FUN WITH MAPS-ROAD MAP TOWARDS IMPLEMENTING A LEARNER-CENTRED CARTOGRAPHIC TRAINING IN KENYA.

Catherine M. Njore, Benjamin M. Siro, Dennis T. Gitundu

Higher Diploma (Cartography), Catherine M. Njore;
Dedan Kimathi University of Technology;
Private bag – 10143, Dedan Kimathi, Nyeri;
+254723796107, catherine.njore@dkut.ac.ke;

MSc (GIS and Remote Sensing), Benjamin Mokoro, Siro;
Ministry of Lands and Physical Planning;
Survey of Kenya Field Headquarters;
P. O. Box 30046 – 00100 Nairobi-Kenya;
+254722398861, mokorosiro@gmail.com;

MSc (Photogrammetry & GeoInformatics), Dennis Theuri, Gitundu;
Dedan Kimathi University of Technology;
Private bag – 10143,Dedan Kimathi, Nyeri;
+254731008826, dennis.gitundu@dkut.ac.ke;

Abstract
The importance of maps as tools providing location-related solutions, supporting spatial behavior, enabling spatial querying, or providing information about space cannot be overstated. In Kenya, cartography is taught at the tertiary education level where thorough instructions on cartographic tools are impacted. However, inculcating the cartographic skills at the earliest primary education level is known to create a greater impact on the learners' interests in mapping. This project aimed at formulating a framework to best aid in the successful incorporation of mapping activities into the country's Competency Based Curriculum education system. The various framework activities were formulated through interactions and discussions with learners and teachers from eight primary schools in Mweiga, Nyeri County, Kenya. The activities were later tested on the learners. From the results, commendable interest in maps in children aged 4 – 10 years was observed with some activities being more successful than others. Future works envisages to incorporate more schools into cartographic mapping activities.

Keywords: *Competency Based Curriculum, Learner-centered Cartography, Model Maps, Cartographic tools.*

INTRODUCTION

Allan & Barbara (1999) noted that most women do not delight in spatial activities nor pursue professions or hobbies that require them. Hence there is a need to create the spatial interest early in the childrens' lives to grow the love of spatial environment in the girls as well. Early interaction will nurture the right attitude towards maps. However, cartographic principles are often ignored resulting to visually unpleasing maps or misleading map communication. This raises concern about map use in regulatory applications. The government of Kenya, in 2017, introduced the Competency Based Curriculum (CBC) education system whose focus is on developing a learner's competencies (Kaviti 2018). This system of education was fully rolled out across the country by the year 2019. It focuses more on the learners' flexibilities on opportunities for specialization, offers balanced foundational and comprehensive assessment and values learners' different skills. A pilot programme by Njore *et a.l* (2019) to introduce mapping to children aged between 4-10 years was successfully implemented in three schools. The objective was to develop a framework of cartographic activities that could be implemented in the CBC. There has been continued interaction with learners on favorable activities. The government while launching the CBC, directed the community to provide supplementary resources to make its implementation a success. The current work with the children shared in this paper aims at augmenting map reading and interpretation skills taught at primary school level by introducing basic cartographic skills particularly creating model maps; a way of learning effective map communication. To make cartography more learner-centred, it is necessary to design activities for the different learning levels. The focus was to initially introduce

cartography through hand-drawn models so that each learner would be more engaged and as such own the final product and create an interest in maps. A team composed of academic staff as well as Survey of Kenya (the National Mapping Agency) staff, is currently developing a childrens' book on cartography and formulating cartographic activities at the Institute of Geomatics, GIS and Remote Sensing at Dedan Kimathi University of Technology.

In the Competency Based Curriculum (CBC), a learner is required to complete two years of pre-primary education, six years of primary education, six years in secondary education and 3 years of tertiary education hence the 2-6-6-3 system. This differs from the old system (8-4-4) which was content based and mostly targeted on classroom performance. CBC aims at developing the core competencies in communication and collaboration, critical thinking and problem solving, citizenship, digital literacy, learning to learn, creativity and imagination and self-efficacy, promoting application of acquired skills and children led activities where parents and the community participation is required (KICD 2017).

