A. Background
Mountain top removal, coal slurry pond failures, rural health care delivery, and economic underdevelopment are of profound concern to the residents of Kentucky, especially Appalachians. At the same time, three populations of students — young women, African Americans, and those from Appalachia — are seriously underrepresented in STEM disciplines. This confluence of problems and underrepresented students creates an imperative to develop programs that will encourage and support these students to major in the STEM disciplines, which will enable them to return to their communities and become positive contributors to the solutions (George et al., 1996). Furthermore, this situation is not limited to Appalachia. Global regionalism teaches us that similar problems exist elsewhere in the US and throughout the world. By addressing the situation in Kentucky, we can develop models that can be applied elsewhere with equally positive impact (Reid & Taylor, 2002).

The Mission Statement of the University of Kentucky (UK) states, in part:

UK is a comprehensive, public, land grant university dedicated to preparing students for an increasingly diverse and technological world, and to improving the lives of people in the Commonwealth, the nation, and the world through teaching, research, and service.

In furtherance of this mission, UK has been dedicated to identifying, supporting, educating, and graduating students from the traditionally underserved populations of the Commonwealth, especially Appalachian and minority students. For example, for 25 years, UK’s Appalachian Center has been helping to fulfill the commitment to study the region, to educate the country regarding the realities of the region, to dispel the myths and stereotypes that linger, and to improve the quality of life for the people of Appalachian Kentucky and the larger Appalachian region. In addition, UK has undertaken a significant number of initiatives that specifically target Appalachian, minority, and women students, such as its minority Engineering program, Robinson Scholars Program, and the Appalachian Rural Systemic Initiative.

Reaffirming this commitment, in his inaugural address in 2002, UK President Lee T. Todd, Jr. said:

We must be a University whose students are motivated not only by our high expectations for them but also by our strong nurturing of them... A second priority in my vision is outreach — both local and across the state...

We must continue to build our reputation nationally and internationally with our research and service accomplishments. But we must also have an impact in Lexington and across the Commonwealth.

In addition to the programs directed specifically at Appalachian and minority students, UK has a large number of programs intended to support undergraduate students in STEM disciplines in general; for example, UK’s Undergraduate Research Program (UK URP) and the Beckman Foundation-funded Undergraduate Research Scholars program.

Given this clear commitment and array of special programs, UK will seize the opportunity and foundation to create a broad, coordinated effort to recruit, retain, and graduate undergraduates from Appalachia and other historically under-represented ethnic groups who intend to or who are currently majoring in STEM disciplines. Because the number of Hispanic and American Indian students at the University is very small (less than 1%), African Americans will constitute the largest ethnic minority group of students served, however, any student from any underrepresented population interested in a STEM major will be included. This proposal presents an overall strategy to create a program called UK AMSTEMM (University of Kentucky Appalachian and Minority Science, Technology, Engineering, and Math Majors) that will 1) coordinate with and build upon the existing programs, 2) add several additional elements and support mechanisms designed specifically to target Appalachian and minority students, and 3) meet the requisite needs that have been identified to ensure the success of these students. A three-pronged approach is envisioned: 1) to identify, encourage, and recruit middle and high school, and enrolled first-year math students who have an interest in STEM subjects; 2) once they matriculate at UK, to support and retain these students through their first two years of college before they actually enter the major; and 3) when they are majors, to provide them with support to complete the major in a timely fashion and to graduate.

B. Proposed Program
UK AMSTEMM is designed to increase the number of Appalachian and minority students graduating in STEM disciplines, and will:

1. Identify and encourage more potential STEM majors from Appalachia and minority populations by employing current Appalachian STEM
majors to visit their high schools; by enhancing the existing programs of early identification, especially those programs that target pre-college students in their schools and communities; by establishing close connections with appropriate high school faculty and counselors in STEM subjects; and by targeting capable, interested students in special sections of pre-calculus who will be recruited to redirect their choices of majors to STEM subjects. (See Section F., Recruitment Phase.)

2. Help these students integrate the many disciplines that relate to real world problems and to tie the study and solution of these problems to their communities in Appalachia and other target minority locales by developing and offering interdisciplinary, place-based Discovery Seminars, enrichment seminars, and STEM courses focused on significant local concerns, such as mountain top removal, coal slurry pond containment, rural health care delivery, or rural economic development. “Place-based” is a phrase that derives from the growing recognition that context and locale provide an important foundation and incentive for students in their studies (Raymer, 2001). When a subject is related to the student’s personal experience of and deep interest in a home community, the student’s understanding is often increased and there is a much greater impetus to apply problem-solving skills (Harvard Graduate School of Education Rural Challenge and Evaluation Program). (See Section F., Retention Phase.)

3. Strengthen the math education of these students by expanding the Kentucky Early Mathematics Testing Program (KEMTP) and the Delay-ed Credit Program, by offering an intensive college algebra course during their pre-first year summer, and by developing one or more collaborative learning (Math Excel) sections of pre-calculus courses. (See Section F., Recruitment and Retention Phases.)

4. Enhance students’ sense of being a part of UK and a “community of scholars” by supporting a bi-weekly research colloquium in which all UK AMSTEMM students and faculty mentors participate. The colloquia will include presentations by both students and faculty mentors concerning their on-going research; group discussions of the research, including its methodology and applications; and guest presentations such as career planning and place-based enrichment seminars. (See Section F., Retention and Graduation Phases.)

5. Strengthen support and advising for Appalachian and minority STEM students by establishing an office, including a dedicated professional advisor as well as faculty- and peer mentors, which will make available to these students information and counseling regarding all of the available programs, support opportunities, and academic program planning, as well as timely interventions based on student grades on individual assignments in key courses, and overall performance. The office will work closely with the UK Council of Appalachian Student Support (CASS) and the Office of Multicultural and Academic Affairs to coordinate with existing support services. (See Section F., Retention and Graduation Phases.)

6. Financially support, strengthen the educational experience of, and retain Appalachian and minority STEM students, by allowing them to realistically afford to attend UK, by 1) establishing an undergraduate research fellowship program that will provide a stipend in exchange for which the student participates in a mentored undergraduate research experience, and 2) providing support for upper-division Appalachian and minority STEM majors to serve as recruitment ambassadors, Math Excel peer tutors, and general peer mentors. (See Section F., Retention and Graduation Phases.)

7. Disseminate results of the program as widely as possible via a web site, a newsletter, professional publications and presentations by both the senior staff and the student participants, and a national conference on NSF STEP with published proceedings. (See Section I, pts. 5-8.)

