographic researches in map design and improvement of map and map symbols are attempts to arrive at the ideal situation. Balogun (1978a) maintained that when the retrieved cartographic information is enormously different in quality and quantity, from the potential cartographic information, there are two checkpoints for determining the cause of the discrepancy. First, the cartographer examines the information processing and mapping procedures; and secondly, he looks at the factors that may affect the retrieval of information from the map. The second aspect is the focus of this paper.

From the foregoing, the more that can be learnt about the requirements of map users and how they detect, recognize and interpret the symbols in maps, the greater will be the opportunity for improving the efficiency of the communication process, to the mutual benefit of both participants. This is specifically important for topographical maps that are under consideration, because they have wider usage. This type of map has to satisfy the consumer's needs and interest, easily readable and understandable, attractive and to crown it; the overall effect should be emotive and rational. According to Kolancy (1969), if the cartographer is to meet such demands, he must very carefully investigate and study the internal and external conditions of those who are to use his creation. He must not only know the needs, interests and tasks of the map users but also be conversant with the level of their knowledge, ability and skill, with the methods they use in working with the map, and also with the environmental conditions in which the map shall be used.

The author strongly supports the view of Wood (1972), that it will never be possible to make a single map-even for a fairly specific task-to suit everyone, because of the wide range of natural abilities, skill experience, education, and so on, within which the user might fall. Also the effects of interests, motivation, and so on, make it even more difficult to predict his reactions and performance in map use situations. Therefore, the cartographer must compromise and produce something which will be intelligible to the highest percentage of users (Wood, 1972).

RESEARCH METHODOLOGY:

Both primary and secondary data were adopted for the study. There are two sources of primary data. These are questionnaire and experimental tests using test cards. The questionnaire is made up of variables relevant to the research work, such as age of respondents,

sex, occupation, level of education, frequency of map use and education in map reading and interpretation among others. Six hundred copies of the questionnaire were administered to respondents in selected schools in Nigeria

The test materials were made up of an extract of a topographical map and test questions. The questions cover delineation, detection, estimation and location/identification choice of test questions for the experiment: First, the questions were reasonably similar to map reading tasks carried out in real life. Secondly, a large number of questions were used in order to be as representative as possible of the variety of different uses of topographic maps. A total of 600 sets of test materials were administered to 600 subjects for the experiment out of which 426 experimental materials were retrieved. This accounts for 71% rate of returns. These subjects were mainly university's undergraduates and secondary school students.

For effective and even coverage the country was divided into four zones: North, South, East and West. The schools were selected in such a way that both standard and less standard schools were chosen in terms of provision of teaching aids and manpower. Thus Federal Government Colleges, recognized state government secondary schools and rural secondary schools were selected for study. Another criterion that influenced the selection of schools was the teaching of map reading and interpretation. Only schools that had covered this aspect of their syllabus were chosen. At the tertiary school level, colleges of Education, Polytechnics and Universities were selected for interview. These schools were randomly selected. At the secondary school level, the respondents were students of Senior Secondary School III; this is because it is at this level that the relevant knowledge of map reading and interpretation is taught. At the tertiary school all levels were interviewed. The reason is to find out the impact of education on respondents performance.

The data were analysed using both cartographic and statistical techniques. The data collected were analysed using diagrams and tables. Results from the questionnaire and the experiments were tabulated and simple statistical techniques were adopted in the analysis and discussion of variables. Specifically the Pearson's Product Moment Correlation Co-efficient was adopted.

CHARACTERISTICS OF THE RESPONDENTS:

The basic characteristics of the subjects are summarized in Tables 1 and 2

Table 1: Basic Characteristics of the Respondents		
CHARACTERISTICS	NUMBER	PERCENTAGE
a) <u>Age of Respondents</u>		
Below 18	52	12.2
18 – 21	126	29.6
22- 25	180	42.2
26 –29	52	12.2
30 and above	16	3.8
b) <u>Sex of Respondents:</u>		
Male	311	73.0
Female	115	27.0
c) <u>Occupation of Respondents:</u>		
Students	419	98.4
Civil Servants	6	1.4
Youth Corp Members	1	0.2
d) <u>Level of Educational of Respondents:</u>		
Secondary School	75	17.6
College of Education	36	8.5
Polytechnic	23	5.4
University	292	68.5
e) <u>Whether respondents have made use of map before</u>		
Yes	419	98.4
No	7	1.6