Maps are initially introduced to school pupils in Kenya at the third grade (learners aged 9 to 10years) of the primary education while only one type of atlas is available. Different grades from pre-school have different understanding on symbols and information contained therein. From the different map activities introduced earlier by Njore *et al* (2019) different atlases should be prepared for the different levels of learning in Kenya. Bulgaria has atlases on geography and history for children from 1st to 12th grade of Bulgarian schools. Given the different map cognitive skills and capabilities observed in children between the ages of 4-10, different atlases should be prepared for the different levels of learning Njore *et al* (2019). The main aim was to design activities that can be employed in the geography content under the social studies subject. Even though the map work starts at Grade 3 (9 years), the map activities were prepared for all the learners from pre primary (aged 4 to 6 years)

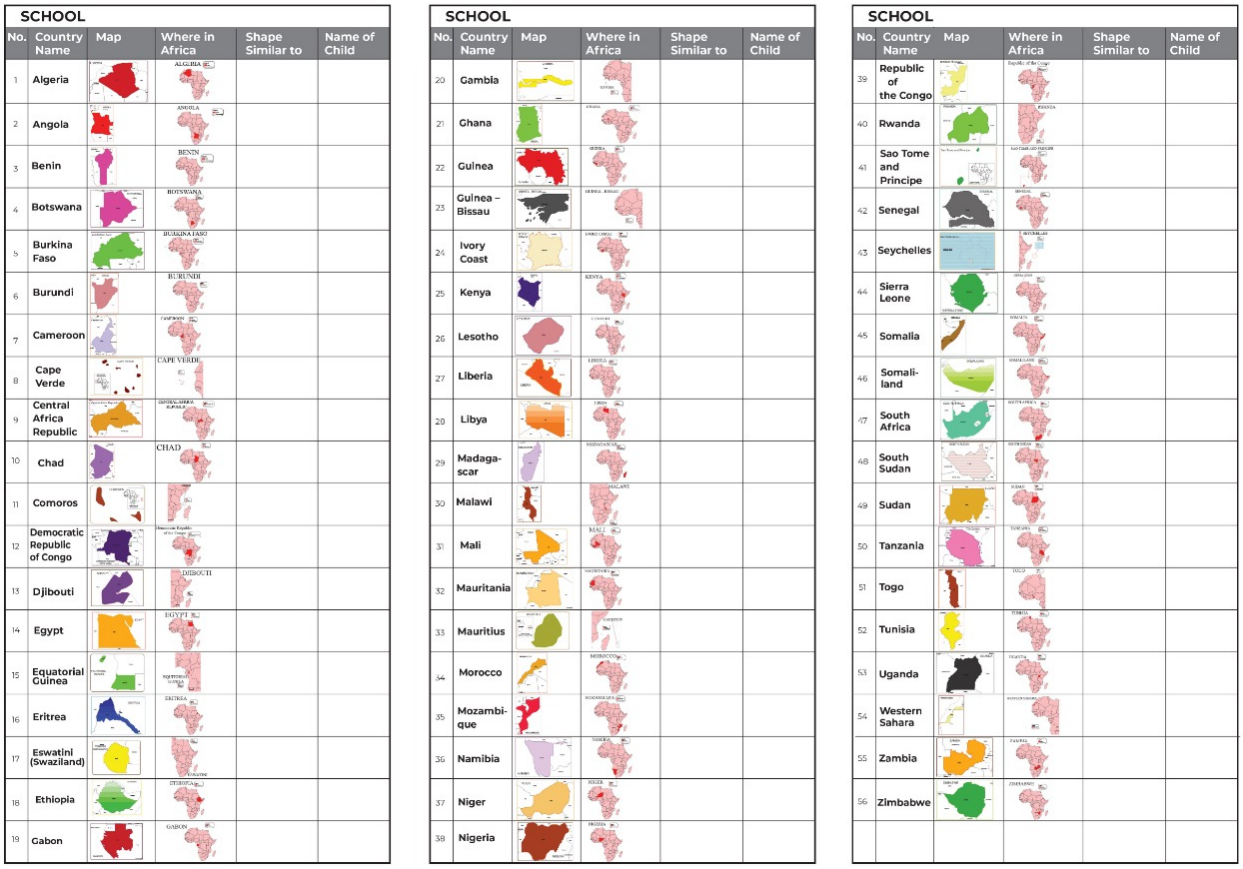
The proposed framework was guided by previous research by Njore *et a l* (2019) that proposed grouping learners in ages of their respective classes since this made it possible to have the map sessions in their classes. The ages of the children ranged from 4 -10 years in three schools. In the first phase of this framework development it was observed that learners in the pre-primary level (aged 4 to 6 years), also comprehended basic maps of their immediate environment.

