Facilitating GIS 2.0 Collaborative Planning Tools
Prospects and Frustrations

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ABSTRACT

The paper explores new potentials of GIS-2 in planning education. The author assumes the fulfillment of the 'GIS for everyone' prophecy begins in the classroom. Collaborative GIS-based problem solving by multi-planners may lead to more efficient solutions as well as better adoption of the spatial plan. Based on collaborative learning and participatory GIS spatial planning theories, it looks into the consequences of using the concept of situated learning and the possibilities of combining social and technical e-mapping with GIS analysis for spatial analysis and decision making. The uncertainty of working solo on GIS planning applications is compared with the frustration and potentials offered by collaborating on solving multi-faceted planning problems on the Web. The experiment uses third level students involved in GIS course to apply GIS-based negotiation tools to formulate a multi-criteria plan and reach consensus on a final draft plan for the city of Jeddah.

Keywords: GIS 2.0, Collaborative Mapping, Web 2.0, Urban Planning, GIS education.

Introduction: Web 2.0, GIS 2.0 and Planners

In 2006, the volume 'Learning to think Spatially' (National Research Council 2006) argued for a strong inclusion of GIS into curricula. This argument was mainly based on the assumption that spatial thinking could enhance the quality of decision making in both science and everyday life.

Up to now, the argument for the merger of the two has focused on the scent of joy over the loss of power by expert spatial planners. There was this zeal over the ultimate empowerment of the 'commons' over the process of knowledge generation. (JEKEL, PREE & KRAXBERGER, in print). While this may be true, but only to the extent to where decision-making ultimatly lies. The ultimate production of analytical maps still relies on experts using systems such as GIS, which could not be easily used intuitively by non-experts.

The prospects of the merger of second-generation World-Wide Web applications and advanced mapping applications may fundementally change the way planners learn and practice. The first - subsumed under the label "Web 2.0" (Graham, 2005; O'Reilly, 2005) - creates a new, un-georeferenced non-elite social space with user-generated content. The second brings all sorts of actors vividly contributing both trivia and serious information with some type of georeferencing (see, for example, wikimapia.org). Goodchild (2007) uses the label "volunteered geographic information" for the local contribution of geospatial knowledge. Both innovations seem to be progressing in the direction of empowering the 'commons' over the monopoly of geographic data and analysis – a trend towards which planners should adapt to and learn from.

This merger has been refered to generally as GIS 2.0. While most of the information on display in this new GIS 2.0 world so far consists of text, pictures, slang attached to a specific 'address' that is usually commercially or socially focused. But, we do know that analytical and organisational tools such as collaborative and argumemtative GIS could lead to a sort of participative spatial planning that may overshadow discrete stand-alone spatial analysis. In a planning setting, this platforms theoretically allows for online discussion amongst both planners working in teams and among other stakeholders. In a GIS educational setting, collaborative city planning case studies with students can be based on digital globes and learning platforms to simulate virtual team building spirit and real-world e-collaboration to extract, transmit and display GIS maps. This is something that map-servers cannot provide since they possess a monopoly over spatial data.

The Case for e-Collaborative Planning

Although Web 2.0 appears to provide the foundation for GIS 2.0 – that is user-friendly online tools for collaborative spatial decision-making, their application in collaborative simulated spatial decision-making environments among planners is still uncommon. Rinner *et. al* (2007) note that "among numerous existing map mashups, we did not find any that are included formally in a planning process, let alone any that relate to the deliberative element in planning." **Table 1** summerizes the most recent attempts.

Early back in 1995, *Michael Stern, and Neal Payton* initiated a collaborative urban design project in Owings Mills, Maryland. Six student teams from the University of Virginia and graduate and from Catholic University of America were asked to develop an urban design master plan for the Owings Mills Town Center. The students used e-mail and online conferencing for communication, and published their reports and master plans on the course Web site. Eight weeks following the on-site *charrette* the members of the design teams reconvened for weekly "digital collaborations" to evaluate and further develop the project through sharing of digital images and teleconferencing over the information networks. An automated script was written by Thornton Staples of IATH allowed students to place image files onto a team directory and then "build" the web page for comments. This early example suggested the complicated ways of using the Web to share information and resources among groups as well as to create a comprehensive overview of key issues in town planning and urban development (**Figure 1**).

