Agenda 21, Cartography and Children in a Changing World

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ABSTRACT

Today, a major issue facing nations is concern for their 'sustainability'. The concept of sustainable development is built upon the three pillars of economic prosperity, ecological integrity, and social equity. Given the important function of maps for visualizing, portraying, and understanding spatial data, including those crucial for sustainable development, how has the issue of graphicacy been addressed in *Agenda 21*? This paper argues, cartographic education is essential for the achievement of the goals for sustainable development articulated in *Agenda 21*. In the context of primary education, as the children of today are the mappers and decision-makers of tomorrow, what role should graphicacy play with regard to *Agenda 21* and its goals for realizing a sustainable planet? This paper explores issues associated with these questions. It concludes with suggestions of ways and means by which the International Cartographic Community can improve the graphic literacy of children.

CONCEPT OF SUSTAINABILITY

In today's world, the major issue facing most nations is concern for their 'sustainability'. One of the most oft quoted and widely accepted definition of this concept is that found in the 1987 Brundtland Report of the World Commission on Environment and Development: "Sustainable development meets the needs of the present without compromising the ability of future generations to meet their own needs" (Bathtram, 2005). The concept of sustainable development is built upon the three pillars of economic prosperity, ecological integrity, and social equity. While sustainability means different things to different people, the process of sustaining sustainable development can be seen as the very complex and delicate process of resolving conflicts between components of these often competing pillars.

Agenda 21

Agenda 21, the global world's plan of action for sustainable development, was an outcome of the 1992 at the Earth Summit in Rio de Janeiro. This forty chapter document (See Appendix 1) is organized around four broad sections: Social and Economic dimensions, Conservation and management of resources for Development, Strengthening the role of major groups, and Means of implementation. Within the chapters of each section, "a basis for action, objectives and means of implementation" (UN 2005a, chapter 1:6) is identified. The two chapters of *Agenda 21* of primary concern to this paper are Chapter 25, in which the need to strengthen the role <u>children</u> and youth play in sustainable development is recognised, and Chapter 36, which examines the means of implementing sustainable development through promoting <u>education</u>, public awareness and training.

Children are singled out as an important player in the quest for sustainable development for many reasons. *Agenda 21* observes that children will inherit the responsibility of looking after the earth. In many developing countries they comprise nearly half the population, and children are highly vulnerable to the effects of environmental degradation (UN 2005a, chapter 25.12). There is also the recognition that, as the future stewards of 'spaceship earth', it is imperative that the specific interests of children in their environment need to be considered. The significance of the education is recognized

through *Agenda 21's* text advocating ratification of the 1989 Rights of the Child as well as the endorsement of the 1990 World Summit of Children, both of which targeted striving for "basic education" as an issue of paramount importance. Like the term sustainability, 'basic education' means different things in different countries. According to the report of 'World Forum Education For All', basic education can be seen as "competencies, knowledge, attitudes and motivations deemed necessary in order for people to become fully literate and have developed the educational foundations for a lifelong learning journey"(UNESCO 2000:16). This forum also identified that although most countries have chosen to restrict the use of this term to the first stages of primary schooling, in others, this term may also encompass early child care as well as part or all of secondary schooling.

Agenda 21 advocates that, "While basic education provides the underpinning for any environmental and development education, the latter needs to be incorporated as an essential part of learning" *(*UN 2005a, chapter 36.3). Therefore, it is not surprising that a major educational component of *Agenda 21* is concerned with re-orientating education at all levels (from primary school to adulthood) towards sustainable development. While acknowledging that there are both formal and non-informal methods of education, there is a call to governments to make available education programs that provide access to learning structures that promote environmental concepts and developmental responsibility as well as, "Establish procedures to incorporate children's concerns into all relevant policies and strategies for environment and development at the local, regional and national levels, including those concerning allocation of and entitlement to natural resources, housing and recreation needs, and control of pollution and toxicity in both rural and urban areas" (UN 2005a, chapter 25.14(f)).

