Certifying GIS Professionals: Challenges and Alternatives

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Abstract: *Recently, state legislatures in California and Georgia, working at the request of surveyors, considered whether or not to adopt legislation that would require certification for GIS professionals. The legislation in Georgia became law. The GIS community had suggested certification previously as one way to address a perceived need to assure the qualifications of GIS professionals. Certification involves the development of an approved program of training for individuals wishing to enter a specific field; the final rite of passage is typically an examination. Similar certification procedures are well established in medicine, law, planning and surveying. The development of a certification process for GIS professionals will not be a simple task, nor is it necessarily desirable. Many problems must be resolved before certification can become a reality. We must first answer several basic questions, including: What skills and level of understanding are needed to become qualified in GIS? Do project managers and GIS programmers need the same skills and understanding? Who will design the examination? How will it be graded? This paper examines these and other relevant issues, taking cues from the experiences of other certification processes in an effort to provide insight into the task that lies ahead if, indeed, we choose this option. This paper also explores alternatives to certification, including accreditation and maintaining the status quo, and makes a case for accreditation as an alternative to certification.*

The idea of developing a certification process for GIS professionals has been the subject of debate in GIS circles recently, and there have reportedly been efforts in this direction driven by GIS specialists among surveying professionals in the states of California and Georgia. The apparent need for certification grows, in large part, from concern within the GIS community to assure a consistently high level of quality within the field—without a doubt, a noble and worthwhile objective. Certification is already well established in other fields, including medicine, law, planning, surveying and even cosmetology. The development of a certification procedure is not without pitfalls that must be carefully considered before any action is taken. In addition there are alternatives to certification that the GIS community may find preferable to certification and which, in any instance, deserve consideration.

This paper begins with an exposition of the roots and rationale of certification which are found in the basic concepts of expertise and professionalism. Following this background material is a description of various aspects of certification drawing examples from the fields of law, medicine, planning and cosmetology. The next section discusses specific considerations for certification in GIS. Finally, the conclusion describes alternatives to certification, and suggests accreditation of GIS programs as an alternative to certification.

Background

To understand the concept of certification, we must begin by exploring its roots, which are found in the ideas of expertise and professionalism. Expertise and professionalism are closely related, but they are by no means synonymous. Much of what we know about these concepts is derived from Weber's theory of bureaucracy (1946).

Expertise

Webster's Dictionary defines expertise as "specialized knowledge or skill: mastery." Expertise exists in all (or nearly all) aspects of life, from dog training to neurosurgery to geographic information systems, and the specialized knowledge or skill required to demonstrate expertise is unique to each field.

In addition to being field-specific, expertise is inherently time-specific. For example, leeches were once a common and acceptable course of treatment within the medical community, and all good doctors understood their uses. Today, lasers and ultrasound are important medical tools over which modern physicians must develop mastery if they are to be considered experts. As innovations enter and pervade a field, the specialized knowledge of that field shifts to include them, as well

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as to eliminate obsolete and discredited techniques and ideas.

Not surprisingly, expertise forms the backbone of professionalism. It is the unique composition of specialized knowledge that makes professionalism possible within a specific field. Fields that cannot achieve consensus on exactly what mix of specialized knowledge is required to demonstrate expertise in the field have been known to question their own validity as a profession. Normally, this occurs within professions with diverse missions and members. Public administration is one such field.

A small body of specialized knowledge is not necessarily an impediment to the evolution of a profession, particularly if that body of knowledge is important to others. For example, beauticians and cosmetologists have been very successful as a profession and have managed to put in place certification processes in many states, thereby gaining public acknowledgement and support of the expertise of members of the profession.

In addition to its role as the backbone of professionalism, expertise is often cited as a key consideration in the development of certification processes. The development of some sort of certification process is frequently perceived and promoted as a means to assure that people who claim to be an expert within a particular field actually possess the necessary expertise to make this claim. Certification thus is designed, in part, to set a standard of competency for members of a profession. Indeed, this rationale is frequently cited as the primary driving force for development of a certification process within the GIS community.

