

**Report on the Value of Including
GIS Tools and Concepts
in Higher Education Emergency
Management Curriculum and Programs**

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**Submitted to:
Barbara L. Johnson
Higher Education Program
FEMA/EMI/NETC
Department of Homeland Security
16825 S. Seton Avenue, E-114B
Emmitsburg, MD 21727
Ph: (301) 447-1452**

**Submitted by:
The Polis Center at IUPUI
1200 Waterway Blvd., Suite 100
Indianapolis, Indiana 46202
Phone: (317) 274-2455
FAX: (317) 278-1830**



Executive Summary

In the summer of 2014 The Polis Center (Polis) at Indiana University Purdue University Indianapolis partnered with the Federal Emergency Management Agency (FEMA) Higher Education Program to identify challenges and opportunities related to identifying and encouraging collaborations between the higher education and emergency management practitioner communities. Polis conducted a survey and a series of interviews for the purpose of collecting information in support of this goal. This report outlines the findings of that work which include four recommendations that FEMA can choose to implement at its discretion. These are that FEMA should consider developing and/or facilitating the collection of GIS tutorials, ideally Web-based, that faculty can use to supplement their classroom curriculum; share information about its key research needs/concerns with the academic community and provide the means for academic researchers to engage with FEMA concerning those needs; increase awareness of its Higher Education Program resources; and consider identifying a school in each state or region that coordinates with the other schools in the state or region and serves as the liaison with FEMA.

Overview

Geographic Information Systems and other types of geospatial technologies are playing an increasingly important role in supporting emergency management missions. These technologies support the creation, analysis, and management of large volumes of information that can enable effective decision making and ultimately lead to a reduction in losses to lives and property.

FEMA, through its Higher Education Program, has defined a mission to provide resources and guidance to higher education institutions that can better position them to support emergency management students, researchers and practitioners. In order to fulfill this mission they require an understanding of the needs of the practitioner community. These needs might include education of students that are currently working toward an academic certificate or degree that will position them to become practitioners. They might also include research or service provided by faculty or staff from academic institutions. They also require an understanding of the capabilities of higher education as well as its commitment to integrating geospatial technologies into their programs. In order to support this need, FEMA partnered with Polis. Polis has over 25 years of experience in the application of geospatial technologies to serving the needs of communities. More than 15 years of this experience is directly related to the use of these technologies in support of emergency management missions including the modeling of flood, earthquake, hurricane, tornado, and other hazards; development of dozens of multihazard mitigation plans; and support of disaster response missions. In addition, Polis staff have provided instruction in scores of emergency management related courses within various academic institutions as well as for the FEMA Emergency Management Institute.

Polis applied its experience in the use and instruction of geospatial tools, along with its experience working with both the academic and practitioner communities, toward the creation of survey instruments and the completion of interviews in order to collect information about current and future needs that can be met by higher education. The results of this effort, as well as recommendations to FEMA for how to proceed to meet the identified needs, are documented in this report.

Study Methodology

Polis developed two surveys in Survey Monkey, one for higher education institutions and the other for emergency management practitioners. The higher education survey was distributed to 138 individuals representing the higher education community. Survey recipients were compiled from a combination of a list of 115 individuals provided by the FEMA Higher Education Program and supplemented by contacts within the higher education community known by Polis to have interest in the survey topics. We received responses to this survey from 48 individuals for a response rate of 34.78%. Of those who responded a little more than 70% were full or associate professors, 56% identified emergency management as their discipline, and half had been at their institution for more than a decade.

The practitioner survey was distributed to a list of 93 individuals identified by The Polis Center as likely to have interest in the survey topics. This list included the State Hazard Mitigation Officers from each state as well as selected FEMA representatives, selected state and local contacts and selected representatives of private sector organizations. We received 23 responses to this survey for a response rate of 24.7%. Among those who responded, all but two organizations indicated that they use GIS in their emergency management work.

Each survey was distributed via email. No follow-up was performed for non-responses. The detailed responses from each survey are provided in *Appendix A: Higher Education Survey Questions and Results* and *Appendix B: Practitioner Survey and Results*.

In addition to the surveys, Polis conducted five phone interviews with selected higher education representatives and five practitioner community representatives.

Representatives of higher education institutions included:

- Dr. Tom Mueller – California University of Pennsylvania
- Dr. Mike Scott – Salisbury University, Maryland
- Dr. Malcolm McGregor – Massachusetts Maritime Academy
- Dr. Jochen Albrecht – Hunter College, City University of New York
- Subhro Guhathakurta, Director at Center for Geographic Information Systems as well as Professor in the School of City & Regional Planning at Georgia Tech.

Representatives of the Practitioner community included:

- Lynn Seirup, Public Safety Data Development Center Director, New York City Office of Emergency Management
- Kris Higgs, GIS Analyst, California Office of Emergency Services
- Dr. Shane Parsons, Program Manager, URS Corporation
- Mary Moran, Mitigation Program Director, Indiana Department of Homeland Security
- Cynthia McCoy, Risk Analyst GIS/HAZUS, FEMA Region III

These individuals were selected based on their experience in emergency management and GIS as well as their past or potential interest in opportunities for collaboration between the higher education and practitioner communities. It is important to note that the comments made by those interviewed

represent their own opinion and do not in any way represent the opinion of their employer or any other institution with which they may be affiliated.

Opportunities and Challenges

While there were a wide range of observations collected from the survey and interviews, a number of themes and key findings emerged. These have been summarized below as opportunities and challenges.

Opportunities

- Higher education institutions often have access to advanced technology resources that are not available to government agencies. This capability positions them to be able to store, distribute, and analyze geospatial data. An example of this ability exists through the Indiana Geological Survey (IGS) at Indiana University. IGS works in partnership with the Indiana Geographic Information Office and the Indiana Geographic Information Council (<http://igic.org>) to support the Indiana geospatial community by acting as the host for the IndianaMap (<http://www.indianamap.org>), a web-based resource that makes hundreds of layers of detailed geospatial information freely viewable and downloadable at no cost. A similar relationship and function exists between the State of West Virginia and West Virginia University (<http://wvgis.wvu.edu/>).
- Higher education may be perceived as being more neutral on some issues than other types of organizations. This provides it with the ability to act as a mediator or to facilitate conversations between parties that other organizations may find difficult. It also positions it to facilitate collaborations that may result in partnerships between academic, public and private sector organizations. While we did not specifically investigate the value or perception of higher education neutrality, this did come up in several of the higher education and practitioner interviews. These comments reflected our own experiences working with the practitioner community and therefore we elected to include this information in our report.
- Internships offer tremendous benefit to students as well as practitioners. 28 of the 41 higher education survey respondents indicated that their students have internship opportunities. These students and others like them are likely to stand out when competing for post-graduation employment from those who have not completed internships.

