EXAMINATION OF STUDENT-ACTIVE LEARNING PRACTICES IN A COLLEGE/MIDDLE SCHOOL EDUCATIONAL COLLABORATION

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A college and middle school student teaching collaboration was developed to interest more college students in teaching K-12 science, to enhance diversity among K-16 teaching faculties, and to inspire the K-12 students to expand their knowledge beyond their classroom curriculum. To assess our results, we used a modified Likert survey instrument and self-reflective analysis in middle school and college students, respectively. Overall, middle school students expressed satisfaction in the science learning in which they participated. In addition, college students reported that they learned specific content when made responsible for teaching material to younger students. Collaborative projects such as this one may positively impact attitudes towards math and science learning among middle school students. Research suggests that middle school girls who have positive experiences in math and science classes select further training and career options in these areas. Similarly, college students reported increased interest in K-12 teaching. Collaborative project based learning could be successfully modified by other educators for use in alternative or mainstream educational settings.

Introduction

The identification, study, and education of gifted and talented students have progressed to become more inclusive over time. Gifted and talented students are those who exhibit marked intellectual ability, control and commitment, all of which may be modified by individual subjective experience [1,2,3]. Gifted and talented individuals have traditionally been less likely to be identified in minority populations and/or in lower income populations [2,4]. Institutional teaching strategies combining gifted and talented special education has included both heterogeneous (mixed ability and inclusion) and homogeneous (peer grouping educational interactions) groups, depending on curricular goals, individual plans, and community educational philosophies [1,5], any of which may influence academic progress.

One of the common myths associated with gifted students is that they can succeed on their own. In reality, they need guidance to help them develop their potential. One way in which students come to view learning as important and share its excitement is by exploring new experiences. Working across disciplines provides a way of exploring new areas while providing a familiar framework that may allow some students to relate knowledge to more comfortable and familiar topics. Creative tasks are considered to be useful when working with gifted students for whom this capacity has been thought to be particularly well developed [1,6]. It has also been suggested that college students more easily develop structured knowledge capacities when they are active, collaborative constructors of their own process of learning; ultimately, such activities may change scientific practices [7]. Inquiry-based teaching practices vary between institutions and individuals, but typically include the following features: 1) students are involved in complex, realistic problems; 2) students gather, analyze, and interpret their own data, learning technical and cognitive skills, attitudes, and intellectual maturity through this process; 3) students are asked to reflect on their own individual learning processes; and, 4) students begin to understand the benefits and constraints of scientific and mathematical practices as they construct knowledge in a given area [7].

Accordingly, college students from three undergraduate natural and cognitive sciences college classes visited and team taught, using active project participation, middle school gifted and talented students in sixth, seventh, and eighth grade classes over the course of eighteen months. The effect of this intervention was evaluated using qualitative data obtained from short questionnaires administered to the middle school students and from self-reflective commentary from collegiate students following their participation in the teaching exercises and at the conclusion of the college courses. This collaboration was a way to interest more college students in teaching K-12 science, to engage the college and middle school students more in their own learning, and to assist in fulfilling the stated goals of the Science, Technology, Engineering, and Mathematics Teaching Education Collaborative (STEMTEC) program. Those goals included the following items: 1) to increase the numbers of undergraduate liberal arts students who consider teaching as a potential career; 2) to facilitate representation of minority students among those who might consider science, mathematics and education careers; 3) to gain exposure of college and university faculty to teaching practices commonly implemented within the context of K-12 education; and, 4) to address content curricular framework requirements mandated by recent Massachusetts Board of Education Educational Reform legislation and their effect on K-12 classrooms.

Institutional Characteristics

Undergraduate institution: College students participating in this collaboration were drawn from a selective baccalaureate–granting private liberal arts college that features a multidisciplinary curriculum and emphasizes nontraditional modes of instruction and student evaluation. Students participating in this collaboration were predominantly female and were white, with the exception of one African-American male matriculant, and were early in their academic career (Table 1).

Middle School institution: Middle school students who participated in this collaboration came from one of two middle schools in a city of 56,000 residents. This school educates 1,050 students equally distributed among grades 6, 7, and 8. Nearly half of the diverse student body qualifies for free or reduced lunch (40.1% free, 8.6% reduced). The ethnic composition of the students is: 75% White, 20% Hispanic, 3.4% Black, 1.5% Asian/Pacific Island, and .5% American Indian/Alaskan. The primary languages of the students are: 84.1% English; 11.2% Spanish; 2.3% Russian; 1.5% Polish; .2% Portuguese; and Chinese, Greek, Italian, Ukranian, Vietnamese, and Urdu at .1% each.