Table 1 - Comparing e-Collaborative Planning Exercies

Year	Author(s)	Study Area	Collaborates	Aim(s)	e-Collaborative Planning Platform
1995	*Michael Stern, and Neal Payton*	Owings Mills, Maryland	Urban Design and Landscape	Urban design master plan	e-mail, online conferencing, Web site for publishing
2004	*Rantanen and Kahila*	City of Jarvenpaa, Finland	City inhabitants	Urban Quality Factors	Online questionnair linked to Aerial photos using JavaScript and HTML.
2006	*Rantanen and Kahila*	Espoon Keskus, Finland	City inhabitants	CBD Renewal	Content management system (Joomla8) and MapServer software
2007	*Rinner et al*	Toronto, Canada	Students, faculty, and staff	Ryerson University's master plan	ArgooMap Mapping application built on Google Maps platform

Figure 1- Examples of e-collaborative planning in Maryland, USA (left) and Finland (Right)

In 2004, a study was carried out in **City of Jarvenpaa, Finland** to solicit the perceptions of 427 inhabitants of their city's environment. An online questionnair linked with aerial photos was used to identify positive and negative factors about the living environment (what they preferred and what they disliked). After defining, the respondents located them on the map of Jarvenpaa together with their daily routines (shops, day care centres, schools, etc.). Every mapped point had different attributes and location information. The application was based on JavaScript and HTML (Rantanen and Kahila 2008, **Figure 1**).

In 2006 Espoon Keskus - a city with 35,000 inhabitants in Finland – initiated Development Forum7, a shared platform and storage facility for all kinds of local knowledge. The Forum brings both formal expert knowledge of the authorities, and informal experiential knowledge of the residents, concerning the renewal of the administrative centre of Espoon keskus. The Forum uses a content management system (Joomla8), which offers tools for data creation, moderation and publishing. Components like discussion forums, news sections and advertisement boards are also used. Picture galleries are maintained by local activists. Spatially referred data are linked to articles and discussion topics in other parts of the site. Two mapping applications were realized by MapServer software, an open source development environment for building online map applications. A Local Knowledge Map is a map application in which local data are linked to places either as points or areas. Administrators of the site can add new data into the system with an easy (point and click) system. Links to official information concerning a certain area can be combined with statements by the residents' associations, news from local magazines or photographs. The map interface brings them into the same local layer. A user can zoom into a map, select a topic (ongoing, archived or future zoning, statements of the associations, etc.) and submit a search. The application shows the results both as spots and areas on the map and as a list. When a certain spot on a map is clicked, the system shows the head-notes of all the articles that have been attached to it.

However, with the advent of Web 2.0, the foundation for user-friendly online tools for collaborative spatial decision-making increased considerably. AJAX-based user interfaces now allow for seamless interaction with online applications. Publicly available geospatial data enable us to used and build applications and online mapping functions are pre-packaged in API toolboxes. From a user's perspective, the small number of service providers and the use of the same user interface and functionality in countless mashups facilitates recognition and learning. In 2007, Ryerson University commenced planning a 20-year project aimed at revitalizing the campus and surrounding community in downtown Toronto, Canada. To gain an understanding of the visions of students, faculty, and staff members, an online discussion was conducted using the Ryerson Intranet. The simulation exercise kept the existing thread structure of the discussion, but each message was given one or more explicit geographic references. Two discussions were copied into a mapping application called the ArgooMap tool in order to demonstrate how participants could have benefited from the use of a Web 2.0-based online mapping component. A map-based discussion forum was presented that is built on the Google Maps platform and enables Internet users to submit place-based comments and respond to other participants' contributions (**Figure 2**). Using a simulated planning debate, they could show how an argumentation map can be used to gain an overview of the status of a debate and help understand the participants' spatial thought processes by navigating the network of messages and geographic references (Rinner *et al* 2008).