METHODOLOGY

Eight schools in Mweiga, Nyeri County were selected. Three of the schools had been involved in the introduction to map use in 2018 – 2019.The working groups were initially created as described in Njore *et al* (2019), and were based on the ages of the learners. The groups were a) pre – school (ages 4-6), b) two lower primary groups (ages 7-8 for Grades 1 and 2, and ages 9-10 for Grades 3 and 4). The 11-12years; Std 7 and 8 were excluded as the existing primary school atlas in Kenya is most relevant to their level.

Identification of the eight schools to participate from the start was based on the proximity to each other to increase the number of visits and also proximity to the university where the authors work. The schools were a mix of public and private schools and within one community. The initial step involved setting up a consultative meeting with the relevant teachers to deliberate and brainstorm on the proposed learning concept. The concept agreed upon involved preparing an activity for each of the three working groups and executing it at least twice as most were interacting with map activities for the first time. Also, it was decided to have a common activity for all learners. Each group contained 15 learners. Total participants were 120. Three sessions of 45 minutes each were utilized.

The map activities introduced aimed at simplicity since there was no map use culture among the learners. Activities introduced also made reference to the content of the curriculum on the application of maps. The common activity was preparation of a map chart (figure 1) with all the countries of Africa. Learners using the similes method of identification that all are familiar with as they learn the alphabets and numbers at 4 years old would fill any shape or object they felt looked like the physical attribute of each of the African countries. The main aim of this activity was to familiarize with the Africa continent as a start.



SCHOOL

No.	Country Name	Map	Where in Africa	Shape Similar to	Name of Child
1	Algeria				
2	Angola				
3	Benin				
4	Botswana				
5	Burkina Faso				
6	Burundi				
7	Cameroon				
8	Cape Verde				
9	Central Africa Republic				
10	Chad				
11	Comoros				
12	Democratic Republic of Congo				
13	Djibouti				
14	Egypt				
15	Equatorial Guinea				
16	Eritrea				
17	Eswatini (Swaziland)				
18	Ethiopia				
19	Gabon				

SCHOOL

No.	Country Name	Map	Where in Africa	Shape Similar to	Name of Child
20	Gambia				
21	Ghana				
22	Guinea				
23	Guinea – Bissau				
24	Ivory Coast				
25	Kenya				
26	Lesotho				
27	Liberia				
28	Libya				
29	Madaga-scar				
30	Malawi				
31	Mali				
32	Mauritania				
33	Mauritius				
34	Morocco				
35	Mozambi-que				
36	Namibia				
37	Niger				
38	Nigeria				

SCHOOL

No.	Country Name	Map	Where in Africa	Shape Similar to	Name of Child
39	Republic of the Congo				
40	Rwanda				
41	Sao Tome and Principe				
42	Senegal				
43	Seychelles				
44	Sierra Leone				
45	Somalia				
46	Somali-land				
47	South Africa				
48	South Sudan				
49	Sudan				
50	Tanzania				
51	Togo				
52	Tunisia				
53	Uganda				
54	Western Sahara				
55	Zambia				
56	Zimbabwe				

Figure 1: List of countries of Africa where the children filled what they felt was similar to the various countries' outlines.

The identification of countries using their physical attributes was a fun way to engage the cognitive skills of the children, most of whom were interacting with the map of Africa for the first time. It would have been an oversight to assume that the learners had keenly looked or used the map of Africa since it was present in their libraries and classrooms or staffrooms.

