

Responses to Guiding Questions for Faculty

Workshop on Education Research Positions in STEM Disciplinary Departments

Geoscience Educators in Geology Departments; Expectations and Experiences

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Six geoscientists (including this author) employed as geoscience educators and housed in geology departments responded to questions by email or phone. Five of these questions were provided by NAS and the sixth was added to provide insight into perceived differences between traditional geology and geoscience education:

- 1) What are your responsibilities for teaching, research, and service? (e.g., teaching loads, courses, coaching/mentoring roles, types of research, liaison roles with education department)?
- 2) In what ways (if any) do your responsibilities differ from your non-education focused colleagues?
- 3) What positions have you held and do you currently hold in your department?
- 4) In what ways (if any) do your current position and your career prospects differ from your non-education focused colleagues? (e.g., title and rank, paths to tenure, resource issues, joint appointments with other departments).
- 5) To what extent and how does your department (or school or university) support your position and your research? (e.g., financial support, cultural support, etc.?).
- 6) Overall, how does geoscience education as a discipline differ from traditional geology disciplines?

Two men and four women responded (Figure 1). Respondents were employed at universities with either a primary focus on teaching, or working towards status as research institutions (none of the schools would be recognized as research institutions). Geographically, three schools were located in the midwest, and one each were located in the west, southeast, and northwest.

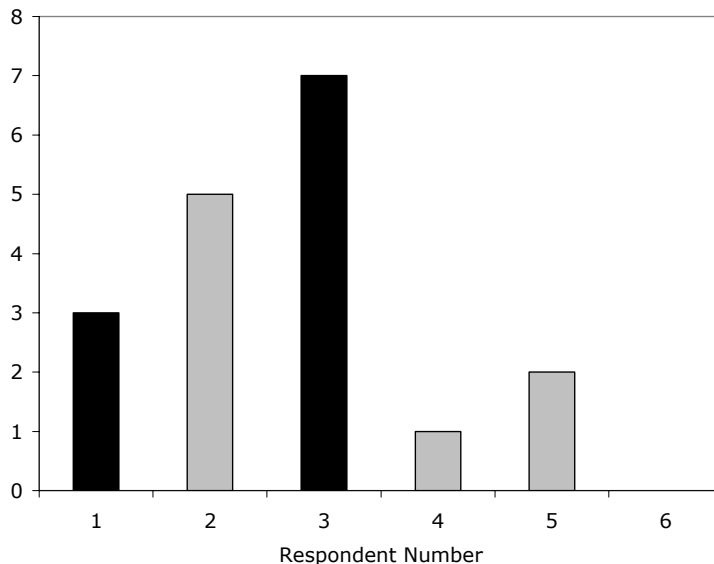


Figure 1. Experience in Geoscience Education faculty positions for each respondent. Respondents shown in black are men, those in gray are women. Respondent number 6 will be starting a tenure-track position in Geoscience Education on Dec. 1, 2005.

Respondents were all trained in PhD programs in geological sciences, and several had undergraduate, graduate, or postdoctoral experience in science education. Three of the respondents, while tenured through a geoscience department, were affiliated with science education departments or research centers. All respondents were Assistant Professors, except for one male Associate Professor (recently tenured). One woman was in the tenure process, one woman was recently hired and would officially begin her new position on December 1, 2005, and the other respondents had five, three, two, and one years of experience in their current positions. Several respondents indicated that anonymity was important in their ability to truthfully respond to these questions. Interesting note: Three of the women were mothers of a young infant or toddler (0-2 years), while the two male respondents were childless.

Review of responses suggests several important themes relevant to the roles, responsibilities, and position of geoscience educators housed in traditional geology departments. A table of actual responses is appended to this summary (Appendix A).

