

# EFFECTS OF KNOWLEDGE MAPPING AND ALTERNATIVE TO LINEAR AND NOTE TAKING ON STUDENT'S ACADEMIC ACHEIVEMENT IN GEOGRAPHY

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## **Abstract**

This study was prompted by the poor performance in Geography in the Senior Secondary School Certificate Examinations. The study sought to find out the effects of Note-taking patterns on students' academic achievement. A quasi experimental non-equivalent control group design was adopted 225 SSI students in three intact classes of each of the three secondary schools in Enugu South LGA of Enugu State formed the sample. The experiment was conducted during the students' normal class periods and their regular class teachers trained by the researchers taught the subjects. Test of Geography Achievement (TOGA) on Geography was used for data collection. The data collected were analysed using covariance analysis. The result showed that knowledge mapping and alternative to linear notes had significant effect on students overall achievement in Geography. The knowledge mapping and alternative to linear were found to be more effective than the conventional method in terms of improving students' achievement. The knowledge mapping notes were more efficacious than the other two methods of alternative to linear and conventional methods in inducing achievement. The results of this study have some implications for Geography teachers, students and educational planners. Some recommendations were made.

In Nigeria, prior to 1985, the traditional approach to the study of Geography in secondary schools was leading the subject towards extinction. Performance in certificate examination was declining. Many choose Geography for school certificate examination to make up the number of subject entries (Okafor, 2000). The poor image of Geography among secondary school students was attributed partly to its wide content and partly to the old fashioned approach to the teaching (Faniran, 1 977). Teaching of Geography in schools then was criticized for not being able to prepare students for effective living in the society. The teaching was theoretical. Performance in examination was also observed to be poor. Question in both teacher-made and external examination analyzed according to processes involved showed overemphasis on memory (Okpala, 1987)

Inspire of these, the federal government still recognizes the importance of Geography in national development by making it a core subject. In the 6-3-3-4 education programme in Nigeria as it concerns secondary education, the curriculum is composed of too major sections, the core subjects and objectives. The core subjects are made up of six groups namely;

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English Language, One Nigerian Language, Mathematics, One of the following alternative subjects, Physics, chemistry and biology, One of the following alternative subjects:- Lit. in English, History and Geography, Agricultural Science or a vocational subject.

The core subjects are basic subjects which will enable students to offer arts or science in higher education. Geography was recognised as one of the core subjects, though an elective with Literature in English and History. By this arrangement, science based students are only left with the option of choosing Geography as one of the subject they must offer.

During the revision of various curricular towards the 6-3-3-4 educational programme in Nigeria in 1985, geographers made a lot of inputs by infusing more realistic topics into the Geography curriculum. Some irrelevant topics were removed without lowering the standard of the subject. In the new curriculum package, emphasis is on conceptualization, local studies, field work and problem solving approach as a means of preparing the minds of the learner for solving environmental problems (Musa, 1989). Realistic topics such as Environmental Hazards and Environmental interactions were included in the curriculum and such innovation made improved teaching methods necessary. For instance, field work became a compulsory aspect of Continuous Assessment and it goes to all aspect of Geography to enable students of Geography acquaint themselves with geographic phenomena. Other important methods such as practical work, game and simulation became essential ingredients for the teaching and learning of Geography.

Despite all these efforts in teaching and learning Geography, performance in the subject in recent time continued to decline as shown in Table 1

**Table I Students Performance in SSCE Geography 2007 to 2011 in Enugu**

Years	Entries	1-6	7-8	Failure	% of Credit	% of Pass	% of Failure
2007	8,273	1751	2532	3990	21.17	51.77	48.23
2008	8,124	2368	2145	3611	29.15	55.55	44.45
2009	9,024	2356	2454	4214	26.11	53.30	46.70
2010	7,758	1754	2042	3962	22.61	48.93	51.07
2011	8,023	1513	1842	4668	18.86	41.82	58.18

Source: West African Examination Council, Enugu (1993).

Looking at the data on the above table, it is clear that the situation of Geography in our secondary schools does not seem to have improved tremendously. On the average, judging from the overall performance, only about

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23,58% of student who entered for the subject during the 2007 – 2011 passed at distinction and credit levels, 49.73% on the average failed.