Source: Field Survey (January, 1999 - June, 2000)

From Table 1, the age of the respondents ranges from mainly 18 years to 30 years, as they were mainly students and with male predominating. Over 98% of the sample population have made use of map before, which is a high percentage for Nigeria, where the rate of map usage is very low. Majority of the inhabitants are not map conscious, the high percentage recorded is as a result of the nature of the respondents, because they are mainly students that make use of maps in their course of study. Their educational level varies from secondary school to tertiary, with the bulk of respondents in the University where topographical maps form a component of curriculum of the departments of Geography and other related disciplines.

S/No	Characteristics	Number	Percentage
a.	<u>Whether respondents have made use of Topographic map before</u>		
	Yes	392	92.0
	No	34	8.0
b.	<u>Frequency of map use</u>		
	Never	7	1.6
	Once every 6 months	113	26.5
	Once a month	81	19.0
	Once every 2 weeks	55	12.9
	Once a week	76	17.9
	Almost everyday	94	22.1
c.	<u>Education in map reading</u>		
	No formal qualification	26	6.2
	Geography ‘O’ level	217	50.9
	Geography ‘A’ Level/NCE	53	12.4
	Degree in Geography	125	29.3
	Higher Degree in Cartography	5	1.2
d.	<u>Where did you grow up?</u>		
	Nigeria	417	97.9
	Outside Nigeria	9	2.1
e.	<u>If in Nigeria where?</u>		
	Urban Environment	231	55.4
	Rural Environment	51	12.2
	Both	135	32.4

Source: Field Survey (January, 1999 – June 2000).

About 92% of the sampled population has made use of topographical maps with frequency of map usage varying from once every 6 months to almost everyday as shown in Table 2.

Over 93% of the subjects have undergone a basic education in map reading, while 6.2% of the respondents have not undertaken any formal education in map reading. Over 97% of the subjects grew up in Nigeria with only 9 respondents representing 2.1% outside Nigeria, 4 from United States of America, 2 from Britain and one each from Japan, Cameroun and Togo respectively. Of those that grew up in Nigeria, most of them live in the urban environment, about a third of them live in both rural and urban environment, while a small sample of the respondents live in the rural environment.

6.3 RESULTS AND DISCUSSIONS.

Wood (1972) observed that several human factors influence the amount of information received in a cartographic communication system, these are natural ability, skill, experience, age, education, interests, motivation etc. According to Balogun (1978a) visual perception includes the processes of seeing and comprehending. This phenomenon varies not only from one person to the other but also from one symbol to the other. He also identified experience in map interpretation, age and education, cultural background, imagination, interest, temperament, and so on, as human factors that affect retrieved cartographic information. Having observed that even the best maps can often fail to communicate their messages to many users, the author proceeded to examine some of the human factors that affect information retrieval from topographical maps using subjects performance in map reading tasks.

The four map reading tasks adopted in the research are delimitation of a feature/area, verification locate–identification and count-estimate. The four-map reading tasks are made up of 6,6, 9 and 11 experiment (test) questions respectively, with a total of 32 test questions. Age and education are to some extent related, and they influence subjects’ performance in the map reading tasks. They both connote some form of experience about the world generally, some wisdom and reasonableness and therefore involve the ability to realize that the map and its symbols are representation of a part of the real world (Balogun, 1978a). Tables 3 and 4 show respectively the performances of the subjects in relation to their age and level of education.

Age Group	Percentage of Respondents	Respondent Mean Performance
Below 18	12.2	18.8
18-21	29.9	19.1
22-25	42.2	20.1
26-29	12.2	20.4
30 and Above	3.8	21.6
	100.0	

Source: Field Survey (January, 1999 - June, 2000).