Theme 1: Value of Geoscience Education Research

Respondents had mixed experiences feeling respected or valued by colleagues for their education research. The three faculty who were cross-listed with education schools felt that their research was valued by colleagues, at least by those in education and often by those in geology as well. Most of the faculty, even those who were cross-listed, felt culturally or academically isolated within their institutions. The three faculty who were solely appointed in science departments felt some disrespect by colleagues in geology, either from within their departments or by the community at large. As one respondent put it, geoscience education *“is not generally perceived as being academically valid. I think most of my colleagues view it as a kind of joke or else they don't understand it”*. One respondent summed up the feelings of some of the geoscience education faculty by stating *“Overall, I feel as if I was hired into a position of disrespect, starting out as a “lesser” faculty member who needed to prove myself”*. Other faculty felt the complete opposite, with one respondent indicating that he feels like *“just one of the team - pretty friendly environment, although my colleagues don't really understand what I'm doing - they're just glad I'm doing it. It helps immensely that I have a PhD in my scientific discipline and that I teach majors courses along with science education courses”*.

Sub-Theme: Purpose/Role of Geoscience Education.

The respondents were split in their perceptions of the purpose of geoscience education as a discipline. This split may reflect a lack of community or cohesive purpose of the geoscience education community at large. Some respondents viewed geoscience education as a research-focused discipline, with two respondents specifically calling for increased rigor in research conducted within the field. One respondent felt that, *“presentations at professional meetings are almost all pedagogical in nature...and many of the publications traditional geologists see are non-research based”*, perhaps adding to the perception of *“many traditional geologists [who] do not recognize that geoscience education (or science education in general) is a rigorous field of scholarly research”* as suggested by another respondent. Other respondents felt that geoscience education had as a primary purpose the dissemination of effective teaching methods, while a few respondents perceived geoscience education as involving both research and practice. Two respondents also felt that the geosciences is an ideal discipline for incorporating science education research into science courses, either because geoscience instruction already mirrors research on “best practices” in developing coursework (*“typical*

geology instruction includes a significant amount of hands-on experience for students in the form of field trips and field work. In this way, I think many geoscience instructors already use some of techniques that are considered more affective [sic]”), or because research methodologies in geosciences are similar to those used in education. One respondent draws connections between research in traditional geology and geoscience education, making the argument “from a philosophical point of view, I have found the geological sciences to be really quite similar to geoscience education in terms of general epistemological and methodological approaches. The geosciences are themselves a mixed-methods field, combining rigorous qualitative and quantitative observations to produce narratives and interpretations - only sometimes can you do a really well-controlled experiment”.

Theme 2: The Tenure Process

Faculty have had a range of experiences in their journeys toward tenure. All respondents felt that their geoscience education work should count towards their tenure, although only some departments and universities had the same perspective. Departments may rely solely upon geoscience tenure guidelines and geoscience faculty input, may request input from education faculty, or may allow faculty flexibility in applying guidelines from education towards tenure decisions made in geosciences. Overall, the faculty were mixed in their comfort regarding their ability to achieve tenure within their departments.

The tenured professor (affiliated with a science education center) found that his tenure review went quite smoothly, and was aided by the addition of education faculty to his tenure committee: *“This has all gone very smoothly in my department. The only difference was the addition of senior science education faculty to the committee that reviewed my tenure and promotion issues at both the department and college levels, just to make sure that the journals commonly used to publish geoscience education work were recognized and non-traditional modes of publishing (relative to most sciences) were also acknowledged for their worth (i.e. book chapters, etc.)”*. Other institutions incorporate input from education colleges into their tenure decisions (*“Tenure decisions require input from the Center for Science Education with the final decision resting with Geosciences. The expectations for tenure (research, teaching, service) are the same as for other members of Geosciences.”*), or allow faculty the choice of using either geology or science education departmental tenure guidelines (*“We advance professionally though our content depts. The criteria for promotion can be taken from either the Science Education Program or content dept criteria -- our choice”*). One faculty member was involved in rewriting tenure guidelines after her hiring, *“so that my education publications would be considered research instead of pedagogy (in the “teaching” category). I get the impression from some colleagues that my education research is not viewed by all as research. I know that some of my colleagues will not be voting for my tenure unless I produce significantly in traditional areas (and perhaps not even then)”*. Four years into a tenure-track position, another faculty member discovered a disconnect between departmental and college expectations. Although hired into a Geoscience Education position, she is currently being reviewed for tenure based solely upon her traditional research. Her departmental chair has informed her *“that the campus did not choose to request outside opinions from any of the geoscience education people on the list of candidates that he provided. They got letters exclusively from traditional geology people. I delayed coming up for tenure to the very last minute because I was afraid that I would be judged only on my 'disciplinary research' and (provided I get tenure) my strategy paid off because I have put a lot more emphasis on doing traditional geology in the last three to four years”*.