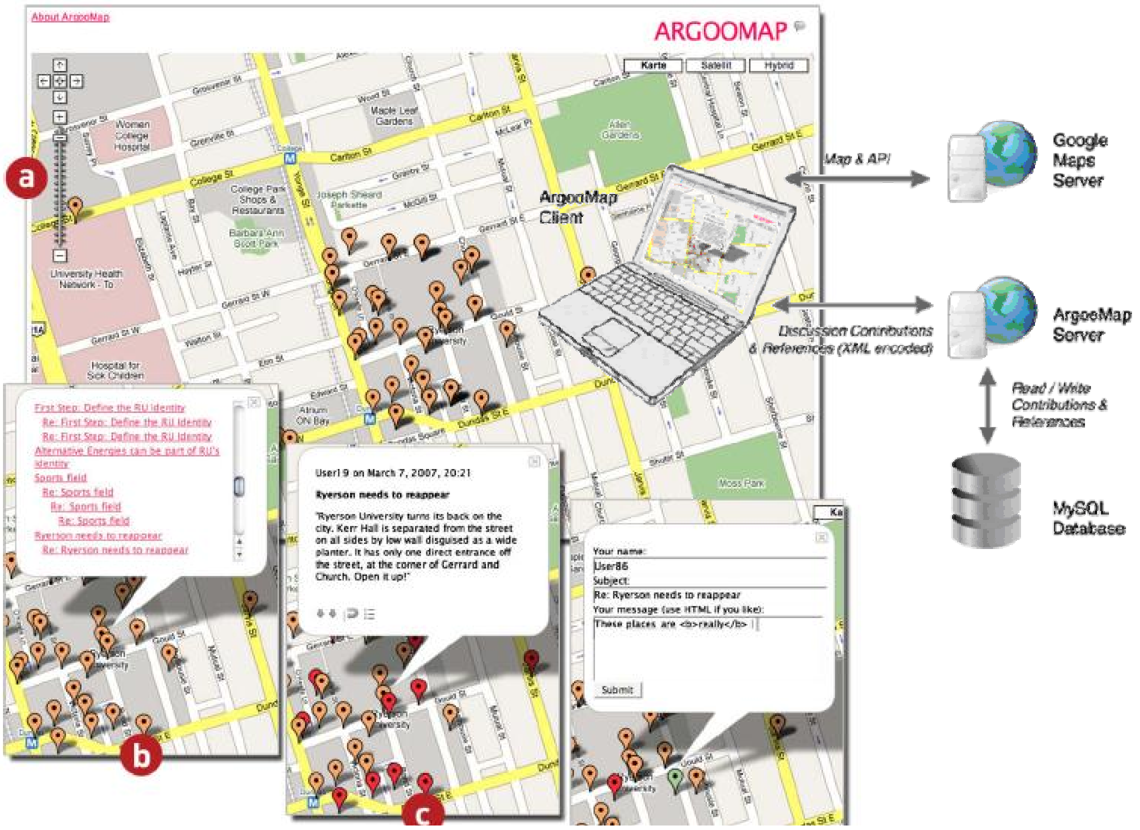

Figure 2 - User Interface of Agroomap

Research directions

Collaborative problem-solving of explicit spatial localations is expected to lead to more efficient solutions as well as better acceptability of spatial decision-making. This has been the basic critique of convential GIS from a social theory (ELWOOD 2006; PICKLES 2006). This provides a considerable shift from the basic ideas of ‘Learning to think Spatially’ and the idea therefore is much closer to LEFEBVRE’S (1991) argument that ‘represented space’ nowadays may be considered the dominant aspect in the social production of space. The -aim, then, is to train stakeholders to visualize their ideas and provide adequate means of scaffolding. Research then has to target means and modalities of spatial interplay that are open to all while being still formalized enough to be considered for analysis. This may be realized through planners collaboration on GIS mapping within a specific problem-solving endeavor. The tools are becoming increasingly available through generic collaborative mapping. But what is collaborative mapping?

Collaborative mapping is an initiative to collectively create models of real-world locations online. It is the aggregation of web maps and user-generated content, from a group of individuals or entities. A very simple collaborative mapping application would just plot users' locations (Social mapping or geosocial networking) or

Wikipedia articles' locations (Placeopedia). Collaborative implies the possibility of edition by several distinct individuals so the term would tend to exclude applications such as wayfaring where the maps are not meant for the general user to modify.