The middle school students who interacted with the college students in this study came from Bellamy's Resources for Enrichment and Advancement in Chicopee (REACH) Program. The REACH course curriculum revolves around interdisciplinary problem-solving activities with the major topics changing several times a year (Table 1). Different topics are selected on a yearly basis. Students must demonstrate that they possess, and are willing to use, advanced academic talents to qualify for this program. Approximately 6% of the school's student population participates in the REACH program. Based on Renzulli's model of giftedness, REACH students must show potential through above-average intelligence, creativity, and task commitment. These characteristics are determined by a combination of scores on national achievement tests (such as IOWA, CAT) in reading comprehension and math concepts, teacher/parent/student recommendation, a cognitive skills index, and report card grades. REACH students meet in small groups (up to fifteen students) consisting only of gifted and talented student classmates for 45 minutes daily, and then spend the remainder of the school day with other middle school students as members of their more traditional classes. Participation in the program is optional for the invited sixth, seventh, and eighth grade students.

Structure of the Collaboration

Prior to the beginning of the first collaborative series, the authors met several times to plan and coordinate discussion topics and to determine specific evaluative goals and methods for each class. In addition, specific collaborative topics were selected by the authors to serve as study and teaching topics for both middle school and undergraduate student participants, within the overall context of each respective course or curriculum. The topics were chosen to complement course or module content curricular goals within each student group (Table 1). As this was the first time that this type of collaboration had been developed between these two institutions, there were also individual visits made to each respective institution by each faculty member prior to the start of the academic year. These visits served to confirm scheduling details and to provide assurance of administrative support for implementing this collaboration.

Experience # 1: First and second year undergraduate college student participants were matriculants in three courses. The first course was an interdisciplinary, 100-level introductory course entitled, *Animals in Human Societies: Relationships, Bioethics, and Welfare* which examined the role of animals in Western and non-Western human societies through their literary, spiritual, artistic, and scientific representations. Each college student was required to work in a small teaching group (chosen based on topical interest, and in the case of very popular topics, by lottery) to develop a project, presentation or actual experiment that would involve the middle school students in inquiry-based activity. The overall goals of this seminar were to introduce early college students to selected scientific areas using an interdisciplinary approach and to foster improved communication and scientific literacy. College student goals were varied and included interest in learning more about selected subjects, to fulfill a desire to become engaged in pre-professional curriculum prerequisite, and to complete college-wide science distribution requirements. Many of the student matriculants in this course were not planning to major or concentrate in a scientific discipline.

College student teaching groups focused on the ocean, and specifically, the role of animals in human activities that might be associated with marine or aquatic environments. The topic assignments that the college students developed are listed in Table 1 and included: 1) Physical sciences - pH Laboratory, in which college students conducted a self-designed, in-class experiment with middle school students using a pH meter to examine predicted and actual pH values among different water sources, such as pond water, rain water, and tap water from the middle school classroom; 2) Health and Medicine - ocean-based substances and foods used to maintain human health or conversely could have been disturbed by environmental pollution; 3) Animal Communication - classical great ape studies of sign language and communication, and dolphin cognition and communication, whereby small groups of middle school students also tested their non-verbal communication skills by finding alternative ways to convey a concept or object among their group members; and, 4) Humanities, Arts and Political - a project with the specific goal of providing information that might allow the younger students to formulate an opinion about several potentially controversial and interesting topics. This student teaching group, the most interdisciplinary of the series, focused on the presence and representation of oceanic animals through the writings of Rachel Carson, followed by playing examples of humpbacked whale song. They also discussed concepts of animal welfare versus animal rights through examples such as the benefits and consequences of maintaining captive animal populations in aquariums and zoos and contrasting veganism/vegetarianism with animal product use and consumption. Animal political representations were depicted through the use of cartoon images and in political symbolism, such as the Democratic and Republican parties. Middle school students participated by drawing an animal or a species with special significance to them and that might be similarly represented in prose, sound or writing, or politics.

The college class focus on marine biology/oceanography paralleled the first gifted and talented middle school curricular module, "Under the Sea." Middle school students participated in a variety of activities to enhance their research of this topic. They designed two-dimensional models of various sea life to surround them in the classroom. The students in eighth grade created a coral reef that covered the entire back wall of the classroom. One seventh grade class specialized in large sea creatures (such as whales and dolphins), which graced the side walls. The other seventh grade class researched deep-sea creatures, which covered the front of the room. The sixth graders each chose a specific fish and produced a three-dimensional model, which hung from the ceiling. The head of an aquarium company held a special assembly for the REACH students so they could experience different types of sea life including samples of shells, coral, the skeleton of a blowfish, and a preserved sand shark. Similarly, the state police diving team also brought their equipment so students could see how rescues are made in water.