While many noble goals of development of expertise exist (for example, setting a standard of competency), Cayer and Weschler (1988) also note that the expertise of professions and the concomitant control over information may lead to a concentration of power within the profession. Similarly, Habermas (1970) suggests that experts may use their specialized knowledge to build a technocracy, thus gaining hegemony within their field. Weber (1968) likewise raises concerns about the elevation of technical experts to the status of a mandarin caste. There is a thin line between the concentration of expertise necessary to assure competency within a field and the use of expertise to create a technocracy. The reports of efforts among GIS specialists within the surveying profession have raised similar concerns among some subsets of the GIS community at large.

Professionalism

The development and maintenance of a specialized body of knowledge (expertise), as previously noted, is a critical prerequisite for the evolution of professionalism within a field. Pugh (1989) identifies this as one of the most important attributes that characterize a profession, and further stipulates that within this body of knowledge there must exist " ... propositions generally accepted by scholars and practitioners" in the field (p. 2). The existence of such a body of knowledge makes possible the evolution of additional attributes that ultimately result in the coalescence of a profession (Pugh 1989).

As the profession coalesces, it develops what Pugh calls a "social idea" that defines the mission of the profession. Eventually, as the profession evolves, members of the professional community join together formally to create a professional organization. Frequently, professional organizations establish a journal, newsletter, or some other mechanism (or mechanisms) for communication among the professional membership.

These publications become integral as a means to continue the development and maintenance of the profession's expertise, as members share new ideas and refine (and sometimes discredit and eliminate) old ones. In addition, professional publications facilitate the development of a common language—sometimes better

Horwood Critique Article

In 1985, URISA established the Horwood Critique Prize in memory of Dr. Edgar Horwood of the University of Washington, who founded URISA in 1966. The objective of the prize is to challenge information systems professionals to more critically interpret developments in the field. The prize is given annually to the author(s) of a paper published in the previous annual *URISA Proceedings* representing the best critical analysis of an urban, federal, regional or local system design, implementation or application; technology policy or issue; or contextual environment.

Papers are judged on their candor, critical insights, and conclusions and methods employed in the critique. All papers appearing in the Proceedings are judged in the competition. In this issue of the *URISA Journal*, we are featuring the 1993 Horwood winner, "Certifying GIS Professionals: Challenges and Alternatives," by Nancy J. Obermeyer.

In keeping with the critical intent of these papers, comments are welcome.

described as jargon. This common professional language serves a valuable function within the profession: it helps to identify who is a member and who is not, and may be used to make entry into the profession more difficult.

In order to understand the profession's common language and enter the field, typically some sort of specialized training is required, often followed by successful completion of some sort of licensing examination leading (finally) to certification. This process smooths a path directly to the establishment of a professional hegemony, as self-defined experts join together to determine what steps qualify non-experts to enter their ranks. Berlant (1975) goes even further in his description of the medical profession, identifying the American Medical Association as a virtual monopoly.

Over time, each self-defined profession develops its own particular culture and lore, spread by a combination of professional journals and gatherings (conferences), specialized education and training, certification or licensing procedures and so on. An important element in this professional culture is what Pugh (1989) calls the professional " . . . hall of fame, a gallery of luminaries." Individuals become part of this hall of fame by performing works in support of the profession, including theoretical and scholarly contributions, teaching and mentoring activities and general advocacy on behalf of the profession.

Pugh (1989) also notes one final component of a profession: the development of a "code of ethics." Codes of ethics may be viewed as taking standards of practice a step farther: not only does the profession assume responsibility for a standard of competency among practitioners, but it endeavors to assure that its members will use their expertise ethically at all times. Professions may adopt any of several mechanisms to encourage ethical practice, including peer pressure and sanctions such as fines, suspensions, or even expulsion from the profession.

Within the context of professionalism, the development of a certification process is a logical step in the process of self-definition. As we review the attributes of a profession, it is apparent that the GIS community is well on its way to becoming a profession. We have formed a professional association, albeit an unusual amalgam of pre-existing organizations (URISA, AAG, ASPRS, ACSM and AM/FM International), and we have several publications by which we communicate, including the *International Journal of GIS* and *GIS World*. We meet regularly. Members from among our group, the National Center for Geographic Information and Analysis, have developed a core curriculum for GIS. There are several esteemed individuals within our profession who undoubtedly would qualify for a "GIS Hall of Fame." Calls for data standards, concerns about accu-

racy and full disclosure regarding data may be interpreted as first steps toward a GIS code of ethics. It is not surprising, then, that some of our members should suggest the institution of a certification process at this time.