Although collaborative mapping has only recently surfaced, there are various groups of people who have worked on collaborative mapping since 1996 or so. Plewe (1999) describes in his pioneering book the concept of geographic information retrieval and data sharing, outlines motivations for sharing geographic data, and includes step-by-step instructions through the planning and development stages of the Web site. More recently, Gillavery (2006) details the theories, processes, and tools for designing and implementing collaborative GIS, and explores collaborative GIS methodologies currently being used or developed. In practice, however, collaborative mapping applications tie in very closely with the blogging community[1], and vary depending on which feature the collaborative edition takes place: on the map itself (shared surface), or on overlays to the map.

> **1) Shared surface:** In this kind of application, the map itself is created collaboratively by sharing a common surface. For example WikiMapia adds user-generated place names and descriptions to locations. Collaborative mapping and specifically surface sharing faces the same problems as revision control, namely concurrent access issues and versioning. In addition to these problems, collaborative maps must deal with the difficult issue of cluttering, due to the geometric constraints inherent in the media. One approach to this problem is using overlays.
>
> **2) Overlays:** Overlays group together items on a map, allowing the user of the map to toggle the overlay's visibility and thus all items contained in the overlay. The application uses map tiles from a third-party (for example one of the mapping APIs) and adds its own collaboratively-edited overlays to them, sometimes in a Wiki fashion. If each user's revisions are contained in an overlay, the issue of revision control and cluttering can be mitigated.

Methodology

The purpose of the initiative is enticing GIS-course students to explore GIS 2.0 concepts and to collaborate to solve specific planning problems. Typical GIS instruction focused on single-user, self-analysis and own-source data. This method no longer replicates real-world multi-user, participative planning environments.

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[1] Webmapper is a website that started off as a personal test bed to develop web mapping applications and has evolved to become a show case and a themed blog, discussing the latest trends in location based services (LBS), Web cartography, and geo-blogging. Oogle Earth is another blog that summarizes all the latest on Google Earth mapping.

The aim of instruction then becomes to expose students in participative spatial planning as collective learning process. Colbeck et al (2000) list many benefits student acquire in collaborative learning:

1) New strategies about the subject and about thinking in general
2) Knowledge about the subject and about thinking in general
3) Managerial skills (arising from the method itself): building consensus, shared responsibility for success and failure.