Theme 3: Workload.

Duties of all of the respondents included typical tenure-track faculty considerations of time spent on research, teaching, and service. All respondents indicated that a majority of their research time was spent on geoscience education, although most indicated that they were either currently involved in traditional work or expected to be involved in traditional research throughout their careers. One faculty member made a conscious switch towards traditional research after it became apparent that she would not be tenured based upon her geoscience education work alone.

Teaching requirements generally followed departmental norms, with one significant exception. Many faculty were required to teach mostly entry-level courses, which are often those courses “*no one else wants to teach*”. Often this was made clear during the interview, as indicated by one faculty member whose department “*wanted someone to teach 280 person lecture section. Made clear in interview*”, and which was made clear to another respondent who “*was originally assigned all entry-level courses and had to fight to teach a course for majors or at the graduate level*”. One instructor said he felt “*like an instructor, not like a tenure-track professor*”. Half of the respondents did not teach undergraduate geology courses for majors or graduate level courses within their geosciences departments, although courses for pre-service teachers or graduate students in science education were common. The ability to work with graduate students, typically counted towards teaching in tenure decisions, differed widely between respondents. Two faculty had established Geoscience Education research programs which allowed students to receive MS degrees in geology through completion of coursework in geosciences and research in geoscience education. Other faculty worked with graduate students in Science Education. One faculty member had one graduate student in traditional geology, and was essentially unable to work with students in an existing MA in teaching program as “*no grad courses [existed] to support that [program] in geology*”.

Service requirements of respondents were generally similar to those of traditional geology faculty. Respondents were often responsible for interfacing with the College of Education, performing assessments for the geosciences department, or recruiting majors. Some faculty were aware that they could be quickly overwhelmed by all of the education related service in their department, suggesting that it is important to turn down service opportunities when service begins to overwhelm other duties. One faculty member felt that the service requirements as portrayed by her job ad were unrealistic. “*Originally the job was conceived as a liason with education, but no one bothered to make sure the education department was actually interested in working with*” the geoscience educator. Although most faculty felt their service requirements were on par with colleagues in science, a faculty member cross-listed with a science education department felt that her service load would be much higher than her colleagues in geology, stating “*it is my understanding from fellow faculty in the Science Education Program that the nature of their work with student teachers and local schools means that they do many times more outreach than typical faculty*”.

Conclusions

The six responding geoscience educators have a wide range of responsibilities, opportunities, and overall career expectations. Major benefits of geoscience education positions include the opportunity to impact instruction within geology departments or colleges of education, the ability to conduct fundamental geoscience education research, and the potential of geoscience education as an emerging field. Pitfalls of these positions mostly relate to tenure, isolation and respect. Some faculty have faced very real obstacles to achieving tenure as geoscience educators, and most faculty feel isolated as researchers. In the end, the geosciences community needs to decide what constitutes “geoscience education”, the roles geoscience educators can and should play in colleges of science,

and the potential geoscience education has for becoming an accepted subdiscipline within the geosciences.

APPENDIX A. RESPONSES

Note: Identifying information has been removed or modified to protect the anonymity of the respondents. These changes are in italics.

1) What are your responsibilities for teaching, research, and service? (e.g., teaching loads, courses, coaching/mentoring roles, types of research, liaison roles with education department)?