From Table 3, there is a strong correlation between age and respondents performance in the map reading tasks. The mean performance by respondents in the 32 test questions ranges from 18.8 for age group below 18 years 21.6 for age group 30 years and above, representing 58.8% and 67.5% respectively. The marginal increase in respondents mean performance with increasing age confirmed that as age increases the level of literacy and ability to concentrate and perceive spatial object also improve. This finding is in line with the view of Vernon (1970), that the perception of form becomes increasingly more accurate and rapid with increasing age.

Educational Level	Percentage of Respondents	Respondent Mean Performance
Secondary School	17.6	19.1
College of Education	8.5	14.1
Polytechnic	5.4	19.6
University	68.5	21.5
	100.00	

Source: Field Survey (January, 1999 – June, 2000).

From Table 4, as the level of education advances, the respondents mean performance marginally increases, except for college of education that is drastically low. The lowest average performance of 14.1 was recorded for college of education and the highest of 21.5 for University, representing 44.1% and 67.2% respectively.

The major factor that one can infer to have influenced performance of the respondents has to do with the nature of the various educational institutions surveyed. The nature of schools has to do with the provision of manpower and facilities that enhance the teaching of geography and the related disciplines; no doubt their provision varies among the schools. The low respondents from the secondary schools in comparison to their counterparts was as a result of the non teaching of map reading and interpretation in most secondary schools as at the time the survey was conducted. This period incidentally was the third term, few months to their final senior secondary school certificate examinations, thus most of the teachers either dodge or shelve the teaching of this aspect of geography at the secondary school level. This will go a long way to influence their performance at the tertiary school level. The high performance of secondary school respondents may be attributed to the fact that map reading and interpretation had been taught to the respondents and the provision of teaching facilities.

The low performance of college of education respondents may be partly attributed to the fact that most of the respondents were not well grounded in map reading and interpretation at the secondary school. Also the provision of manpower and teaching facilities in the college or misinterpretations might occur due to the relatively small sample size. An interesting dimension in the respondents performance is that the higher their level of education, the less their performances for only college of education. To justify this result, the author supports the view of Wood (1972) that “the only conclusion one can draw from this is that the nature of formal education in map use has not developed this potential and might even have depressed it in certain cases” this is the dilemma of these respondents.

In the University, the respondents performances increases as the level of study advances, although the increases recorded are in some cases marginal. Also there are variations in performances within the universities. The Universities that are very good in terms of the development of cartography and Remote Sensing have a solid foundation in map reading and interpretation as exhibited by the respondents’ performance. The issue raised is based on the author’s knowledge of the manpower and facilities situation in the various schools. However, it must be noted that this study did not consider the impact of facilities and manpower. The relationship between age and educational level and respondents’ performances are depicted in figures 1 and 2 respectively.

Experience in map interpretation and education in map reading also affects the amount and quality of information retrieved from the map (Wood, 1972); Olson, 1975; Balogun, 1978a; and Clarke, 1989). There is a strong correlation between experience and frequency of map use. An experienced map interpreter realizes that the map symbols are not usually drawn to scale and he knows what the standardized symbols mean without even consulting the legends (Balogun, 1978a). While one would expect experience to have a positive effect on the ability of users to extract information from maps, there are several studies in cartographic literature that have concluded that a general cartographic or geographic background has no effect on subject accuracy (Olson, 1975). According to him, a general lack of effect with age and experience was noted, only speed was enhanced. From several studies on map comparisons, it has also been concluded that experience, defined as geographic or related training, does not result in greater accuracy. However, this is not true as the research findings indicate.

In this study, experience is measured, using frequency of map use, no doubt, the more frequent one makes use of a particular thing, the more experience one acquires about the thing. Table 5 shows the performance of the respondents in relation to the frequency of map use.

Fig.1: The Relationship Between Age and Respondents Performance in Map Reading Tasks.