8. Implement the model detailed in Section G. for coordinating this support in the future by working closely with the directors and chairs of the various programs and departments and UK central administration to design an administrative structure and a funding mechanism that will enable the continuation and strengthening of the program after the initial grant period is completed.

C. Present STEM Demographics at UK

As shown in charts 1 and 2 above, in Fall, 2003, UK’s total undergraduate enrollment was 18,190. Only 2,530 (13.9%) of these undergraduates come from Appalachian counties in
Kentucky (as defined by the US government). 2000 census figures show 27.64% of Kentucky’s population residing in Appalachian counties. Therefore, Appalachian students are underrepresented by about half (13.9% versus 27.6%) compared to the general population.

At UK, 13 majors (biology, chemistry, geology, math, physics, and 8 engineering specialties) plus 8 pre-engineering programs are within the STEM disciplines. UK had 3,005 students in these 21 STEM programs in Fall, 2003 and 540 students graduated with bachelors degrees in one of the 13 STEM majors. Of the enrolled STEM students, 559 (18.6%) were from the Appalachian counties. Of the graduates, 79 (14.6%) were from the Appalachian counties. Therefore, enrolled Appalachian students are underrepresented by approximately one-third in the STEM disciplines versus the census figures (18.6% vs. 27.6%).

Appalachian students are majoring in STEM disciplines at a higher rate (22.1%) than non-Appalachian students (15.5). In addition, Appalachian students constitute a much larger proportion (18.6%) of STEM majors than their overall representation in the undergraduate student body (13.9%). These data are a clear indication of their interest in these majors. However, Appalachian students constitute a somewhat lower percentage of the STEM graduates (14.6%) than their percentage in the total STEM undergraduate population (18.6%), indicating their ability and determination to complete their bachelors degrees in these fields, but also the great importance of and need for the retention and graduation programs proposed as part of UK AMSTEMM.

Interviews with high school students, their teachers, and UK students and alumni, suggest strongly that these students are particularly interested in subjects that will prepare them to return with the skills to make a positive impact on the quality of life in their communities. Therefore, Appalachian students constitute a significant potential pool of STEM majors.

In contrast to the favorable proportion of Appalachian undergraduates in STEM majors, the proportion of women in these majors (26.9%) is much lower than their proportion in the total undergraduate population (52%). Of the Appalachian STEM majors, the proportion of women is almost identical, 26.8%. UK AMSTEMM will work closely with the existing recruitment and support programs at UK specifically directed toward women and will endeavor to bring an increased number of women into the STEM majors, especially through the Math 109 recruitment program described below.

Programs that directly target women already enrolled in college, such as the “Women in Science Program” (Dartmouth College, 2003), acknowledge the need for early intervention, and have made heroic efforts to provide intervention strategies that support their women students. These programs have shown measurable success (Mulder & Pavone 1997). Based on this previous research, UK AMSTEMM will include an aggressive effort to redirect into STEM majors those students, especially women, enrolled in a special pre-calculus course. However, it must be recognized that many studies (e.g., Noland et al., 2001) have found that in order to persuade young women to enter STEM fields, they must be approached no later than middle school and supported thereafter. Therefore, UK AMSTEMM will work with the other UK programs that reach students this young to bring them into the UK AMSTEMM program as they matriculate.

In 2003, there were 181 minority bachelors degree recipients at UK. Of these, 17 (9.4%) were in the STEM disciplines. Minorities constituted about 3% of the STEM graduates, less than half of their proportion in the student body (6.5%). The pool of minority students both in the state and enrolled at UK is considerably smaller than the pool of Appalachian students, but indications are that the Hispanic population in Kentucky is beginning to grow rapidly. UK AMSTEMM will have a positive impact on the number of minority students who choose to major in a STEM discipline and who eventually graduate in that field. Because both minority students and Appalachian students often experience marginalization and isolation, bringing them together will help both groups and will contribute to breaking down some of the cultural barriers.

Proposed increases in enrollment
The first year of the UK AMSTEMM program will be devoted largely to the initial recruiting efforts and developing the support materials, courses, and programs for the increased number of students. The primary goal of the program
will be to increase the number of Appalachian students in STEM programs by at least 50 students per year (about 1 per Appalachian county) over years 2-4, and the number of minority students by at least 10 per year, to a total of almost 950 by the end of the 5-year grant period, a 34% increase. This would raise the percentage of Appalachian students in STEM majors to approximately 23%, a significant step toward proportionate representation relative to the population. In addition, the number of minority students will be increased by at least ten per year. In both of these populations and especially in the special sections of pre-calculus, women will be targeted for recruitment. A third goal is to support these students so that they remain in the majors and graduate “on-time.”

**D. Results of prior and continuing efforts**

UK has a long history of providing special programs and support for minority and Appalachian students, both in the STEM disciplines and across the rest of the curriculum. A recent compilation contains 24 different programs (including 15 specifically targeted to Appalachian students) for young people from as early as grade 6 through those already admitted to UK. These programs include summer camps; campus visits; workshops for students, faculty, and teachers in their own communities; mentoring arrangements; research experiences; tuition assistance; math early testing and delayed credit programs; and intensive pre-first year summer preparation courses.

Qualitative evidence from each of these programs supports their effectiveness. There has been some quantitative research that further confirms the value of the programs. Noland, et al. (2001) report statistically significant improvement in several variables comparing scores on pre- and post-tests, including increased science knowledge and confidence in science, among girls in their program designed to encourage girls from Appalachia to pursue scientific careers in drug and alcohol research.

Another objective measure of the success of these programs is provided by the annual reports of the “Freshman Summer Program” (FSP), which provides intensive summer training in math for minority students about to enter their first year at UK. Students who completed the FSP had significantly higher grade point averages in their math and sciences courses in their first years compared to students who did not take the program.

A third objective measure of the success of these programs is included in the report (Goan, 2002) to the UK Board of Trustees by the Director of UK’s Robinson Scholars Program (RSP), which serves first generation college-bound and college-enrolled students who have demonstrated the potential to succeed but who might encounter economic, cultural, or institutional impediments to their completion of four-year college degrees. In the RSP, students who enroll in college are performing well and persisting. The overall college retention rate is 92% (compared to about 79% for all students at UK) and the students’ mean and median college grade point averages are higher than those of non-RSP Scholars in the same cohorts. Similar success rates can be cited for the other programs. However, there is still a major untapped and underserved pool of students who need to be recruited, retained, and graduated in the STEM disciplines.