While interns can support a wide range of needs, one of the things that they are ideally positioned to do is address challenges of local governments that are important, but that are not high priorities and likely to warrant a funding process – e.g. using GIS to analyze how to get people that need medication to their doctor or creating non-vital, but still useful GIS data that can better inform decision making. Well-designed internships that involve close collaboration between student, faculty and practitioner can also lead to enhancement of curriculum that will contribute to the building of a cadre of technology savvy experts.

- Conducting research is one of the core functions of higher education. There is an expectation that higher education institutions will be 'on the cutting edge' of exploring new ideas and that, while some ideas may fail, others may lead to solutions to current or future needs.

Challenges

We divided observations about the challenges of higher education support of the practitioner community into two categories, those that pertain primarily to teaching and research and those that relate more to service.

Teaching and Research

- There exists a lack of awareness among many in the academic community of the extensive resources that the FEMA Higher Education Program – and other components of FEMA - offer. Examples include the higher education newsletter and the annual Higher Education Conference at the Emergency Management Institute.
- There is inconsistency between higher education programs in terms of how GIS is taught. The practitioners that we interviewed identified GIS web application design, programming skills, map design and communication skills, and analytical skills as important. However, how – or even if - these topics are addressed in a curriculum can vary widely between higher education programs or even within programs if the same class is taught by different faculty.

It should be noted that efforts are underway to address this issue. Examples include the work of the GeoTech Center (<http://www.geotechcenter.org/>) which has developed the Geospatial Technology Competency Model that guides academics and practitioners alike on the skills and concepts that GIS professionals should grasp. Another organization, the Urban and Regional Information Systems Association (<http://www.urisa.org>) also takes an active role in developing guidance for the geospatial industry. While the work of these and other organizations is noteworthy, it generally does not address the specific needs of the emergency management community as they relate to the application of GIS tools and concepts.

- Several practitioners noted a mismatch between their needs and the culture of academic researchers. One unfortunate, but easily addressed, issue was the tendency of some individuals in the academic community to fail to follow-up after requesting letters of support for grant applications. While these letters were provided, no follow-up was done to indicate whether the grants were received. A second noted issue was the perception that academics do not want to 'stick their neck out'. It was observed that academic papers and presentations tend to end with statements such as 'more research is needed.' While this can be very appropriate from an academic perspective, the need of the practitioner is for actionable recommendations that can address specific challenges.

Service

- The cumbersome nature of the higher education contracting environment can be a strong disincentive for governments and other practitioners to collaborate with higher education. This is especially true of 'small' projects. Contract offices at higher education institutions are typically setup to manage complex federal grants rather than small projects. The amount of

effort and cost involved with the contracting process, especially for small projects, can consume a significant amount of the budget available for the project. This can mean the loss of collaborative opportunities that could benefit both higher education and practitioner communities. Our survey indicated that less than 25% of the higher education survey respondents stated that their institutions had received external funding for applied research or service in the past year. The Practitioner survey indicated that less than half of the respondent organizations had partnered with or subcontracted a college or university in its emergency management work. However, when asked if their organization would be interested in growing or developing its relationship with higher education in emergency management and/or GIS, all but one respondent said yes. All other respondents indicated that they would either be interested or that they were not sure. Contracting challenges are certainly not the only impediment to more collaboration between higher education and practitioners. However, if these challenges could be eased, additional collaborations might be realized.

- Academic calendars can provide challenges as well as opportunities for faculty to collaborate with practitioners. Academic contracts, which are typically for 9 or 10 months, can limit faculty availability due to teaching loads. However, during summers there are opportunities for collaboration with faculty if contract needs can match their availability.
- The mission of higher education has traditionally been focused on research and teaching. While service is becoming more common, it is sometimes still necessary for these activities to be rationalized within academia as appropriate for universities to pursue.

Recommendations

Most higher education representatives indicated an interest in FEMA assistance to strengthen the relationship between emergency management and GIS. Given this interest, what actionable steps can FEMA take to encourage the potential that higher education offers for supporting emergency management practitioners?

The following recommendations are offered.

- FEMA should consider developing and/or facilitating the collection of GIS tutorials, ideally Web-based, that faculty can use to supplement their classroom curriculum. These tutorials need to be based on practical applications that address specific questions and needs of emergency management practitioners.
- FEMA should share information about its key research needs/concerns with the academic community and provide the means for academic researchers to engage with FEMA concerning those needs. In addition, because the needs of emergency management change over time, FEMA could also establish a web-based resource through which current research questions can easily be shared and updated.
- FEMA needs to increase awareness of its Higher Education Program resources. For example, the FEMA Higher Education Program generates a newsletter that is full of useful information.

The mailing list for this newsletter could be enhanced with the addition of schools that offer GIS as part of their curriculum. One resource that could be consulted for this purpose is the GeoTech Center's GeoSpatial Education Program Finder that was established in the late Fall of 2014 (<http://www.geotechcenter.org/national-map.html>). This resource provides the locations, program details and contact information for many geospatial programs across the United States.

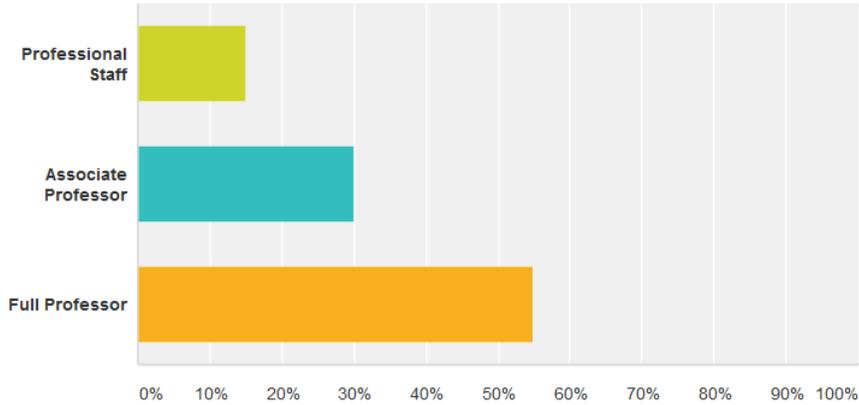
- FEMA should consider identifying a school in each state or region that coordinates with the other schools in the state or region and serves as the liaison with FEMA. If FEMA supports this vision, there would be value in convening a focus group – in person – to discuss how this could be implemented.

