

# **Creative collaboration: A phenomenological study of a science faculty curriculum project**

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## **Abstract**

Creative collaborations between scientists and educators can be difficult. It is often the case that faculty members from the College of Science and College of Education resist collaboration. Is the culprit ego, agenda, busy schedules, lack of support or something else? This phenomenological study unravels the secret behind successful collaboration between scientists, a mathematician, and a science educator. This study identifies seven critical actions that are necessary for successful curriculum collaborations.

*Educational reform must be collaborative to succeed. In the case of science, mathematics, and technology education, the scientific community must enter into partnership with the education community.” (AAAS, 1990, 224)*

## **Introduction**

Collaboration is the cornerstone of most successful, innovative, and meaningful pursuits. “The notion of the solitary thinker still appeals to those molded by the Western belief in individualism. A careful scrutiny of how knowledge is constructed and artistic forms are shaped reveals a different reality. Generative ideas emerge from joint thinking, from significant conversations, and from sustained, shared struggles to achieve new insights by partners in thought” (John-Steiner, 2000, p. 3). Creative collaborations are necessary for clever solutions to the plethora of problems facing our educational

system today, particularly in the area of mathematics and science education reform (Moolenaar, Slegers and Daly, 2012). For decades, the call for significant changes in science, mathematics, and technology education have been loud and clear. And yet, most American students are still not performing at a level deemed “proficient” in science (Robelen, 2011). Data from the Nation’s Report Card Science 2011 show that less than one-third of the American elementary and high school students were at or above the proficient level science, and that the United States is trailing their counterparts in many European and Asian countries (Banchemo, 2011). This trend has continued for the 2015 data (The Nation’s Report Card 2015), with the following percentages of students achieving at or above proficient ratings: 4<sup>th</sup> grade – 38%, 8<sup>th</sup> Grade – 34%, and 12<sup>th</sup> Grade – 22%. Often faculty members from Colleges of Arts & Sciences and Colleges of Education resist collaboration. Is the culprit ego, agenda, busy schedules, lack of support, or something else? This phenomenological study unravels the secrets behind a successful collaboration between scientists and educators. This paper first reviews prior research on collaborations in higher education, particularly in science and mathematics education, and then elaborates on how faculty collaboration between College of Arts & Science and College of Education faculty designed an innovative science curriculum program at our institution.

## **Research on Collaboration in Higher Education**

In the past few decades, numerous studies

on transforming science, mathematics, and technology education through interdisciplinary collaboration in higher education have surfaced (Laursen, Thiry, and Hunter, 2008; Tanner, Chatman, and Allen, 2003; Bower, 2005; Carr, 2002; Sunai et al., 2001; Loucks-Horsely and Matsumoto, 1999; Girgus, 1994; and Goldston and Bland, 2002). The “work and research findings within collaborative initiatives support the early work conducted by Darling-Hammond (1994), who discussed the necessity of generating shared vision among collaborators, and Loucks-Horsley, Hewson, Love, and Stiles (1998), who pointed out that partners must have equal status for a collaborative to be successful” (Goldston & Bland, 2002, 1). Many researchers claim to have struggled with negotiating personal/professional agendas while working with their partners to create a shared vision for the collaborative. To improve collaboration, “it’s not technology, it’s leadership. To create an environment where people like to collaborate, you literally have to understand every single member of the group. It’s a fascinating flock of birds phenomena that makes this whole experience rewarding” (Abele, 2009, 1). Defining roles, establishing a common language, and building the necessary relationships to create and sustain such partnerships is exhausting work. Nonetheless, in spite of these struggles, in the spirit of shared responsibility for preparing highly qualified K-12 teachers in science, mathematics, and technology, most collaborators are inspired and motivated by the opportunities to share ideas, generate a shared vision, and devise action plans to accomplish this goal (Goldston & Bland, 2002). Most educators also recognize that recruitment of quality teacher candidates doesn’t happen without conscientious efforts and “buy-in” from both scientists and educators.