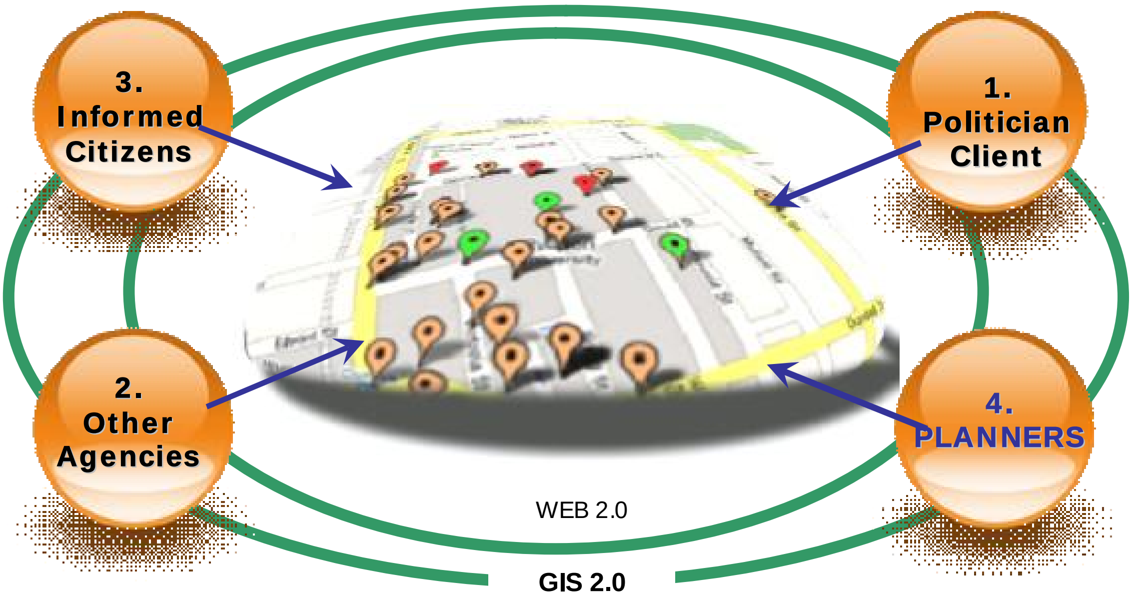

Figure 3 - Proposed skeleton for the case study

In principle, there are three basic collaborative tasks in which planners are involved with: *first*, among politicians or decision-makers, *second* among other agncies and departments, and *third* among citizens. Concurrently, and at the core of this process, the planners also collaborate among themselves, deliberating and brainstroming to develop a proposal. Technical development of GIS 2.0 should enable students playing various roles to easily communicate their visions of space and to discuss these with other relevant actors. In other words, students should be able to translate their ideas of development, make them open to discussion and decision making. The concept of socially constructed meaning becomes attached to the representation of the physical analysis using GIS, thus allowing for the visualisation of both social and physical conflict and consensus.

The class was divided into three groups: the first group represented the *planners*, the second *agencies that hold data*, and the third the *public*. The client /politician was represented by the instructor who identified the problems and evaluated the answers (**Figure 3**).

The tools and applications used for this experiment were numerous: e-groups, google earth community and google maps. Students were required to form working groups using the “collaborate” command in googlemaps. Each project was assigned to a new map in which students acting various roles received, collaborated online or offline to create a new map which was then imported and displayed onto googlearth.

Students were assigned three specific tasks:

- Task 1: To receive each assignment online
- Task 2: To build a Geodatabase of relevant layers through i-collaborative teamwork
- Task 3: To formulate a GIS2.0 Plan of Action
- Task 4: To test the plan interactively with the Community and the decision-maker

The chosen problem represented some of three major urban planning issues that face any planner mainly (**Figure 4**):

1. Poverty Alleviation
2. High Incidence of Crime
3. Incidence of Disease

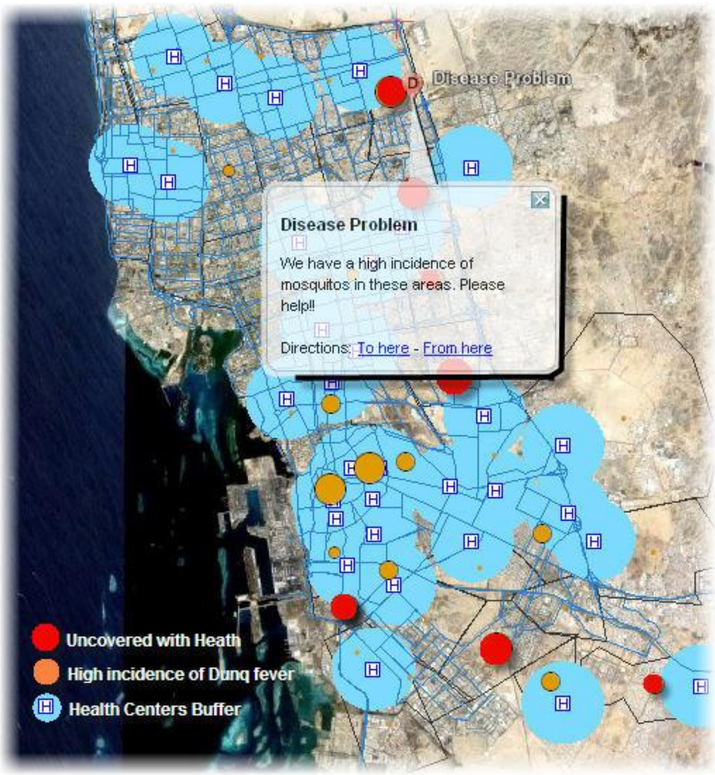

Figure 4 - Initial problem statement

Student groups collaborated to formulate relevant data needed to address the problem. For example, poverty alleviation in a certain area requires sufficient income data that is to be found through census, accessibility to jobs data that is to be acquired from transportation authority, education facitilities data that is maintained by the Ministry of Education, and so on. Group 2 students had members who had access to these data through web folders in the e-group. The planner(s) is obliged to seek the assistance of his counterpart in these agencies to collect the data. Then collaborate with peers and the public to make sense of the data and formulate a proposal. Finally the politician (instructor) was to approve or revoke the proposal based on its merit (**Figure 5**).