Appendix A: Higher Education Survey Questions and Results

The questions asked and responses received from the higher education survey are provided below.

Question 1: What is your role at the university?

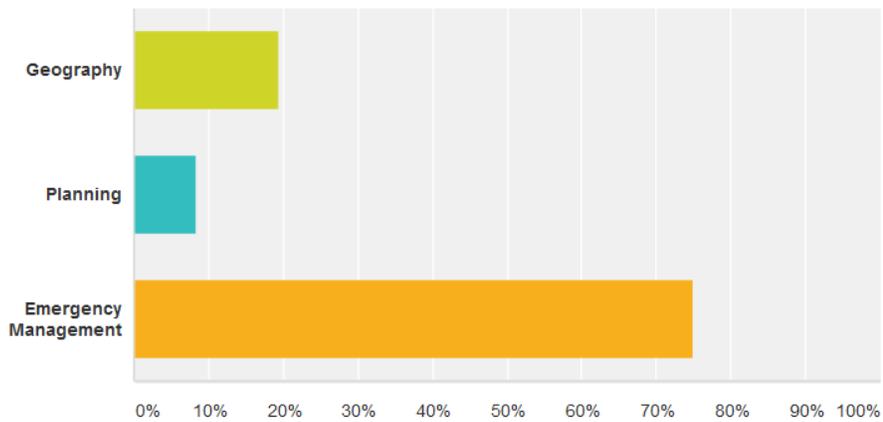
Answered: 40 Skipped: 8



Answer Choices	Responses
Professional Staff	15.00% 6
Associate Professor	30.00% 12
Full Professor	55.00% 22

Question 2: What is your discipline?

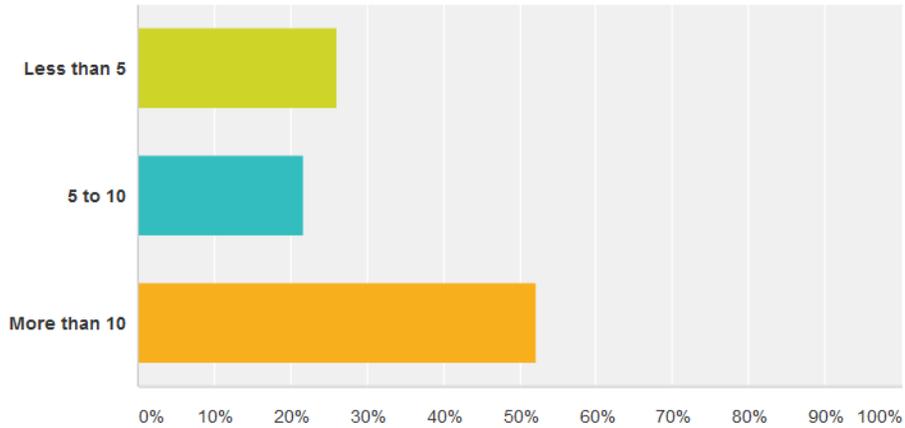
Answered: 36 Skipped: 12



Answer Choices	Responses
Geography	19.44% 7
Planning	8.33% 3
Emergency Management	75.00% 27

Question 3: How many years have you been at your college or university?

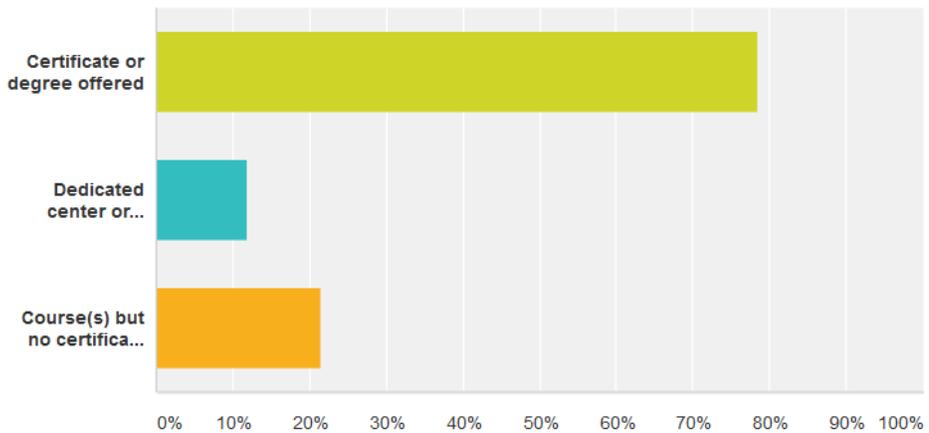
Answered: 46 Skipped: 2



Answer Choices	Responses
Less than 5	26.09% 12
5 to 10	21.74% 10
More than 10	52.17% 24

Question 4: In what way is your college or university involved in emergency management?

Answered: 42 Skipped: 6



Answer Choices	Responses
Certificate or degree offered	78.57% 33
Dedicated center or institution	11.90% 5
Course(s) but no certificate or degree offered	21.43% 9

Question 5: How many staff and faculty are involved in your emergency management related courses and centers?