Following the Earth Summit in 1992, the United Nations Sustainable Development Commission was created to aid in the implementation of the goals of *Agenda 21*, in part by making the indicators of sustainable development accessible at a national level. Through the work of the Commission 15 themes were identified each with major sub-themes having measurable indicators. For example, for one of these themes 'Education' there are the two sub-themes, 'Educational Level' and 'Literacy (Adult)'. The two indicators used to measure 'Educational Level' are identified as 'children reaching Grade 5 of primary education' and 'adult secondary education Achievement Level'. In 2002 the Food and Agricultural Organization (FAO) documented that 130 million children did not attend school (FAO, 2002). The attainment of universal primary education by 2015 is now a goal established at the UN Millennium Summit in September 2001 and reiterated a year later at the World Summit on Sustainable Development in Johannesburg. In connection with improving education and placing an emphasis on sustainable development, there has been the development of courses and seminars (World Bank Institute (WBI), 2005) and programmes, such as the UNESCO/International Environmental Education Programme (UN, 2005b).

Graphicacy

Graphicacy is a term which is very familiar to cartographers. In 1965, Balchin and Coleman, argued that "graphicacy" together with literacy, numeracy, and articulacy should be the "fourth ace in the pack". Graphicacy has been described as "the educated counterpart of the visual-spatial aspect of human intelligence and communication" (Balchin, 1976:34). Cartography is an important component of graphicacy since maps are, "an extremely efficient way of manipulating, analyzing, and expressing ideas, forms and relationships that occur in two and three-dimensional space" (Robinson et al., 1995:9). However, a map is a complex form of graphic expression and *to use* effectively and efficiently existing maps (that is to read, interpret, analyze and synthesize spatial information) or *to produc*e maps requires an awareness and understanding of the characteristics of all maps. The characteristics associated with all maps are scale reduction, geometric transformation, an abstraction of reality and the use of signs to stand for elements (Robinson et al., 1995). Despite the fact that maps are a complex form of graphic expression, it would appear that, because maps are universal and interdisciplinary, there is the basic belief that in education concepts associated with maps and mapping require little attention.

AGENDA 21 AND GRAPHICACY

Given that the emphasis of *Agenda 21* was on broad goals and priorities, it is not surprising that this document neither explicitly mentioned graphicacy nor included specific reference to maps and mapping. The author, however, would argue that within 'basic education' in *Agenda 21* graphicacy, and more specifically cartographic literacy, is an implicit goal. Given the inherent spatial nature of the data associated with economic prosperity, ecological integrity and social equality linked to sustainable development such as promoting sustainable agriculture, monitoring and managing fragile ecosystems, and the nature and control of pollution, it is inconceivable that individuals, of all ages will not be involved, directly or indirectly, either mapping or working with maps (in analogue or digital form) as a tool in the decision making process. For

these reasons, it is imperative that any basic universal education should incorporate graphic education, in which maps and mapping should play a major role.

AGENDA 21, CHILDREN AND CARTOGRAPHY

As president of the International Cartographic Association (ICA), the world authoritative body for cartography (http://www.icaci.org), Wood (1999) identified two actions related to cartography and children: the establishment in 1993 of the Barbara Petchenick map competition and the 1995 founding of the Cartography and Children Speciality Group (http://lazarus.elte.hu/ccc/ccc.htm).

ICA Barbara Petchenick map competition

This Children's World Map Competition, which has been held every two years since its inception in 1993, has to date involved thousands of children under the age of 16 years from 52 countries. The aims of the competition have evolved over time. Today these are to promote children's creative representation of the world, to enhance their cartographic awareness, and to make them more conscious of their environment (http://lazarus.elte.hu/ccc/ccc.htm).

What do these competition maps tell us about *Agenda 21*, cartography and children? In reference to the nature of the subjects mapped they reveal that children of all ages are aware of the environment -- its importance and fragility as well as concern about topics associated with the three pillars of sustainable development, economic prosperity (e.g., the world's computer networks), ecological integrity (e.g., maps on the themes endangered species and the need to save our planet) and social inequality (e.g., maps with the theme of peace and conflict, pollution, and hunger). The maps also recognize the need for nations to work harmoniously together (e.g., maps of children dressed in national costumes holding hands encircling the world).

Identifying what these tell us about children and cartography is more challenging. Since the ICA's guidelines do not identify specific cartographic elements (other than a title) the children have great flexibility in expressing the "creative representations of their world" (Anderson, 1999:427). A review of the maps, however, enables some general statements to be made in connection with the incorporation of and use of conventional cartographic elements (Kwan and Anderson, 2001). The children use point, line and area symbols – with pictorial point symbols predominating. Few maps include a legend. In observing the representation of the contents, there is great range with regard its accuracy in shape, size and placement when compared to the real world. Few maps include scale or map constructs associated with distribution and location, such as cardinal directions (i.e., compass points, north sign) and a reference system (latitude and longitude). In addition, when incorporated, their inclusion does not guarantee correct comprehension or application. Recently, ESRI Press published 100 maps from this competition. Included in the introduction is the statement, "Although the maps in this book show children's early experimentation with cartographic principles, they also reveal an agenda for education. There is much these children do not yet understand about maps and how maps work. And there is probably also much that their teachers and parents would like to learn" (Anderson et al., 2005). In addition it is recognized that, "Proceeds from the sale of this book will go into a fund, administered by the International Cartographic Association, to promote graphic literacy, in developing countries and/or disadvantaged learners".