Respondent	Response
1	<p>Teaching: 2 courses/semester, +1 over required: <i>Special Course</i>-entry level (Env. Studies), 300 level non-majors Geology of National Parks; Geology 101 (280 students) (Part of agreement...dept. had position thrown at them, wanted someone to teach 280 person lecture section. Clear in interview). Taught one grad course before <i>Special Course</i> began (TA training). No majors or grad courses: Ok with it, glad no more courses than have to. Personally, makes my role to feed in majors, therefore has value. Don't know if they take research part seriously. Dept. is glad I teach courses no one else wants to teach. <i>Special Course</i> brings in majors. Feel like an instructor, not like a tenure-track professor. Try to envision leaving, but I am a glorified instructor.</p> <p>Research in ed (80%) and trad, (20%) only grad student in traditional geology. MA in teaching (K-12 teachers to get Masters); no grad courses to support that in geology. No ability to have grad in GeoEd.</p> <p>Service: First contact for ed committee (accreditation), handle gen ed committee issues. Geoclub advisor, advisor for <i>Special Course</i> alumni group. Promoting <i>Special Course</i> (table session to show off dept.). No undergrad major advising. Dept. salesman.</p>
2	<p>My campus does not have the most clear workload policy - up until a few years ago we didn't have any real workload policy. So in that context, I have the same teaching load and research expectations as everyone else. There has been disagreement in the administration as to whether my geoscience education work should count as part of my scholarship or not, everyone has their own idea. It has influenced what I teach - I teach a course in Earth Science for pre-service teachers but the other activities (running an REU program, teacher workshops, committee work in college of ed) do not count as part of my teaching load. They don't count as scholarship either. So essentially I have a massive service load which is not officially valued for tenure or promotion. (I am in the midst of coming up for tenure right now) My chair tells me that the campus did not choose to request outside opinions from any of the geoscience education people on the list of candidates that he provided. They got letters exclusively from <i>traditional geology</i> people. I delayed coming up for tenure to the very last minute because I was afraid that I would be judged only on my 'disciplinary research' and (provided I get tenure) my strategy paid off because I have put a lot more emphasis on doing <i>traditional geology</i> in the last three to four years.</p>
3	<p>My teaching load is the same as all faculty in our college of sciences - i.e. 6 units per semester, which is typically two courses. I am typically expected to oversee and/or teach courses for pre-service teachers and teach graduate courses in geoscience education research. I also teach majors courses regularly in the core curriculum - in my case <i>traditional discipline</i>.</p> <p>My mentoring roles are no different than any other faculty member - my MS students are full members of the department and earn Geological Sciences MS degrees doing geoscience education research. I also mentor BS senior theses (required of all majors in our department) also doing geoscience education and/or <i>traditional discipline</i>-related thesis projects. An additional role that I enjoy in mentoring is being part of our doctoral faculty in the joint [<i>deleted</i>] Mathematics and Science Education program. This is a joint, stand-alone program not connected to any particular department and housed in our science education research center [<i>deleted</i>]. I am on thesis committees and can as of this year (because of my promotion and tenure) be major professor for doctoral dissertations.</p> <p>My research is focused almost entirely on geoscience education, but I do work a little in <i>traditional geology</i> as I find time and relevant projects. We are expected to publish one to two papers per year on average and earn external funding in order to earn tenure or promotion.</p>

