

THE DEVELOPMENT OF AN INTERNET SCHOOL ATLAS - A CASE STUDY: THE ATLAS OF QUEBEC

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Introduction

In Canada, as elsewhere in the world, school curriculums are undergoing reform. Education is in the domain of each province or territory. In the province of Quebec education is moving from objective-based to competency-based instruction [1]. Coupled with this movement is the view that, "the Internet can transform the world of education and learning as people of all ages can communicate and work with others from all over the world" [2]. In September 2000 the project, of producing a prototype Internet atlas to Quebec's primary and secondary Social Science program was commenced [3].

Aspects of the decisions behind the Atlas's structure

A requirement of any application for funding is the identification of the project's 'deliverables'. It is therefore not surprising that the proposed, six interactively linked, contents of the prototype atlas were identified as a large number of pre-prepared maps, a data base, identified hyperlinks, a glossary, guidelines (a "tool box") to allow users to become map authors, and a guide to the use of the web site.

Receipt of the grant permitted detailed investigations in numerous areas. These included the available literature about educational parameters and user knowledge (e.g., level of basic map skills), requirements (learning strategies) and skills (cognitive abilities). In connection with literature related to the role, content and design and use of a elementary atlases, 150 books, 65 glossaries, 25 paper atlases, 45 CD-ROM's and 50 Internet sites were examined. There was also an investigation of the ability of 8 year old students to work with a variety of graphic representations of the same area: topographic maps, a black and white air photograph, an analogue 3D model and a computer fly-by [1].

Two focus groups of Cycle 2 teachers (teaching students 8-10 years of age) provided insight into the electronic atlas needs of instructors and students. For students, these needs were identified as a well-designed, age appropriate, easy to use product, with sound that was, colourful, and interactive, containing stimulating and relevant textual and graphic information - maps, photographs and illustrations (static and animation). In addition the teachers wanted self-correctable concrete activities, quizzes, games and links to appropriate sites containing supporting materials (such as data) together with accompanying hardcopy related teaching exercise books [1].

Based upon information about the curriculum reform, perceived requirements of teachers and students and the nature of the Internet, it was decided that the architecture developed for the pilot atlas would be child-centered, rather than map centered (Figure 1). Such a structure provides students with the opportunity to think for themselves about the organization and use of space, allowing students to construct knowledge through their own experiences with the means put at their disposal.