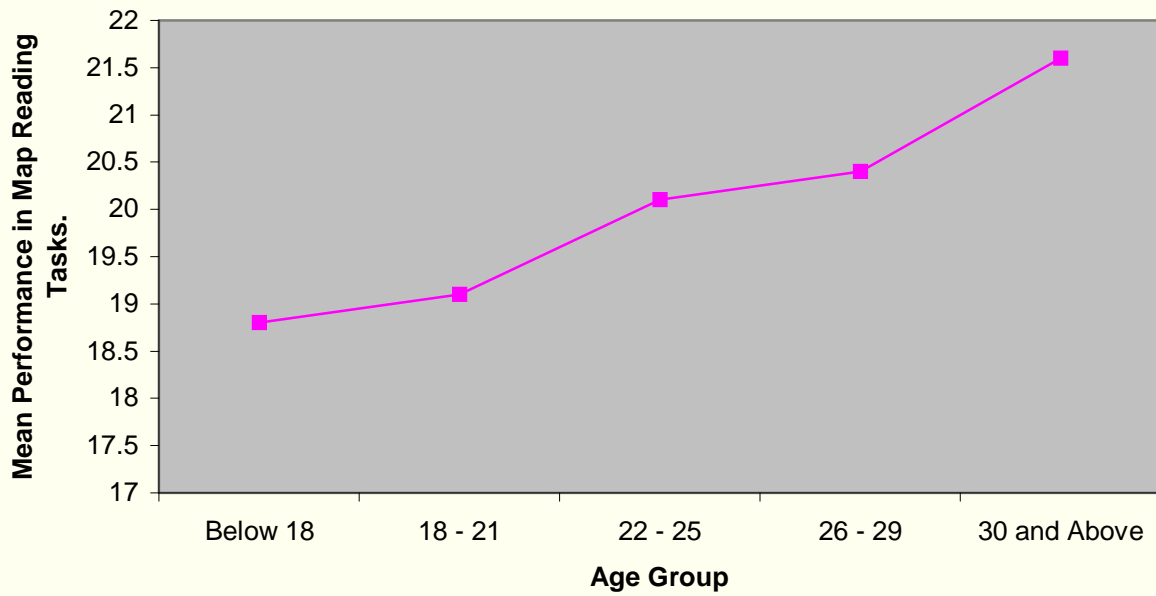


Fig. 2: The Relationship Between Educational Level and Respondents Performance in Map Reading Tasks.

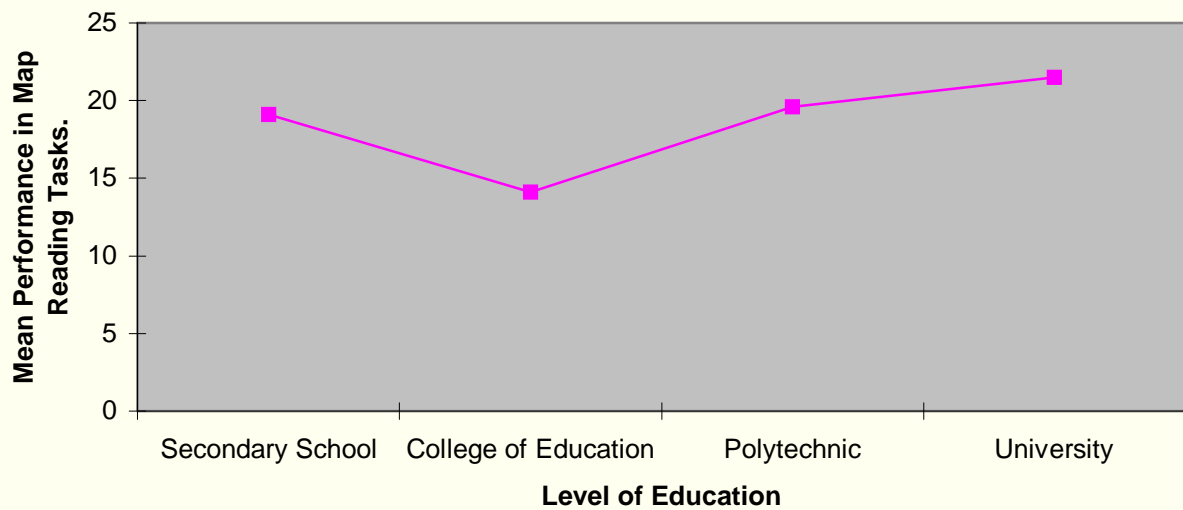


Table 5: Frequency of Map Use and Respondents Performance in Map Reading Tasks.		
Map use Frequency	Percentage of Respondents	Mean Performance of Respondents
Never	1.6	18.6
Once every 6 months	26.5	19.5
Once a month	19.0	19.5
Once every 2 week	12.9	19.6
Once a week	17.9	20.4
Almost everyday	22.1	19.8
	100.0	

Source: Field Survey (January, 1999 - June, 2000).