A number of collaborative efforts identify “lessons learned” in regard to the collaboration

experience. For example, a case study (Girgus, 1994) that focused on working together to achieve diversity in science and mathematics identifies the following indicators of success:

- Working with like-minded souls on problems of common interest is extremely energizing.
- Committed energetic leadership and smoothly running administrative processes are as crucial to the success of the collaborative projects as they are to every other kind of enterprise.
- Collaboration permits you to do things you probably would not or could not do alone.
- Most importantly, conversation counts -- every successful collaboration depends on opportunities for participants to develop mutual respect and explore shared priorities and interests. This applies equally to individuals working on a project, to a department revising its curriculum, and to institutions engaged in planning. (Girgus, 1994, 3)

A greater commitment by science faculty to focus on science education could drive education reform at universities and public schools, according to a report co-authored by several researchers from California State University and one from Purdue University (Laursen, Thiry, & Hunter, 2008). In *What Works: Building Natural Science Communities* (Narum 1991), the focus was on the concept of community from the perspective of the learning environment for students: what they learn, how they learn, where they learn. This dialogue recognizes that creating an effective community of learners requires dissolving any boundaries that inhibit dialogue and action, and thus community. How to achieve the systemic reform this nation needs in science, mathematics, engineering and technology

education is a key question for collaborators. The basic pieces are the same - students and faculty, program and institution - but now there are questions about communities of interest: about stakeholders across the educational sectors, in public and private agencies. All have a stake in ensuring that the undergraduate science/mathematics community serves the national interest into the next century. A plethora of questions arise as we consider the challenge of collaboration. How do the patterns change when we ask questions about financing reforms at the local and national level; when we consider exploring new collaborations between departments and between institutions? How do the patterns change when we decide to take some risks asking some hard and uncomfortable questions of ourselves and of our colleagues? How do the patterns change when there is an individual, institutional, and national commitment to dialogue and action to overcoming inertia? (Laursen, Thiry, & Hunter, 2008).

Girgus (1994) cautions creative collaborators that an innovation that works well in one context may not be transplanted into a different context. As innovations move out from their original settings, they must be adapted to the dynamics and the needs of each new setting. Imagine a series of collaborative opportunities that spiral outward from the faculty member as a series of concentric circles. In the innermost circle are colleagues from the faculty member's own department, in the next circle are colleagues from intellectually adjacent departments, in the next circle are the deans, provosts, and presidents, in the next are colleagues in other institutions. According to Girgus (1994), if we can learn how to harness good collaboration as we move from circle to circle, we might be able to institutionalize a particular reform into the curriculum and adapt

the reform to the needs of a growing number of institutions. Figure 1.1 illustrates this model of collaborative relationships between and among institutions.

Pushkin (2008) reminds scientists that it is imperative to take on some responsibility in the preparation of science teachers. He recognizes that as the number of teacher education courses required for initial certification dwindles, the predominantly de facto pedagogical influence on K-12 science teaching comes from undergraduate science professors, not teacher education professors. There is a tremendous need for collaboration between science and education faculty.

Carr (2002) tells us that powerful preparation of science teachers involves significant contributions from both scientists and teacher educators. Ironically, faculty and students in science and teacher education departments are often isolated from one another, not only across the physical boundaries of the university, but across the cultural boundaries of academe. Coordination and collaboration between science and education faculty requires careful negotiation of these cultural boundaries. Carr illustrates Patterns of Difference in both teacher education departments and science departments in Table 1 on next page. These cultural differences, if not understood or recognized, can be a key barrier to successful collaboration.

Carr (2002) also highlights the conflicting epistemologies among scientists and educators. "Science is hard and teaching is easy," represents a very real epistemological belief of many scientists and one that we confronted in our collaborative effort. The following section describes the methodology and the players in our collaborative experience.