The problem of Geography at the implementation levels of the curriculum process has been of much concern to Nigerian geographers. These problems range from poor methods of teaching and evaluating the subject, lack of teaching materials, interest and motivated teachers. Geographers have therefore, focused attention on how to improve the teaching of the subject. Ayeni (1990) indicated that the problem with Geography is methodology. It is methodology problem according to Ayeni (1990) that led to such criticisms that the scope of the subject is very wide or that the time allocated to the teaching of the subject is not enough. Therefore the question is how can the teaching of this wide content subject be made more meaningful and attractive to the students? Which learning strategies would attempt to reduce the scope without lowering the standard of the subject so as to facilitate revision for students during their internal and external examinations?

Okpala (1987) indicated that practical work is the hallmark of the new Geography. According to him, for Geography teaching to be practical, a lot may be needed which requires financial involvements. Unfortunately, the government has not done much to improve the financial base for Geography teaching. As a result, for instance Alaba (1988) found out that none of the schools he used for his study has all the necessary materials. The seriousness of the situation is best understood by observing the proportion of schools that lack equipment. According to Okpala (1987) percentage of school that did not possess the following equipment were: wall maps and atlas (5%), thermometer (25%), topographical sheet (26%), wind vane (37%), Globes (37%), Rain gauge (63%) and Compass (70%).

Therefore, to keep the Geography flag flying Okpala, (1989), Geography has to be taught more meaningfully by resourceful, dedicated and intrinsically motivated teachers especially in the period of depressed economy. However, Geography educators and researchers have been working on how to improve the teaching of the subject so that meaningful learning will take place. This has led to the development of various models, methods and techniques for the teaching and learning of Geography. For instance, minimum structure simulation exercises has been developed and used (Okpala, 1989; Okarazu, 1989 and Anikweze, 1989), project-works have been developed and used (Ezeudu, 1991). Computer Assisted learning procedure have been popularized. Role-play in Geography has been practicalized (Ekweghariri and Okpala, 1991). Team-teaching approaches in Geography have been explored (Johnson, 1988) and field work technique practicalized and found useful (Adinna, 1989).

In all these research efforts highlighted above in the area of Geography education, little effort has been made to look into note-taking pattern as it is an

important factor in learning. It is the most readily available cue to the memory. At both secondary and tertiary levels, scholars learn from many sources, therefore taking good notes is of practical importance, hence, without good notes, students would find it difficult to integrate information from all these sources. Acquiring skill in bringing together various aspect of learning that took place in formal setting such as the classroom is important in learning process. An ideal note is supposed to be a rich summary containing all the items and necessary ingredients for effective qualitative utilization. The most common note-taking patterns are:

- i) Patterned-notes in form of brain pattern notes (Mind maps), knowledge map or concept maps,
- ii) Conventional notes including underlining and
- iii) Alternative to linear notes (Buzan, 1974).

The researchers observed that the conventional note taking method is the most popular method being used in secondary schools. According to Paul (1989), alternative to linear note is a modified conventional note-taking pattern adopted as a way of checking comprehension. The teacher delivers his/her lesson, students jot down salient points the teacher makes as lesson progresses. At the end of the lesson, students recall and develop their notes in details.

It is a note form of instructional procedures which has been studied under varieties of names like Map (Floyd 1984); Concept-Mapping (Novak, 1984); Cognitive Instruction Cartoon (Lambiotte, 1989), Systematic Institutional Design and Cognitive Maps (Norak and Godwin 1984). Knowledge mapping make the note to resemble a programme of instruction such as seen in a computer. It has the advantage of giving the user a bird's eye view of the note. The notes contain key ideas and the links specifying the relationship between nodes (Mac Cagg and Danserean, 1991) and add structure and organization to the map (Reyway, 1992).

It has been claimed that knowledge maps facilitate the organization, presentation and acquisition of information. Research in cognitive and educational psychology support the use of knowledge mapping as spatial learning strategy to form .spatial representation of information (Novak and Godwin, 1984). As Geography is basically the science of spatial organization, it will be interesting to find out how teaching strategy that seek to form spatial representation would be effective in the teaching of Geography. Amer (1994) had earlier sought to find the effect of knowledge mapping and underlining on the Reading Comprehension of the Scientific Texts. He concluded that the fact that the knowledge map group performed better than the underlining group on summary task might be a tentative suggestion that knowledge-mapping might be more effective strategy for scientific texts.