	<p>I have no formal role in liaison work with our school of education but am a full member of our <i>Science Education Center</i>, which is a joint venture between the Colleges of Education and Sciences. I have many friends/colleagues from the College of Education and have collaborated with them on projects and on student thesis committees frequently in the past 6 years.</p> <p>My service role in the department is focused on assessment of student learning outcomes program-wide and undergraduate curriculum coordination in the major. I also serve as undergraduate advisor currently, but this is a rotating responsibility.</p>
4	<p>Teaching: 2 courses per semester. At least one course each semester is an <i>earth science for elementary educators course</i> which is an inquiry format (lab & discussion), small-enrollment course covering basic geoscience content such as earth materials, earth history, and surface processes. Although it is a content course we also talk about issues related to K-8 teaching (student misconceptions, teaching methods, etc.). Starting next year, I also will teach a graduate level courses in science education. In the summer (not part of my 8-month appointment) I co-teach a 2-week geology field course for pre-service secondary earth science teachers.</p> <p>Research: Main research focus is science education. I have two pilot studies underway -- one looking at earth science misconceptions among pre-service elementary teachers, the other looking at field-based learning. I am also publishing dissertation research on <i>traditional geology</i> and hope to continue this as a secondary line of research.</p> <p>Mentoring, etc.: Masters and doctoral student advisor in science education</p> <p>Service: Because of my joint appointment service is split between science education and geosciences. Most service is in geosciences (tenure home). Typical service is departmental committees where input from an "education person" is needed. I'm also active in GSA <i>[deleted]</i> and have participated on NSF review panels.</p>
5	<p>Teaching: 4 courses per year <i>[deleted]</i>. I am in charge of the 101 laboratories, which counts towards the 4 course load. I also teach our TA training course which is one credit and does not count towards my teaching load. I was originally assigned all entry-level courses and had to fight to teach a course for majors or at the graduate level. Our chair changed, and the new chair is dedicated to my teaching 101 only once per year.</p> <p>Research: I do 75% of my research in science education and 25% in traditional geology.</p> <p>Mentoring: I recruit 3-5 majors from my 101 course and I serve as a mentor. I have geosciences graduate students conducting research in geoscience education, and have a geosciences undergraduate working on a <i>traditional geology</i> research project. I have also worked with pre-service teachers on science education research projects.</p> <p>Service: Originally the job was conceived as a liaison with education, but no one bothered to make sure the education department was actually interested in working with us. I have been turned away on three occasions when trying to interact with Curriculum and Instruction, although I have found the faculty in mathematics education and through the Research in Education department to be very receptive. would like to do more assessment in the department, by overall I don't get the impression that the faculty are particularly interested.</p>
6	<p><i>My university</i> is a Primarily Undergraduate Inst. (some Masters students). The teaching load is thus quite high compared to Research-1 universities. Professors are required to have 15 hours of contact time per week teaching. This usually translates to 3 classes per term plus some advising. There is an increasing emphasis on conducting research too -- particularly in ways that can include undergraduates. Community service is also expected and it is my understanding from fellow faculty in the Science Education Program that the nature of their work with student teachers and local schools means that they do many times more outreach than typical faculty.</p>

2) In what ways (if any) do your responsibilities differ from your non-education focused colleagues?

Respondent	Response
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1	All PR for department, outreach (cub scouts). All other faculty teach entry/major/grad, while I only teach entry-level.
2	They are less clearly defined. Mostly I have extra responsibilities. I get tapped for educational policy tasks and committees (we are dealing with a lot of program assessment and accountability stuff these days).
3	None. I am a full and equal faculty member in all respects.
4	Overall not too different -- I am not involved in the graduate program in the geosciences department, nor do I teach any courses for geoscience majors (so far). Because of my joint appointment, I try to keep service activities in the geosciences program to a minimum, but am often asked to participate in more departmental activities and committees than my colleagues are.
5	<p>The intended responsibilities for the position (as stated in the job ad) were to:</p> <ol style="list-style-type: none"> 1) enhance the active learning environment of the department's general education courses, 2) coordinate the introductory laboratories, and 3) develop the department's contribution to teacher education in collaboration with the College of Education. 4) teach a variety of undergraduate geoscience courses including those designed for teacher education students, 5) plan/conduct professional development for area public school teachers, 6) and work with faculty in the College of Education. <p>In reality, most of the intended responsibilities are untenable. Enhancement of learning environment can only happen in courses assigned to me. I am deeply resented by the faculty member who was previously in charge of the 101 lab sections, Collaboration with the College of Education is only possible if that college has bought into collaborating (!). Teaching undergraduate courses designed for teacher ed students has mainly translated to only teaching entry-level courses as other courses taken by pre-service teacher are already assigned to other faculty. Professional development for area teachers is really only possible in collaboration with the College of Education, particularly the teacher preparation group, and building these connections is a long process that may take longer than the six pre-tenure years.</p>
6	I believe that the significantly higher service is the main difference. The Science Education program does not have graduate students, so any graduate advisees will likely be through the science content dept.