The pre-school learners (4-6years) fun map activity involved drawing their classroom (figure 2a) out of which a simple treasure map was prepared (figure 2b). From previous interaction with the learners referring to previous map drawing activities by Njore *et al* (2019), the pre-school children aged 4-6 years had no understanding of scale hence the abstraction of their classroom for a map activity did not focus on scale. Also important was where a pictorial symbol was used inside the teaching map had be exactly the same as on the legend to avoid confusing the learners.

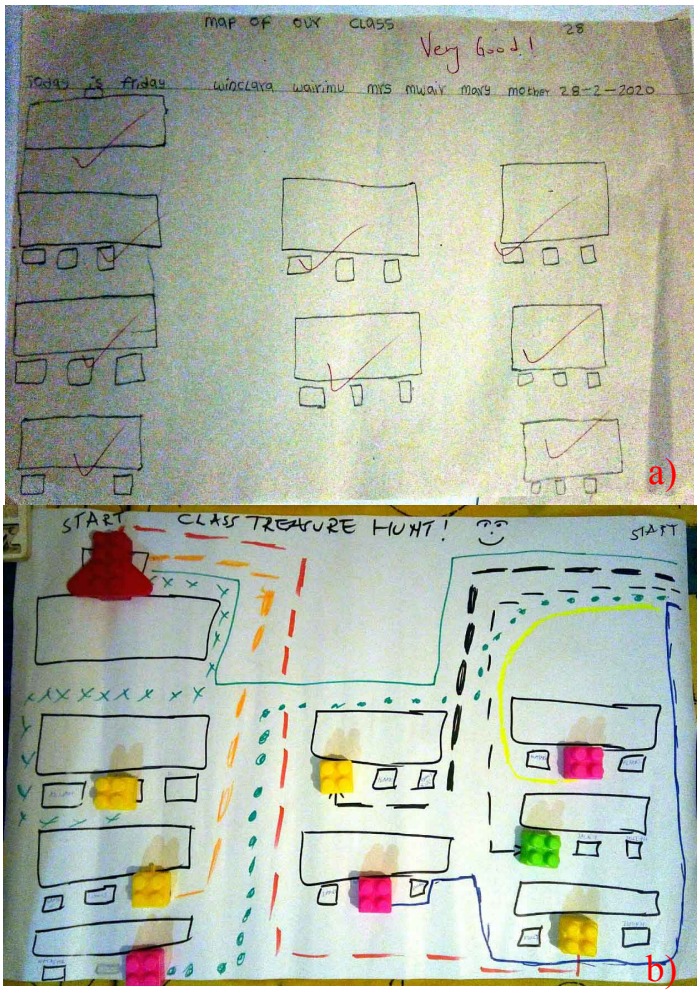


Figure 2. a)is the class room map drawn by a 6 year old child, and b) is the treasure hunt map prepared from a) and used for the treasure hunt activity.

The lower primary Grade 1 and 2 working group activity was suggested by one child and was adopted. In the child's words: "with our school map showing our classes, you ask me where to go and where to start from, I leave the map and try to follow that path from memory, if I get it right I win!" The learners' initial task was to prepare their school maps for the activity. Example task was how to get to the staffroom using the path by the parade ground, and avoid walking by the big black tank. This was successful with all that participated, as they were familiar with their school surroundings.

The lower primary Grade 3 and 4 working group activity was a suggestion from a child, which was to draw roads connecting all Africa countries on the map of Africa, having folded papers or a dice with the alphabets A to Z, the letter a learner (player) picked would be his/her country of destination. The starting point was home which was randomly picked by the player. As the learner used the road to get to the destination, he /she was tasked to name the countries on the way. If one failed to name them correctly, the player would go back to home till their next turn to play.

RESULTS AND DISCUSSIONS

Table 1 shows responses to the identification of maps using their physical attribute was very enlightening, but the results showed no particular list of similes could be compiled for that specific activity. For example, South Africa and Djibouti were identified as rhino by different school children, also Burundi and Liberia were identified by a bat whereas in some responses were the same; for example Kenya was likened to a baby vest by all learners in all participating schools. To note is that most countries were not identified using the physical attribute. This activity was successful in that they had great recollection on the countries identified. The table content was compiled from all the filled charts by the learners in all the eight schools (figure 3)

During the treasure hunt exercise with the age 4-6 years old learners, two marked routes were not accessible and the children easily pointed out alternative routes. This showed their understanding of maps was advancing as they continued to be taught more on maps. At every marked treasure point, the learner were rewarded (figure 4).