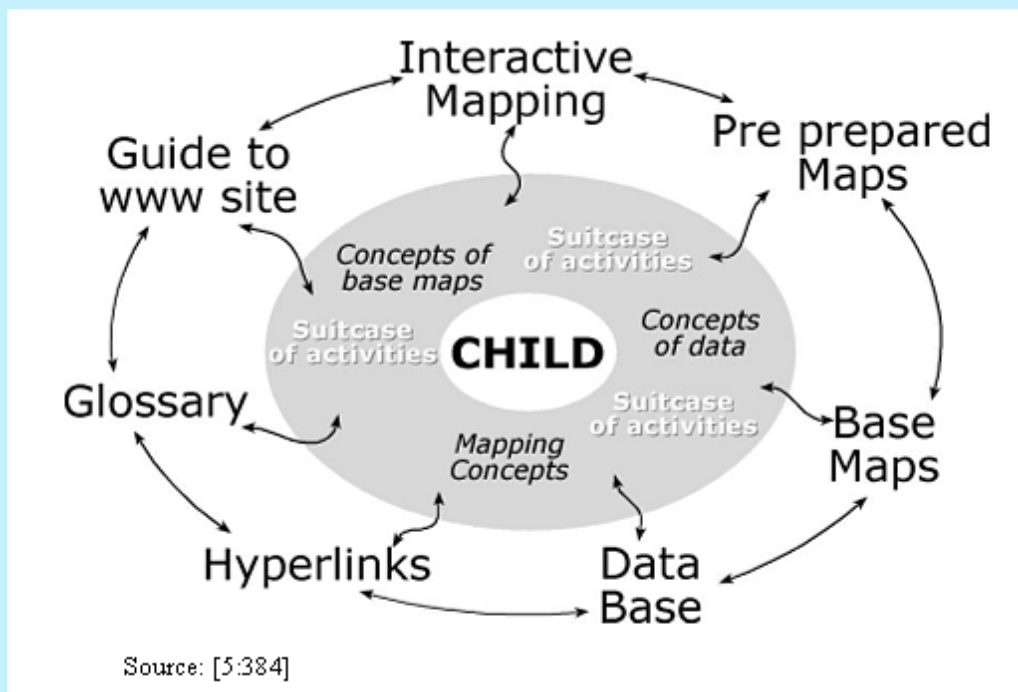


Figure 1: Structure and contents of the prototype Internet school atlas of Quebec

To address the issue of age-appropriateness it was decided that there should be four different levels of treatment of both the Interface and supplied materials. These are: Level 1 (Cycle 2, 8-10 years of age), Level 2 (Cycle 3, 10-12 years of age), Level 3 - Junior High School (12-14 years of age) and Level 4 (Other -15 years and older). For each level, there will be appropriate terminology (e.g., glossary), as well as attention to the number and type of thematic maps available (their content and design), the nature of the concepts, and the provided data, hyperlinks and interactive mapping capabilities.

Atlas components and their design

Figure 1 shows the components of the prototype atlas. Centered around a suitcase providing the user with basic concepts related to understanding maps, mapping and the nature of data are the guide to the site, maps both static (pre-prepared, and base maps) and interactive, a data base, hyperlinks and a glossary. Given its nature, only selected elements of different components have been developed at different levels. These components were built using Microsoft ACCESS as this allowed the creation of dynamic, recyclable web pages. Other software combinations have been tested on parts of the site, such as Pre Hypertext Pre-Processor Language and the more robust My Structured Query Language, and may be pursued in future developments. Initially to address the users' need for rapid download (i. e., small files) the maps, (static and animated) were produced using Freehand and displayed in a Macromedia Flash format. All map and mapping files are small -- less than 50K in size. Currently MapServer, an open source development environment for building Web mapping applications, is being explored as this application delivers on-line, interactive Geographic Information Systems and image processing information quickly and reliably. The prototype will be able to be viewed using any browser with Flash plugins enabled. The manipulation of the geographical data is performed using Map Info.

The interfaces developed have been designed for transparency and to facilitate easy navigation. For Level 1 (Figure 2) nothing is hidden -- all the items that the user has access to appear on the same page. At the top of the frame above the active viewing area there is a toolbar containing a series of iconic buttons representing the functions available. The two buttons on the left permit the user to identify complementary material (top button) and interact with the computer (bottom button). The icons appearing on the bottom toolbar correspond to the mode of operations possible with a particular function. Whereas help (the question mark) is always available and most of the atlas maps can be printed, other functions are "outcome" specific, e.g., the buttons associated with identifying and moving a map, panning, zooming and layer control will only appear when the user is involved in interactive mapping.



Figure 2: Interface for student's 8-10 years of age (Level 1)

With each Level the nature and complexity of the content increases. Nevertheless, there has been an attempt to maintain, for the user, transparency and ease of navigation. The interface of Level 3 (Figure 3) has been designed so that the user can either access general content information on for example the glossary or specific information such as entry to the actual glossary menu or thus access to a particular word. At all times the user can return to the Level's home page by clicking on the Atlas's logo.

In Level 1, students may institute a search by entering a key word, phrase or general question. In Level 3 different components may be searched in different ways. For example the word "géographie" in the glossary may be accessed through the letter G or as a word in an alphabetic list. Within each menu a hierarchy of information is provided e.g., in Level 3, "Maps" contains regional maps on selected themes, e.g., Hydrographic maps of the Maurice Ottawa Drainage Basin, base maps, and access to interactive mapping.

