

Developing a Blueprint for an Educational Version of GIS

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1. Current State of GIS in K-12

Studies show that many teachers are having a hard time using GIS. One percent of a highly motivated group of teachers reported satisfaction with using GIS in the classroom (Kerski 2003). Using GIS has its rewards, but it can also be frustrating to teachers (Keiper 1999). Many teachers have undergone 40-hour training classes, but this training is not effective: it is too expensive to train individual teachers and the trained teachers do not feel prepared to conduct GIS activities in the classroom (Baker 2005).

The National Research Council states that “GIS software must be redesigned if GIS is to succeed ...” The Council makes several recommendations for the new educational version of GIS, including broadening the accessibility to the full range of learners, strengthening the capacity for non-spatial data, overcoming visual limitations, providing age- and experience-appropriate versions, designing intuitive interfaces, making the software customizable, and being more “teacher-friendly” (NRC 2006).

What is the purpose of GIS in the classroom? The literature shows us two goals: display/visualization and computation/analysis. Meyer makes a distinction between “display GIS” and “analytical GIS” (Meyer et al. 1999). The National Research Council distinguishes between “visualization” and “computation” roles for GIS (NRC 2006). Whatever the terminology used, there seems to be a “fork in the road” where teachers have an end-goal in mind for their GIS project. This is an unexplored area, and we need to know more about what types of functionality teachers want.

Some researchers have reservations about the technology in general. Some have argued for a simple and minimalistic GIS and claim that there is a risk of teaching “buttonology” at the expense of educational concepts (Marsh 2007). Using GIS software to follow

cookie cutter instructions may introduce students to the functionality of a GIS but lacks the development of both the content and analytical understandings educators are interested in nurturing in their students. Cunningham points out that schools need to go back to the basics and use pen and ink cartography because simple technologies give students the opportunity to practice thinking geographically (Cunningham 2005). There is a place for basic skills in cartography and map analysis when introducing GIS to the classroom, but it should represent a starting point and not an end. With the emphasis on technology that exists in today's classroom, we are missing a perfect opportunity for geography to be a leader in the science and technology realm. If we do not embrace geospatial tools and skills relevant to the world of today we are not serving our discipline or our students well. So what is appropriate for the K-12 education community?

The purpose of GIS can impact the user's choice of platform. The desktop version of GIS is very complicated and full of functionality and is equipped to perform complex analytics. The internet is mentioned as a possible new platform, although the current versions of Internet GIS (IGIS) do not offer the full GIS functionality. Baker states that most educational GIS activities use only a handful of the available functions (Baker 2005). The complexity of a future GIS could have a bearing on the technical platform and whether or not it is appropriate for educational use. This further clarifies the question, what platform and functionality then are appropriate for the K-12 education community?

The literature suggests that the roles for GIS have not yet been fully established. There is a strong possibility that there may be several definitions of GIS in the educational arena. Are teachers interested in display/visualization or do they want analysis/computation? Are teachers teaching GIS specifically or are they using it to visualize their subject matter? These gray areas increase the need to learn more about what we expect of GIS in the classroom.

2. Software Design Considerations

Before beginning software design, a requirement analysis is necessary to determine the needs of a software product. There are two methods of obtaining a requirement analysis. One method is contract-driven, which is when a customer writes a requirements document. These documents can be filled with ambiguity, uncertainty, wishful thinking, and gaps. Software developers must carefully review, analyze, and refine their understanding of the documented requirements. A second method is market-driven, where there is no easily definable customer and no customer-sanctioned requirements document. Developers are tasked with producing a document from user statements, which can be vague in nature (Potts et al. 1994). Because there is no easily identifiable “customer” for developing a new educational version of GIS, this project is considered to be market-driven. As such, the requirements analysis should be broad and consider diverse groups. Therefore the next logical assumption would be to introduce a stakeholder analysis as the proper tool for determining the needs and expectations of the multiple parties.

Stakeholder analysis is a technique to identify stakeholders and analyze their needs. It is used to identify those with a vested interest in the project. A stakeholder analysis helps to identify: interests of all stakeholders (those affecting and those affected); potential issues that could disrupt the project; key people for information distribution; groups that should be encouraged to participate; communication planning and stakeholder management strategy; and ways to reduce potential negative impacts. Engaging stakeholders throughout the project life cycle is a key to projects success but not a guarantee (Babou 2008).

Stakeholders are individuals or organizations actively involved in a project or those whose interests may be affected by the project. They are defined as actors with an interest in the issue, who are affected by issue, or could influence the decision-making process. They can be individuals, organizations, or a mix of individuals, organizations, and/or networks (Varvasovszky et al. 2007). Teachers, various levels of administrators, and students are all stakeholders as well as those tasked

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with designing and training the education community to effectively use this tool.

Qualitative methods should be used in the early stages of data collection. Face-to-face semi-structured interviews help organize the data collection while maintaining a broad enough focus so that emerging themes can be identified. Checklists and structured questionnaires can be paired with the semi-structured interviews to organize ideas. Qualitative approaches are important to prevent premature focus on a limited number of issues. As issues emerge, more structured tools can be used to better quantify stakeholder positions. However, prematurely using quantitative tools may lead to neglect of important issues (Varvasovszky et al. 2007).