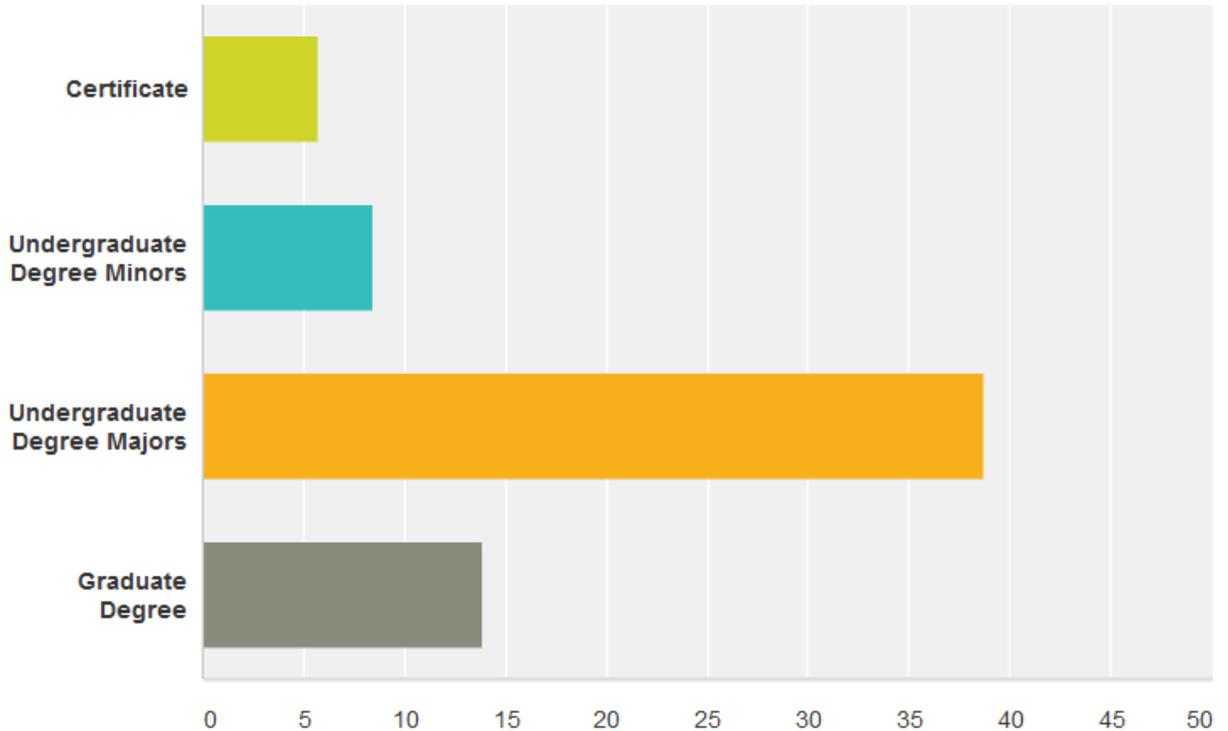
Answered: 44 Skipped: 4

Number of Staff	Responses
0	7
0.25	1
1	14
2	9
4	3
5	2

Number of Faculty	Responses
0	1
1	6
1.5	1
2	6
3	5
4	4
5	2
6	1
8	3
9	2
10	4
11	2
16	1
25	1
2 fulltime 16 adjuncts	1

Question 6: Approximately how many majors do you have in emergency management courses annually?

Answered: 40 Skipped: 8



Choices	Average Number	Total Number	Responses
Certificate	6	133	23
Undergraduate Degree Minors	8	169	20
Undergraduate Degree Majors	39	1,199	31
Graduate Degree	14	277	20

Question 7: In which school(s) are your emergency management courses located?

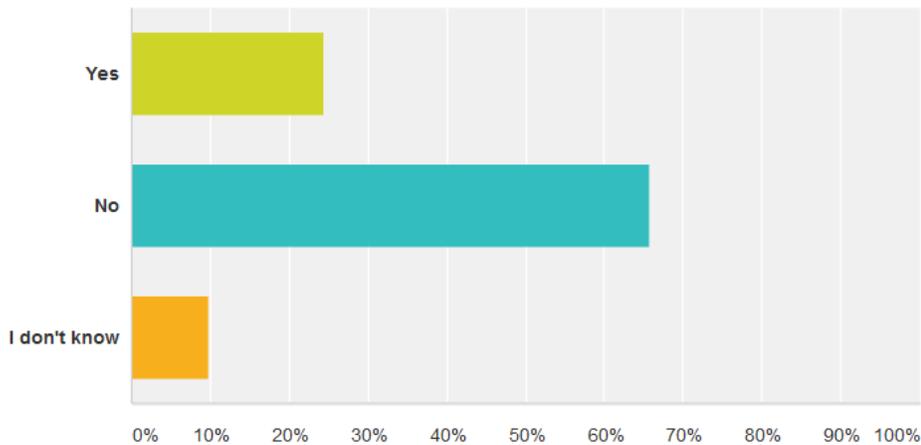
Answered: 38 Skipped: 10

- Allied Health, Emergency & Legal Services Division - Career Technical Education
- Arts & Sciences – Geography (2 responses)
- Business
- Department of Public Safety and Professional Services
- College of Education
- College of Liberal Arts & Sciences
- College of Liberal Arts, Health and Human Services
- College of Public Safety
- College of Science and Technology
- College of Science, Health and the Liberal Arts
- Criminology & Criminal Justice

- Division of Behavioral Studies and Human Inquiry (2 responses)
- Division of Health Science
- Division of Social Sciences (2 responses)
- Emergency Management and Exercise Science
- Fire Protection & Emergency Management Department
- Global Campus
- Greenspun College of Urban Affairs and Department of Environmental and Public Affairs
- Harmon College of Business and Professional Studies
- Health Sciences
- School of Science and Technology
- Interdisciplinary but housed in Humanities and Social Sciences
- Medical School Criminal Justice
- Public Policy and Administration
- Public Safety
- School for Public Affairs and Administration
- School of Criminology, Criminal Justice and Emergency Management
- School of Medicine
- School of Public Services
- Homeland Security and Public Health
- N/A (5 responses)

Question 8: In the past year, has your college or university received external funding for applied research or service in emergency management?

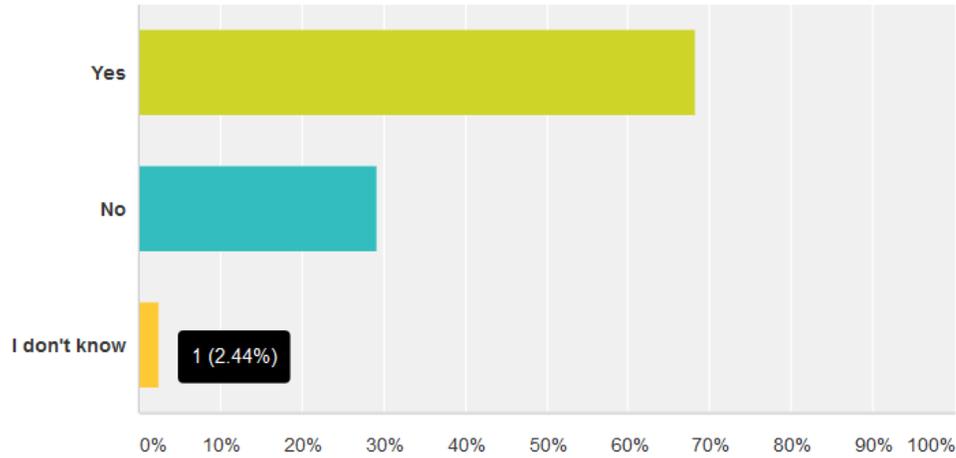
Answered: 41 Skipped: 7



Options	Responses
Yes	10
No	27
I don't know	4

Question 9: Do the students in your emergency management courses have internship opportunities?