**E. UK’s plan to increase STEM majors**

UK AMSTEMM will employ a three-pronged approach to increasing the number of students majoring in and graduating from the STEM disciplines consisting of recruiting, retaining, and graduating students from the target populations.

Given the magnitude of the UK AMSTEMM program and the large number of existing and planned programs for Appalachian students, the first step is to work closely with the UK Council of Appalachian Student Support (CASS) to take advantage of, build upon, and avoid duplicating the myriad of existing programs and support systems, none of which focus specifically on STEM students. In this way, UK AMSTEMM students, faculty, and staff have a single focused point of reference, considerable efficiency is achieved, and significant synergies are developed. Furthermore, UK AMSTEMM will add the major additional components detailed below to the existing array of programs, providing greatly increased support for underrepresented students majoring in STEM disciplines.

![Figure 1. The UK AMSTEMM Program](image-url)
Clearly, UK AMSTEMM includes a large number of components with complex interrelationships. The entire program is depicted as a simplified schematic in Figure 1. Each component is explained below.

F. Specific strategies
In order to increase the number of STEM students, UK AMSTEMM will cooperate with a number of existing programs and new initiatives detailed below will be undertaken. The activities are organized according to the three phases: recruitment, retention, and graduation.

Recruitment Phase

Figure 2. Recruitment and Summer Programs
CASS — The UK AMSTEMM senior staff, especially the coordinator/advisor, will work closely with the Council of Appalachian Student Support (CASS) consisting of the leaders of each of the 15 independent UK-based programs that serve students from Appalachia, together with the chief minority student recruiter, to share information among the programs, to facilitate efficient utilization of program resources by sharing among programs, to coordinate related activities across programs, and to provide a smooth transition for students from their high school experience to their first year at UK. Although the CASS programs are not aimed specifically at STEM students, a significant increase in efficiency will be achieved by UK AMSTEMM catalyzing the sharing of information and experiences.

Pre-college math preparation — Many Kentucky students come to UK with inadequate math preparation. Yet math is the gateway to success in higher level STEM courses. According to AMSP findings, few Appalachian high schools provide math-related science courses such as physics or engineering, and there is little or no curricular connection made between math and science. Enrollment data indicates that about 70% of entering first year students must begin with pre-calculus or remedial courses, and this problem is reasonably constant over time.

Many UK students experience frustration and failure because they must take — and often repeat — courses covering material that they may have seen before but have not mastered in practice. They, therefore, leave UK or, at least, change their intention to major in a STEM discipline. Reported reasons for lack of success include insufficient preparation at the high school level, poor study skills, inadequate time devoted to courses outside of class, strong kin and community attractions for leaving campus on weekends, low confidence in their ability, and an attempt to learn in isolation from sources of help such as instructors, teaching assistants, and fellow students.

On the other hand, Kentucky’s high schools have the potential to prepare these students for college-level work, if students and their advisors are given reliable information and feedback about the student’s level of preparation and UK’s expectations for entering first year students. Once at UK, these students have the potential to learn, if they devote adequate time to their work and avail themselves of resources to help them develop conceptual and problem-solving skills. UK’s response to this challenge, already implemented in part in other NSF- and UK-sponsored programs, is twofold. The first part, early intervention at the high school level, falls in the recruitment phase of the UK AMSTEMM program. The second part of the response, collaborative learning, falls in the retention phase of the program and will be described there. The early intervention program includes testing, advising, and delayed credit programs:

1. The Kentucky Early Mathematics Testing Program (KEMTP). A cooperative venture of UK and Northern Kentucky University (NKU), mandated by the state legislature, this testing program allows high school students to take an on-line examination to assess their level of preparation for college-level math.

2. The Delayed Credit Program. AMSP is offering students in participating school districts an opportunity to earn college credit in calculus and pre-calculus courses by taking a placement examination administered and graded by UK and AMSP affiliate colleges.

UK AMSTEMM will expand these efforts first to the 14 Kentucky Appalachian counties not currently served by AMSP and then to a state-wide program to greatly increase the impact of these programs via a self-sustaining (through minimal fees) program of testing and counseling at the high school level, which will result in
a larger number of STEM students coming to UK without the need to delay their academic progress by taking remedial math courses. These programs will also serve Kentucky’s regional and private universities and the University of Louisville (UofL).

Workshops will be held in the 14 counties to familiarize high school guidance counselors with the delayed credit program. To forge ongoing relationships between high school math teachers and their colleagues in the Kentucky Community and Technical College System, at regional universities, and at UK and UofL, UK AMSTEMM will work with partners in AMSP and at NKU who are already involved in the KEMTP program and have developed extensive contacts at high schools throughout the state.

**School workshops** — building on the success of several of the current UK-based programs and the contacts made by them, UK AMSTEMM will organize and conduct workshops at local schools throughout Appalachian counties, coordinated with recruiting visits by UK’s admissions office, the UK minority recruiter, and representatives of the UK Career Center. Related workshops will be offered for students, teachers, and parents. The **student workshops** will focus on various examples of research being conducted at UK that will be of interest to the students and of relevance to their communities, and on career opportunities related to STEM disciplines, especially those that relate to their communities. At least part of the research presentation will be made by an undergraduate who is participating in research through the mentored research experiences portion of UK AMSTEMM. The goals are to enrich the Appalachian students’ science and math educations, to expose them to career opportunities related to STEM disciplines, to demonstrate to them the mentored research experiences and funding available to undergraduates at UK, to enhance their self-esteem, and to help persuade them to come to UK to major in a STEM discipline.

A lack of self-esteem is a major obstacle to be over-come with Appalachian students. John O’Brien (2003), winner of the 2002 Best Book prize from the Appalachian Studies Association, put it clearly: “. . . one of the student counselors. . . told me the most persistent problem she encounters is a lack of self-esteem. Bright, capable, young men and women do not think they belong in college because they are hillbillies.” These young people have been deceived by the inaccurate, derogatory stereotypes of Appalachian people. Similar statements apply to other minority students. One of the most important aspects of the UK AMSTEMM recruitment and retention activities will be to help these students dispel these misconceptions of their own abilities and potentials.

In addition, for young people from Appalachia and other minority students, kin attachments are extremely significant, as are their home churches, and their cultural heritage and peer attachments. These students often need to work to help support their families. All of these factors combine to make the pull of their communities particularly important (DeYoung, 2002; Photiadis, 1986, Raitz & Ulack, 1984). In the student workshops, these points will be addressed explicitly to help students understand them and use them to strengthen their UK education and make it relevant to their lives.