Informal learning opportunities were also made available to the middle school students and were financially supported by this collaboration. Middle school student classes visited Hampshire College and participated in an on-campus college introductory, problem-based learning class. They toured the campus, participated in a college level problem–based learning problem, discussed college preparation with the director of admissions, and visited the Pratt Museum of Amherst College, where they were engaged in a natural history "puzzle" hunt. In the middle school classroom, a marine aquarium that was stocked with several marine fish species and maintained by a professional marine aquarium service was also supported through this collaboration. Its presence became an additional focus of the "Under the Sea" module that the middle school students completed, added a living component with opportunities for observation, analysis, and data collection in marine science, and illustrated the habitat and marine ecosystem that the middle school students were concurrently studying. Pre- and post-field trip evaluations were obtained by the middle school faculty member from the middle school students who visited the campuses, many of whom had never been on a college campus prior to this visit.

Collegiate groups in the first teaching series met outside of class times to develop their project with the support of a student peer facilitator who was also matriculated in the class. This student was a more advanced student class participant: she had completed all major distribution requirements and had proceeded into her major field of study. STEMTEC programmatic funding support provided stipend and expense monies; the peer mentor student usually provided transportation for herself, and college study group members. College students visited the middle school classroom once and gave presentations and/or led exercises for two successive middle school classes (Table 1). The college student presenters, and both faculty members, had a brief classroom meeting to discuss the experience with them at the conclusion of each session. This was followed by a longer meeting in which the students, peer facilitator, and college faculty member reviewed the experience with college participants and discussed their perceptions of the presentation experience and preparation period, in conveying interest and information to middle school students in a format that they could understand, and in the overall teaching experience. In addition, each college student group made formal midterm poster presentations of their experiences in the classroom for their classmates and the middle school faculty member.

These presentations were also evaluated as a component of each college student's individual academic class evaluation portfolio, a standard institutional method of evaluation in lieu of grade assignment. Students were evaluated by the college faculty member for teaching projects, using the following criteria: originality of presentation; knowledge content and literature cited; analysis, integration, and communication of scientific and interdisciplinary knowledge; and, their ability to interact with middle school students in an active way. The middle school faculty member provided additional insight about their activities within the classroom, but was not responsible for an overall academic evaluation for the undergraduate students. The college student who served as a peer facilitator was also evaluated as a course matriculant; both faculty members in the collaboration evaluated her activities as peer facilitator.

College students had the opportunity to comment anonymously on their experiences in the classroom as a part of their overall class evaluation at the end of the semester. They were also able to convey their thoughts as a component of their self-reflective goal-setting assessment essay that was submitted as a part of the course portfolio. To assess the effect of these sessions on the attitudes that middle school students held towards science and college student teaching sessions, a short survey was developed by the middle school faculty member and was administered to the middle school students participating in the first series of college student teaching visits. This survey asked them to indicate what items they learned, what they liked and disliked in the college student presentations, and provided a space for free writing of any additional comments that they might wish to make. Generally, middle school students received the surveys within one week of their college student teaching experience and completed them during a classroom period.

Experience # 2: Based on comments obtained from undergraduate students in their post-presentation meetings and self reflective portfolio essays, and from middle school students through informal surveys given after each teaching project in the Teaching Experience # 1, the second and third series of college student class visit procedures and schedules were modified (Table 1). First year and transfer college students were drawn from a Natural and Cognitive Sciences course, *The Neurobiology of Learning and Memory*, a seminar and laboratory course whose goal was to understand and develop expertise in the biological mechanisms underlying learning and memory in vertebrates through study of texts and primary journal articles. College students worked with sixth grade middle school students who were very interested in finding out more about how people and animals learn. Middle school students participated in the collaboration as part of the regularly scheduled class. College student participants were volunteers and their performance in this area was incorporated into their course evaluation. In their presentations, two groups of college students ran experiments using two animal behavioral assays in class with middle school students. The college students also presented data from their own experiments using these assays to the middle school students. A representative of the second student group ran the Weschler Digit Span Memory Test, a standard psychological instrument used to assess human memory and cognitive function, with middle school student participation. Each middle school student group had an opportunity to experience both types of learning experiments. Student feedback and assessment was performed for each group as previously discussed with the following modification: middle school students received a modified formal formative assessment survey instrument, Science Laboratory Environment

Inventory (SLEI) [8] (Figure 1) to determine the effect of this intervention on their view of science learning. In a manner similar to those held at the conclusion of each first series visit, there was a meeting in which college students participating in the study discussed their perceptions with us of the experience that they had just had in preparing the material, conveying their thoughts, and working with the middle school students, and their overall teaching experience.