On the problem of the study, Geography education in Nigeria had been criticized for not quite preparing students for effective living in the society. There

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was evidence to show that the level of achievement in Geography was lower than expected (Onasanya, 1985; Okpala, 1987; Okpalama, 1987). The low level of achievement had been attributed to a number of factors. For instance many researchers identified that the teaching had been theoretical (Adejuyigbe, 1973), while some pointed accusing fingers to poor teaching methods involving overemphasis on memory (Okpala, 1987, Nwagu1985, Okafor, 1990). Okey (1984) noted that the problem of vastness of Geography syllabus was responsible for the overall low standard of Geography education. Evidence was therefore abound that results of external examinations leave much to be desired of Geography teachers and students. It is disheartening to see the degree of ignorance among candidates of Geography in their home country.

### **Purpose of the Study**

This study aimed at investigating effects of knowledge mapping, alternative to linear and conventional pattern on academic achievement, of SS I students in Geography.

### **Significant of the Study**

The significance of the study is viewed from the theoretical and practical perspectives. Theoretically, this study is anchored on both the constructionist theorist school of philosophy and cognitive behaviourist theorist of psychology. The constructionists believe that human cognitive structure is weblike (Novak, 1990). Knowledge map, which is structured in weblike manner, is supposed to be meaningful to students. A knowledge map is a schematic representation of concepts and their inter-relation, often arranged in a framework that appears like a flow-chart. It is a meta-cognitive strategy, which is based on Ausubel-Novak-Gowin theory of meaningful learning. Simply put, it is an application of some psychological principles which aim at helping the students to "learn how to learn" by applying cartography in representing concepts.

The cognitive behaviourists believed that children are expected to vary widely in their mental abilities, past achievement, learning rate, motivation, interest and learning style. This wide range of individual differences among students makes it unlikely that group instruction alone with or without ability grouping can meet the variety need of students. Individualized instruction involves adopting instructional procedure to fit each student's individual needs so as to maximize his learning and development. This will permit the student to select the objectives, the method and materials of study. Thus, the student can design individual programme that best satisfies his own interest, learning style and learning rate. Emphasis here is on learner's responsibility and learners direction. This system of learning will be facilitated when the alternative to linear note-taking method is adopted in a setting such as classroom.

On the practical dimension, the study which aimed at exploring the efficacy of knowledge mapping or/and Alternative to linear pattern over the conventional/linear note-taking pattern on academic achievement may likely provide valid empirical support to the previous studies (Amer, 1994). The study will provide pedagogical information to improve learning of Geography.

In making the knowledge maps, students would be able to consider all possible relationship between learning materials with the previous knowledge. By this type of learning, new materials are organised deliberately in cognitive structures such that they can be retained and easily retrieved for use to solve problem of their everyday living. The strategy would therefore go a long way to boost achievement and foster interest and retention in Geography since it allows students to take charge of their learning by being able to prepare their notes on their own based on available learning experience.

### **Scope of the Study**

The study was limited to find out the effect of note-taking patterns (knowledge mapping and Alternative to linear notes with the Conventional method as a control).

The scope covered specific topics under Geography that form the basis of this study are the topics under study for the first six (6) weeks in the first term of senior secondary class one (SS 1) in Enugu Education Zone of Enugu State. This is because, the study will be carried out during the first term as the researcher would not like to disrupt normal school calendar.

### **The Research Question**

What is the effect of knowledge mapping and alternative to linear notes with the conventional method as a control on students achievements in Geography?

### **The Null Hypothesis was Tested at Alpha 0.05**

There is no significant different among the mean achievement scores of students taught with knowledge mapping, alternative to linear method and those taught with conventional method in selected Geography topics.

### **Research Methods**

The research is a quasi-experimental study of non-equivalent control group design. This is because it is not possible to have complete randomization of the subjects. Intact classes were used. The intact classes randomly assigned to experimental and control groups were used. The treatment of the subjects was done as indicated below.