Certification in Other Fields

The idea of certification is not new. Indeed, many professions, including medicine, law, planning, surveying and cosmetology, have long-established certification procedures. These certification processes are characterized by varying degrees of effectiveness. This section describes some of the successes and failures of each of these processes as a means to provide insight into certification in GIS.

Although the concept of professionalism and certification as an internal, self-regulatory device as well as a promotional process is implied by the preceding descriptions, it is important to make this aspect of certification explicit. It is within this context that we understand the effectiveness of the certification process. On the one hand, effectiveness is defined by the appropriate and ethical behavior of members of the profession to the larger society. On the other hand, effectiveness is defined by the success of members of the profession in the marketplace, and the ability of the profession to insure that practitioners it has certified are hired in preference to practitioners who do not have the profession's official seal of approval (certification).

Development of a Monopoly: The American Medical Association

One of the most successful of all professional organizations in the United States is the American Medical Association. Formed in 1847, its objective was to upgrade the educational standards in medicine (Berlant 1975). At the urging of Nathan Smith Davis, whose ideas formed the basis for early AMA policy, the AMA adopted a system that separated teaching and licensing. Medical schools continued to function as before, while licensing was instituted at the state level, with medical societies having responsibility for appointing individuals to the state licensing boards. In addition, the AMA established a policy that required *both* a diploma *and* a license in order to enter the practice of medicine. Previously *either* a diploma from a medical school or a license had been sufficient to allow doctors to set up a practice (Berlant 1975).

"Protection of the public against quacks," Berlant (1975) notes, was the primary justification for the development of what eventually became a monopoly in medical services by the AMA. Following in the German tradition of state licensing superimposed on university examinations, Davis effectively promoted legislation

that ultimately pressured medical schools into a specific line of development, what Berlant describes as "orthodox medicine" (p. 227). This legislation effectively made "orthodox medicine" (i.e., that promoted by the AMA) the only medicine that would receive the legislature's official seal of approval. What had previously been professional dominance by the AMA became hegemony; with the support of state legislatures, this hegemony became a virtual monopoly (Berlant 1975).

In the years after its establishment, the American Medical Association became synonymous with quality health care. Practitioners and medical products alike proudly displayed the AMA's seal of approval. In recent years, however, concern about the monopolistic domination by the AMA has arisen. Complaints about the arrogance of doctors have become commonplace. A patient dared not question the medical judgment of his or her doctor; the physician alone possessed the medical expertise to save a life. The AMA had come to resemble the technocracy described by Habermas (1970). Berlant (1975) suggests that the legislative seal of approval played an important role in the evolution of the AMA into an exceedingly powerful monopoly. We might also conclude that the complexity of medicine itself, along with the universal importance of medical care, were critical factors in the strength of the AMA.

The American Institute of Certified Planners

If the American Medical Association stands out as a professional organization whose certification process assured a virtual monopoly for its members, then the American Institute of Certified Planners (AICP) is an example of what happens when certification is a totally voluntary exercise.

In his discussion of the AICP certification examination, Rasmussen (1986) argues that "Certification by the professional society means planners themselves control their own occupational standards. In contrast, state licensing or registration gives the state legislatures statutory control over occupational standards by regulating the right to practice planning or to use the title of planner." Rasmussen seems to imply that the current arrangement promotes maximum autonomy for the AICP. However, comparing the AICP to the AMA suggests that the American Institute of Certified Planners pays a price for its autonomy.

 As described above, the AMA exercises considerable authority over the appointment of members to state medical licensure boards. This authority, Belant argues, has resulted in development of a virtual monopoly by the AMA over the entire medical practice. One aspect of this monopoly control is that only physicians certified by the AMA may practice medicine. By contrast, the

planning profession is open to any individual who cares to call himself or herself a planner.

While certain jobs in planning (most commonly academic positions) require that candidates have AICP certification, most do not. Many do not even require completion of a degree program in planning. For example, in the June 15, 1991 issue of the American Planning Association's *JobMart*, of 37 positions advertised, none required AICP certification, while only one gave preference to AICP planners. Furthermore, barely half (18) required a degree in planning, and 10 listed planning as one of several acceptable degrees. The nine remaining positions did not specify educational requirements, or did not specify planning among their lists of acceptable programs of study.