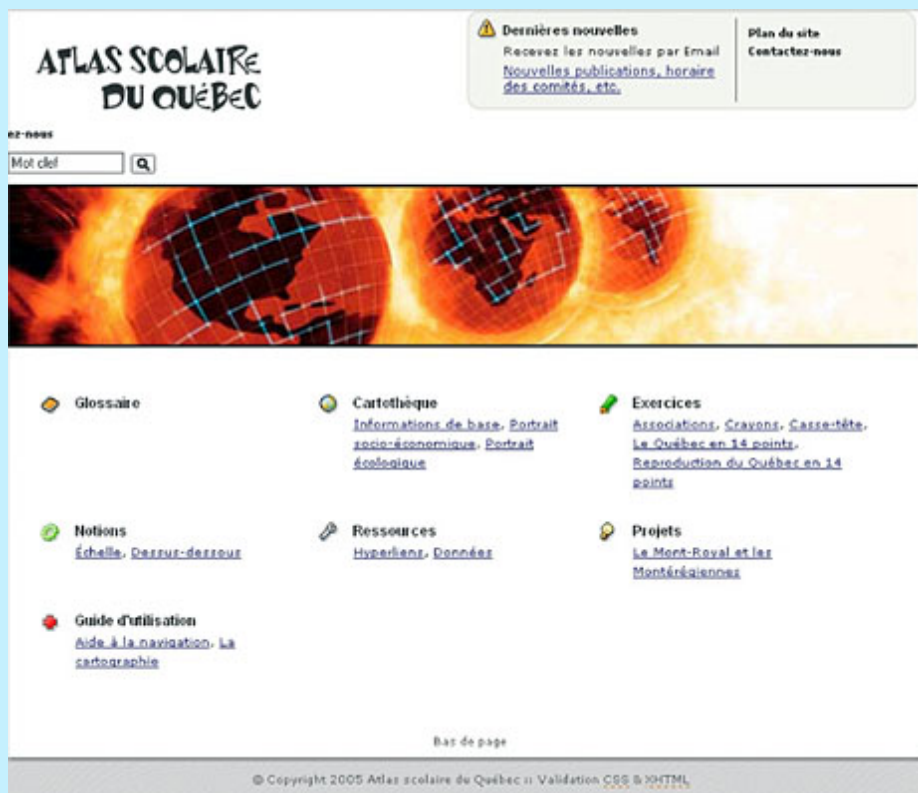


Figure 3: Interface for student's 12-14 years of age (Level 3)

The components of the atlas have been built around a suitcase of concepts and exercises relating to understanding of map related concepts, concepts associated with data and base map. Why? Given the structure of Quebec's new curriculum students, prior to the age of 8 years, will be exposed to mapping concepts via the four programs of: Languages: Technology, Science and Mathematics; Arts Education and; Personal Development. Educators will have flexibility in the implementation of these programs thus, "it is not unreasonable to expect that students entering Cycle 2 will arrive with a great range of competencies, skills, and knowledge essential to understanding maps and work with maps" [3: 10]. To date, emphasis has been placed on developing materials related to the concept of scale and reference systems.

In the Prototype four kinds of maps will be available: base maps, pre-prepared thematic maps, animated maps and interactive maps. The need for simple Quebec base maps was identified by teachers. The maps available in the atlas are of different areas at a variety of scales and contain administrative boundaries and selected components of the infrastructure. Because of the importance teachers placed on access to base maps, links to other relevant base maps will also be provided. It is proposed that the pre-prepared thematic maps for each of Quebec's 17 Regions will treat social themes (population, education, health, citizenship and the economy) and physical themes (environment, climate, vegetation and land use, geology and relief and drainage basin) for each of the four levels. With each change in Level the scale of detail available increases.