3) What positions have you held and do you currently hold in your department?

Respondent	Response
1	Merit Committee, Awards Committee, GeoClub Advisor, Alumni Advisor
2	Assistant professor
3	Positions? Assistant Professor, Associate Professor. I guess I don't fully understand the question if you want more than that.
4	Assistant Professor
5	Assistant Professor
6	I am about to start (Dec 1, 2005) as an assistant professor in a joint appointment between the Geological Sciences Dept and the Science Education Program (housed within the College of Science, not the College of Education). My colleagues in the Sci Educ Program all have such joint appointments -- 1 physics, 1 biology, 2 chemistry.

4) In what ways (if any) do your current position and your career prospects differ from your non-education focused colleagues? (e.g., title and rank, paths to tenure, resource issues, joint appointments with other departments).

Respondent	Response
1	Created 4 new courses (2 outside of dept.). Budgetary issue was like starting academic unit (univ. provided). Had to work with university accountant and univ lawyer). Same tenure guidelines, same title
2	I don't know. We will see if I get tenure...After four years it became clear that there was a disconnect between department and college. Realized this in midst of trainwreck of tenure expectations so I put off tenure decision as long as possible as I switched back to doing traditional

	research
3	This has all gone very smoothly in my department. The only difference was the addition of senior science education faculty to the committee that reviewed my tenure and promotion issues at both the department and college levels, just to make sure that the journals commonly used to publish geoscience education work were recognized and non-traditional modes of publishing (relative to most sciences) were also acknowledged for their worth (i.e. book chapters, etc.). Otherwise in any of the categories mentioned, I have noticed no differences at all between my own prospects and those of my "traditional" junior or senior colleagues.
4	I hold a joint appointment between the Geosciences Department and <i>Center for Science Education</i> . The science education faculty in the <i>Center for Science Education</i> are jointly appointed with the tenure home in their science department (biology, chemistry, geography, geosciences, or physics) or in the College of Education. Tenure decisions require input from the <i>Center for Science Education</i> with the final decision resting with Geosciences. The expectations for tenure (research, teaching, service) are the same as for other members of Geosciences.
5	I am full-time in the geology department and on paper am considered a full tenure-track member of the department. The department reconsidered their tenure guidelines so that my education publications would be considered research instead of pedagogy (in the "teaching" category). I get the impression from some colleagues that my education research is not viewed by all as research. I know that some of my colleagues will not be voting for my tenure unless I produce significantly in traditional areas (and perhaps not even then).
6	There should be no difference. The Sci Educ faculty members appear to advance professionally at the same rate as regular science faculty. One of the Sci Educ faculty members has progressed to Full Professor. We advance professionally through our content depts. The criteria for promotion can be taken from either the Science Education Program or content dept criteria -- our choice.

5) To what extent and how does your department (or school or university) support your position and your research? (e.g., financial support, cultural support, etc.?).