Table 1. Answers of countries identified using the simile style by the learners.

Country	Shape similar to	Number of learners
Algeria	1. Flower vase	40
	2. Heart	70
Angola	1. dress	42
	2. girl cloth	60
Benin	1. Monkey wrench	70
	2. Tree	40
	3. Flower	10
Botswana	1. Castle tilted to the right	80
Burundi	1. Face of a puppy	30
	2. A bat	90
Benin	1. Monkey wrench	70
	2. Tree	40
	3. Flower	10
Cameroon	1. Bird with crown	60
	2. Duck / hen	60
Cape Verde	1. Blood plateletes	30
	2. Chocolate chips in a cookie	70
Djibouti	1. Toothless hippo with mouth open	70
	2. Stiletto shoe	40
Equatorial Guinea	1. Trapezium	70
	2. Van	50
Eritrea	1. Funnel	80
	2. Ear canal	10
	3. Vuvu zela	10
	4. Elephant trunk	20
Gambia	1. Earthworm	80

	2. Snake	40
Kenya	1. baby vest	120
Liberia	1. Flying bird 2. Boat	70 30
Madagascar	1. Sweet potato 2. Car without wheels 3. Boat	90 20 10
Malawi	1. Sea horse	100
Mauritius	1. bowl 2. Irish potato	30 20
Mozambique	1. Baby crawling towards South Africa 2. puppy	50 30
Niger	1. Tied sack 2. Fish	50 70
Senegal	1. Sperm whale head	100
Mozambique	1. Baby crawling towards South Africa 2. puppy	50 30
Somalia	1. raised and fisted right hand from behind 2. horn	100 20
South Africa	1. Rhino head	100
Uganda	1. male lion head	120
Zimbabwe	1. bird's head 2. chick head	40 30