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**Table 2: Assignment of Subjects to Treatment Groups**

Experimental Group I	EI	OI	Ex Km	02
Experimental Group II	E2	OI	Ex A1	02
Experimental Group III	C	OI	Ex Cm	02

Where EI = Experimental Group One  
E2 = Experimental Group Two  
C = Control Group  
O<sup>1</sup> = Pre-test  
O<sup>2</sup> = Post-test  
Ex Km = Knowledge map treatment on Experimental Group One  
Ex AI = Alternative to linear treatment on Experimental Group Two  
Ex Cm = Conventional method for control group

The population for this study consisted of all the 1225 senior secondary school (SS 1) students who offered Geography in all the 42 secondary schools that have at least three streams in Enugu South L.G.A. SS I students were used because they had not yet made choices on which subjects to offer in the Senior School Certificate Examination. This enabled the researcher had enough subjects for the study. Secondly, since the SS1 students were exposed to the study of Geography for the first time, they had not formed fixed opinion on the subject.

The sample consisted of 225 SS 1 students. The sample was drawn through a multi-stage techniques. Schools in Enugu Education Zone were clustered into three local government areas (Enugu East, Enugu North and Isi-Uzo L G A's). Then random sampling technique was used to select one co-education school from each of the LGA's in the zone. The schools selected had up to three or more streams (classes) of SS 1 students. A simple random sampling technique was used to choose three streams if there were more than three streams of SS 1 in the schools picked. This was because in each school, two streams were experimental group one and two while the third stream was the control group. Finally, there was random assignment of intact classes from each school to Experiment Group I, Experimental Group 11 and control group.

The researcher constructed one instrument pertinent to the study. This was the test of Geography achievement (TOGA).

The TOGA covered the six units taught during the study. The test blue print as well as the TOGA was face validated by two experts in the Department of Geography and one from measurement and evaluation of sub-department of Science Education, University of Nigeria, Nsukka, their criticism and vetting helped in modifying and/or replacing some items. A total of thirty-five (35) items made up the TOGA. The items measured objectives in the cognitive domain of

Blooms taxonomy of education objectives. The weighting of the objective level was based on the proportion of low order level and high order level as suggested by Margaret (1990) in Ebouh, (2004) in the same units of study in the SS 1 Geography curriculum in Enugu State. This is because it was observed that students do not normally exceed the comprehension level by the time they complete their post primary school programme in some social science subjects (Supper, 1960).

The initial test of TOGA was carried out at Opi High School, Nsukka in Nsukka Education zone. The test was written by 30 SS I students who were about starting their promotion examination to SS II and who had already covered the topics under study, The 30 students were made up of members of intact class who were available at the time the researcher visited the school. The purpose of the pilot testing was to determine the item mortality. From the test scores, two psychometric characteristics of the items were calculated in order to determine the items that will be finally used. These were the item Difficult Index and the item Discrimination Index. Based on these, 30-test items were finally selected. The consideration for including an item in the final version of the TOGA was based on the item satisfying these psychometric properties:

- i) An item difficult level of between 0.30 and 0.70-
- ii) An item discrimination level of between 0.20 and 1.00 (Nwana, 1989)

The thirty (30) test item finally selected was trial-tested on the sample of two classes of SS I Geography students from two schools in Nsukka Education zone. The purpose of the trial test was to determine the coefficient of internal consistency of the TOGA. The TOGA was therefore a 30-test item of the 4-option multiple choice objective test.

To establish the co-efficient of internal consistency of the instruments used for the study the following steps were taken: scores generated from the SS I students used for the trial test were subjected to the Kuder Richardson-20 (K-R) formular and found to be 0.90 K.R. 20 formula was considered appropriate since TOGA consisted of items that are dichotomously scored.

In order to reduce as much as possible experimental bias so as to increase validity of the experiment the following measures were adopted.

1. **Experimental Bias:** - The researcher did not do the actual teaching of both the experimental and the conventional groups. The actual teaching was done by the regular teachers of the participant classes.
2. **Teachers Variables:** - There was a training programme of all the teachers that were involved in the study. During the period, the validated lesson plans were discussed between the researchers and the teachers. The researchers gave the teachers common instructions. There was trial teaching by the teachers during the training programme, which was supervised by the

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researchers. The researchers did not show the tests to be used to evaluate the students to the teachers during the training.