3. Performing Stakeholder Analysis

Considering the market-driven nature of developing this blueprint, there are many voices to consider in this planning. The steps below lay out a process for identifying and communicating issues important to stakeholders. These ideas are based on “How to do (or not do) ... A stakeholder analysis” by Varvasovsky and Brugha.

Step 1. Identify the Stakeholders

At a minimum, teachers, students, school systems, and policy makers should be considered to have a vested interest in this new software. Additionally, there could be other groups such as educational organizations, private businesses, or the actual software designers that could provide valuable input.

A stakeholder analysis can be a tedious process. It is necessary to identify all stakeholders and take their needs into account and make sure they understand the implications of the new system.

Step 2. Gather Data

The data gathering process involves communicating with users to determine their needs. Semi-structured interviews should be used. Other techniques are structured interviews, focus groups, and creating a requirements list. Several ideas for data gathering are listed below:

A. Interview Teachers

Most teacher surveys provide information on teacher opinions of past GIS usage. While this information is useful in determining areas of strength and weakness, this strategy is not effective in a planning stage for several reasons: it limits input to teachers who have used GIS, and it limits ideas to what is currently known. Planning stages should include a wide range of teachers and should open the conversation to what could be possible in the future and not limit the conversation to the version of GIS that we have now. It is possible that a teacher who has never heard of GIS could have a creative and useful idea.

i. Assess Current Concerns with GIS

What are teachers' concerns with GIS? We need to know what level of GIS they are comfortable with right now as well as how they see their comfort level if they had more training. It would be interesting to show GIS to teachers who have never seen it and compare their concerns with other K-12 teachers. .

ii. Develop a List of Lesson Ideas

What can we do with GIS? It would be helpful to develop a list of subject matters and lessons that would benefit from the visual nature of GIS. Ideally, this list should be interdisciplinary in nature and cover multiple content areas.

iii. Show Sample Portfolio

Demonstrating lessons using GIS or a GIS-based alternative would be helpful in communicating to teachers, especially those new to GIS, the benefits of GIS.

iv. See The Big Picture

“If you could have a GIS that did anything you wanted, what would you ask for?” Answering this question will go a long way toward envisioning any new technology features.

vi. Explore Alternatives to GIS

Are there other technologies that might work better than GIS? If so, why not use them instead? While these questions may be seemingly oppositional, they serve as a challenge to define what we expect of GIS. Alternative methods, such as Google Earth, Google Maps, and customized multimedia, have potential and should be fully explored.

B. Interview School System Technical Specialists

How does GIS affect school networking and security? The literature generally treats school hardware and networking issues as a “local” matter, and consequently the subject is not generally discussed at a national level. However, studies show that schools have patch-work hardware, so it is a logical conclusion that this problem is pervasive and should not be defined as “local.” Some school staff members have described GIS as being “toxic” to their networking and security systems. A study needs to be conducted to find out how school hardware and networking experts view this software. This study should cover several counties with varying demographics in order to gain perspective on how widespread any hardware, networking, or security issues prevail. The results of this study would be useful in identifying a suitable and appropriate platform (desktop or internet).

C. Examine the Literature

There are many written accounts of using GIS in the classroom. In light of the fact that there are two purposes to GIS, examining the literature is a worthy exercise as it reflects actual classroom usage. This study could be a simple exercise of reading the articles describing GIS usage and determining the complexity of the functions used. Because there are so many GIS functions available, it would be sufficient to categorize them into two groups: display/visualization and analytical/computational. The display/visualization group would contain a few basic functions (zoom, pan, identify, layer toggle) while the analytical/computational group would tap into the more complex functions that are available with a GIS. If we could provide more than anecdotal evidence that a large percentage of past GIS use exercised

only a handful of GIS functions, this would support the idea of the need for a simpler GIS.

Step 3. Analyze Data

Providing feedback of discussion summaries to stakeholders can build trust, help them report inaccuracies, or encourage them to add to or justify a previous response. The data must be analyzed carefully because contradictions and gaps can surface and these should be reviewed by the development team. The analysis determines whether requirements are clear, contradictory, incomplete, or if there are gaps in the material.

Step 4. Present Findings

There are many techniques for communicating and presenting data. The results from this could be incorporated into a contract-style requirements list. This document would be an assessment of stakeholder ideas and would likely contain a checklist of requirements and a high level of description, such as case studies and user stories. This document could serve as a baseline for a stakeholder wish list and be used in determining the next steps in project development.

4. Conclusions

Stakeholder analysis is a useful tool for identifying and clarifying the needs and positions of those who would be affected by a project. The face-to-face nature of stakeholder interviews are believed to provide a richer understanding of the business processes and perceived needs. The interviews provide opportunities to gain highly focused knowledge and to explore emerging patterns of thought. The recommendations described here could be used to help determine the next step in deciding the course for the next step in the planning process. Teachers, students, and school systems should be given a voice in blueprint design for educational GIS.

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While the list of ideas presented here is in no way comprehensive, it serves to stimulate thinking and conversation among stakeholders. It is hoped that information gathered from the results of these ideas will be useful as a stakeholder wish list that can be used in the next level of the blueprint. There is much more that we need to learn about GIS usage, both present and future, before designing a new version for educational use.

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