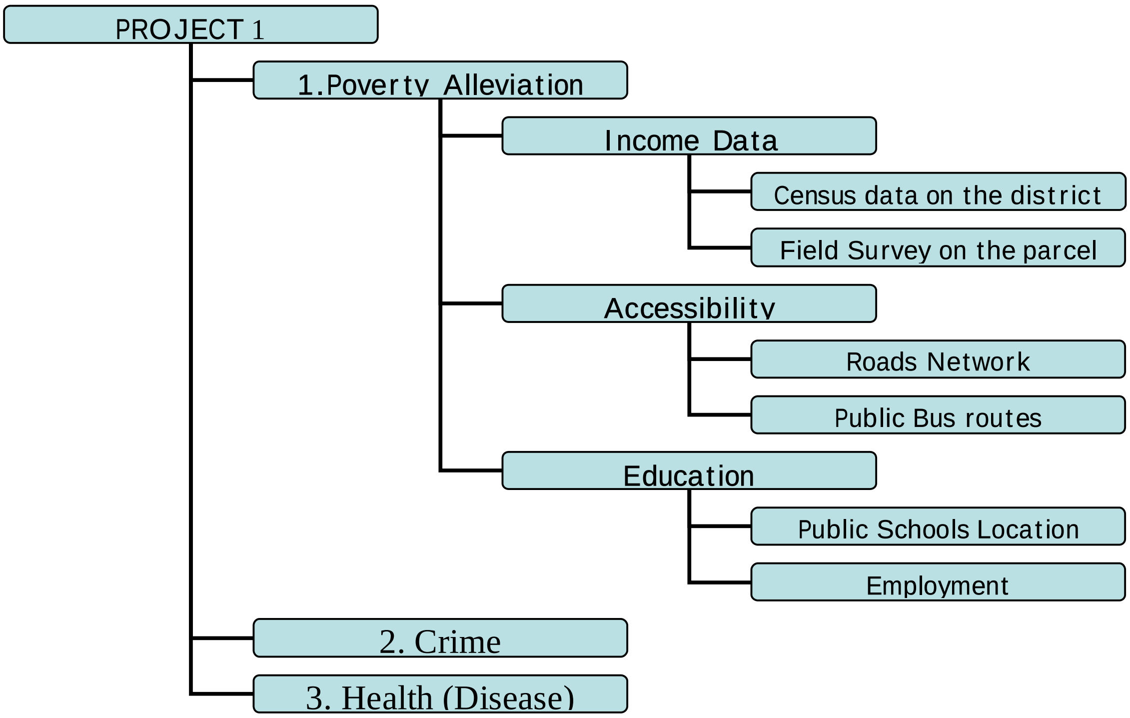

Figure 5 - Mind-map of the solution

Results:

The experiment applied on third year students from the department of urban and regional planning has provided several qualitative and quantitative benefits (**Figure 6** and **Figure 7**).