A final component of the student workshop will be to administer a 20-minute mini-KEMTP test to be graded immediately, with the results used to encourage students to take further math courses in high school. Then students will be shown the on-line version of the KEMTP. Thus, they will be enabled to gain a realistic assessment of their current ability and make appropriate plans to prepare for a STEM major at UK. Based on the results of these tests and other data, UK AMSTEMM will work with school districts to assist their understanding of how and where math curricula can be improved to provide their students with the skills necessary to be successful in college-level math.

The **faculty workshops**, organized by Dr. Osborn, Co-PI, who has considerable experience in this area with AMSP, will concentrate on research being conducted at UK, but the emphases will be on expanding the high school teachers’ science knowledge and making it relevant to their local communities, providing pedagogical strategies for appropriate student preparation in STEM disciplines, and informing the teachers about the research opportunities available to their students at UK. The parents’ workshops will be designed to demonstrate to them the relevance of the STEM disciplines and a STEM career for their children, the fact that their children are as capable as any others, that college is a realistic goal for them, the feasibility and desirability of having their children
major in a STEM discipline, and the support, both academic and financial, available for them at UK through UK AMSTEMM.

Parents are a key factor in student success (Fantuzzo et al., 1995; Henderson & Berla, 1994; Wilson et al., 1997). It has been found in retention studies that the difference between campus and home life is significant. The distance from a rural community or from an inner-city urban area to UK is great physically, culturally, and emotionally. There may be a fear of and lack of familiarity with the UK culture. Many potential students will be the first in their entire extended families to attend college. Those students who tend to go home every weekend experience sufficient disruption to their studies and their campus connections that they are less likely to form strong ties to UK and, thus, do not return for a second and subsequent years. Parents need to be helped to understand their role in facilitating their children’s transition to college.

It is obvious that it is necessary to approach students directly to recruit them to careers in STEM disciplines. It may be less obvious that their teachers and parents also need to be approached directly, especially to recruit girls. A number of studies have found stereotyping that may stigmatize careers in STEM disciplines for girls in general and for students from rural settings. Noland et al. (2001) make a strong case for directly involving both high school teachers and parents, based on their experience in Appalachia. The adults need to be convinced of the value of having their students and children enter these fields, and they must come to understand the cultural obstacles to be overcome by the children, so that they can provide as much assistance and encouragement as possible. UK AMSTEMM workshops will be based on these findings.

There is a collateral benefit to the rest of Kentucky from these workshops. Even if a student who attends a workshop chooses not to attend UK, he or she may very well be introduced to a STEM discipline and may elect to major in it at another college; their teachers will be better able to prepare additional STEM students because of their workshop participation; and their parents will be better informed about the STEM disciplines and about the university experience in general.

On-campus visits and workshops — in coordination with a number of on-going on-campus events, UK AMSTEMM will host visits by Appalachian and minority students, their teachers, and their parents, and will conduct workshops and tours for them at UK. For example, on-campus events will introduce the students to the STEM disciplines and curricula with the faculty and current students who are part of them, in the laboratories and other facilities where the students will study, should they come to UK. Campus visits by minority students and students from Appalachia to UK are even more important and effective than at most schools, because of the factors mentioned above of “distance” from UK and because of the feelings of inferiority and localism, in addition to the respect and reverence for UK. Not only is it crucial to introduce the students to the STEM disciplines, facilities, and curricula, but they also must learn how friendly, personal, and supportive UK can be, especially for UK AMSTEMM students. Also, they must be reassured that they are bright and capable of succeeding at UK.

Minority recruitment — Through its Office of Multicultural and Academic Affairs, UK conducts an extensive recruitment program for minority students. This program has been successful in bringing the current enrollment of minority students to 10% greater than the Kentucky general population. This recruitment effort is and will continue to be funded by UK. Even though less than 2% of the population of the Appalachian counties is minority (approximately 15,000 people), in the future, the state-wide minority recruitment effort, targeting counties with high minority populations, especially Hispanics (estimated to grow 35% in the next decade), will be closely coordinated with UK AMSTEMM recruitment activities to share events and resources, making both more efficient.

Pre-first year summer math course — In addition to the KEMTP and delayed credit initiatives directed at high school students in general, the UK Office of Multicultural and Academic Affairs and the Department of Mathematics offer an intensive preparation course for minority students admitted to UK, during the summer prior to their first year. The Freshman Summer Program (FSP) is a 6-week academic transitional program that orients first-year minority students to academic and student life at UK.

A Math/Science Team, in which each student is assigned to a faculty mentor, emerged as a component of FSP in response to the low
number of minority students earning degrees in STEM disciplines, even though they aspire to these majors when they matriculate. Such students often change their major after the “critical first year” because of their poor performance in their introductory math or science classes. However, students on the math/science team have demonstrated success: they often have the highest grade point average of any other group of minority students. Just as important, they utilize their faculty mentors throughout the academic year for advice and counsel. In some cases, the faculty mentors have been able to continue to engage the students in their research projects. Many of the students have gone on to participate in the Undergraduate Research Program (UK URP).

UK AMSTEMM will expand this offering to make it available to admitted Appalachian students for whom it would be of value. At first, one additional section of the college algebra course will be required. Based on the extremely positive impact noted above that this program has for minority students, it is clear that it will be of similar worth to any under-prepared UK AMSTEMM Appalachian students. They will begin their college careers with a positive experience: earning credits while becoming better prepared for their subsequent math and science courses; learning essential college study habits skills; becoming familiar with the resources available to them at UK; building their self-image and self-confidence; and making friends and developing relationships, both of which are key factors in being comfortable and remaining at UK.

Recruitment in Math 109 (College Algebra) — Math 109 is one more fertile area from which UK AMSTEMM students will be recruited. More than 1,500 students are enrolled in this college algebra course each fall. In Fall 2003, 488 women and 68 minority students earned either an A or a B in Math 109. However, fewer than 25% of these students who earn As and Bs eventually take any calculus course, and fewer than 5% take Calculus I, which is required of all STEM majors. It is clear from an inspection of the qualifications of Math 109 students (ACT and SAT scores, high school grades, and UK grade point average) that they are quite capable of continuing in math and a STEM major. Most of these students were advised to take Math 109 and then, perhaps, a terminal calculus course, because it might be the easiest way for them to fulfill UK’s basic math requirement or the math requirement of many other majors.

