Lost Scrolls of Geospatia

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All too often we become enamored of new technologies and look for ways to take advantage of the latest features. Rapid – and rather impressive – advances in geospatial tools make this quite easy to do: every year there are new ways to explore and integrate spatial data into educational settings. The risk of course is that the tools become an end unto themselves. Educational goals become replaced by a desire to engage kids with the power of geospatial technology. When this happens, a course correction is in order. Fortunately, help is at hand.

Beginning with his work in the philosophy department at the University of Chicago in the late 1800's, and later as the founder of the University's still-running Lab School, John Dewey articulated principles that are quite useful in guiding geospatial inquiry. His ability to provide structure for intellectually challenging, student-friendly inquiry retains its value more than 100 years and many generations of technology later. As such, there is great benefit to be derived in unearthing what I will euphemistically call "the lost scrolls of geospatia."

Most fundamentally, Dewey argues that we need to keep the student's development in mind, focused primarily on equipping them for responsible functioning today. All too often, we "bank" skills and knowledge for future use, just in case they are needed. Dewey would argue that the need is great today, and that strong and growing capacity today is the best preparation for tomorrow. As he notes in My Pedagogic Creed (1897), *"I believe that education...is a process of living and not a preparation for future living."* Going further, he notes that "*...it is impossible to foretell definitely just what civilization will be twenty years from now. Hence it is impossible to prepare the child for any precise set of conditions. To prepare him for the future life means to give him command of himself: it means so to train him that he will have the full and ready use of all his capacities.*"

A corollary of this is the need to anchor the work in something meaningful and relevant to the student, and not in an external imposition. Elsewhere in the Creed, Dewey challenges us: *"Save as the efforts of the educator connect with some activity which the child is carrying out of his own initiative independent of the educator, education becomes reduced to a pressure from without. It may, indeed, give certain external results, but cannot truly be called educative."* In an era of externally imposed Common Core and Next Generation Standards, this anchoring in the life of the child represents a real challenge, which we'll take up in the second half of this paper.

At this stage, it is important to explore the implications of starting with the child's current experience. There are schools such as Summerhill (Neill, 1995) and the Sudbury Valley School (Greenberg, 1995) which give students free rein to explore their interests. Adult guidance is optional: The teachers are there as a resource to be used (or not) as the student in his or her sole determination deems useful. Dewey doesn't go that far, seeing instead a vitally important yet circumscribed role for the teacher. For Dewey, *"[t]he teacher is not in the school to impose certain ideas or to form certain habits in the child, but is there as a member of the community to select the influences which shall affect the child and to assist him in properly responding to these influences."* This sets up an interesting dance in which the child's interests and experiences provide the driver, but the teacher also plays a vital role in orchestrating the larger experience in light of her "larger experience and riper wisdom."

At this point, we have two baseline premises: That learning needs to emerge from and extend the life of the child, and that the teacher has a vital and complementary role in shaping students' experiences. This presents an interesting and ultimately productive tension which can lead to better learning than is possible with an externally imposed curriculum. Still, these two factors are incomplete without a third: What is the nature of the work for the student to undertake, and how can the teacher's experience and wisdom be used to structure and guide the work?

For our road map, we need to look to a later "scroll," Dewey's *Logic: The Theory of Inquiry* (1938). Here Dewey proposes five major steps underlying productive inquiry:

1. Identifying an 'indeterminate' or 'problematic' situation
2. The institution of a problem: 'To see that a situation requires inquiry'
3. 'Determination of a problem-solution' – what factors might be involved?
4. 'Reasoning' connections to other scientific understandings
5. Determining the 'operational character of facts-meanings' – in other words, carrying out 'experimental observations' that serve an 'evidential function' in resolving the situation.

Here you can see the expansive nature of an investigation, starting with awareness of something interesting, puzzling out aspects of what is being observed and what might be causing the interesting phenomenon. From there, reasoning connects to what else the student knows, and an effort can be made to assemble facts and concepts with an eye toward resolving the initially indeterminate or problematic situation. While there is a superficial resemblance to the standard "scientific method" students are taught, note how much front-end ownership the inquirer has in this model through identification of the problem, deciding that it needs resolution, and thinking through parameters and methods before starting out on the actual inquiry. All too often, kids are taught science as a lock-step method to "prove" pre-determined results. Once it's done, that part of the curriculum can be checked off as having been covered.

Using the 'Lost Scrolls' as a Curriculum Design Tool

If we accept the premises laid out here – that learning starts with a student's experiences and interests but is guided by a teacher's greater wisdom and experience toward resolving puzzling situations – it is still fair to ask what this might look like in practice. How can a curriculum unit be structured in a way that is responsive to these premises and is still meeting curriculum mandates? While Dewey would argue that the mandates themselves are problematic, the current reality of most schools in the United States is that the curriculum is built on external mandates. While we continue to advocate for reform, we still have real kids showing up in our classrooms who need the best experiences we can provide under the present circumstances. The balance of this paper describes work being done at the Missouri Botanical Garden to build a curriculum informed by Deweyan principles while at the same time being responsive to the Common Core State Standards for Language Arts and Mathematics and the Next Generation Science Standards.