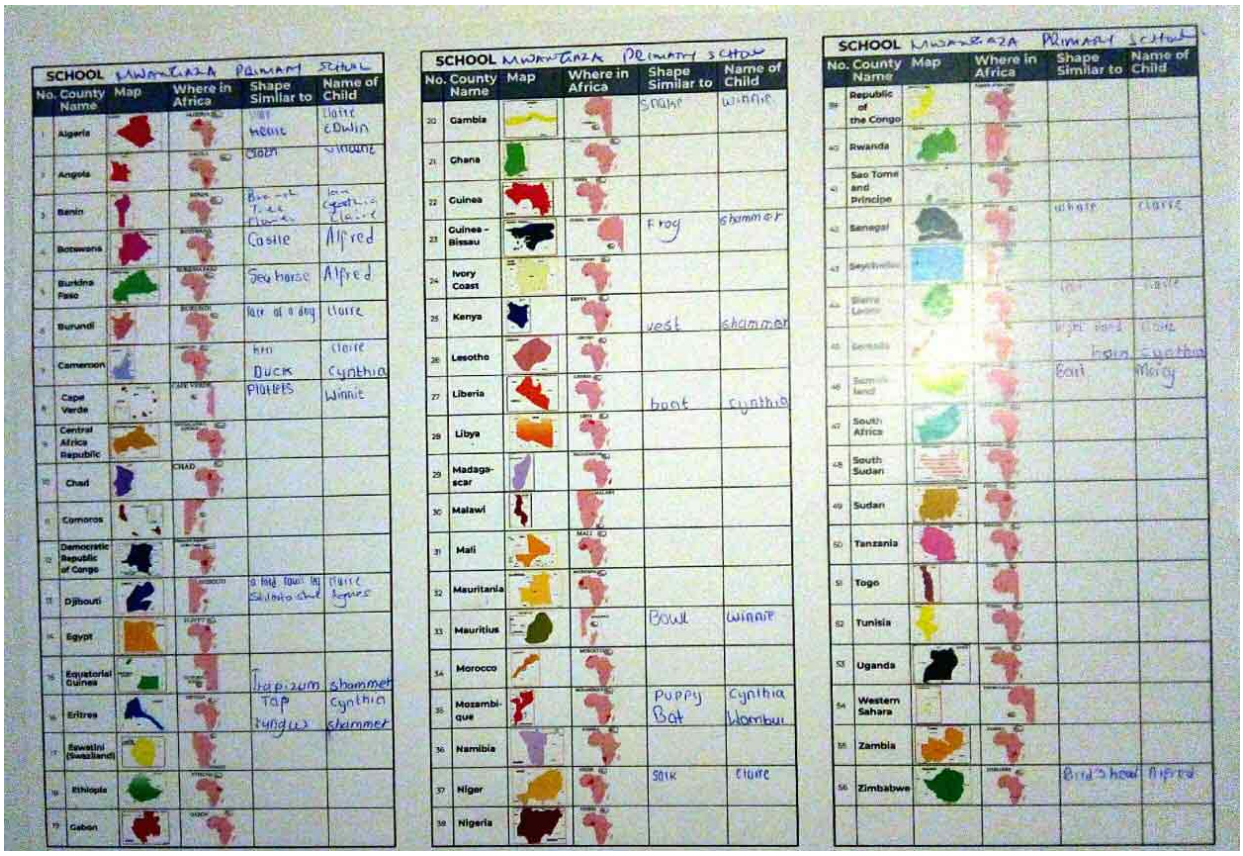


Figure 3. Sample of a filled list of the identification of countries using physical attributes.

Figure 4. Learner during treasure hunt activity.

The Grade 1 and 2 activity was a 'how to' scenario and the learners understood what was required of them. The Grade 3 and 4 activity was prepared but never got executed as the Corona Virus Pandemic (COVID-19) led to abrupt closure of all schools. When we inquired about the choice of activity (for the Grade 3 and 4), learners reported that the previous activity of identifying countries using similes was fun but many countries were left out and they wished to memorize them too.

There were occasions of variation in symbol identification thus creating a challenge in an activity for example the treasure hunt game. Color differentiation was a challenge to some learners across all age groups and scale concept was

not applicable to the 4 – 6 year old learners. To note is that during these interactions the learners were also consulted on what they wished captured in the children map book being prepared. The book will be in form of a narration by a young boy about his adventures and use of maps. He meets with friends and animals that teach him more on maps. He is empowered with more information on maps and learns what a cartographer does. This shall demystify Cartography in the mind of the learners. It is hoped to be an interesting read for all ages who have had little or no interaction with maps.

The activities using maps were most successful with the first 3 schools which had been familiarized with maps for over a year. Clearly showing that the more a learner were exposed to maps the more they understood them.

RECOMMENDATIONS

More time would have been required as it was literally introducing maps to the learners. Most had not yet interacted with maps more than once. Children maps of all administrative units of Kenya should be compiled for the learners as it will be a guide to the teachers to formulate relevant activities. For example, activity 9 in Grade 4 social studies recommended text book: in pairs children are supposed to identify the sub-county where their school is located, name their neighboring sub counties, name their county and draw and color their sub county. Lacking children themed atlases is an oversight that needs to be acted on.

Some decisions should be made initially before interacting with the learners; abstraction of the classroom when the pre – school learners draw their classroom map should not focus on scale as they have no understanding of scale. Also important is where a pictorial symbol is used inside the test maps it should be exactly the same on the key/ legend to avoid the problem of reification, Liben and Downs (1986). At every instant when a new map product is to be designed there is need to interact with the children to get guidance on how best to design their maps. Spatial thinking is vital from a tender age especially in this technological era where almost anyone in possession of a smart phone can make a simple map using the many available mapping applications.

This project advocates for incorporation of more schools into cartographic mapping activities and introduction of the map activities and children themed maps in the Social studies subject in the Competency Based Curriculum. This is projected to help Kenya advance in children use of maps and enable application of sophisticated activities such as those outlined by Juliasz and Castellar (2019) for children aged 4-6, which are the ages of Kenya pre –school classes. Further, for children with special need, activities and products by Zada (2019) would be pretty handy.