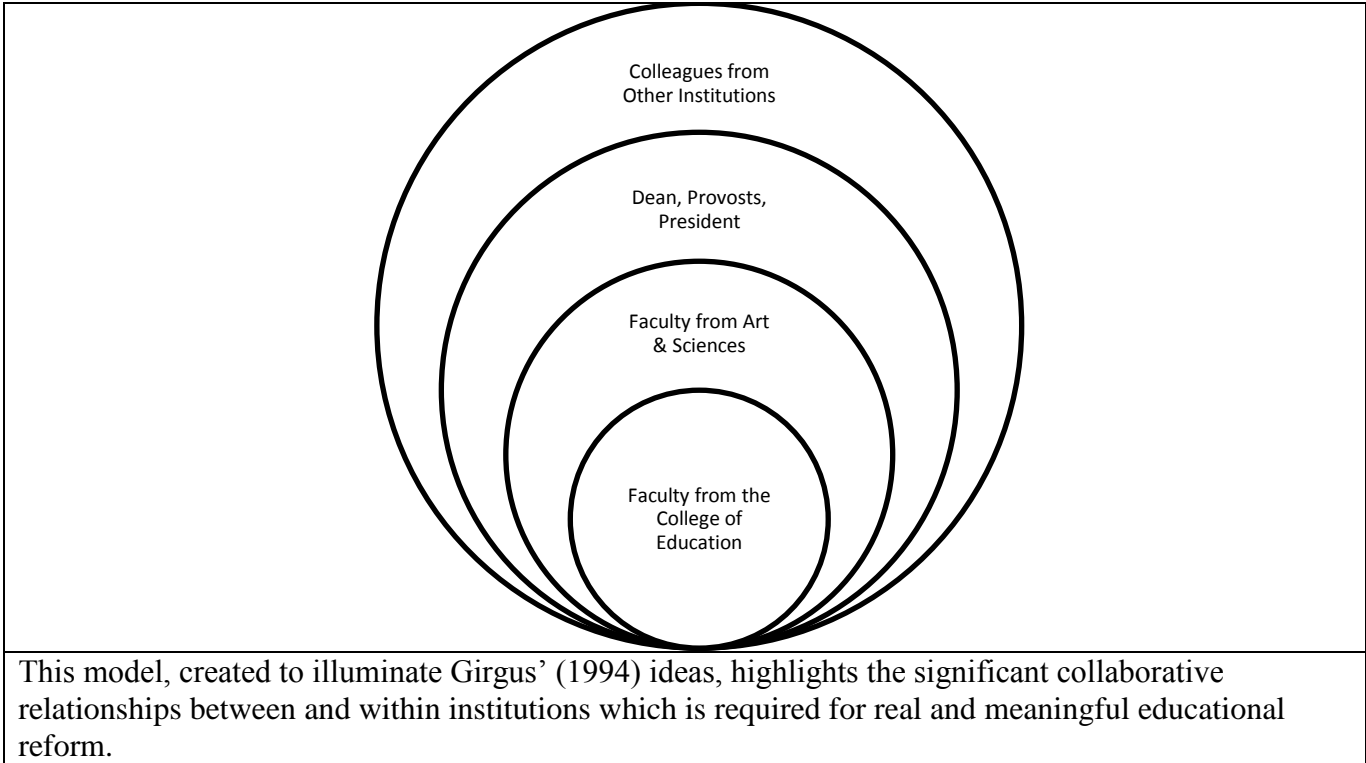


Figure 1: Model of Collaborative Relationships Between and Among Institutions

<b>Pattern of Difference</b>	<b>Teacher Education Dept.</b>	<b>Science Department</b>
<b>Communication Style</b>	Direct and clear communication is valued but sometimes must be sacrificed to preserve relationships.	Direct and clear communication is highly valued and rarely compromised.
<b>Attitude toward Conflict</b>	Direct conflict is avoided, especially in public between colleagues.	Conflict is an integral part of the process of creating knowledge and is often carried out publicly.
<b>Approaches to Completing Tasks</b>	Tasks are seen as ongoing and the process malleable, the building of relationships sometimes interferes with task completion.	Tasks meticulously planned and carried out with efficiency.
<b>Decision-making Style</b>	Group consensus	Delegation by authority
<b>Learning and Knowing</b>	Everybody is seen as a co-learner, and knowledge is gained through not only individual effort, but a result of relationships and dialogue.	Learning is the assimilation of knowledge delivered by experts.

Table 1: Carr's (2002, 9) Comparison of the Patterns of Difference between Teacher Education and Science Departments

## Methodology

For this study, the researchers used a phenomenological approach to make sense of our experience working with scientists and educators. According to Lester (1999), the purpose of a phenomenological approach is to “illuminate the specific and to identify phenomena through how they are perceived by the actors in a situation” (p. 1). This translates into gathering “deep” information and perceptions through inductive, qualitative methods such as interviews, discussions and participant observation, and representing it from the perspective of the research participant(s). The deep information gathered for this study are derived from weekly meetings where the participants shared ideas, understandings and visions for a premiere middle school science program. There were key participants in this study, a science educator, a mathematics educator, and a scientist. Several additional scientists representing all the scientific fields were also part of the process of this study. The scientists, who came to the table, showed an interest in improving science education at our institution and helped to create course outlines for Biology, Physics, and an existing Chemistry course that were aligned to the state science standards. For this study email transcripts, memos, and meeting notes were key to making sense of the episodes that occurred during the collaborative process.

Data from the document artifacts (email correspondences, meeting notes, and interactions among the participants) were analyzed using a constant comparative method (Lincoln & Guba, 1985) in an effort to enhance meaning making – in other words, to make sense of the process of collaboration between the participants and individual scientists who share a common goal – an improved science education program. Themes emerged from the participants’ interaction with the data sets which shed light on their collaborative

process. These themes helped the researchers better understand the challenges and triumphs of their work to build a successful middle school science teacher preparation program.