From the perspective of the planning professional, the value of AICP certification seems limited at best, since few jobs in planning require AICP certification. Furthermore, one could logically challenge Rasmussen's implication that the AICP exercises autonomous control over the quality of planning practitioners. In fact, if one need not achieve AICP certification in order to work as a planner, and indeed, since *most* planning positions do not require AICP certification, then it is clear that the AICP exercises almost no quality control in the planning marketplace. Rasmussen himself admits that only about 20 percent of the members of the American Planning Association are also members of the AICP (and, by implication, have passed the AICP's certification examination).

The AICP certification procedure is intended as a means to assure quality among planning practitioners. It is probable that planners with AICP certification possess high quality skills and experience. However, in practice, the AICP exercises little control over the practice of planning in the United States. Without some mechanism (either voluntary or coercive) to limit entry into planning practice exclusively to AICP members, it is virtually impossible to assure quality across the board within the planning profession.

The differences between the American Medical Association, which has a virtual monopoly on medical practice in the United States, and the American Institute of Certified Planners are readily apparent. In the first instance, their approaches are very different, as the AMA assiduously courted legislators in its early stages to assure the dominance of its practice of medicine over all other types. The AICP, by contrast, has resisted what it perceives as the threat of legislative control of its profession. The outcomes are dramatically different: while the AMA has achieved a virtual stranglehold on medical care in the United States, certification by the AICP is a lofty goal to which many planners may aspire, but which few attain.

Questions We Should Ask About Certification

Implementing a certification process for GIS will not be a simple task. It is not clear, based in part on the experiences of the AICP, if it is necessarily even a worthwhile task. In order to decide if the potential advantages of certification outweigh the potential problems, we should begin by asking several questions, and discussing our responses within the GIS community. I have listed some of the key questions below. Since most discussions of certification emphasize examinations, I will initially raise questions about establishing a test.

Who Will Develop the Examination?

The core of the GIS community can be found for the most part within the membership of the following organizations that have joined together to sponsor the annual GIS/LIS conference: the AAG, ACSM, AM/FM International, ASPRS and URISA. However, all members of all these organizations do not identify with the GIS community. To put it another way, only a fraction of the membership of each of these organizations self-identify with the GIS community. Moreover, each of these organizations as a whole has a specific organizational mission, different from that of the others, and not specifically dedicated to GIS.

Within this framework, have we the necessary cohesion to identify a core of individuals who can develop an appropriate examination for GIS professionals? Perhaps it would be possible to empower a committee comprised of representatives of each of these five organizations to begin work on a certification examination. However, there is a lack of a formal structure to legitimize such an arrangement. For example, within the AAG, regular elections are held and all administrative actions are carried out by elected representatives, thereby assuring accountability to the membership and legitimizing the organization's leadership.

Currently the GIS community as a whole does not have such a formalized structure. (Perhaps on paper the GIS community exists as little more than a highly developed and refined mailing list.) In spite of this, we are surprisingly well-informed, cohesive, and even congenial. Moreover, the GIS community is extremely active. Perhaps these characteristics could enable us to work together to achieve consensus regarding the establishment of an examination development group and appropriate mechanisms for soliciting input from members of the community. Or perhaps it is time to organize a professional group whose formal mission is to continue the development and promote the responsible use of GIS.

The constitution of the committee developing a certification is not a trivial matter. Such a committee must have the respect of the GIS community at large and in

some way reflect our diverse interests. Such a group will be perceived as legitimate, and its products will likewise be perceived as legitimate. On the other hand, an examination devised by a committee that fails to meet these qualifications will be subject to challenge as illegitimate.

How Will the Examination Approach the Diverse Applications of GIS?

That the annual conference of the GIS community has five separate sponsors provides ample evidence of the diversity of the applications of GIS. The conference program for GIS/LIS, for example, describes a vast array of tasks to which GIS is put, including emergency management, forestry and wildlife management, public utilities and so on. How would a GIS certification examination approach these diverse applications?