UK AMSTEMM will support a revision of Math 109 under the direction of Dr. Eberhart, Co-PI, to strengthen it to better prepare students for further study of math, including calculus and, hence, a STEM major (cf., letter of endorsement from the Math Department chair in Appendix A.) At their summer advising conference, all incoming UK students, particularly Appalachian and minority students, who express an interest in a STEM major, but who are not qualified to begin calculus immediately, will be directed to one or more sections of Math 109 that will have added content, an increased level of feedback, and significant collaborative assistance. Homework assignments will be delivered using the UK Web Homework System, to be printed off by the student, worked, and then the solutions submitted on-line for automatic grading and feedback. The Mathskeller, a campus Math Resource Center, will provide additional help. Students who are very successful in this enhanced Math 109 course (grade of A) will be advised to take Calculus I; those who are moderately successful (grade of B) will be advised to take elementary Calculus and then Calculus I or II. This effort will lead to an increase of at least 10-20 more potential UK AMSTEMM students each fall.

Retention Phase

Academic advising — UK AMSTEMM will work closely with the advisors already provided by UK and also will give students extensive specialized advising (Figure 3). Undergraduates at UK receive academic advising from different sources: students who have not yet declared a major are advised by UK’s Central Advising Service; students who have declared a major are advised by the Directors of Undergraduate Studies (DUS) and the faculty of their major departments. Undergraduate advising at UK is considered to be quite effective and professional, as...
determined by internal and external evaluations and by student surveys.

Special populations derive considerable benefit from having their own additional advising. For example, the Office of Multicultural and Academic Affairs, and the Robinson Scholars Program each provide additional advising and counseling for minority and selected Appalachian students respectively. **UK AMSTERM** students will benefit from the more intensive, personal advising to be provided by the program, including extensive information and support to help ensure that they are made aware of all of the special opportunities available to them and assisted in making appropriate academic decisions, including, for example, selecting the appropriate section of Math 109.

In addition, the **UK AMSTERM** Coordinator/Advisor (C/A) will meet with and advise each UK AMSTERM student regularly in individual and group sessions to offer assistance with the transition to college and with taking advantage of the special **UK AMSTERM** services and programs. The C/A will use the Learning and Study Skills Inventory (LASSI) as an important tool for helping **UK AMSTERM** students make the most effective use of their abilities and experience. The C/A will carefully monitor each student, especially those in their first semester, to provide immediate attention and intervention if there are any problems. For example, it has been found that first-semester students who fail the first exam in a STEM course are likely to drop that course or plan a change of major. Intervention at this critical juncture usually means the difference between retaining or losing these students.

In addition to regular academic advising, **UK AMSTERM** will provide faculty mentors for all students who are part of the program. These mentors, who will be trained in a special workshop concerning the particular needs and interests of **UK AMSTERM** students, will meet with the students a minimum of 4 times per semester. UK has a long history of providing faculty mentoring for undergraduates, for example through the UK URP, the FSP, the “Bucks for Brains” program (described below), and numerous STEM research and REU programs. Each of these programs has more faculty volunteering to mentor than required. Therefore, finding sufficient qualified and interested faculty mentors for **UK AMSTERM** is assured.

**Peer mentoring** — Based on the successful peer mentoring already in place in several departments and programs, **UK AMSTERM** will recruit and train upper-division Appalachian and minority STEM majors to serve as paid peer mentors and informal counselors to the new **UK AMSTERM** students during their first two years at UK. Peer mentoring is a win-win-win situation: 1) The lower-division students benefit because, in addition to becoming friends and role models, perhaps even “fictive kin,” peer mentors offer advice and support regarding decisions on all aspects of UK life, for example, class selection, study skills, time management, extra-curricular activities, and utilizing academic support services. 2) The upper-division students gain the satisfaction, the status, and the self-worth of their supportive role. And 3) the peer mentors’ pay serves as a form of much-needed financial aid for the upper-division **UK AMSTERM** students.

There is considerable evidence from studies of undergraduates who remain at UK versus those who leave that one of the major factors affecting retention is the formation of personal relationships with other students. Those who form such relationships are much more likely to be retained from their first to their second years. Those who do not form such relationships are much more likely to leave. Peer mentoring is designed not only to provide advice and guidance, but also to provide a personal network that will help encourage the **UK AMSTERM** student to return after the first year.

**Figure 4. UK AMSTERM Research & Education**

The research and education activities (Figure 4) will include the following:

**Place-based Discovery Seminars** — Many studies have found that intensive first-year seminars have a positive effect on student
performance, satisfaction, and retention (Barefoot, 2001; Belcheir, 2001; National Resource Center for The First-Year Experience & Students in Transition, 2000; Swing, 2002). UK offers new students the opportunity to enroll in a first-year Discovery Seminar. This highly praised program provides incoming first-year students with a small seminar, taught by a highly skilled and motivated faculty member, on a subject of deep personal interest to that faculty member, such as poverty and homelessness in Appalachia, the physics of time travel, and the science and politics of mercury. UK tracks students who take a Discovery Seminar: they return for their second year at a much higher rate than their peers who do not take one, and earn significantly higher overall grade point averages.

All incoming UK AMSTEMM students will be strongly advised to enroll in a Discovery Seminar. In each year of the UK AMSTEMM program, one or more STEM-discipline, place-based Discovery Seminars will be developed or refined and offered to incoming UK AMSTEMM students. The first such place-based STEM discipline discovery seminar is being developed currently and will be offered in the Fall of 2004 by Dr. Osborn, Co-PI of this proposal, on a pilot basis even before UK AMSTEMM begins.

UK has particular expertise in place-based education. The UK Appalachian Center, has sponsored a workshop for cultivating and promoting place-based education and published a report (Raymer, 2001) on the subject. The past President of the Appalachian Studies Association, Dr. Billings, and the director of the Discovery Seminar Program, Dr. Badagliacco, both Appalachian scholars, will serve as consultants to UK AMSTEMM to assist faculty members to develop new place-based, STEM-discipline Discovery Seminars for incoming UK AMSTEMM students, e.g., there is considerable controversy and concern in Appalachia regarding the mining process called “mountain top removal.” Basing a Discovery Seminar on mountain top removal will allow consideration of various scientific, ecological, political, environmental, economic, and social factors, and will enable Appalachian students to relate their studies to their home communities.

Mentored research experiences — There is undeniable evidence supporting the value and effectiveness of involving undergraduates in mentored research (e.g., the 7 articles in Kinkaid, 2003). UK URP, co-directed by the PI, matches undergraduate students with faculty members who include them in various capacities in their research and scholarly activities. UK URP has been successful in providing more than 150 interested students (every one who has applied) with the opportunity to experience scholarly activities at a very early stage of their undergraduate careers. These students are highly motivated and their retention rate is quite high.