From Table 5, the more frequent the respondents make use of map, the higher their mean performance, except for ties of 19.5 recorded in the mean performance in the two map use frequency of once every 6 months and once a month and a fall in mean performance of 20.4 recorded for map use frequency of once a week to 19.8 for map use frequency of almost everyday. This observation may be due to the higher sample population map use frequency for once every 6 months and almost everyday respectively. However, the mean performance in map use frequency for almost everyday is higher than those of previous map use frequencies except for once a week. The relatively high performance of those who have never made use of map before may be attributed to their level of education, natural abilities, interest and motivation.

From the foregoing analysis there is significant relationship between the frequency of map use and the efficient interpretation of information from the map. There is positive relationship between frequency of map use and the efficient interpretation of information from the map; the Pearson's Product Moment Correlation Co-efficient is 0.68. Thus the more frequent the map user (recipient) makes use of the map, the more accurate the recipient will be in obtaining information from the map, including map reading/interpretation tasks. Although from Table 5 the increase are marginal. A reason that may have affected the above result is the inability of the respondents to identify the exact map use frequency class they belong, as the terms used in measuring the frequency of map use lack precision.

According to Wood (1972), there is little doubt that those who have been trained specifically to use maps, perform considerably better than even the general user of above average intelligence and experience. Olson (1975) also supported this view by stating that both reader training and improved map designs can be used to increase the communicative effectiveness of maps. He went further to say that a small amount of reader training can clarify the concept involved in that task and such clarification increases accuracy. Olson (1975) succinctly pointed out the existence of a strong correlation between educational training in map reading and accurate information retrieval from map. According to him, while the results of tests with such specific tasks do not mean that geographic training and map reading ability in general have no relationship, they surely suggest that the ability to deal with some tasks is not acquired during such training. He advanced many reasons for this, including the possibility that these tasks simply cannot be learned as a part of map training or that they are unrelated to actual map tasks, citing examples that are basically perceptual in nature.

Studies showing that training has no effect may be due simply to a lack of relevant experience for the specific tasks involved in the tests. If this is true, it cannot be concluded that map training does not affect accuracy but rather that the training must include experience, if it is to

affect performance. Thus it is possible to evaluate the impact of training in map reading in the reader's ability (performance) on map reading tasks such as those involved in topographic map interpretation. Table 6 shows the performance of the respondents in relation to their education in map reading.

Table 6: Education in Map Reading and Respondents Performance in Map Reading Tasks.		
Education in Map Reading	Percentage of Respondents	Mean Performance of Respondents
No formal Education	6.2	18.0
Geography O'Level	50.9	19.5
Geography A'Level	12.4	18.5
Degree in Geography	29.3	21.9
Higher Degree in Cartography	1.2	22.2
	100.0	

Source; Field Survey (January, 1999 – June, 2000).

From Table 6, the result of the research findings also supported the view of Wood (1972) and Olson (1975) that education in map reading has positive impact on the reader's performance in map reading and interpretation tasks. The only exception to the rule is recorded for subjects that acquired their education in map reading at Geography Advance Level/NCE, whose mean performance decline from 19.5 for Geography O'level to 18.5. The low performance of college of education respondents was noted in the section that relate performance to the level of education, and some reasons were offered for the low performance, this is also reflected here. The relatively high performance for those without formal education in map reading may be attributed to the subjects' natural abilities, experience, educational level, interest and motivation. The relationship between frequency of map use and education in map reading and respondents performance are represented in figures 3 and 4 respectively.