This question takes on additional relevance when we acknowledge that those who achieve certification will practice within the context of a specific organizational mission. How will we assure that the GIS professional using the technology in a forestry (or emergency management, or a public utility and so on) context will be qualified for his or her assignment? Can any testing procedure take account of such diversity? The alternative is to test on the basis of a common denominator in GIS, which brings us to our next question.

What Are the Core Skills and Knowledge Tested by the Certification Examination?

While a certification examination may not be appropriate for use in testing a variety of GIS applications, such an exam must cover the core GIS skills and knowledge needed by a professional in the real world. The NCGIA Core Curriculum has gained widespread acceptance within the GIS community as a guideline for teaching GIS. It may be useful as a general guide to identifying specific skills and knowledge to be covered on the certification exam. In addition, we should also be aware that the group designated to develop a GIS certification exam will have a great deal of influence in identifying essential skills and knowledge in GIS.

Should a certification exam cover historical development of GIS? What about elements of spatial analysis? Database management? Specific commands within one or more GIS programs? Issues related to managing a GIS project? Ethical and legal issues?

GIS is a broad area; identifying its core will be more than a notion. In addition to the diversity of applications described above, we know that GIS professionals practice at different levels, from digitizing and basic data entry to project management. The core skills and knowledge to be tested by a certification examination must at

least acknowledge, if not reflect, this variation in practice among GIS professionals.

How Will the Certification Exam Assure High Standards among GIS Professionals?

It is clear that the driving force behind suggestions to develop a certification procedure for GIS is the noble desire within the GIS community to assure high standards among GIS professionals. However, as we have seen in the cases of the American Medical Association and the American Institute of Certified Planners, simply instituting a testing procedure provides no such assurances.

The AMA strategy of garnering legislative support to force doctors to pass a certification exam in order to earn their licenses to practice has proven very effective in the sense that the AMA exercises virtually monopoly control over the qualifications of practicing physicians. (Keep in mind the role of the AMA in appointing state medical licensing boards.) Such monopoly control, which is indeed an extreme case of unbridled technocracy, is clearly not an appropriate goal for the GIS community. However, it seems necessary to develop some system to assure that a GIS certification body exercises adequate control of GIS professionals.

When we look at the situation in the planning profession, it is apparent that if there is no way to assure that the large majority of jobs within the profession go to certified professionals, there is little or no advantage to the individual practitioner to earn certification. Under these circumstances, the certifying body has little, if any, control over the quality of the profession as a whole, but controls only those who seek their certification.

How might the GIS community assure the necessary control to assure quality? The development of state licensing for GIS professionals is a possibility, and as noted, is the strategy reportedly being adopted by members of the surveying profession in at least two states. Other professions besides medicine and surveying have taken advantage of this alternative, including the legal profession as well as beauticians and cosmetologists. These examples suggest that the profession need not be associated with advanced education and high income in order to develop state-required licensing procedures.

It is not clear that the GIS community at large—not to mention state legislatures—would embrace this approach, and even if they did, it would take time to put in place a comprehensive state licensing system throughout the United States. In fact, some non-surveying members of the GIS community are concerned about the key role of surveying professionals in pushing for state licensure.

Given the cohesiveness of the GIS community, it may be feasible and preferable to develop a voluntary system among potential GIS employers, whereby they would agree to hire only certified GIS professionals. Negotiating agreements with key GIS employers, such as the federal government, state governments and large corporations may set the stage for general acceptance of such a voluntary system. In addition, the institution of a job listing service within the GIS community that would announce positions for certified GIS professionals could be a supplemental tool in gaining support.

The basic task will be to convince the majority of GIS employers that a GIS certified professional is better qualified and will perform better on the job than one who is non-certified. If there is no difference, the employer will have no incentive to hire the certified person, especially (as is sometimes the case) if the certified person comes at a premium price. On the flip side, if there are more costs (study time, test fee, anxiety, and so on) than benefits (a better job or higher salary) to the professional in becoming certified, few will endure the trouble.

I therefore see this question as critical to any discussion about whether or not we should, as a community of professionals, establish a certification procedure, since it goes to the heart of whether or not we will be able to achieve the stated goal of improving the overall quality of GIS professionals. If a GIS certification process does not gain universal (or at least near-universal) support, it will be ineffective as a tool to assure the quality of GIS practitioners.