ICA Cartography and Children Speciality Group

The international cartographic community's concern with cartography and children is recent. Previous to the formation of the ICA's Specialty Group in 1995, few works in ICA-sponsored publications addressing topics relevant to cartography and children can be found. Following the 1993 Barbara Petchenick map competition, a joint Canada-Brazil survey revealed an international level of interest and support in a formal working group concerned with cartography and children. The 1995-1999 mandate "to improve general cartographic literacy by enriching the understanding of the relationships children have with maps" focused on elementary students (12 years of age and less). The 1999-2003 mandate extended the Commission's work to all children (less than 18 years), with the goal of improving children's cartographic literacy by promoting international and national discussion of the experiences about, awareness of, and research into the problems related to children as map makers and map users (Anderson, 2002). Within the current mandate the Commission aims internationally to promote the use and enjoyment of maps by children and young people, increase understanding of children and young people's engagement with maps, and raise the standard of maps and atlases produced for children and young people (http://lazarus.elte.hu/ccc/ccc.htm).

Since its inception there have been over 200 presentations, papers, posters and workshops, by members of the Speciality Group, at ICA conference and sponsored seminars. These have involved the investigation of theoretical issues relating to space and its representation, documenting teaching philosophies, international teaching practices and classroom experiences relevant to maps and mapping, the design and evaluation of teaching materials (notably atlases) and investigations into the nature, role and impact of changing technology (Anderson, 2003).

What does a review of these works tell us about graphicacy and primary education? It reveals that three broad areas associated with the cartographic literacy of children can be identified. The first concerns the role that maps and mapping can play in achieving a graphically literate society. The second general area is directly associated with the maps produced for children while the third area encompasses issues related to the effective and efficient use of maps (Anderson, 2003). More specifically what does this literature tell us with regard to graphicacy and primary education? In connection with the need for and role of mapping instruction a continuum of opinions exists. Although there is an increasing appreciation that there has been the underestimation of children's understanding and ability to work with maps there is still controversy as to what skills should be introduced at what age and how these should be taught. One line of research which can be identified, relevant to the design and production of maps for children, has focused on the development of students' comprehension of the basic processes of mapping. These studies have tended to concentrate on concepts such as distance, classification and symbolization. The content and structure of 'the School Atlas', in both analogue and digital formats (CD-ROM and Internet), has also received study. A large body of the literature is related to children's' abilities to use maps and the fact that they need necessary skills to work with and produce maps. Similarly, there are numerous associated with issues facing teachers. A shortcoming of the literature is that, although it provides invaluable snapshots into aspects of graphic literacy and young children, little international comparison is available.

In 1999 in an attempt to provide comparable international information, an international survey was conducted to obtain information on the nature of programs available; their inclusion of statements concerning concepts such as position, scale and the activity of children reading their own maps; use of selected materials aspects of teacher training; and identification of the major problems encountered in working with maps at the elementary level (Anderson, 2004). Twenty five countries, the majority with a national programme, responded. Almost all respondents (92%) identified that their programme included a statement about maps and mapping. Primary education meant different thing in different countries. Normally commenced between the ages of 4 and 7 this could be completed between the ages of 10 to 15 years. The survey revealed that the most widely used materials were atlas and globes, and in many countries it was 'not easy' or 'impossible' to get access to large scale topographic maps at scales ranging from 1;5000 to 1:50 000.

Figure 1 illustrates the responses to the question regarding the inclusion of programme statements linked to instruction of the concepts of relative position (near, far, above, below); alpha-numeric position (grid reference e.g., A3); geographic position (latitude and longitude); bird's eye view/perspective; symbolization; map key/map legend; scale; cardinal directions (north, south, east, west); relief; projections; generalization and children reading their own map. The graph reveals that whereas there was widespread inclusion in the curriculum of concepts such as relative position, cardinal directions and symbols, in many cases concepts were excluded particularly bird's eye perspective and generalization. One surprising finding is the fact that over 60% of the respondents indicated an absence of reference to children reading maps they had created.