From the result above, there is significant relationship between education in map reading and accurate retrieval of information from the map. There is a positive relationship between education in map reading and accurate retrieval of information from the map; the Pearson's Product Moment Correlation Co-efficient is 0.71. Thus as education in map reading advances the better interpreter/analyse the recipient will be in map reading and interpretation tasks. There is little doubt that improved education techniques in map work and geography and some means of informing people about the principles that underlay selection and symbolization in cartography will go a long way toward helping to improve the situation for the future (Wood, 1972).

However, there are fundamental problems confronting the teaching of map reading at the secondary schools, which is supposed to be the bedrock of students' performance at the tertiary level. Okoye (1975) in teacher's forum, examine "the problems and, methods of teaching map work in post-primary schools in Nigeria". He identified lack of interest on the part of students who regard map as the most difficult aspect of Geography; weaknesses in the methods of teaching map work, making it abstract and difficult and coupled with the fact that in most schools map work is not taught until final class. He concluded that this unwholesome attitude towards geography in general and map work in particular, calls for a reappraisal of our method of teaching geography, and particularly map work in schools.

Other factors that have been identified that can influence information retrieval from maps are interests, motivation, skill, natural ability, cultural background, imagination and temperament. However, skill natural ability and imaginative ability are directly or indirectly related to some of

the factors examined in this study. Interests, motivation and temperament were however, not covered in this study. The impact of cultural background was observed in the study, especially in the interpretation of mosque, where respondents' performance from the northern parts of the country was higher than their southern counterparts. The role of memory of the respondents, which could be of long-term memory and short-term memory span, cannot be ignored. Also, important is learning which vary with individuals.

Fig 3: The Relationship Between the Frequency of Map Use and Respondents Performance in Map Reading Tasks.

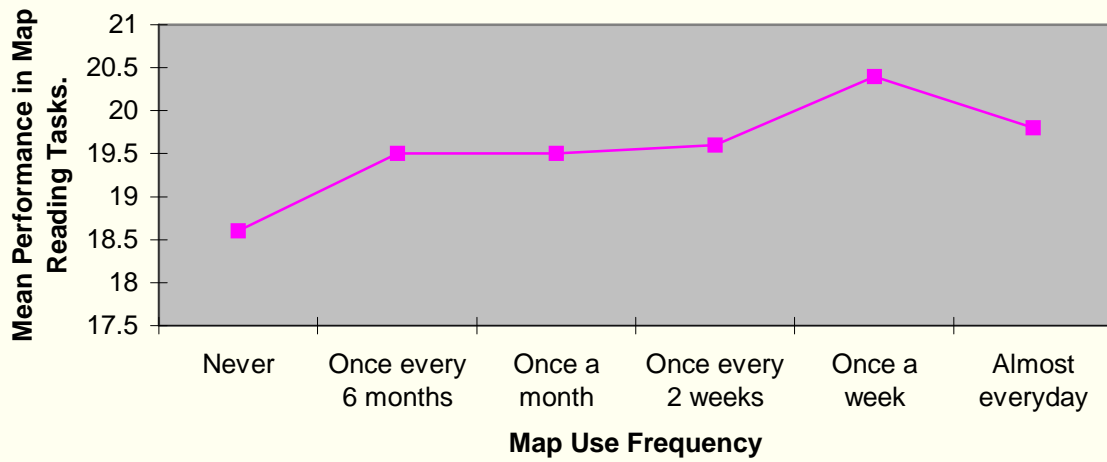
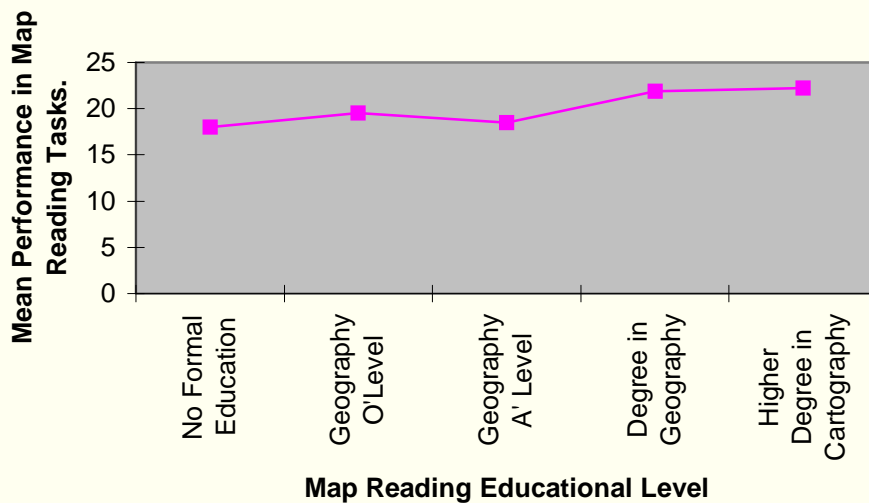