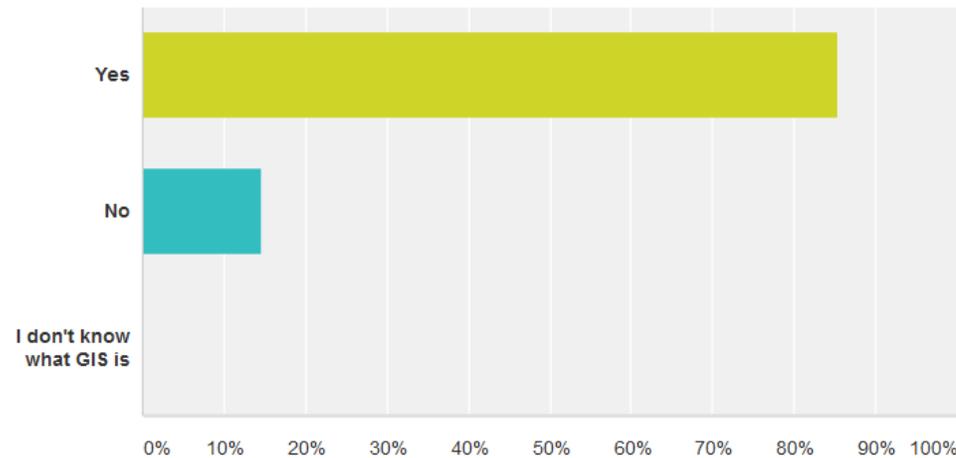
Answered: 41 Skipped: 7



Options	Responses
Yes	28
No	12
I don't know	1

Question 10: Does your college or university use or teach Geographic Information Systems/Science (GIS) in one or more courses?

Answered: 41 Skipped: 7



Options	Responses
Yes	35
No	6
I don't know what GIS is	0

Question 11: Why not? (check all that apply)?

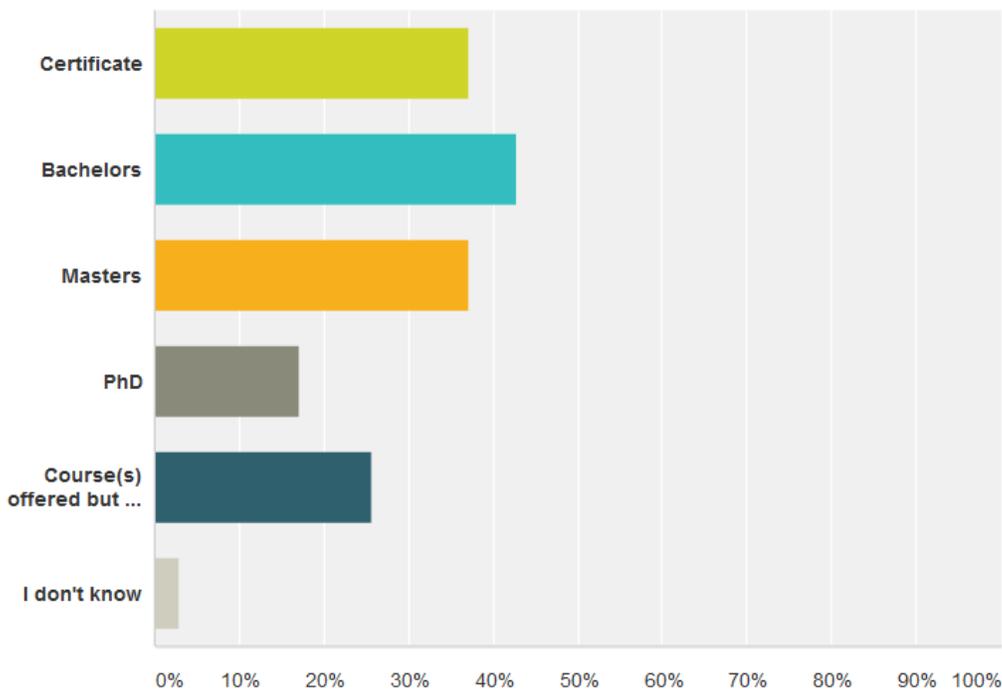
Note: This question refers to question 10.

Answered: 4 Skipped: 44

- Cost of license (1)
- Interest of staff and/or university (4 responses)

Question 12: At what level does your university have GIS programs?

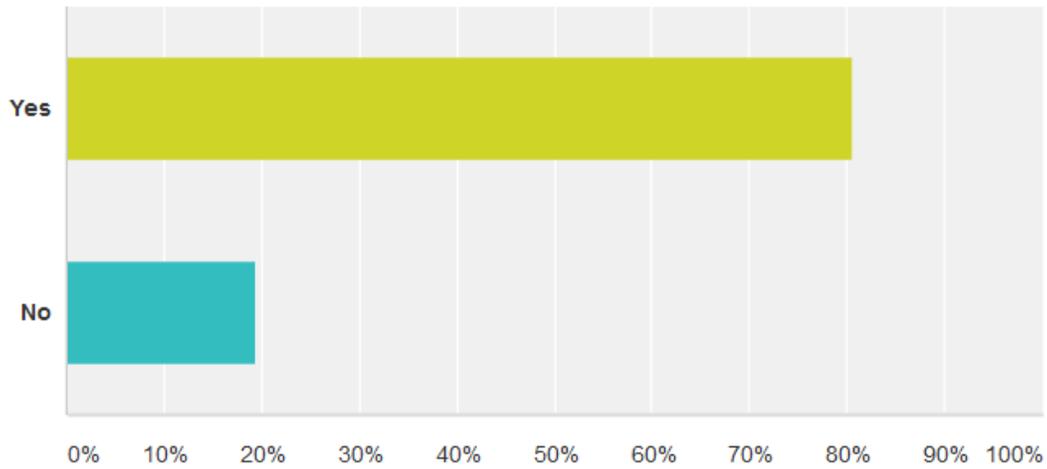
Answered: 35 Skipped: 13



Options	Response %	Response Count
Certificate	37.14%	13
Bachelors	42.86%	15
Masters	37.14%	13
PhD	17.14%	6
Course(s) offered but no certificate or degree program	25.71%	9
I don't know	2.86%	1

Question 13: Would you be interested in FEMA assistance to strengthen the relationship between emergency management and GIS?