Respondent	Response
1	Created new academic unit. Supportive of activities. Didn't know what geod research was about (on both sides), let him shop around to find out what to do. Looking for academic institution to host GeoJ, so as a grad student looked for a school to do this. No previous expr. in ed research.. Certified teacher (also instructor for course in graduate school).. exp as teacher but not in research. Dept. didn't know what they wanted...sold dept. something that they liked the idea of.
2	<p>The department provides \$1,200 per year for each faculty for travel and research expenses. I receive no additional support. The department is largely skeptical about education and very ambivalent about my position. On one hand, I have been encouraged to metamorphose into a straight <i>traditional geology</i> person and people here felt that my REU program placed a heavy burden on the department. On the other hand, they really like the money and the publicity and they want more of both.</p> <p>Phone call: Provost decided to hire science ed people in departments. Dean was against the whole idea and didn't have high regard for this whole scheme. Geology decided they were small and needed another faculty member. Provost is giving direction to position by writing memos that direct position duties (e.g., systemic reform committees). Chair was happy to make Provost happy. Chair is interested in science education, meanwhile the Dean who has no direct contact with me is sitting there thinking this is bs.</p>
3	<p>Financial support - none. Just like everybody else, we have to raise all of our own funds for everything down to travel and printer cartridges. I have been able to use existing departmental equipment for research (GPS units in particular), especially if my work is connected to ongoing courses, which it typically is.</p> <p>Cultural support - I am just one of the team - pretty friendly environment, although my colleagues don't really understand what I'm doing - they're just glad I'm doing it. It helps immensely that I have a PhD in my scientific discipline and that I teach majors courses along with science education courses. I did have to work hard to make sure that all "outreach" activities didn't land on my doorstep - I said NO to a lot of this stuff and still do in order to preserve my research time. My colleagues ultimately understood this part, but I did have to put my foot down.</p>

	<p>Physical support - I have a dedicated lab and experimental classroom space. - very nice. But, we moved into a new building, so the space was available - it was not created for me upon my arrival but appeared opportunistically mid-way through my time at <i>my institution</i>.</p> <p>Academic support - none. There is nobody else at <i>my institution</i> in any college who does geoscience education work, so I have nobody to share ideas with typically. This academic isolation has been the toughest part of my career path to date and would probably be a major factor in me leaving <i>my institution</i> if that came to pass.</p>
4	I have collaborated on a number of NSF educational research proposals with colleagues from both the geosciences and the science education programs. Most research support is through the science education program -- <i>Center for Science Education</i> has a good record of funded research in science education, and I am often able to collaborate with more senior colleagues. We meet monthly to discuss and critique one another's proposals and papers in progress. I've been encouraged by the science education program chair to pursue both internal and external funding for my own work.
5	I do feel culturally isolated. I have been supported through the development of an MS option in Geoscience Education. I was given less space than the other faculty when hired, was given a course load that consisted of entry-level courses only, and was given a much lower start-up package. Overall, I feel as if I was hired into a position of disrespect, starting out as a "lesser" faculty member who needed to prove myself.
6	It is a bit hard to comment on this because I have not actually started yet, but it is my impression that science education is respected by my colleagues in Geological Sciences. I was very sensitive about this issue during the interview process, but did not detect any signs that I would be considered somehow less "serious" because I was split between science and science education. I think this broadmindedness is not the norm. I believe that my colleagues in the Sci Educ Program feel that they are overall respected, but perhaps have to fight a bit harder for the respect and appreciation. They have commented that we should (tactfully) try to do more self-promotion to make sure others appreciate the full amount of service we undertake - sometimes at the expense of research. All faculty in <i>[deleted]</i> Geological Sciences Dept and Science Education Program are actively involved in research (two of the more active groups on campus). Most of the research done by the science education faculty is in science education. However, we are free to choose what type of research we want to undertake. I will continue to do at least some pure science research.

6) Overall, how does geoscience education as a discipline differ from traditional geology disciplines?