UK URP students have the option of enrolling in a popular methods course in conjunction with their research experience. The course covers basic aspects of scholarly research such as conducting searches for authenticated materials, finding funding sources for research, preparing a grant proposal, and administering a research project.

UK AMSTEMM students in their first two years at UK will be strongly urged and expected to participate in the UK URP program and methods course as a means of introducing them to STEM research and exciting them about remaining and completing the major. To further encourage participation and to reduce the need for the UK AMSTEMM students to work while attending school, 8 to 12 of those students each year (24 total by year four) who join UK URP will be provided with a stipend of $750 per semester and $2000 per summer for their research. Both the research experience and the financial assistance will serve as strong inducements to enroll in the first place, to remain at UK, and to continue in the STEM major.

A highly successful precedent exists at UK for funding mentored undergraduate research. The UK “Bucks For Brains” Summer Research Program, sponsored by the UK President and Executive VP for Research, is designed to provide minority undergraduates with opportunities to work one-on-one with leading faculty members on research projects funded by the state’s Research Challenge Trust Fund, commonly known as “Bucks for Brains.” The program is designed to increase the mentored participation of minority students in UK research laboratories and to build a student research pipeline at UK.

Bi-weekly Research Colloquia — It is a long-standing practice in research settings to hold colloquia in which local researchers and invited guests share the status and results of their on-going research to keep abreast of developments in their field and receive valuable insights and suggestions from their
peers, as well as establish and maintain a “community of scholars.” These benefits, especially the building of community, are of considerable value to undergraduate students. Therefore, UK AMSTEMM will sponsor bi-weekly research colloquia including all UK AMSTEMM students, their faculty and peer mentors, and the researchers in whose laboratories they are working. Whenever appropriate, outside researchers will be invited either to present their work or to discuss the research in which the UK AMSTEMM students are engaged. Each UK AMSTEMM student will be expected to make a presentation to a colloquium at least once per year. The value of such colloquia to the students’ educations as STEM researchers and the reinforcement of the bonding and community among them cannot be overestimated.

**Place-based enrichment seminars** — For students in two other UK undergraduate research scholarship programs, the PI has offered at least three enrichment seminars per semester. These evening sessions bring the students together with scientists and other scholars who present lectures and conduct discussions relating to subjects that enrich the normal curricular offerings. The enrichment seminars expand the vision of science and of research on the part of the students. They experience areas of science beyond their own majors, and can consider the societal and political ramifications of scientific research, discoveries, and decisions. The seminars are an important factor in creating and maintaining a community of the scholars.

Based on the proven success of these enrichment seminars, the UK AMSTEMM program will offer a series of at least three place-based enrichment seminars each semester for its students and for the rest of the UK community as part of the bi-weekly research colloquia described above. The cost of these seminars is minimal (for space and refreshments), but the benefits are extraordinary.

**Pre-calculus Math Excel** — The second phase of UK AMSTEMM’s response to the challenge of students who are under-prepared in math entails extensive support through collaborative learning. For nearly ten years, UK has offered students the opportunity to participate in Math Excel calculus, inspired by Uri Treisman’s collaborative learning approach (e.g., Treisman, 1992 & 2001), which supplements UK’s lecture/recitation format with intensive problem-solving workshops led by TA’s trained in the Treisman method. Students devote greater and more focused time to learning, build learning communities, and develop study skills needed for success in university-level math and science courses. **UK AMSTEMM** will pilot an analogous program in Math 109, analytic geometry, making it a “gateway” course to the calculus sequence for potential STEM majors, who have been specially recruited as described above.

In the past, Math 109 has been a course for under-prepared students who take it to meet the UK math requirement, but do not intend to enter the calculus sequence. It is offered in a 3 lecture per week format. The new collaborative learning format will replace one of the lectures with two hours per week of problem-solving workshops led by specially trained TA’s under the supervision of Dr. Eberhart, Co-PI of UK AMSTEMM. The intensive problem-solving will better prepare students with the necessary background in algebra, trigonometry, and analytic geometry to succeed in calculus. Moreover, the problem-solving workshop format will help students build collaborative learning skills, practice valuable study skills, and master the discipline of working on math with the necessary effort and time commitment.

Many UK AMSTEMM students will have to take Math 109 or will be specially recruited to it and, therefore, will be positively impacted by this aspect of UK AMSTEMM. In addition, many other potential pre-STEM students will also be taking this course. Therefore, the impact will reach well beyond just the UK AMSTEMM students and should result in a significant decrease in the number of students who abandon plans for a STEM major because of difficulties with math.

**Graduation phase**

**Continuation of retention-phase programs** — The UK AMSTEMM C/A will work closely with the STEM department advisors to help them understand any special needs and circumstances of the UK AMSTEMM students. In addition, the C/A will continue to provide supplementary personal and group advising sessions for the students on a regular schedule. Peer mentoring will also continue for upper-division students. They will be mentored by senior students or by Appalachian or minority graduate students. They will themselves be recruited to serve as peer mentors for incoming and lower-division UK AMSTEMM students.

In the STEM majors, students are strongly encouraged to become involved in research activities either in faculty laboratories or
projects, as part of a research course, or both. Such research involvement is considered to be a key aspect of the major curriculum. UK AMSTEMM students will be further encouraged to engage in mentored research experiences by a continuation of the stipends for participation in such research. All the evidence from internal UK tracking indicates that the students who undertake research earn higher grade point averages and are more likely to complete their majors and graduate.

In addition, UK AMSTEMM students who successfully complete research projects will be encouraged and assisted to submit their findings in the form of an article for publication in a scientific journal or in Kaleidoscope, the UK Journal of Undergraduate Scholarship. Students will also be supported in making conference presentations of their findings. The experience and prestige of publishing or presenting makes a significant difference in a student’s self-esteem and attractiveness to graduate programs. The PI, as Editor of Kaleidoscope, has considerable experience in mentoring student authors and will work closely with each UK AMSTEMM student author to ensure the best learning experience, as well as the most professional article possible.

The place-based enrichment seminars described above will be continued as part of the bi-weekly research colloquia and upper-division UK AMSTEMM students will be expected to attend. The more advanced the student, the more value is gained from the enrichment seminar, because it can be related to that much more scientific knowledge and experience. Therefore, UK AMSTEMM students should realize even more value from the seminars and colloquia in their junior and senior years. The colloquia will continue to contribute to the students’ feeling of belonging to a community of scholars.