## The Participants

The science educator in the collaboration brings sixteen years teaching middle school and high school science to the collaborative triad. During her inner city public school experience, she was closely involved with the American Association for the Advancement of Science (AAAS) Project 2061’s K-12 national reform effort in science, mathematics and technology education as a Project 2061 Texas team member. Her early teaching experiences were enhanced through collaborations with scientists and educators from across the country including Jim Rutherford, Andrew (Chic) Ahlgren, and Joellen Roseman, key visionaries that produced critical reform documents such *Science for all Americans*, *Benchmarks for Science Literacy*, *Designs for Science Literacy*, *Blueprints for Reform* (AAAS, 2002), and the *Atlas for Science Literacy*. This science educator was charged early in her science teaching career to become an ambassador for science literacy, a challenge she took very seriously. After becoming a National Presidential Awardee for Excellence in Science Teaching, she shifted her work to higher education and for the past thirteen years, she has been teaching science methods to prospective elementary and middle school teachers. Her role in the collaboration was to promote new and innovative ways of thinking about middle school science teaching and to educate the science faculty about the state standards for middle school science teaching with the Texas Essential Knowledge and Skills (TEKS); Career and College Readiness Standards (CCRS); and the Project 2061 reform tenets. She also worked on reducing the physical barriers of the

university campus by walking to and from the College of Arts & Science once a week for regular “dream building” sessions with her two other main collaborators.

### **The College of Arts & Sciences Mathematics Educator**

The mathematician, or rather as he would prefer to be identified, the mathematics educator in this story played a critical role in creating and sustaining the significant relationships within the collaboration. His prior career in the Air Force provided the foundation for the many tactical and logistical approaches to bringing key players together. He knew exactly who to talk to first, what groups to gather informally and formally to share our ideas for the innovative program. His middle school and university mathematics teaching experience afforded the necessary understanding of appropriate pedagogy and content for the science and mathematics disciplines. In fact, the highly successful mathematics education program (arguably the best in the state) served as a model for building the middle level science program. His constant energy, friendly demeanor coupled with the knowledge of how to navigate the hierarchy that comprises the university system were invaluable to the overall collaborative effort. He was not simply the glue that held the group together but the “superglue!” He was also the collaborative initiator.

### **The College of Arts & Sciences Research Scientist & Associate Dean**

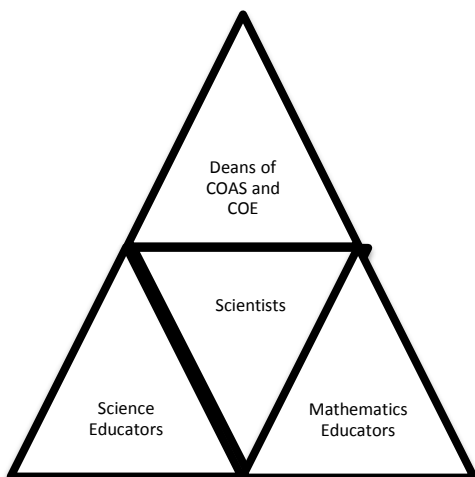
The scientist in the story is an entomologist/parasitologist who also was the Associate Dean of the College of Arts & Sciences. She was more than willing to take on a worthy project that would mean better prepared middle school science teachers. Her position and her passion for the innovation moved the collaborative

effort closer to its goal. Her communications to the science department chairs were crucial to the ongoing participation and support of the project. She was completely committed to seeing this project to fruition. Her guidance and “reality checks” meant a great deal to the scientists and was, most likely, the primary reason for the high attendance at meetings. The science faculty had a great respect for her expertise as she was truly, “one of them.” Her knowledge of the curriculum process was a strength as well. She kept the group informed of the deadlines for submitting new course proposals as well as what possible barriers to anticipate with regard to the department/college political climate.

These individual collaborators came together each week for two years to grapple with how to develop a new program for middle school science. They dreamed, argued, debated, celebrated, and experienced the unique phenomenon of very different faculty members coming together to build something worthwhile – a middle school science program with newly aligned, inquiry-based, project-based science courses. Their relationship formed a very supportive “triad” structure that showed others that with teamwork and commitment, that effective communication between the Colleges could occur and curricular change could happen. See Figure 2 on next page.