The maps were designed for the web. Following a review of the literature, and an evaluation of the style and contents of a variety (national, provincial and school) of paper and digital environment, several decisions were taken. To ensure the legibility of the map information in the viewing area, colours were selected from the Websafe colour palette (216 colours possible); a sans-serif typeface (either Arial or Verdana) was used; and, for Level 1 maps, the minimum size adopted was 15 points [3]. Level 1's maps have limited content and are highly generalized whereas Level 3 maps are more detailed e.g., contain more classes and a different level of generalization.

The maps are interactive in that if the user is unfamiliar with meaning of a term (e.g., the word "Climate" in the title of the map), clicking on this text will provide an age appropriate glossary definition. Additional information may also be accessed by a 'mouse-over' of elements of the maps [3].

Students can also produce their own maps [3]. The amount of interactivity offered changes with the different Levels. At the lower levels, students are only able to select from the layers presented. These maps can then be downloaded and printed so that data can be added manually. At the higher levels, students will interactively access data and symbolize it directly on the maps shown in their viewing area prior to downloading and printing.

The data base included is in the form of tables. It comprises the data used to produce the thematic maps, exercises and graphics in the atlas as well as other data relevant to the atlases components.

The atlas hyperlinks selected complement its suitcase of concepts, activities and exercises, pre-prepared maps, database and glossary as well as sustaining the teachers' and students' queries on different topics. The software program COPERNIC was used to identify sites which were then located and evaluated [3]. The existing sites were selected by a team of educational consultants.

The glossary contains age appropriate bi-lingual definitions for each of the four levels. Each word is accompanied by an example that may be a graphic (photograph, drawing, table, graph etc.) or a link to an element e.g., map contained in the atlas [3]. At Level 1 access is primarily through clicking on a word associated with the graphic or tabular material. In Level 3, the more detailed glossary may also be accessed alphabetically.

To accommodate components of the curriculum Level 3's general menu includes 'Projects' (Case Studies). The project currently under development relates to "the Monteregiennes and Mount Royal". The Monteregiennes are a series of volcanic plugs, one of which is Mount Royal (in Montreal). The project comprises a hierarchical series of pages which give access to textual descriptions, location maps (with the option of selecting different scales), and an animated map of Mount Royal's three summits.

Lessons that have been learnt along the way (and project modifications)

During the 5 year project, many lessons have been learnt. Three of these will be outlined here; the reality of the school environment, interactivity - its strength and curse! and competing with the 'big league' (electronic games).

Internet and the reality of the school environment

A 2003 Household Internet Use Survey revealed that an estimated 7.9 million (64%) of the 12.3 million Canadian households had access to the Internet [6]. In a previous survey investigating access and use of information technology, "66 percent of parents report[ed] educational advantages as the greatest benefit of their child use of the Internet" [2:6].

Without question, the Internet is here to stay...but it must be remembered that NOT everyone at home or in school, has access to it. In addition where available there are often problems with access and its unreliability. There is also the great variety in the nature of hardware available. For Quebec's Cycle 2 children, the teachers in the focus groups' first preference was a paper atlas -- which was seen as a complete tool and accessible to all -- physically as well as cost-wise. "This was followed by a CD-ROM atlas which, although interactive, educational and allowing for self-correction, was seen as less available to students in a class due to the hardware requirements and its cost. An Internet atlas was their last choice of mediums. Although permitting student access to large amounts of data, it was seen as problematic due to its availability, access, and teacher control relating to navigation" [4:2947]. Because of the issues of access and heterogeneity of available hardware, it was decided that the maximum graphic file size would be 50k, animation would be used judiciously, and Websafe colour palette would be use - the product was designed for the lowest common denominator of hardware. At the same time emphasis was placed on the advantages of the medium - its ability to include animation and 3D, interactivity and capacity to provide access to current information on a variety of topics for a diverse group of individuals of different ages. The inclusion of printable material, particularly quality base maps, was included to address an identified teacher need. However it was also recognized that, given current technology at this time, the inclusion of sound as well as long animation sequences are not practical and are best left to the medium of the CD-ROM.