CONCLUSION

All participants gained new knowledge on maps and more wished to participate. This project helped to demystify cartography and ignited a lot of interest on map use among school pupils. Introduction of relevant maps is evident that it shall aid in the current classwork and the map activities will bring about daily map use by the children. Only one activity failed to be executed with the abrupt national closure of schools but it shall be implemented when normalcy resumes.

Some learners got very interested and are hoping for more map activities. The pre-school learners shall have three more activities this year relating to the subject content of the environmental studies. Children themed maps will create interest to the learner to engage with the maps more often and their use in activities will make maps a part of their daily lives. There is need for continued studies on childrens' map use in Kenya.

REFERENCES

Bulgarian atlases.https://www.maps.bg/category/10/uchebni-pomagala.html

Juliasz, P. C. S. and Castellar, S. M. V.: Spatial Thinking in Children's Education: The relationship between Geography and Cartography, Proc. Int. Cartogr. Assoc., 2, 56, https://doi.org/10.5194/ica-proc-2-56-2019, 2019.

Kareem Zada, A. A.: Testing Maps for Visually Impaired People in Kurdistan, Proc. Int. Cartogr. Assoc., 2, 58, https://doi.org/10.5194/ica-proc-2-58-2019, 2019.

Kaviti L. ": The new curriculum of Education in Kenya: A Linguistic and Education Paradigm shift. ." In the Journal of Humanities and Social Sciences peer reviewed reviewed by the international organization of Scientific Research International Journal of Scien. 2018.

KICD (2017) Basic Education Curriculum Framework; https://kicd.ac.ke/wp-content/uploads/2017/10/CURRICULUMFRAMEWORK.pdf

Liben,L., and Downs, R. (1986). Children's comprehension of maps: Increasing graphic literacy. Pennsylvania State University. Final Report to the National Institute of Education. Grant NIE-G-83-0025

Muraya F., Kanjoya J., Kadenge G., Mwova M., Mungai P.: Longhorn Social Studies Learner's Book Grade Four 2019 edition

Njore, C. M., Kimari, C. M., and Thiong'o, K.: Initiative aiming to introduce children to maps in Kenya, Proc. Int. Cartogr. Assoc., 2, 93, https://doi.org/10.5194/ica-proc-2-93-2019, 2019.

Pease, B., & Pease, A. (1999). Why Men Don't Listen & Women Can't Read Maps: How We're Different and What to Do about It.

BIOGRAPHY

Institute of Geomatics, GIS & Remote Sensing
Dedan Kimathi University of Technology,
Private bag – 10143,Dedan Kimathi
Nyeri. Kenya.

Higher Diploma in Cartography. Senior Technologist. Currently In-charge of cartographic drawing practical for undergraduate students in Geomatics, GIS and Remote Sensing (GeGIS) and GIS and Remote Sensing (GIS & RS). 14 years of cartographic experience: Formerly a Cartographer at Survey of Kenya; the National Mapping Agency and at Kenya National Bureau of Statistics, additionally was an instructor at Kenya Institute of Surveying and Mapping. Catherine's passion in Cartography preservation fostered founding think words book club for children (one activity is specifically introducing children from age 4 to map use)
https://www.thinkwordsbookclub.or.ke/

Ministry of Lands and Physical Planning
Survey of Kenya Field Headquarters P. O. Box 30046 – 00100,
Nairobi-Kenya

Graduated from Dedan Kimathi University of Technology with MSc in GIS and Remote Sensing. Geospatial Officer with over 17years wide experience in mapping and cadastral …. at the National Mapping Agency, Survey of Kenya Field headquarters

Institute of Geomatics, GIS & Remote Sensing
Dedan Kimathi University of Technology,
Private bag – 10143,Dedan Kimathi
Nyeri. Kenya.

Dennis T. Gitundu is a spatial scientist with nine years' experience in both industry and academia. He trained as a Geospatial engineer and later undertook a postgraduate course in Photogrammetry and Geoinformatics. Currently, Dennis is pursuing his doctoral degree in Environmental Engineering and Management. His research interests include Participatory GIS, Digital Image Processing, Structure from motion as well as Flood Risk Modelling and Management.