### **What worked for us -- Key factors of Collaboration at the University Level Establishing University Partnerships**

Four years ago, there was virtually no contact among the science department chairs in the College of Arts and Sciences and the primary science educator in the College of Education. The mathematics educator on this project set up initial contacts and meetings among these key players. Another key player in establishing these



*Figure 2.* The three essential components of the triad that hold the collaborative together are the science educator, the mathematics educator and the scientists. The college deans are represented at the top of the figure to illustrate their overall direction and support.

collaborations was the Associate Dean of the College of Arts and Sciences, who strongly supported improving science teacher preparation programs, and who chaired frequent meetings among scientists and educators. Initially, most science department chairs were not excited about enhancing the science teacher preparation program at our university, and were more focused on recruiting students as majors in their respective departments. As a result, there were only a few students seeking high school science teaching certification, and none seeking middle school science teaching certification at our university. However, these initial meetings opened up communication channels and regular meetings began. With communication, collaboration began.

### **Support from Key Administrators**

Once an initial vision of our program was created, presentations were made to the Deans of the Colleges of Arts and Sciences and Education. Both Deans enthusiastically endorsed creating a model science teacher preparation program,

recognizing the need for exceptional science teachers in our public schools. Without the strong support from the Deans, it is unlikely that science department chairs and key educators would have responded favorably to this effort. It was important for the Dean to assure science faculty members that work on this project (in addition to hard research within their discipline) would be respected and honored. Most university faculty members are very busy within their own domains, and it takes special interest in a new project to dedicate precious time. Course release time and other support would help even more, but we did not have this as an option at our university. In addition, the Associate Dean of the College of Arts and Sciences communicated directly with the science department chairs, scheduled meetings, and served as a bridge between the two colleges. The top-level enthusiastic approval of the project helped science department chairs realize the importance of the project. This would have been harder to accomplish if only a science educator in the College of Education were dealing with science department chairs.

The Dean and Associate Dean for the College of Education expressed their strong support for the collaboration via these email correspondences.

*This is SO great! Thank you so much for all your thought and hard work on this vitally important issue. I am excited about the possibilities.*

*This is so exciting, and I'm so glad you all are doing this work.....our university really could be a leader in Texas in science education. And, since candidates planning to teach science are eligible for the TEACH grants, they could have their tuition and fees entirely covered for their junior and senior years! We really look forward to the*

*development process and to the new beginning for middle school science education. You three make a fantastic team!*

### **Communicating the need for a new science teacher preparation program**

Several years ago, the State of Texas changed the certification levels of teachers to grades 7-12; 4-8, and Early Childhood-6. The 7-12 certifications only cover the high school science teaching requirements, and the EC-6 certification prepares teachers for the elementary grades. Because the EC-6 program is very popular with pre-service teachers, middle school programs (grades 4-8 certification levels) saw reduced enrollments. At our university, the 4-8 science teacher certification plan was deleted due to low numbers of students. So, who will teach middle school science in the future? (Authors, 2010). The need for a middle school certification program with strong science content and pedagogy is very high. Once scientists at our university realized this, they raised their commitment levels to our project.

In November, the Associate Dean for the College of Arts & Sciences, in an effort to jumpstart the collaborative effort to revive the middle level science program at our institution sent a long email to the science and education department chairs and copied to the Deans of both Colleges. The emailed outlined the need for collaboration and recapped efforts during the preceding two years (see Appendix 1). That email was followed by another email setting a date to begin work on the middle grades certification program (see Appendix 2). The second email was also sent to key science faculty.

### **Mutual Respect and Appreciation for Science and Education Faculty**

At regular meetings with the science department chairs, the need to improve science teacher preparation programs, vision sharing, and program development guidelines were analyzed and discussed. These discussions were sometimes heated, yet, over time, there developed a sense of respect and appreciation for the positions, ideas, and limitations of both the scientists and educators. This was not easy to accomplish and it was sometimes difficult for scientists to visualize good educational practices, and also for educators to understand the requirements of rigorous course study in the sciences. But scientists began to empathize with the need to create a great teacher preparation program, and educators came to understand the needs and limitations of the science departments. Gradually, we made compromises and we developed a great vision for our program together. This would not have happened without respect and appreciation for each other.

### **Team Building**

Once science department chairs committed to the program, we recruited volunteer science faculty members in Biology, Physics and Chemistry who were interested in the teaching side of science, and who were passionate about our mission to create a model science teacher preparation program. Now it was time for the detailed work to begin. Because these scientists strongly believed in this program, they worked diligently to construct the science course content needed to best prepare future science teachers. The science educator worked closely with the scientists, and strong bonds were formed among these faculty members, with high levels of respect for each other, and good understanding of the needs of the program. This working group was the heart of the collaboration effort. In fact, these

same dedicated faculty members also began to work together on other related projects, and one result was submission of a National Science Foundation grant proposal for scholarships for future science teachers.