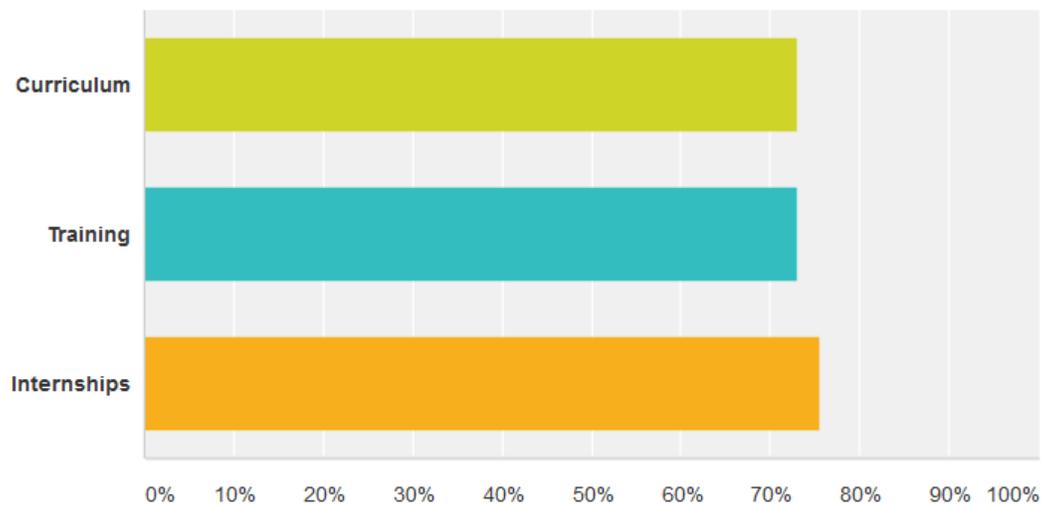
Answered: 41 Skipped: 7



Options	Responses
Yes	33
No	8

Question 14: Which of the following services would be most helpful? Select all that apply.

Answered: 37 Skipped: 11

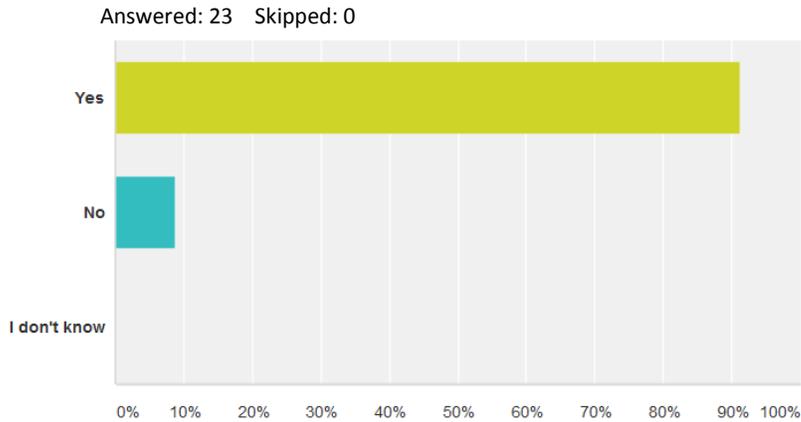


Options	Responses
Curriculum	27
Training	27
Internships	28

Appendix B: Practitioner Survey and Results

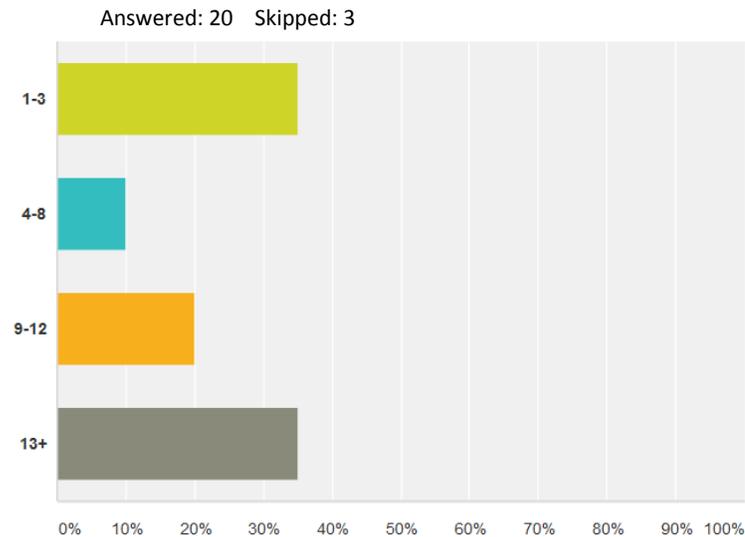
The questions asked and responses received from the Practitioner survey are provided below.

Question 1: Does your organization utilize Geographic Information Systems (GIS) in it's emergency management work?



Options	Responses
Yes	21
No	2
I don't know	0

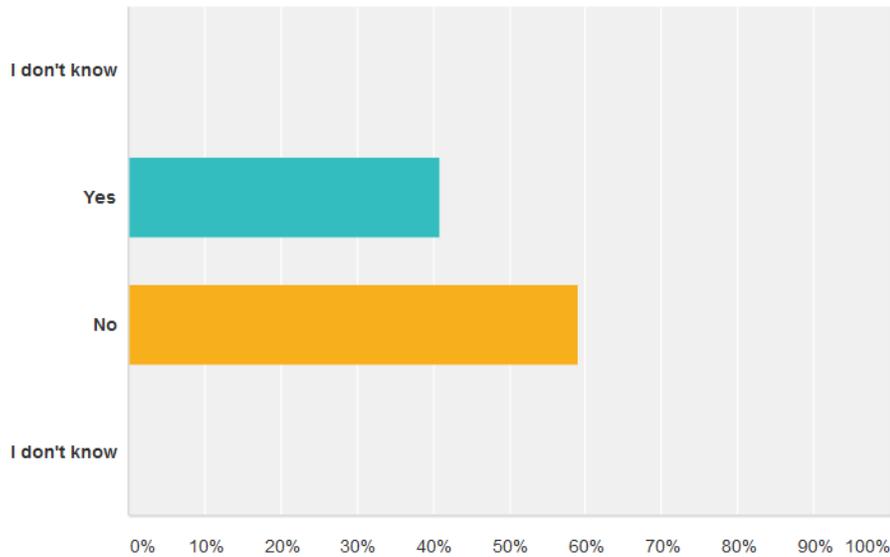
Question 2: How many GIS software licenses does your organization have?