An analysis of 75 responses given to the question, "What do you perceive as the three major problems in working with maps and mapping at the elementary level"? could be categorized as those related to teachers and teaching (26%), the curriculum (37%), materials (26.5%) and; miscellaneous (9.5%). Issues identified with the teaching of map skills were the teacher's lack of understanding of the conceptual development of the child, insufficient knowledge of the topic and a lack of information of how to teach a topic. Reasons given for these deficiencies were attributed to the lack of the perceived importance of the role of maps and mapping to the teaching community and thus a lack of teacher training and support. The problems identified in connection with the curriculum were linked to the perceived lack of importance placed on maps and mapping, which resulted in insufficient time being devoted (generally in Geography), to superficial lessons, and lessons where the emphasis was on memorization rather than promoting an understanding of the nature of maps and mapping. The concepts that were identified as those children found most difficult were position, scale, generalization and relief (isolines). The major complaints related to resources revolved around the issues of lack of availability of maps and aids or noted that those available were not child appropriate. The remaining 'miscellaneous problems' identified by the teachers were associated with the attitudes of parents – no perceived need, a lack of home reinforcement of the nature and value of maps, and competition from computers and television.
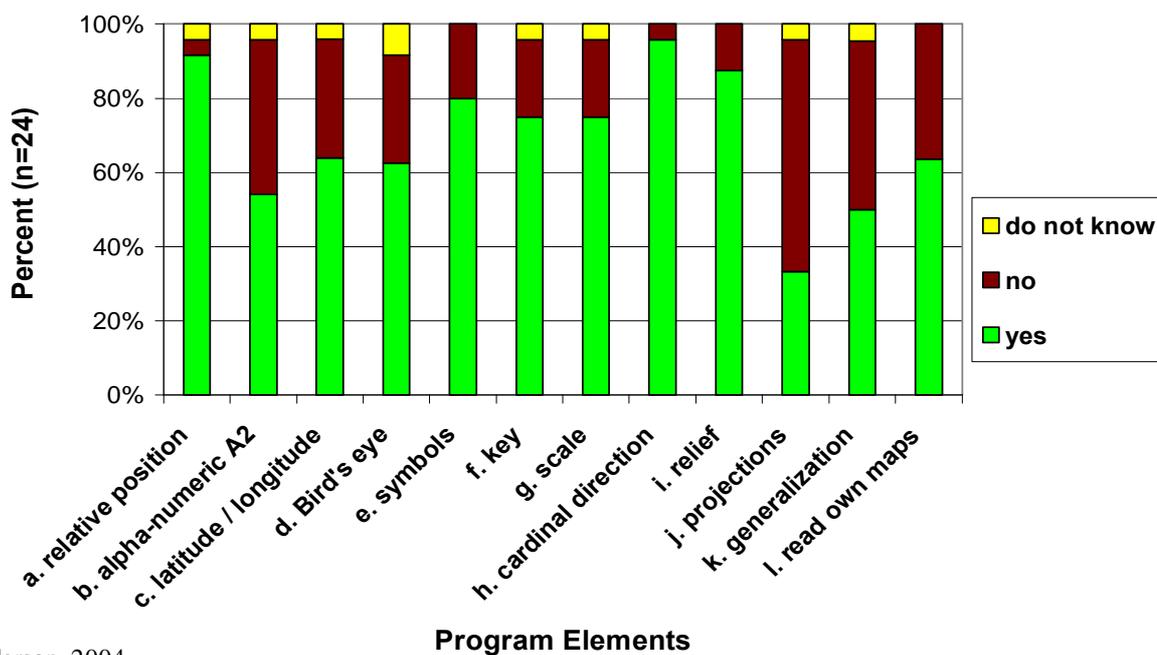
Source: Anderson, 2004.

Figure 1. Map related components

ICA INVOLVEMENT IN IMPROVING THE ROLE THE GRAPHIC LITERACY OF CHILDREN

Given the importance of the position maps play in developing visual–spatial abilities, and the role of maps and mapping in representing the wide range of sustainability indicators associated with the economic, ecological and social issues the question arises, How can the ICA best respond to the major problem areas associated with the teaching of graphicacy highlighted by the survey?