Other Questions

There are several additional questions that bear raising within the context of this discussion.

If the GIS community should decide to adopt some sort of a certification examination, it will face the challenge of developing an appropriate test format. Typically certification examinations feature multiple choice questions for the ease they present in grading and the consistent results they provide. However, problems with multiple choice exams abound. Some people simply have trouble with multiple choice exams, and numerous researchers have identified cultural bias in standardized tests generally that must not be overlooked. Essay exams may provide more and better insight into the qualifications of professionals, but it takes time to grade them. And what about a test at the workstation?

Administering a certification exam will cost money. Expenses include preparing and printing the exam, proctoring the exam, grading the exam, notifying exam-takers of their grades, and maintaining records. Often exam fees are used to help pay for these activities. Membership fees may also be used to fund part of the cost. Record-keeping, for example, could be covered by an employee of the professional organization who is already responsible for some other similar task. Alterna-

tively, members of the professional community may donate their time, thus keeping costs low.

Given the growth in the field of GIS, if the idea of a certification process catches on, it may precipitate the need for an administrative structure to manage the process. As noted in the preceding section, a certification process will not run itself. Presumably exams will be given at regular (possibly annual) intervals. Even if members are willing to contribute their time to this endeavor, the need for accountability will require that someone has ultimate responsibility for assuring that the process runs smoothly. If an administrative bureaucracy is needed, the bureaucracy will need office space.

This is a sample of the questions that we as a community must discuss as a prelude to making a decision on whether or not a GIS certification process is desirable. It is clear that the stated goal of assuring that GIS professionals will be fully qualified for their assignments is a worthwhile goal. How we as a community of professionals choose to achieve this goal is another question entirely.

Alternatives to a Certification Exam

Maintain the Status Quo

If our goal is to assure that GIS professionals will meet a minimum standard of qualification, then there are other means to achieve this goal which may be used alone or in combination with one or more other alternatives. Among these alternatives is to continue as we now exist, within an informal, yet relatively cohesive network of GIS professionals. This framework, similar to formal professional organizations, relies primarily on peer pressure as a means to assure appropriate and ethical professional behavior. We would continue to keep each other honest.

Establish a New GIS Organization to Monitor GIS Practice

It is also possible to formalize our current arrangement. Establishing a formal professional organization will make it increasingly possible to impose sanctions on members whose professional behavior is inconsistent with community norms and conventions. The disadvantage of this alternative is that most of us are already dues-paying members in at least one or two other professional organizations, and may find the cost of joining a third (or fourth or fifth) prohibitive.

Develop a Code of Ethics

Another alternative to a certification exam is developing a code of professional ethics for GIS practioners. This has the advantage of being completely voluntary. More-over, it is the kind of action that recalls Mom and apple pie, and therefore should be relatively popular within the community. Regardless of what other specific actions the GIS community may adopt to assure the competence of GIS professionals, I would argue that developing a code of ethics is desirable at this time, in part because of the rapid growth in the rate of adoption of GIS in the United States. Taking this step would at least force us as a group to determine what is—and what is not—ethical behavior in the development, implementation, and operation of geographic information systems.

Develop an Accreditation System for GIS Programs

A final alternative to institution of a certification exam would be to develop an accreditation system for GIS programs. Possibly using the NCGIA Core Curriculum as a starting point, the GIS community could develop a set of performance criteria that GIS programs would be required to meet in order to earn accreditation. There are several advantages to instituting accreditation at the school level (as opposed to certification at the individual level). First, there are fewer schools with GIS programs than individuals studying GIS, making them an easier target for intervention. In addition, many faculty members involved in GIS programs are already active members of the GIS community, and presumably already share a more-or-less common vision of GIS. Reaching them will likely be easier than reaching individuals who come from a wider variety of backgrounds. Most importantly, however, is that an accreditation program could take into consideration the many and varied uses to which geographic information systems are put nowadays. It would do so by emphasizing core skills and education in GIS at the program level, while allowing the student to major in a variety of disciplines.