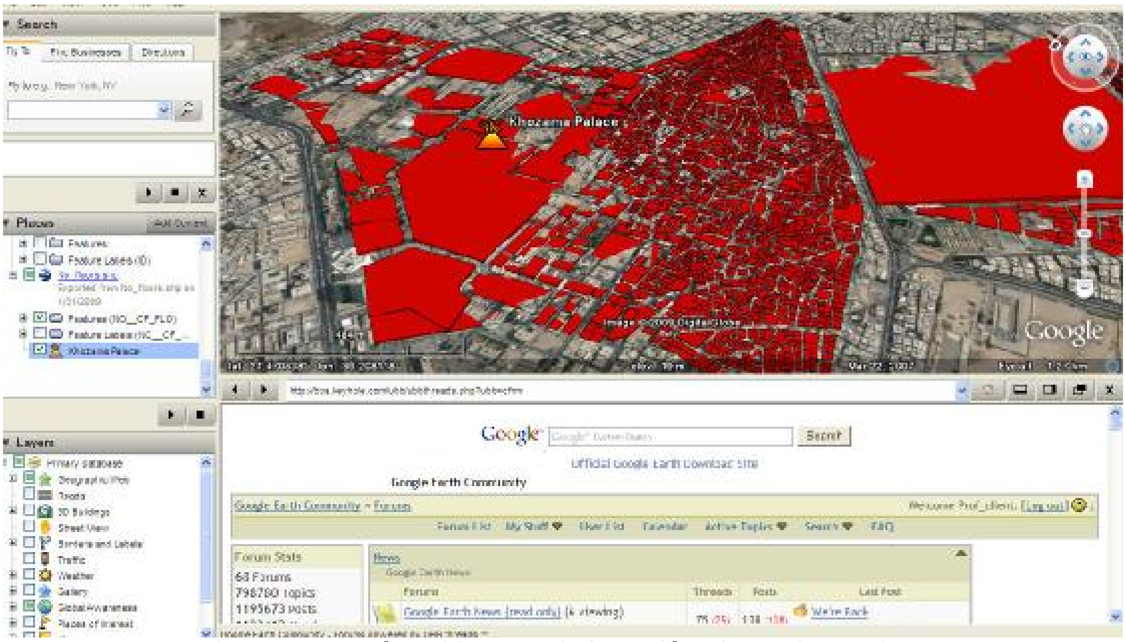

Figure 6 - Overlayed imported shape file of one the study areas

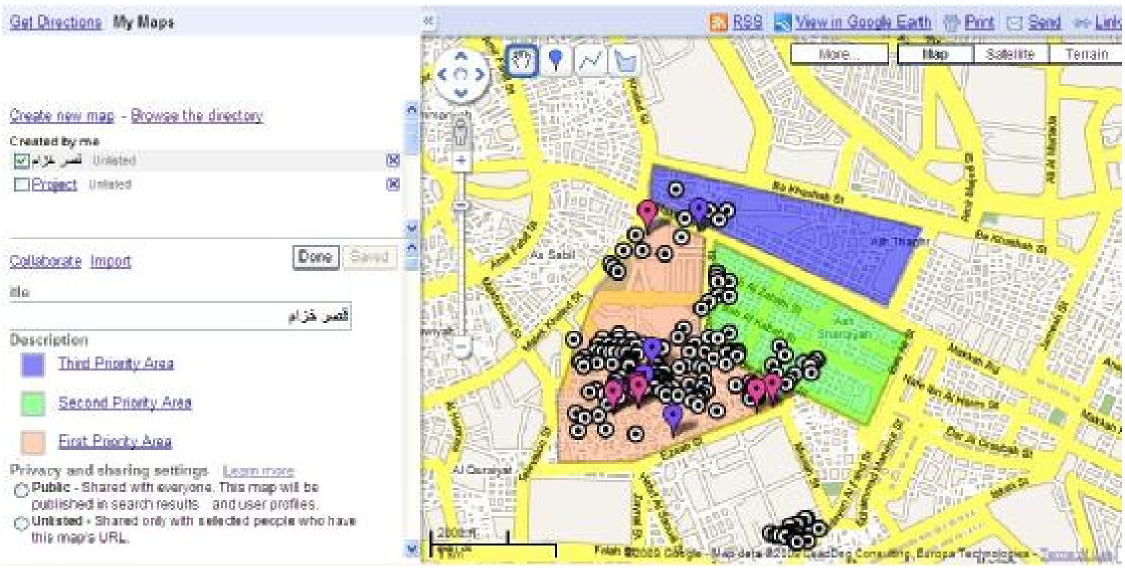

Figure 7 - One of the produced collaborative maps

Judging from the difference between their responses to a questionnaire at the beginning and end of the class, students have acquired a better understanding of the processes involved in urban planning *and* GIS analysis. They were better able to link the tool with the process and to conceive a more mature planning goal. They were further able to translate a social or economic problem into a set of specific spatial data that needed to be modeled, collected and used. Quantitatively, students' e-skills were dramatically improved from a 55% who had active emails with close to zero experience with Web 2.0 and collaborative spatial experience to the results shown in the following table.