Options	Responses
1-3	7
4-8	2
9-12	4
13+	7

Question 3: Has your organization partnered with or subcontracted a college or university in it's emergency management work?

Answered: 22 Skipped: 1

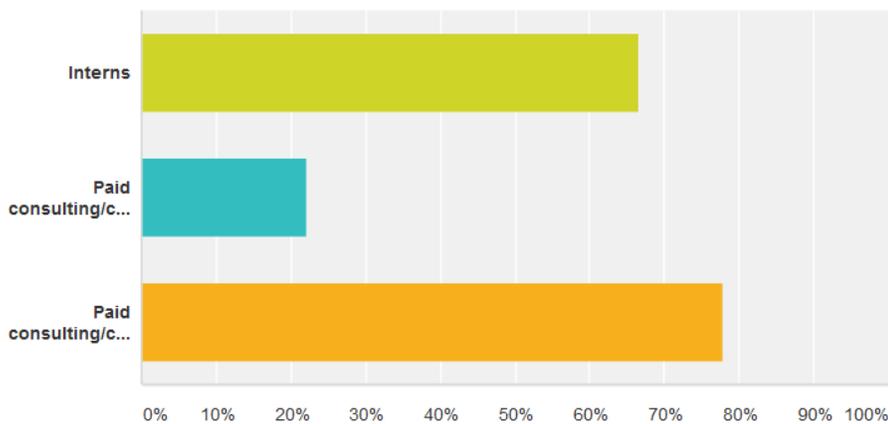


Options	Responses
Yes	9
No	13
I don't know	0

Question 4: In what capacity? Check all that apply?

Note: This question refers to question 3.

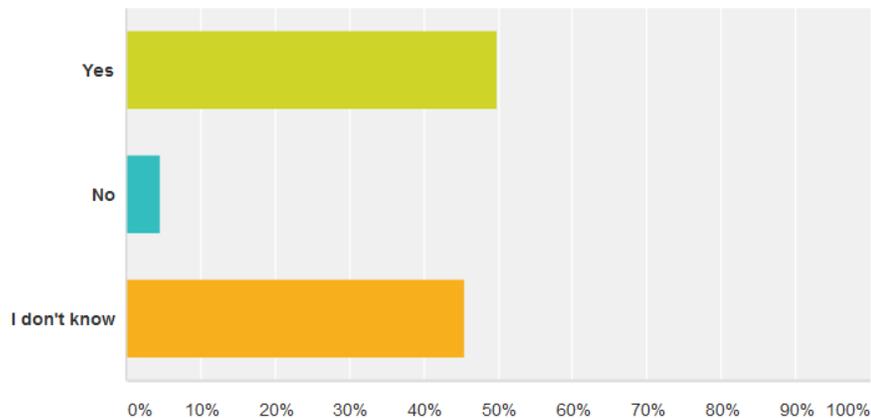
Answered: 9 Skipped: 14



Options	Responses
Interns	6
Paid consulting / contracting an individual	2
Paid consulting / contracting a center, institution or department	7

Question 5: Would your organization be interested in growing or developing it's relationship with higher education in emergency management and/or GIS?

Answered: 22 Skipped: 1



Options	Responses
Yes	11
No	1
I don't know	10

Question 6: Why not?

Note: This question refers to question 5.

Answered: 1 Skipped: 22

Responses:

- We have contractors in place that we utilize for large scale projects. The majority of the work in analysis and scripting is done in house by the GIS team.

Question 7: How could higher education be of greatest assistance to your organization?

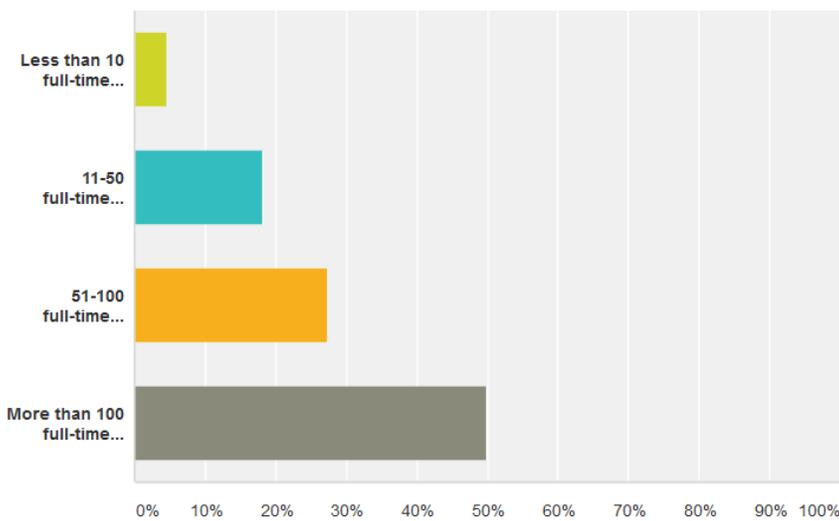
Responses:

- Development, testing, implementation, and training of new GIS tools to emergency management community.
- Good source of trained potential employees
- Manpower
- The University of Delaware has a robust GIS program. The one collective endeavor we did was during a Radiological Preparedness Federally graded drill. The resulting GIS products were extremely useful and were highly praised by the federal evaluators. Why do we not do more of it - funding!

- By working on specific problems that we identify
- Back up GIS personal during a disaster.
- Training
- Qualified graduates increase reliability of work products.
- Developing our risk MAP non-regulatory products, hosting datasets and serving as a local champion for communicating the need for risk awareness
- We usually find some elements of higher education useful as partners for grant proposals for future projects.

Question 8: How large is your organization?