Interactivity is both a strength and curse of the medium!

The ability to introduce activity enables the designer to incorporate elements such as animation, e.g., to show the evolution of population over time, and to design a hierarchy of accessible information. Interactivity also allows users to produce maps to their own specification. At the same time, however, it introduces the tremendous challenge of developing interfaces - user guides. These are both general such as the home page (navigation of the site), and specific e.g., navigating within a specific component (e.g., project/case study). Each needs to be transparent, logical and easy to navigate. Interactivity requires great attention to the organization of access to information throughout the whole site.

In his book on web usability, "Don't make me think", Krug [7] identifies the importance of providing a site where the contents are self evident or self explanatory. He identified that most users scan rather than reads pages, muddling through, choosing the first reasonable option - which may not be the best of available options. He advocates that there

are five important things that should be done to make a site seen and understood:

- "Create a clear visual hierarchy on each page
- Take advantage of conventions
- Break up pages into clearly defined areas
- Make obvious what is clickable
- Minimize noise." [7:31].

What of the Prototype Atlas's user guides is intuitive to the user? For example, is the content of the home page of Level 3 self evident? How easy is it for the user to navigate to general components of the site e.g., glossary. How easy is it to navigate within a specific component e.g., a case study? At any point in time do students know where they are? Do they know how they got to that location? Currently, for Level 3 students, research is being conducted to explore aspects of the user guides and address such questions. Choices and navigation pathways are being examined in relation to identified tasks. The study comprises two groups. Group 1 (85 students), in a class environment, are being asked to perform a series of specific tasks of increasing complexity. Observation of their performance will be recorded as well as their responses to questions regarding the components the web site used to accomplish the tasks together with their ease-difficulty of use. Data on their knowledge of and use of computers is also to be collected. For the second group of students (20 students), a more detailed investigation is being undertaken. In the 30 minute individual interaction with the researcher (to be videotaped with two synchronized cameras, one focused on the student, the other on the screen) the student will be asked to verbalize their choices in response to responding to a question which can only be answered by accessing the Quebec School Atlas. A second component involves the student's responses to viewing the interfaces of four education games (e.g., Which has too many icons? Which has too much information?). In a third component, the student's replies to a series of specific questions related to the use of both the general and specific components accessed to respond to the initial question posed will be collected. Responses to the same questions posed to Group 1, concerning their knowledge of and use of computers, will also be collected. It is hoped that the analysis of the children's verbal responses together with the qualitative observations will contribute to providing data which will allow modifications to be made both general and specific user interfaces of the site more intuitive.

Competing with the "big league" (electronic games)

Last - but not least -- is the fact that the audience of the Atlas are 'children of the electronic age' with many having been exposed to a wide variety of electronic games. Educational software such as an Atlas, with a more sophisticated content, narrower market, and budgetary constraints, cannot provide children with the same thrill and 'fun' component which children have encountered and now expect in an electronic product.

Conclusions

Developing a school prototype Internet atlas of Quebec posed many challenges. Nevertheless, it provided the freedom to explore this medium and experiment with its strength while at the same time facing the reality of the nature and use of the medium. Over the 5 year life of this project there has been a significant increase in the freeware associated with interactivity and it is envisioned that any future developments will see a movement towards the use of Scalable Vector Graphics. The development of any Internet Atlas for use in the schools needs to be able to accommodate the constantly improvements to hardware and the software developments which attempt to make the product lighter to facilitate quicker access yet also accommodate the lowest common denominator of hardware. The Quebec Prototype School Atlas is to be launched in September 2005 (<http://atlasduquebec.qc.ca>). The objective of the prototype was to explore the Internet as an avenue for producing a teaching tool which would allow a diverse group of individuals, in the school environment, to learn about the Province of Quebec. Your feedback on this site will be greatly appreciated. It is the hope that in the future this project will be linked to a public broadcast site housing educational tools, supported by a governmental body, thus allowing for its further content development.

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