3. **Class-Interaction:-** The researchers instructed the teachers to make sure that each group completed the note-taking using the appropriate note-taking pattern for the class before he/she leaves the class at the end of each lesson. This was to prevent the students to exchange ideas and notebooks outside the classroom.
4. **School Variables:-** To check this variable, the sampled schools were drawn from the same neighbourhood, Enugu Education Zone and therefore are assumed to be most likely to have the same environmental conditions.
5. **Initial Group Differences:** All the sampled schools were public schools. Unity schools as Government Colleges, University demonstrating Schools etc. were not used. In the public schools, there is nothing like ability streaming arrangement. The use of analysis of covariance served as a controller for the initial differences across groups as well as to increase the experimental precision by partitioning out the variation due to extraneous variables thereby reducing error variance (Ferguson, 1981).
6. **Homogeneity of the Instruction Situation:** - To ensure the homogeneity of the instruction across all groups, the following conditions was met.
  - (a) The subjects were taught by their subject teachers who had already been trained.
  - (b) The teachers strictly followed the lesson plans prepared by the researchers.
  - (c) All the subjects were exposed to the same instructional content within the school regular periods allocated to Geography in the school time table.

The initial drafts of the lesson plans by the researchers for the experimental and the control groups were faced validated by three Geography teachers and two experts in Measurement and Evaluation (with Geography background) from the Department of Education, University of Nigeria, Nsukka. The modified plans were used during the training programme for the teachers. This was to ensure that the lesson plans were readily usable and comprehensive. This was also to ensure that the lesson plans were achieving the stated objectives of each lesson. Feedback from the training programme on the lesson plans was incorporated in the final draft of the lesson plans.

The TOGA was administered to the subjects before the study starts. This was the pre-treatment tests, which served as covariates for the variables. The lesson plans were used in teaching the subjects. The actual teaching lasted for six weeks. The TOGA was administered to the subjects immediately after the last period of teaching. This was the post treatment test. The teachers in each school taught the lesson and administered the instrument under close supervision of the researchers.

The training programme for the teachers from the sampled schools was as follows:

- i. Meaning of Knowledge mapping, alternative to linear and the conventional note-taking methods.
- ii. Definition of terms associated with note-taking patterns e.g. General to specific, relationship, hierarchy and cross link.
- iii. Identifying main concepts of topic.
- iv. Identifying key points of a concept.
- v. Construction of Knowledge mapping.
- vi. Steps involved in formulating notes through Alternative to linear method.
- vii. Rehearsal of Conventional method of note-taking pattern.
- viii. Review of the Lesson Plans.
- ix. Teaching demonstrations

During the training, the researchers pointed out that the emphasis was on note-taking by the subjects. All the teachers were trained together. At the end of the training the teachers were given the lesson plans and the knowledge map models of notes. The training therefore enhanced the achievement of minimum uniform standard in the implementation of the experimental conditions.

The research questions were answered using the means and standard deviations. A Two-way (3x2) i.e. (Knowledge mapping, Alternative to linear, Conventional method) analysis of covariance (ANCOVA) was used in testing the hypotheses. The pre-achievement was used as covariates to post-achievement scores. The ANCOVA served as a controller for the initial differences across groups as well as to increase the experimental precision by partitioning out the variation due to extraneous variables thereby reducing error variance (Ferguson, 1981). To ensure the suitability for the use of ANCOVA, a preliminary analysis of linearity and homogeneity of variables were established using Pearson Correlation Coefficient for linearity and Levene test for homogeneity of variance. Where significant main effect existed, a Scheffe post-hoc comparison test was conducted to determine the size and direction of the difference. The method was preferred because of its simplicity and suitability for any group comparison (Ferguson, 1989). All analysis were carried out using computer.

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### **Results**

The results were presented below according to the research question and hypothesis to which they pertain

### **Research Question**

What is the effect of knowledge mapping and alternative to linear notes with the conventional method as a control on students achievements in Geography?

Results utilised in answering this research question were shown on table three below.