The existence of a curriculum that has apparently gained wide acceptance among the members of the GIS community gives us a starting point for discussions on the development of an accreditation system. The NCGIA Core Curriculum, by focusing on core GIS skills and education, implicitly recognizes that the applications in which a particular professional will use a GIS will vary depending on that professional's place of employment.

How might this accreditation system work? Schools seeking accreditation would be required to offer a GIS program emphasizing core GIS skills and education as defined by members of the GIS community or their legitimate representatives that students could couple with a major program of study designed to give them substantive expertise in a field as they develop their expertise in GIS. For example, a student might choose a major in political science and complete an accredited program

of study in GIS with the idea of finding employment in political redistricting or public policy analysis. Another student might major in demography and complete an accredited program of study in GIS and take a job with a marketing firm. The advantage of this type of system is that it explicitly recognizes that most GIS professionals will work in specific areas of application and use GIS as a tool.

Of course, many of the same questions raised about certification apply to accreditation. For example, who will develop accreditation procedures? What criteria will they use as the basis for the development of accreditation standards? How will the operation be run? How will it be funded? How will accreditation help to assure the qualifications of GIS professionals?

If accreditation is selected as the primary means to assure the qualifications of GIS professionals, the first step is to select a committee to develop accreditation standards. Such a committee should include individuals from the broadest spectrum of GIS applications possible; practitioners, educators and vendors should all be represented. Committee members should have the respect of the GIS community at large—we might call on those qualified for the GIS "Hall of Fame" to participate. The GIS community at large should have some input into the accreditation criteria, perhaps through a "review and comment" disseminated through existing publications serving the GIS community (*URISA Journal* and publications of the AAG, ASPRS, ACSM, and AM/FM International, for example).

If a GIS accreditation process were patterned after accreditation processes generally, *ad hoc* accreditation teams could carry out the bulk of the task, thus limiting the number of permanent staff and resources required to implement accreditation as compared to those that might be required for certification. Funding for the system might perhaps be covered by accreditation fees.

If the GIS community decides to implement an accreditation system, as opposed to a state-licensed certification system, we will obviously not be able to rely on the government to enforce hiring practices that favor members of our profession. It will be incumbent on us, as members of the GIS community, to develop our own network for developing job opportunities for members of the community. This network already exists informally, inasmuch as we often know one another, if not personally, then through a colleague or by reputation. Many of us have explored the job market using this informal network. By building on this informal network, we can develop a voluntary system that would encourage the hiring of GIS professionals who have graduated from accredited programs, as described earlier in the discussion of certification.

A serious concern that some may raise about the accreditation alternative is that it vests a great deal of con-

trol over the GIS profession within higher education. Some may feel uncomfortable about this arrangement. However, such an arrangement has the potential to broaden the control over assuring professional competence across disciplinary boundaries. This, I believe, is a significant advantage. If there is real concern about the large role that institutions of higher learning may play in accreditation, then we should explore the possibility of enabling GIS vendors and other stable entities to earn GIS accreditation, possibly through the accreditation of "short courses," special GIS workshops and institutes, and other options. In line with such an array of alternatives, the GIS community may suggest two or more levels of accreditation associated with different levels of proficiency.

Conclusion: The Need for Discussion

Developing a formal system to assure the qualifications of GIS professionals is an issue that is not going to go away by itself. Indeed, it seems to be gaining momentum, as state legislatures debate and vote on bills that would make certification a reality. The GIS community has a responsibility to address this issue forthrightly.

In this paper, I have deliberately taken a position on the need to institute a particular system within the GIS community to assure the quality of GIS professionals. My purpose in so doing is three-fold. First, I have tried to raise relevant questions that we may discuss among ourselves. These questions do not have right or wrong answers, but that does not mean that they are unresolvable, or that they do not lend themselves to consensus.

Second, I have tried to provide some examples of successes and failures in other professional certification processes. Ironically, both major examples contained elements of both success and failure. These experiences should help heighten our own awareness of the difficulties inherent in establishing a certification process.

Finally, I have taken a position as a means to stimulate debate on this subject. Whether we like it or not, certification is an idea that is becoming reality. We can ignore the actions on certification that have occurred so far, or we can acknowledge them, discuss their ramifications, consider alternatives, and try to reach a consensus within the GIS community. If this paper stimulates debate, I will have met my objective.

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