To keep the challenge level up, this work is focusing on a traditionally dreary aspect of schooling: elementary school science. Long the realm of dry terminology-laden textbooks and avoidance of direct, student-initiated experience, we are trying to build learning experiences that honor the student as an active sense-maker starting with direct engagement with the local community. In this way we endeavor to respond to Dewey's concern articulated in My Pedagogic Creed about how science is learned in school. While written more than 100 years ago, the underlying truth is all too evident today:

> *I believe that one of the greatest difficulties in the present teaching of science is that the material is presented in purely objective form, or is treated as a new peculiar kind of experience which the child can add to that which he has already had. In reality, science is of value because it gives the ability to interpret and control the experience already had. It should be introduced, not as so much subject matter, but as showing the factors already involved in previous experience and as furnishing tools by which that experience can be more easily and effectively regulated.*

The first phase of the curriculum involves the teacher helping the students to have an enhanced experience of what they do every day: noticing their surroundings. While we often take our local ecoregion as normal and thus not very interesting, it is actually a result of the confluence of many factors. Temperature, precipitation, soil types, geology, and more all serve to help define which plants and animals live in our area. Viewed more broadly, one of the many concerns about climate change is the effect such changes will have on local ecosystems, many of which are critical to life support functions such as food production.

So, the teacher and students engage in focused study of what lives in the area and what distinctive characteristics local species possess. In eastern Missouri we have a cross-over from woodland to prairie ecosystems, so there are particularly rich offerings to investigate. Students in Yuma, Arizona and Barrow, Alaska, on the other hand, will have different plants and animals to observe. Wherever you are located, students can be challenged to find the most interesting species, or perhaps share a favorite. It's too early at this stage to name all of the plants and study range maps. Rather, this initial exploratory work enhances the baseline from which students can develop advanced levels of understanding. In parallel with this field work, students can be challenged to describe the temperature and precipitation in their community, and record it in tables and graphs. The goal here is to formalize their lived experience. Is today warmer or colder than yesterday? Kids will hear adults talking about unusually warm or cold spells (or wet or dry). What does that mean? How do we know? The key here is that under the teacher's expert guidance, students' experiences are deepened and enlarged through recording and analyzing temperature and precipitation data, enabling them to make greater sense of their local surroundings.

From here, students can be challenged to think about other places. Do they have the same plants and animals? Students may have lived in other parts of the world and could be asked to share their experiences. Also, books such as *The Three Little Javelinas* (Lowell, 1992) can make distant ecosystems accessible to young kids. The goal here in the second phase of the project is to enable kids to compare and contrast the local and the distant: What is similar, and what is different? Students split into teams and conduct research on a focus city in a different ecoregion. As they do this, they can use data tables and geospatial tools to locate their focus city and use map layers to see how this distant location compares to their home region. Annual temperature and precipitation levels provide a start, while more advanced investigations might look at differences in monthly patterns. Are their wet and dry seasons? Is the temperature pretty steady all year, or is there some variation?

Throughout, the initially 'indeterminate' or 'problematic' situation of trying to understand what makes things different guides the inquiry. The inherent need to make sense of our world motivates puzzling out what we are seeing and looking for reasons. In this case, previously developed understanding such as the basic needs of plants and animals for certain amounts of water might be called on as students interpret variations in the plants and animals found in distant ecoregions. What features favor survival in those conditions?

Consistent with Dewey's dictum, this is not a "new peculiar kind of experience," but rather one of enlarging the original experience in the schoolyard the the community. It is incumbent upon the teacher to have the wisdom and art of knowing just the right approaches to scaffold this inquiry so that it truly is generative of greater interest and understanding. Deploying a range of graphing and mapping tools and reference materials are not ends unto themselves, but rather are resources for deepening engagement. Quantitative and spatial perspectives add layers of meaning for the student that simple descriptive text and pictures can't achieve.

The inquiry culminates in a sharing festival of sorts, with students making presentations about unique and interesting features about their focus city and how it compares to their home region. Images, text, tables, graphs, and maps are all used to the extent that they contribute to building understanding for both the young researchers and their audience.

By way of contrast, students could have done a simple diorama project depicting life in other locations, highlighting plants and animals characteristic of the focal region. Facts drawn from online and print data sources could be presented neatly, and perhaps even an ArcGIS lesson on ecoregions could be completed. The teacher would be seen as competent, and the students would be meeting their curriculum requirements and developing mythical 21st century skills. Still, this work would be very external to the students' interests and would call on very little from the teacher beyond being the supervising technician – a role toward which many current 'reforms' are pushing teachers. As we strive to meet the challenges of new curriculum requirements, we would do well to keep in mind the guidance offered by the "lost scrolls of geospatia." Dewey's advocacy for students as being capable of making growing sense of their experience, and for teachers to serve as their guides and mentors help us work toward a goal of pursuing thoughtful, productive, and educative inquiry.

References

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