### **Overcoming Hurdles – Moving Beyond the Misunderstandings and The Harsh Reality that Change is Difficult**

“Everyone in the College of Education should be shot!” These words still resonate with the science educator at the very first meeting with the group of scientists to discuss the possibility of a new middle school science program. The antagonist was a distinguished professor who wanted to make it quite clear that he was not happy with how things were done in the College of Education. Rather than back down, cave in, or run-away from the direct assault, the science educator discovered why he felt this way. As it turned out, his course was haphazardly removed from the 4-8 integrated mathematics/science degree plan implemented in several years before. This faculty member had good reason to be upset. His lively debate and argumentative style could have been a bit difficult to take; but, he was the very person who would leave the meetings with negative comments and then send thoughtful, reflective, and brilliant communications to the group about how to better prepare prospective science teachers. The multi-page email can be found in Appendix 3.

Disagreement and compromise are expected and necessary – we must overcome the deep antagonism. It becomes very personal. Because there was disagreement, a better program evolved. Collaborators must not expect a group of “Yes-men” and they do not want them either. The power of the collaboration lies within these provocative conversations. This is a painful process because people generally don’t like to be disagreeable. Again, Carr (2002) reminds us that

scientists and educators represent entirely different epistemologies and academic cultures. After the dust settles, we realize that we all saying the same thing, yet in different ways. Our goals were not that far apart. There was not a huge valley between our positions and vision.

Continuing conversations and overcoming perceived obstacles became an important and necessary part of the collaborative process. A special meeting was set up to meet with the Geology department chairs to discuss the draft Middle School Science plan, and many of their suggestions were incorporated into the revised plan.

### **Feelings of Discouragement**

There were times when the core collaborators left meetings thinking that our “vision” had been squelched or waylaid by the scientists. Nonetheless, the passion for the program was still there—so we recharged our batteries, revised our goals, and set up another meeting to discuss our plan of action. Over time and some degree of compromise a stronger program evolved and that was supportable, sustainable, and had the buy-in of the scientists. We all have automatic negative reactions to change, to education; to teaching . . . we are all programmed to protect our empire and epistemologies. Frustration was a two-way street. The science educator did not understand the resistance by the science faculty (many of whom had served as department chairs and deans). “We can’t do that.” “We have never done that before.” “We don’t have faculty lines to teach those courses.” “Why not just use our existing courses.” The science educator wondered why the scientists were resistant to the idea of creating the ideal without worrying about the obstacles. Why were these scientists so concerned with why this will *not* work rather than the possibilities that could exist if

we create it? Again, compromise and understanding each collaborative member's patterns of difference seemed to help us to overcome some potential paralyzing obstacles. Reaching a "common ground" and understanding the professional cultures of the scientists and educators in the group made the difference.

### Summary and Implications

The lessons we learned from our collaborative experiences were many. When working with scientists and educators, the following actions are critical to successful collaborations.

- Identify a shared need
- Achieve support from key administrators
- Know your collaborators and their patterns of difference
- Demonstrate mutual respect and appreciation for science and education faculty
- Recruit enthusiastic and talented faculty to form a working team
- Recognize that disagreements are a healthy part of the process
- Expect to be discouraged and, most importantly, don't give up!

These actions sustained our efforts to create a strong science program at our institution and led to enduring professional relationships between and among faculty and administrators from both colleges within our university.

We see our collaboration to build a middle school science program as a successful endeavor. We accomplished our initial goal of aligning a set of science courses to the Science TEKS and the *Texas Career and College Readiness Standards*, created scope and sequences, course descriptions, we have mapped out an exciting degree plan for the

new middle school science teacher preparation program which is strong in content and includes extensive field experiences. We have reached consensus with regard to having our program recognized by both college administrators and key faculty. As our journey continues, relationships have to be maintained, communications must continue. We have plans to present the new courses to each of the science departments for their approval before it moves through the formal institutional curriculum process. We are very excited about the new Interdisciplinary Science Literacy course that will serve as a recruiting ground for future middle school science teachers as well as the upper level biology and physics courses that will use inquiry, project, and problem-based approaches. The bottom-line to the success of creative collaborations is that there is no secret formula to getting it done. The process is tricky, egos must not get in the way of ideas, and key support structures through productive relationships are necessary. A greater commitment by science faculty to focus on science teacher education could drive education reform at universities and K-12 classrooms. Communication and patience are needed. Effective collaboration does not happen overnight.