Answered: 22 Skipped: 1



Options	Responses
Less than 10 full-time employees	1
11-50 full-time employees	4
51-100 full-time employees	6
More than 100 full-time employees	11

Question 9: Approximately how many people at your organization use GIS to support emergency management related activities?

Answered: 22 Skipped: 1

Number of People	Responses
0	2
1	3
2	2
3	4
4	1
5	1
8	1
10	1
20	1
25	1
30	1
35	1
50	2
300	1

Question 10: Other Comments?

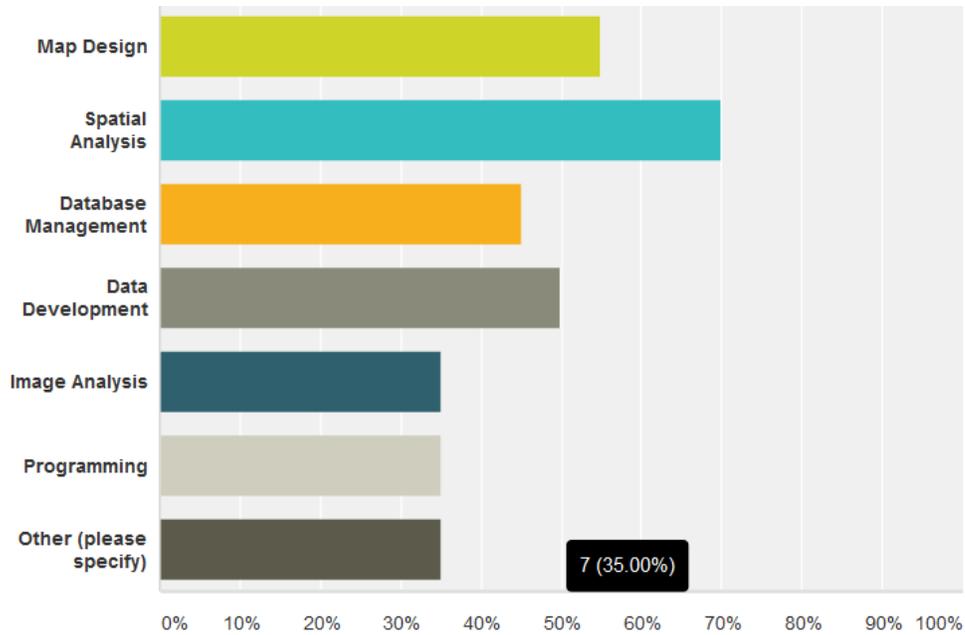
Answered: 22 Skipped: 1

Responses:

- There is a need to have many more people utilize GIS for their daily workflow and to help gather intelligence during incidents
- Need to incorporate GIS more! It applies to everything emergency management.
- Limited staffing is a real problem that can be overcome with a better partnership with our local University

Question 11: What GIS related skills are most important for new employees to have?

Answered: 20 Skipped: 3



Option	Responses
Map Design	11
Spatial Analysis	14
Database Management	9
Data Development	10
Image Analysis	7
Programming	7
Other (please specify)	7

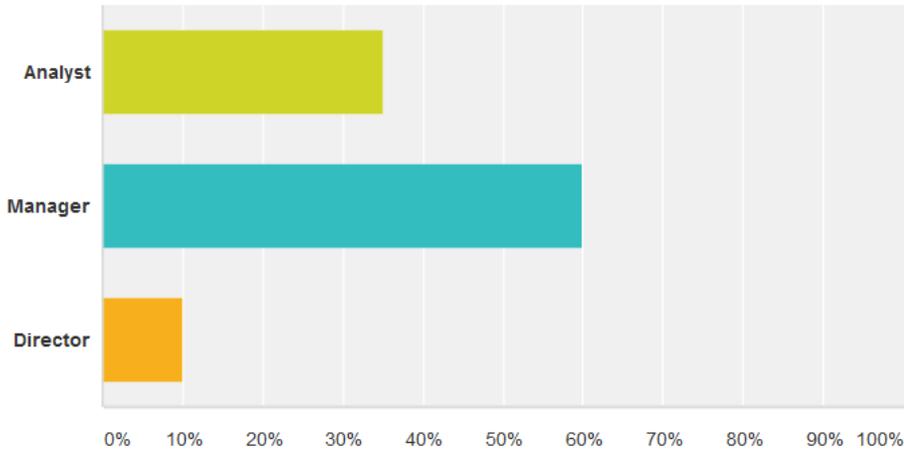
Other responses:

- Use of mobile tools
- troubleshooting
- There is only two positions that actually require GIS expertise. Most new employees are expected to utilized and understand and possibly analyze GIS Maps, but knowledge of ArcMap is not a requirement.
- Hazus
- an idea of what GIS can do for them
- Effective Communication/Confidence
- Systems Support, technical writing

Questions 12 and 13 requested contact information and ability to participate in follow-up interviews

Question 14: What is your role in your organization?

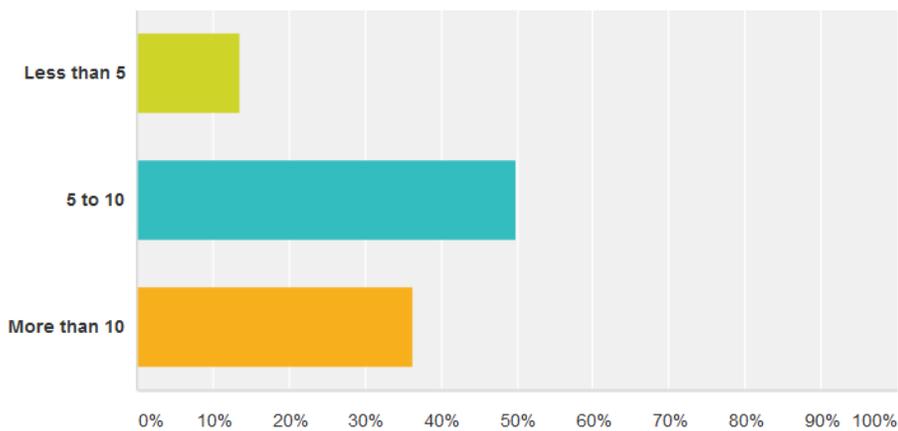
Answered: 20 Skipped: 3



Option	Responses
Analyst	7
Manager	12
Director	2

Question 15: How many years have you been at your organization?

Answered: 22 Skipped: 1



Option	Responses
Less than 5	3
5 to 10	11
More than 10	8