Place-based STEM courses — UK AMSTEMM

will help departments modify courses in STEM majors to be place-based, as are the Discovery Seminars. Appalachian and minority students indicate that they have an extremely strong identification with their home communities, want to return home to live their lives and serve their communities, and, therefore, are urgently seeking ways to relate their majors and their educations in general to these communities.

UK AMSTEMM will meet this desire on the part of students and take advantage of it by helping departments modify existing courses or develop new place-based STEM courses to offer to all students, but especially to UK AMSTEMM students. For example, in Biology, a course in the ecology of wetlands concentrating on the natural and reclaimed wetlands in Appalachia; in civil engineering, courses in transportation focused on roads and bridges in Appalachia; and in applied math, courses in statistical and economic analyses utilizing data from Appalachia. Dr. Billings, will serve as consultant in the development of these place-based STEM courses. At least one will be developed each year. A letter from the chair of the Biology Department endorsing the development of such courses in his department is included in Appendix A.

G. Activities to be institutionalized

At the conclusion of the 5-year UK AMSTEMM program, the following will be continued as regular responsibilities of the Office of Undergraduate Education and other UK programs:

1. The Council of Appalachian Student Support
2. The on-campus recruiting efforts for Appalachian students
3. The minority recruitment efforts
4. The Kentucky Early Mathematics Testing and the mathematics Delayed Credit Programs
5. The pre-first year summer math courses for minority and Appalachian students
6. The intensive professional advising of Appalachian and minority students
7. The mentored undergraduate research experiences, but without stipends
8. The place-based Discovery Seminars
9. The bi-weekly research colloquia
10. The place-based STEM discipline courses will be continued by the departments involved with support from the Provost
11. The Math Excel program for pre-calculus courses will be continued by the math department with support from the Provost

Additional funding will be required to support the stipends for Appalachian and minority students engaged in mentored research, to develop new place-based Discovery Seminars and STEM courses, and to support the place-based enrichment seminars. During the fourth and fifth years of UK AMSTEMM, extensive efforts will be made to obtain this funding from external sources. Based on previous success in obtaining funding for such programs from UK donors, it is quite likely that these efforts will be highly successful.

H. Advice, assessment, & evaluation

The two major components of UK AMSTEMM advising and assessment are shown in Figure 5.
UK AMSTEMM will have the benefit of an Advisory Board consisting of the Provost, the Associate Provost for Undergraduate Studies, the Executive VP for Research, the Director of the Discovery Seminar Program, the UK chief minority recruiter, the Director of the Appalachian Center, the Director of the Robinson Scholars Program, two regional high school science teachers, the chairs of the UK STEM departments, and 4 UK AMSTEMM students, 2 lower- and 2 upper-division. The PI will convene the Board at least once per semester to consider the progress of the program, to provide advice for strengthening it and taking advantage of other UK programs, and to plan for the eventual institutionalization of the UK AMSTEMM components.

Assessment entails the determination of whether UK AMSTEMM is meeting its stated goals. Evaluation seeks to determine ways to strengthen the program and improve it. Both activities will be directed by Dr. Witzke, a member of the Pathology research faculty, who has conducted the appraisals of a number of other externally funded projects at UK. Dr. Houglund, Chair of the Department of Sociology, an Appalachian Scholar and past Director of the UK Appalachian Center, will serve as co-evaluator to ensure that the appraisal accounts for the special features of Appalachian and minority students and their communities. Their activities will be entirely independent, but they will have available all of the materials developed by the program and all of the advising data from the UK AMSTEMM C/A.

The project will be appraised in several ways: the numbers of entering students from Appalachia and those who are minorities who declare an interest in STEM fields will be monitored as will the number of Appalachian and minority students who elect and remain with STEM majors. An increase in these data will demonstrate success. The assessment will consider the absolute numbers, but will also endeavor to determine the reasons for changes in the numbers.

Qualitative techniques, such as interviewing UK AMSTEMM students and conducting focus groups, will be used to gather evidence of students’ perceptions of and satisfaction with advising, the mentored research fellowships, the math courses and support systems, and the place-based Discovery Seminars and STEM courses. UK has considerable expertise in developing specialized course- and engaged-learning evaluation forms that are routinely administered to students. The Discovery Seminar Program already uses a specialized form to great advantage. The UK AMSTEMM evaluation team will develop and employ such a specialized form. The data will be used both to strengthen these aspects of UK AMSTEMM and to demonstrate the success of the project overall, as well as to formulate recommendations for other similar efforts to increase STEM enrollments.

Assessment of the success of the plan developed for perpetuation of UK AMSTEMM will be particularly important. If this model results in continuation and enhancement of 1) coordination with existing projects, 2) the academic advising, 3) the mentored research fellowships, 4) the math support mechanisms, and 5) the place-based Discovery Seminars and STEM courses, then the project can be deemed to have succeeded.

I. Expected outcomes (deliverables) and dissemination of information

UK AMSTEMM will disseminate information and deliver the following outcomes:

1. Because increasing the number of Appalachian and minority STEM graduates depends on recruiting the students and then supporting them through their undergraduate careers, this effect of UK AMSTEMM will not be seen until at least year 4. Therefore, the numerical outcomes are:

   a. The number of Appalachian students applying to UK intending to major in STEM disciplines will increase by at least 50/year (about 1 per Appalachian county) and the number of minority student applicants will increase by at least 10/year in each of years 2-5.

   b. The number of students recruited from Math 109 to take Calculus and choose a STEM major will increase by at least 10/year in each of years 2 - 5.

   c. The number of Appalachian students enrolled in a STEM major will increase by at least 40/year and the number of minority students will increase by at least 7/year in each of years 2 – 5, from the current 703 to a total of almost 950, an increase of 34%.
d. The number of Appalachian students graduating from a STEM discipline will increase by at least 30 and the number of minority graduates will increase by at least 5 in the year 5 and by at least that number in subsequent years.

2. At the completion of this NSF initiative, the aspects of UK AMSTEMM listed above will be continued as responsibilities of the UK Office of Undergraduate Education and other STEM departments.

3. Given all of the activities listed above that will be continued by UK, the number of Appalachian and minority STEM students will continue to increase. Furthermore, the success of UK AMSTEMM will form the basis and the incentive for continuing and expanding efforts in this area, both with UK funds and external grants.

4. In year 5, program results will be presented to the Provost together with recommendations for the continuation and expansion of the project. The Provost has indicated his strong support for this project and successful aspects of the program will be continued and/or expanded.