Respondent	Response
1	Feel like I should be connected with DLESE, afraid it will hurt in tenure with external letters. In traditional research, because we were reading so much that has to do with each others work there was a community. Huge lit and ongoing (30 yr)...Lineages and connections, felt like better connected to that group than geod. Geod is so big and research is so disparate that it is hard to find people...Lot of people publish in geod who are not researchers...Connections with phy and chem., no real direct correlation. Look at field based ed research in geod...3 people! Others are geo prof who are teaching (not doing research).
2	It is not generally perceived as being academically valid. I think most of my colleagues view it as a kind of joke or else they don't understand it. This is consistent with general attitudes towards colleges of education as well as the social sciences. As a discipline geoscience education has some genuine problems, too. It lacks a well known set of criteria for rigor and it lacks a rigorous literature. Many people don't know what it is and contribute to the problem by publishing "this is how I spent my summer" papers. Many of its practitioners (especially me) were not formally trained in it but drifted in through teaching.
3	Wow, what a broad question... Other than the obvious differences, the hardest challenge is that of learning and mastering specific education research methodologies (an ongoing process) and finding students who are willing and able to climb the very steep learning curve to move from straight geoscience to rigorous geoscience education research. I have been able to lean heavily on graduate courses taught my colleagues at <i>Center for Science Education</i> and in <i>graduate science education program</i> , in that I can send my MS students to doctoral courses so they can learn

	<p>qualitative methodology. There is little available in quantitative methodology in the program, so (not surprisingly) the strongest research from my group has been qualitative to mixed-methods in nature.</p> <p>Otherwise, from a philosophical point of view, I have found the geological sciences to be really quite similar to geoscience education in terms of general epistemological and methodological approaches. The geosciences are themselves a mixed-methods field, combining rigorous qualitative and quantitative observations to produce narratives and interpretations - only sometimes can you do a really well-controlled experiment. The overall approach is quite similar in geoscience education research, at least as I see it, so many geoscience-trained students are well prepared for working with often ambiguous and fragmentary data in geoscience education research. The main difference is human subjects ethics training and IRB approval, but that I can handle. In this sense I think that geoscience education research fits very cleanly into disciplinary geoscience departments perhaps better than physics education fits into physics departments, for example. The sociological and educational research methods in science education fit neatly with geoscience research approaches, and this helps our work to be incorporated directly into mainstream geoscience teaching at the majors level - an integration that has been lacking in many other science or math-ed fields.</p>
4	<p>I think that many traditional geologists do not recognize that geoscience education (or science education in general) is a rigorous field of scholarly research, albeit with its own means and methods. I also think that the unvoiced opinion of many of my colleagues is that geoscience education is a collection of nifty methods and approaches for teaching, or new technology for the classroom (i.e., GeoWall, student response "clickers"), or new ways of assessing student learning. There is a general lack of understanding (and not to mention appreciation) for the qualitative and quantitative methodologies that underlie educational research. My view is that geoscience education in general involves both research and practice (the classroom "tricks"), each informing the other.</p>
5	<p>Geoscience education research can be as rigorous as traditional geology research, but the community suffers from a split personality. The image that is portrayed to the mainstream geoscience community is that science education mainly focuses on pedagogy, and that often research is impossible because of the large number of variables inherent to studying people. As a result, presentations at professional meetings are almost all pedagogical in nature (~10% of the posters and talks at GSA 2005 had data supporting assertions of "best practice") and many of the publications traditional geologists see are non-research based. The geoscience education community needs to take a page from physics and step up the rigor in geoscience education!</p> <p>Although I have written and spoken about the similarities between science education research methods and traditional geology research, I find that it is really difficult to convince traditional geologists that education research can be rigorous. For example, I recently gave a talk at a departmental colloquium and an old friend from graduate school was perplexed by my talk. He wanted to hear more about what he should be doing in the classroom, and was frankly bored by the qualitative and quantitative data I presented in making an argument about learning. Some of his colleagues were more interested, but the overall impression I received was that a talk about my own anecdotal experiences would be more palatable than a research talk. I can't imagine a mineralogist, for example, being asked to talk about his mineral collection instead of his traditional research!</p>
6	<p>I see geoscience education (and science education in general) as more consciously trying to use and promote teaching methods that are shown in educational research to be most affective for science learning. Typical geology instruction includes a significant amount of hands-on experience for students in the form of field trips and field work. In this way, I think many geoscience instructors already use some of techniques that are considered more affective. However, this is often not a conscious consideration of the instructor so the application of these techniques can be inconsistent.</p>