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## Appendix 1

Sent: Wednesday, November 11<sup>th</sup>  
To: Science Faculty  
Cc: College Deans and Department Chairs  
Subject: Middle-level science teacher prep

Dear Science Educators,

As you recall, last spring we met to discuss a potential model middle level science teacher preparation program at SHSU. We appreciated your input, ideas, expertise, and positive response towards this endeavor. Even though we have all been extremely busy with NCATE accreditation, conferences, teaching, and research efforts, we have managed to find some time to move forward with this project, incorporating your input from last spring. We are now to the point that we have a number of items ready for discussion and further input.

Over the past two years, interested faculty from the College of Arts and Sciences (COAS) and the College of Education (COE) have been working together to strengthen an almost non-existent middle level science teacher preparation program at SHSU. We are in the initial stages of designing five new science courses targeted specifically to middle school science teacher candidates. Our goal is to align the five courses to the TCCRS and at the same time further develop the courses at the scope & sequence level. Our plan is to invite a talented COAS faculty from physics, geology, biology and chemistry with a science educator from COE to align the Texas College and Career Readiness Standards for Science (TCCRS) with the new innovative, interdisciplinary science content courses. The TCCRS will serve as a framework and provide a necessary infrastructure for as these new science courses as they come to fruition. We are proposing a standalone 4-8 Science Program in which we recruit earlier in their program to turn teacher candidates on to science, strengthen science content knowledge with additional courses specialized for middle level education; and align content of those courses with what these students are expected to teach (Science for all Americans, National Science Teachers Association standards, the TCCRS, and the TEKS framework for middle school science).

The second item for your consideration is a proposed sequence of courses for this program (see attached file “program proposal”). Briefly, we propose two, 3-credit hour freshmen level interdisciplinary courses, one each, 4-credit hour upper level course in Biology, Geology and Physics, and four freshmen level courses already offered by our science departments. This proposal is based on the new TEKS (Texas Essential Knowledge and Skills) framework for middle school science. The new TEKS focus primarily on physical science, life science, and earth and space science. What we hope to discuss with you is whether you feel that our proposed sequence of courses adequately addresses these standards and based on these standards if you feel we should also include an upper level chemistry course in the proposed course sequence. I have attached an electronic copy of the new

TEKS.

We have developed a VERY preliminary scope and sequence for the two new freshmen level courses using the TEKS as a guideline and based on the text book “The Sciences: An Integrated Approach” 5th ed. by Trefil and Hazen, 2007. I have attached draft forms for these two courses and we are hoping to discuss our ideas with you.

If you are interested in continuing the discussion about creating an excellent program for middle-level science education, please let me know if you are available for a meeting either November 17th or December 1st at 3:30 PM in the COAS dean’s conference room. Also, please invite any other faculty in your departments that you feel would be interested in pursuing the development of such a program.

Thank you so much for your consideration. We look forward to hearing from you soon.

Cheers

## Appendix 2

Hello all,

We hope that your semester is off to a great start and that you are ready to continue discussing middle-level science teacher preparation. We feel that the discussion thus far has been very productive (and provocative at times) and are eager to start developing a plan. To that end, I have attached a document outlining some ideas stemming from our initial discussions. Through continued discussions, we would like to have the foundation laid for a middle-level science teacher preparation program by the end of the semester. Please let me know at your earliest convenience if you are available for a meeting on Monday February 8th at 3 p.m. to discuss the attached document.

All the Best.

### Appendix 3

**To:** The Science Collaborative Team  
**From:** Geology Department  
**Date:** November 20<sup>th</sup>  
**Subject:** Middle School Science Teacher Preparation  
**CC:** Science Department Chairs

Please see my attached response. It is meant to be provocative.

Permit us to offer some comments by way of a follow-up from Tuesday's meeting as well as response to Science Department Chair memo of November 19<sup>th</sup>.

#### **Scientific Literacy**

Obviously, I endorse the basic thesis of the memo: the underlying copout that pervades, so it seems, the whole of science teacher preparation is a continuing scandal – both institutionally and nationally. Ultimately the solution to the ills of all levels of science education – but particularly K-12 – is to actually impose some real rigor. Colleges of Education must seek to move beyond the Detroit model (*viz*: ill-trained, border line illiterate students churned out like so many irrelevant gas guzzling monster SUVs that are justified in terms of “volume” rather than anything that connects with relevance or modernity or real rigor.) As far as I am concerned only the highest possible standards should be acceptable in terms of preparing students for the critical task of teacher training – offering contentless or dumbed-down (“for non-science...”) or baby math courses (here I do not include customized math course such as the X8X course) should not be an option for any prospective teacher, no matter the grade they intend to teach.