The bottom line is a greater commitment to involvement. To date, involvement has been with the UN in connection with an agreement to consider maps from Barbara Petchenik World Map Competition as candidates for their greetings cards, and the inclusion of some of these maps in a CD-ROM 'My city' and on a UNICEF Canada prepared educational wall sheet on the subject of' 'Children Draw the World'. The ICA's links with these international organizations need to be strengthened. UNICEF makes child-oriented material available as educational available tools. It has a programme, called the 'school-in-a-box' (UNICEF, 2005). Could materials pertinent to map skills be incorporated in such a programme and other assistance given in relation to the provision of supplemental materials? A recent UN initiative is a video game, designed for children (8 -13 years), to make them more aware of problem of world hunger (UN, 2005c). In this educational tool, participants are presented for an imaginary country with a series of challenges similar to those faced every day by the UN. Could a similar project be developed that included addressing the significance and consequences, in decision making, of graphic, map literacy? In addition to renewing and reinforcing new partnerships there is also a need to forge new alliances and be involved in international web based programmes such as The UNESCO/UNEP International Environmental Education Programme (UN, 2005b).

In his presidential report on the achievements of the ICA, Wood recognized the increasing encouragement of children's involvement with maps through the Barbara Petchenik World Map Competition as an important new direction of the ICA (Wood, 1995). Since its inception countless children have participate in this competition at a national level. Now a large number of the internationally submitted maps – many tackling themes associated with sustainability, are readily accessible on the web (Carleton site). Henry Caster has prepared "A teacher's guide to the Barbara Petchenik World Map Design Competition" showing how children could explore the basic map concepts, in various disciplines, while involved in the

production of a map for submission to the competition (http://lazarus.elte.hu/ccc/ccc.htm) . Should this guide be revised and developed? Should any proceeds from the sale of the book "Children Mapping the World" be directed towards developing this guide in an attempt to further promote graphic literacy in developing countries?

The members of the Cartography and Children Speciality Group, in addition to pursuing their individual research interests, could further graphicacy by identifying which nations have an existing program where an emphasis has been placed on graphicacy (e.g., U.K) or a programme in which it currently is being pursued (e.g., South Africa). Identifying and documenting what measures are being taken to implement graphic literacy, with particular reference to the first five years of primary education, would be a valuable record. The comparisons of such data for different countries would allow the exploration of the preparation of guidelines, which in turn could lead to the establishment of some form of basic standards, measures of comparability and maybe some form of basic internationally recognized standards, such as "ISOCARTO5". Another potential area to which members could contribute would be the identification, documentation, and review of existent teaching resources and materials, with a commitment of national and international dissemination (via the web).

As cartographers, we know the importance of the visualization and graphic representation of data, its strengths and limitations in analogue and digital forms, but we are not very good at communicating the importance and nature of this to the general public. We need to become more proactive in spreading the word by informing and educating our peers about the nature and value of maps as tools for optimizing decisions involving spatially related data.

CONCLUSIONS

According to the World Bank (2004:5), "Education is the foundation of democratic societies and globally competitive economies. It is the basis for reducing poverty and inequality, increasing productivity, enabling the use of new technologies, and creating and spreading knowledge". Meeting the goals of sustainable development proposed in *Agenda 21,* one of the quests in today's changing world, is proving to be challenging. The decade 2005-2015 has been declared the 'UN Decade Education for of Sustainable Development' with the objective of the attainment of universal primary education by 2015 (UN, 2005d) Given the important function of maps for visualizing, portraying, and understanding spatial data (including those crucial for sustainable development) the author argues that it is imperative that graphic literacy, with maps playing a major role as an aid to optimizing decision making, be recognized as an essential component in the basic education movement.

Today's children are tomorrow's decision makers. Although concern with cartography and children is relatively recent within the ICA, issues associated with working with maps and mapping (the nature and provision of teaching instruction, curriculum design and availability of suitable materials) can be identified. Any attempt to alleviate these problems by the world's authoritative body on cartography necessitates a more active ICA involvement with world organizations such as the UN, UNESCO and their programmes (such as e.g., UNESCO/UNEP). The expertise of the ICA should be considered when published guidelines, developing programmes and materials related to the topic of 'basic primary education'. Within the ICA, at an Executive Level, it is also recommended that, since the content of the maps produced for the Children's Map Competition generally relates to issues associated with sustainable, there should be an investigation into how this map competition can be developed to play a greater role both in promoting and improving cartographic literacy.