**Table 3: Means and Standard Deviations of Students Pretest and Post Achievement Scores.**

	Exp Group I Knowledge Mapping			Exp Group II Alternative to Linear			Control Group conventional Method		
	X (mean)	SD	N	X (Mean)	SD	N	X (mean)	SD	N
Pretest	55.80	9.55	40	44.44	11.90	32	40.16	6.68	38
Post test	55.37	9.72	38	44.19	8.84	42	40.69	4.70	35
Overall Score	55.59	9.57	78	44.30	10.20	74	40.07	6.27	73

Table 3 showed that the mean achievement scores for the experimental group I, experimental group II and the conventional group were 55.59: 44.30 and 40.07 respectively. Therefore students taught with knowledge mapping notes had the highest mean achievement scores, followed by those taught with alternative to linear note-taking. The group taught with the conventional method had the least mean achievement-scores.

### **Research Hypothesis**

There is no significance difference among the mean achievement scores of students taught with knowledge mapping, alternative to linear and those taught with conventional method of note-taking in Geography.

**Table 4: Analysis of Covariance (ANCOVA) of Overall Students' Achievement Scores by Note Taking Patterns**

Source of Variation	Sum of Squares	Df	Mean Squares	F-Calculated	F-Critical	Remarks
Covariates	5835.357	1	5835.357	102.417	3.84	*
Main Effects	11806.423	3	3935.474	69.072	2.60	*
Methods	11196.397	2	5596.257	98.256	2.99	
Explained	19006.098	6	3167.516	55.501	2.09	
Residual	12420.331	218	56.976			
Total	31425.929	224	140.296			

\*Significance at  $P < 0.05$

Information on Table 4 provided data for the testing of the hypothesis. The data showed that the calculated F-value for the effect of treatment on students' achievement in Geography of 98.26 was significant at 0.05 level of significance. This was because the value was much higher than that critical value of 2.99 for 2 and 218 degrees of freedom. A significant F. value suggests that rejection of null hypothesis as stated. Therefore on the basis of this, the null hypothesis was rejected. This implies that there was a significant difference in the mean achievement scores of students taught with different method of note-taking patterns.

As a result of the significant main effects observed on Table 4 above, Scheffe post-hoc comparison test was conducted to determine the direction of difference.

**Table 5: Scheffes Post-Hoc Pair Wise Multiple Comparison Test of the Treatment Groups for Achievement.**

	Mean	Group 1 Knowledge Mapping	Group Alternative to Linear	Group 11 Conventional Method
		55.59	44.30	40.07
Knowledge Mapping Group I	55.59			
Alternative Group II	44.30			
Conventional Group III	40.07			
Significance difference				

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When a Scheffe post-hoc pairwise multiple comparison test was conducted on the mean achievement scores of the three groups, it was observed that significant difference existed between Group I and Group II; Group I and Group III; and Group II and Group III. This implies that Group I scored significantly higher than Group II and Group III and that Group II score significantly higher than Group III. The implication of this result was that knowledge mapping probably indicated superiority over the second and third methods of note-taking in enhancing achievement.

### **Discussion of Findings**

The evidence obtained in this study showed that the two experimental groups achieved more than the conventional groups taught with the conventional method. Data on Table 4 indicated that there was a significant effect of treatment on students' overall achievement in Geography. This finding was in line with that of similar experimental studies in science and science related subjects.

This finding agreed with the experimental studies similar to the present study but in science subjects where experimental group taught with knowledge mapping achieved significantly better than the control group. Such studies (Okebukola 1990, Amer 1994, Nwodo 1994; Ezeudu, 1995; Osisioma, 1995) attested to the efficacy of knowledge mapping in facilitating learning.

Knowledge mapping from pedagogical view point might be an effective learning tool for science students (Amer, 1994). The use of knowledge mapping strategy made students to participate actively in the learning process, being able to organize their learning experiences in order to discover relationship with what they already know and their new experience. Ali (1992) found that the level of hand on activities which encourage pupils' participation in on-going lesson foster learning.

Based on the findings, the following recommendations are made:

1. Since knowledge mapping and alternative to linear notes were found efficacious in engendering achievement in Geography and since the techniques are not yet popular in school system, they should be incorporated in the curriculum for teacher training institutions.
2. Obviously the serving teachers in the field lack the necessary competencies to develop knowledge mapping and alternative to linear notes.
3. On acquiring the necessary skill, the teachers should be encouraged to employ these techniques more in teaching Geography so that students will no longer be scared the vastness of the subject.

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