While I strongly endorse the concept of a science facility that addresses the specific needs of middle school teachers I also feel that to only focus on this grade range is to apply the Band Aid a tad too late: the damage has already been done to school children by equally limited elementary teachers who are perhaps even more math and science phobic. If colleges of education are to genuinely attempt to deal with the crushing scientific and mathematical illiteracy of teachers they will have to revise their requirements for all teachers. Given the dependency of the United States on science and technology it is beyond my comprehension that critically important elementary teachers are to all intents and purposes little better than the modern equivalent of those wonderful ladies that populated the dame schools and the single room schools of the eighteenth and nineteenth centuries: kind to children, competent at instilling basic values but woefully undereducated when it comes to science and mathematics. It is this part of the educational system that instills the basic malaise of math and science phobia. Elementary teachers who encounter such a shallow education in science and mathematics beget future generations of young people who are wonderfully motivated to teach but who lack a solid half of what is now required of modern teachers. That being said I do admire the clever approach at relevant customization that underpins our existing Math Education approach. I think we can and should respond positively to its transfer to Science.

#### **Science Education Resource Center (SERC)**

I support the notion of the development of some form of Science facility to be housed in the College of Arts and Sciences. While a model based on the present configuration of Math Education seems desirable there are some serious challenges to a simple copy. Math is a single discipline. The sciences are necessarily all different. Thus, they need a more complex system of loose affiliation that leads to a meaningful amalgam composed of different, mutually respectful, disciplines. My colleagues suggest a hub-like configuration and propose a notion of a “Science Education Resource Center”.

The Center might offer courses in its own right – content loaded Science Foundation Course(s) including, perhaps SCI courses such as the existing Fundamentals of Sciences courses that appear to me to be ill-housed in individual discipline departments; cross-listed science discipline courses; or upper level capstone course(s). The Center would also provide to the scientific disciplines insight and guidance as to how best to customize their content, order, pacing, etc. that would best service the specific pedagogical interface needs of this program. However I do not foresee the educational weak dog wagging the scientific tail.

### **Geoscience course offerings**

As Chemistry Chair noted, Geology and Geography do not offer “not for science majors” courses. All of our introductory level courses (GEL132/112 Geological Hazards; 133/113 Physical Geology; 134/114 Historical Geology; GEO 131/111 Weather and Climate) exist as part of the science core and are used to various degrees as prerequisites for upper level courses in the majors. It would be a relatively simple task for us to identify and customize either individual sections for 6-8 science teachers or to engineer combined courses (for example, our reading of *Texas College and Career Readiness Standards* appears to demand not just an introduction to Physical Geology (GEL133/113) but also to Historical Geology (GEL134/114) and also to Weather and Climate (GEO131/111). Perhaps three full individual courses from a single discipline would be unfair to the other disciplines and it may perhaps be better to think about a combined foundation course in Earth (Geological) Science (GEL133/134).

Beyond the introductory foundation level we might contemplate a selection of existing and new courses that would reflect the sort of structure outlined (by our chemistry professor) on Tuesday – rigorous content-heavy courses that also specifically bridge down to the limited foundation provided by the 100-level courses. In the development of the detailed content of these courses we envisage some significant guidance and nudging from our science educator to make them sensitive not only to our particular scientific discipline but also to the customized needs of grades 6-8 teachers-to-be. Our broad, possibly integrated, focus for all three grades but specifically for Grade 8 requirements would be on *Earth Cycles*. To this end we are cogitating (!) the following:

#### Page 3

#### **Existing Courses:**

GEL 330 Oceanography	Already directed at an education and/or general science audience Could be adapted to deal more directly with Ocean/Atmosphere cycles Already contains a Human impacts component
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#### **New Courses:**

GEL 38X Earth Cycles	Biogeochem (C; S, O, Hydro, etc.) cycles in space and time
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Rock/Wilson Cycles  
Human impacts and influences

GEO 38Y Climate Cycles    Global Climate Change  
   Biogeography  
   Human impacts and influences

Both Geography and Geology would like to be active players if this proposal moves forward. We foresee a symbiotic linkage for certain new courses that would service both a Science Education purpose and, perhaps, also a major(?) / minor purpose. However, like Chemistry Chair, we are presently at, indeed beyond, capacity with faculty already teaching overloads in order to accommodate our basic major/minor teaching responsibilities. For the time being I doubt that any contribution that we might make will amount to much more than applause from the sidelines! For this idea to move forward into reality will, I suspect, need some senior level input to reallocate certain faculty resources.