At the same time, as individuals, we all need to examine how we can make a contribution through active involvement within our own countries. As experts in visual spatial communication, we need to continue to undertake research into all facets of issues related to children's use and understanding of maps. We also need to inform and educate our peers about the nature (strengths and weaknesses), value and importance of maps as tools for optimizing decisions involving spatially related data. This can be accomplished and needs to be pursued at all levels. It involves contributions ranging from involvement in local activities connected with environmental education to participation in national advisory bodies.

In this era of greater access to digital data and reliance on computers, what are the consequences of not becoming more actively involved in promoting the inclusion of graphic literacy, particularly map literacy, in primary education? Could it be the widespread adoption of a belief such as, "Why do we need when maps when we have Geographic Information Systems?"

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Appendix 1 - Chapters of Agenda 21

 1. Preamble

SECTION I. SOCIAL AND ECONOMIC DIMENSIONS
 2. International cooperation to accelerate sustainable development in developing countries and related domestic policies
 3. Combating poverty
 4. Changing consumption patterns
 5. Demographic dynamics and sustainability
 6. Protecting and promoting human health conditions
 7. Promoting sustainable human settlement development
 8. Integrating environment and development in decision-making

SECTION II .CONSERVATION AND MANAGEMENT OF RESOURCES FOR DEVELOPMENT
9. Protection of the atmosphere
10. Integrated approach to the planning and management of land resources
11. Combating deforestation
12. Managing fragile ecosystems: combating desertification and drought
13. Managing fragile ecosystems: sustainable mountain development
14. Promoting sustainable agriculture and rural development
15. Conservation of biological diversity
16. Environmentally sound management of biotechnology
17. Protection of the oceans, all kinds of seas, including enclosed and semi-enclosed seas, and coastal areas and the protection, rational use and development of their living resources
18. Protection of the quality and supply of freshwater resources: application of integrated approaches to the development, management and use of water resources
19. Environmentally sound management of toxic chemicals, including prevention of illegal international traffic in toxic and dangerous products
20. Environmentally sound management of hazardous wastes, in hazardous wastes
21. Environmentally sound management of solid wastes and sewage-related issues
22. Safe and environmentally sound management of radioactive wastes

SECTION III. STRENGTHENING THE ROLE OF MAJOR GROUPS
23. Preamble
24. Global action for women towards sustainable and equitable development
25. Children and youth in sustainable development
26. Recognizing and strengthening the role of indigenous people and their communities
27. Strengthening the role of non-governmental organizations: partners for sustainable development
28. Local authorities' initiatives in support of Agenda 21
29. Strengthening the role of workers and their trade unions
30. Strengthening the role of business and industry
31. Scientific and technological community
32. Strengthening the role of farmers

SECTION IV. MEANS OF IMPLEMENTATION
33. Financial resources and mechanisms
34. Transfer of environmentally sound technology, cooperation and capacity-building
35. Science for sustainable development
36. Promoting education, public awareness and training
37. National mechanisms and international cooperation for capacity-building in developing countries
38. International institutional arrangements
39. International legal instruments and mechanisms
40. Information for decision-making

Source: UN (2005a)

Biography

Jacqueline Anderson, Ph.D. Geography (Wisconsin), Associate Professor. Her research interests lie in cartographic design and visualization, map user abilities and map skills education for all ages and levels of competence. Between 1995 and 2003 she chaired the speciality group "Cartography and Children" of the International Cartographic Association. Her current areas of interest are the development and evaluation of map related media, analogue and electronic, for elementary and high school children and investigating the various approaches which can be used to introduce concepts basic to mapping skills.

Cartography made a technological leap during World War I with the development of aerial photography. Then came radars and GPS, as maps moved into the digital sphere. Through this technology, our understanding of maps has changed entirely, according to Eric Gunderson, CEO of Mapbox, a platform that provides mapping tool to companies like Foursquare, Evernote and Snapchat. "They are instantly available, customized, interactive," he said in a phone interview. "The first rule of geography is that everything is related to everything else," she said in a phone interview. "Today's cartography reflects exactly that: It combines design, geography, anthropology, human impressions and ideas within spatial contexts. Agenda 21 is a non-binding action plan of the United Nations with regard to sustainable development. It is a product of the Earth Summit (UN Conference on Environment and Development) held in Rio de Janeiro, Brazil, in 1992. It is an action agenda for the UN, other multilateral organizations, and individual governments around the world that can be executed at local, national, and global levels.