Fig 4: The Relationship Between Education in Map Reading and Respondents Performance in Map Reading Tasks.



CONCLUSION:

The study examined the effect of human factors on the retrieval of information presented with cultural symbols on Nigerian topographical maps. The more that can be learnt about the requirements of map users and how they detect, recognize and interpret the symbols in maps, the greater will be the opportunity for improving the efficiency of the communication process, to the mutual benefits of both participants. Wood (1972) observed that several human factors influence the amount of information received in a cartographic communicating system, these are natural ability, skill, experience, age, education, interests, motivation etc. Balogun (1978a) identified experience in map interpretation age and education, cultural background, imagination, interest, temperament as human factors that affect retrieved cartographic information.

Experience in map interpretation and education in map reading also affects the amount and quality of information retrieved from the map (Wood, 1972; Olson, 1975; Balagun, 1982; and Clarke, 1989). There is a strong correlation between experience and frequency of map use on the retrieval of information as the research findings indicated. Thus, the more frequent the map user (recipient) makes use of the map, the more accurate the recipient will be in obtaining information from the map, including map reading/interpretation tasks. According to Wood (1972), there is little doubt that those who have been trained specifically to use maps, perform considerably better than even the general user of above average intelligence and experience. Olson (1975) also supported this view by stating that both reader training and improved map design can be used to increase the communicative effectiveness of maps.

The result of the research findings also supported the view of Wood (1972) and Olson (1975), that education in map reading has positive impact on the reader's performance in map reading and interpretation tasks. From the study, the influence of the map user level of education, experience, age, interest, etc, is seen to be one of the stumbling blocks (obstacles) to effective communication. As a result of the variation among people in the above factors considered, the information obtained from a map also varies. Thus a consideration of these factors by the cartographer is essential when maps are designed.

REFERENCES

- Balogun, O.Y. (1978a): Cartographic Information Transferal: A new look at Communication in Cartographic, Proceedings of the 3rd Australian Cartographic Conference, PP. 64 – 84.
- Balogun, O.Y. (1982): Communicating through statistical Maps, International Year. Book of Cartography Vol. XX1.
- Clarke, L.M. (1969): An experimental investigation of the communicative efficiency of point symbols on tourist maps, The Cartographic Journal, Vol. 26, June, 1989, PP.105 –110.
- Kolacny A. (1969): Cartographic Information – a Fundamental Term in Modern Cartography, The Cartographic Journal, Vol. 6.
- Okoye, T.O (1975): The Problems of Teaching Map Work in Post – Primary Schools in Nigeria, The Nigerian Geographical journal, Vol. 18, December, 1975, No.2, PP. 173 - 180.
- Olson, J.M. (1975): Experience and improvement of Cartographic Communication, The Cartographic Journal, Vol. 12 , No.2, December, 1975, PP. 94 – 108.
- Vernon, M.D. (1970): Perception through Experience, Barnes and Noble Inc.
- Wood, M. (1972): Human Factors in Cartographic Communication, The Cartographic Journal, Vol. 19, No.2, December, 1972, PP.123 – 132.
- Topographical Maps:
- 1 : 500 000 – Nigeria sheet 28.
 - 1 : 250 000 – Benin City sheet 70.
 - 1 : 100 000 – Idah sheet 267.
 - 1 : 50 000 – Ado-Ekiti, N.W. Sheet 244.