Table 2 - Class survey results

Functionality	Has email	GIS user	iForum user	Yahoogroup Member	GoogleEarth Placemark	GoogleEarth Community	GIS-GE conversion
No of students	24	24	18	18	11	18	3
Percent	100 %	100 %	75%	75%	46%	75%	12%

Naturally, not all students benefited equally. As shown from the table many were not actively involved in the discussions and processes. While few had internet connection problems, others were too lazy or too scared to try the challenge.
Among the problems noted:

- The loading and sharing of kml and shapefiles files into google earth is unstable.
- Importing kml polygon files into google map results in their conversion into vertex points.
- Lables and attributes are not attached properly. Each map feature in a shape file is converted into a km layer.
- Map online drawing is complicated, the application does not allow for map points to be overlayed with existing placemarks or where navigation and zoom toolbars are located.
- The constant transfer between platforms such as google earth, google maps and online forums makes the exercise difficult to track and frustrates students.

Conclusions

The paper explored how GIS-2 can be used in GIS urban planning education. The application of GIS 2.0 in urban planning collaborative projects for GIS students is a promising horizon, yet poses a lot of challenges. On-line collaborative problem solving of spatial problems was found to enhance technical and methodological skills of students, explicitly multi-planner mind-mapping of structured problems. It is too early to judge if such approach may lead to more efficient solutions, given the glitches and bugs of the mapping software and applications. The new collaborative maps feature for Google Maps is less than a year old and was previously based a third-party-only API-based extensions for maps that became folded into Google's default offering. Closed collaboration tool extension became recently standard and that is a significant tool that contains the option of allowing map-editing privileges to members.

References

Claus Rinner A, Carsten Kessler B, Stephen Andrulis A The use of Web 2.0 concepts to support deliberation in spatial decision-making in Computers, Environment and Urban Systems 32 (2008) 386–395

Colbeck, C. L, Campbell, S. E., & Bjorklund, S. A. (2000). Grouping in the dark: What college students learn from group projects. Journal of Higher Education, 71, 60–83

Goodchild, M. F. (2007a). Geographic information science: The grand challenges. In J. Wilson & A. S. Fotheringham (Eds.), The handbook of geographic information science (pp. 596–608). Malden, MA: Blackwell Publishing.

Goodchild, M. F. (2007b). Citizens as voluntary sensors: Spatial data infrastructure in the World of Web 2.0. International Journal of Spatial Data Infrastructures Research, 2, 24–32.

Graham, P. (2005). Web 2.0. Essay dated November 2005. <http://www.paulgraham.com/web20.html> [last visited January 4, 2008].

Jekel, Thomas "What you all want is GIS 2.0!" - Collaborative GI based learning environments for spatial planning and education

Lee, Y Park, K and Shibasaki, R (2006)Collaborative GIS Environment for Exploratory Spatial Data Analysis Based on Hybrid P2P Network. Z. Pan et al. (Eds.): Edutainment 2006, LNCS 3942, pp. 330–333, 2006. (C) Springer-Verlag Berlin Heidelberg 2006

Mac Gillavry, E. (2006) Collaborative Mapping and GIS: An Alternative Geographic Information Framework. In: Balram, S. & S. Dragicevic (eds.) Collaborative Geographic Information Systems, pp.103-119. London: Idea Group Publishing

O'Reilly, T. (2005). What is Web 2.0? Design patterns and business models for the next generation of software. Essay dated 09/30/2005. http://www.oreillynet.com/

Plewe , B.(1999) GIS Online: Information Retrieval, Mapping, and the Internet. OnWord Press

Rantanen, H and Kahila, M. (2008) The SoftGIS approach to local knowledge in Journal of Environmental Management xxx (2008) 1–10