**Dissemination** of UK AMSTEMM activities (Figure 6) is explained in outcomes 5–8, below:

![UK AMSTEMM Diagram]

**Figure 6. UK AMSTEMM Dissemination Activities**

5. Throughout the grant period, UK AMSTEMM will maintain a web site for students, faculty, community members, and interested parties across academe, including all UK AMSTEMM materials, such as syllabi, workshop outlines, peer mentoring guidelines and training materials, articles by students and faculty, and assessment findings. Furthermore, significant assessment results will be submitted for publication in appropriate academic periodicals. The syllabi and descriptions of the place-based Discovery Seminars and STEM courses will also be available on the Web site, as well as through the UK Appalachian Center, and appropriate academic journals. The annual and final reports of the grant project will be made available to all interested parties. The web site will be cross-linked with the AMSP web site, which is highly interactive and widely utilized, making Appalachian high school teachers and students much more aware of **UK AMSTEMM**.

6. Throughout the grant period, **UK AMSTEMM** will publish a newsletter containing a wide range of information regarding the program. This newsletter will overlap with the Web site in some ways, but it will also serve as a powerful recruiting tool, because it will be personalized to spotlight the activities of individual UK AMSTEMM students.

7. Throughout the grant period, **UK AMSTEMM** senior staff will publish papers and make professional presentations concerning the program, and students will present and publish papers related to their research.

8. In year 3, **UK AMSTEMM** will seek a grant to host and conduct a national NSF STEP conference in year 4. The purpose of the conference will be to provide an occasion for all current NSF STEP programs to convene to share their findings and results, both what works and what doesn’t work, with each other and with all other institutions that may be interested in STEP activities. Proceedings of the conference will be published in year 5.

**J. Project Team**

**UK AMSTEMM** will benefit from a particularly experienced team. The PI, Dr. Tannenbaum, Associate Director of Undergraduate Studies at UK, has over 35 years of service in higher education. He has degrees in chemistry and science education, and extensive experience with undergraduate programs in the STEM disciplines. He currently directs the CSEMS and Beckman Scholars programs at UK and edits the UK Journal of Undergraduate Scholarship, *Kaleidoscope*, as well as teaching various courses including a Discovery Seminar.

The Co-PIs are Dr. Eberhart, Professor of Mathematics, DUS in Mathematics, and a senior faculty member of the AMSP team, and Dr. Osborn, Professor of Biology and Outreach Coordinator for AMSP.

The consultants to the program include 1) Dr. Billings, past Director of the UK Appalachian Center, past President of the Appalachian Studies Association, editor of the *Journal of Appalachian Studies*, and winner of the “Outstanding Teacher” and Research Professorship awards at UK; 2) Dr. Byars, Associate Provost for Minority Affairs, a nationally recognized expert on minority student recruitment, support, and education, and also experienced
in directing the UK TRIO Student Support Services program; 3) Dr. Badagliacc, Director of the Discovery Seminar Program, winner of the UK “Outstanding Teacher” award, and expert and consultant on poverty and family homelessness in Appalachia; 4) Dr. Witzke, member of the research faculty of the Department of Pathology, and an expert on the evaluation of sponsored research projects; and 5) Dr. Houglane, Chair of the Department of Sociology, past Direct-or of the UK Appalachian Center, an Appalachian scholar and expert on project evaluation.

The program will also benefit through CASS from the cooperation and assistance of the directors and staffs of all of the existing UK Appalachian and minority student support programs, particularly AMSP, plus the professional advising staff at UK and the Directors of Undergraduate Studies in the STEM departments, and the staffs of the UK Teaching and Learning Center and the Appalachian Center. In addition, a full-time Coordinator/Advisor and a program administrative assistant will be hired.

At least one faculty member per year will work during each summer to develop and then offer (in the following year) a STEM discipline, place-based Discovery Seminar, and during years 3-5, another faculty member will develop and deliver a place-based STEM course. Dr. Eberhart and several Teaching Assistants will be responsible for the pre-calculus Math Excel courses and the pre-first year summer intensive math course. Many research faculty members will be involved in mentoring UK AMSTEMM students in their research activities. Finally, the project team will include a number of UK minority and Appalachian STEM majors serving as peer mentors.

K. Conclusion
Speaking to a leadership conference in 2002, President Lee T. Todd, Jr. said:

We are a GREAT university but we must do better. Not for our egos, but for the people of Kentucky and beyond. I look forward to working with you to make the dreams of Eastern Kentucky become the realities of tomorrow.

This proposal is designed with just such a vision in mind — to increase the number of minority and Appalachian students who choose majors and careers in STEM disciplines and then to provide them with as much support as possible (counseling, mentoring, place-based education, and financial assistance) to ensure that they maintain their interest and continue their studies to graduate on schedule.

<table>
<thead>
<tr>
<th>Task</th>
<th>Year 1 2005</th>
<th>Year 2 2006</th>
<th>Year 3 2007</th>
<th>Year 4 2008</th>
<th>Year 5 2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>Establish strong relationship with CASS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Establish enhanced academic advising system</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Revise Math 109; offer 1 section; recruit A &amp; B students</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Develop UK AMSTEMM web site and newsletter</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expand KEMTP &amp; Delayed Credit program</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conduct bi-weekly colloquia + place-based enrichment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recruit, train, and assign peer mentors</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Organize research and faculty mentoring</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Develop/deliver school- &amp; on-campus workshops</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Offer pre-first year summer pre-calculus course</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Develop &amp; offer a place-based Discovery Seminar</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conduct on-going assessment and evaluation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conduct at least two Advisory Board meetings</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Offer 2 sections of revised Math 109; recruit A &amp; B students</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maintain and update web site and newsletter</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Publish reports on project activities and student research</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Develop and offer at least one place-based STEM course</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seek funding for a national NSF STEP conference</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Host the NSF STEP conference</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Publish proceedings of the NSF STEP conference</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conduct final project evaluation and assessment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
References


Noland, Melody Powers, Carl Leukefeld, and Caroline Reid. (2001) ”Careers in Drug and Alcohol Research: An Innovative Program for Young Appalachian Women.” Journal
of Women and Minorities in Science and Engineering. 7(3) 233-241.


PEW Charitable Trust. (2002) "Understanding University Success." Brochure or CD-ROM


University of Kentucky Appalachian Center. http://www.uky.edu/RGS/AppalCenter/

University of Kentucky Office of Minority Affairs. http://www.uky.edu/MinorityAffairs/