Experience # 3: A single, afterschool workshop was developed by college student volunteers featuring active field investigation of environmental microbiology in samples collected on the middle school campus. College students were matriculants in a first year course, *Cellular Pathology: Bacteria and Viruses*, which consisted of a classroom and laboratory format. Most students were in the second semester of their first collegiate year. The focal areas studied in this course were: 1) Environmental microbiology, featuring an individually designed laboratory project examining differences in microbial flora between varied sites on the Hampshire College campus; 2) Food-borne enteric and neural diseases which focused on significant diseases such as E. coli enteritis, Salmonellosis and Listeriosis, with a second investigative student project; and, 3) Retrovirology, with special emphasis on human immunodeficiency virus, feline immunodeficiency virus, and simian immunodeficiency virus as animal models of infectious disease, and including examination of the secondary complications of these diseases. Middle school students were drawn from a single middle school classroom module, *Introduction of Microbiology*, and consisted of sixth through eighth grade gifted and talented children. Participation in the middle school afterschool workshop was voluntary for both college and middle school student populations.

The college students developed a workshop module that paralleled their experiences in the laboratory and field. After personal introductions, the college students gave a scientific poster presentation to the middle school workshop class illustrating their group work on each respective project that was performed on the college campus. They also showed middle school students bacterial specimens on culture plates originating from college laboratory experiments that had been used to identify previously not well-characterized environmental bacterial samples. College student teachers also demonstrated how the plates were streaked with bacteria and examined glass slides containing fixed, Gram-stained bacterial specimens while explaining differences between Gram-negative and Gram-positive bacteria. Environmental sampling and differential staining of local soil and water sites at the middle school was then executed as a group led by the college students. The middle school students rotated through individual stations in the classroom that allowed them to process their samples, fix, stain, and observe bacterial populations on microscope slides using a hand-held microscope, and more closely, using video light microscopy. At the conclusion of the afterschool workshop, the college students met with the middle school and college faculty members to discuss their experiences and to give feedback for future workshop development of this type. College students were evaluated as noted earlier, while middle school students were queried by the middle school faculty member in subsequent classes to determine their attitude, and enthusiasm, towards science learning stemming from their involvement in the workshop.

Collegiate Outcomes

Experience # 1: Most college students participating in the teaching exercises met all course expectations, and their own varied goals in matriculating into the class. Most also completed Division I examinations in Natural Sciences, a prerequisite to advancing through the Hampshire College academic program. Several college students expressed increased interest in teaching as a career and felt that their participation in this experience facilitated their exposure to the field. All students reported that they understood the content that they presented, and that they had greater ease of scientific communication.

Experience # 2: There were fewer college students participating in the second teaching series. Eligible student volunteers also completed Division I examinations in Cognitive Science. Decreased participation may be attributed to the voluntary status of the teaching project, which required additional time, intellectual effort, and travel. All participating students provided commentary that they were more effective learners once they became responsible for conveying information to middle school students.

Experience # 3: Participation in the third teaching experience, an afterschool workshop, also assisted students in completing their Division I examination in Natural Science. This experience also appeared to increase their experience in leading field and laboratory experiments.

Overall, collegiate students reported that they had fun teaching in the middle school classroom. They were impressed by the energy, attentiveness, and range of questions that they received from the younger students, and their previous experience in independent project execution gained through their participation in the REACH program. Some of the first-year undergraduate students reported that it was difficult for them to gather, and condense, their topic information into a format that could be easily conveyed to their audience. In some cases, their presentation was the first time that they had had an opportunity to present to a large group of students since beginning their undergraduate education. However, college students were impressed with how much better they felt that they had learned the teaching presentation material. They attributed this outcome to discussing it with other group members, interpreting data and associated information, and communicating to a group of middle school students concepts and attitudes that college students thought might be difficult to understand. While there was no attempt to specifically teach students "how" to teach, our goal was to provide opportunities for college and middle school students to learn using active collaboration, and to generate enthusiasm about science in an educational setting. Based on comments from these college students, it seems that these goals were achieved. In their final class evaluations, students in all teaching experiences commented that the experience of working in groups, and teaching the middle school students, was one of the highlights of their semester in the class.

Middle School Outcomes

Experience # 1: Middle school students enjoyed having college students come into their classrooms, and they became excited about learning scientific and interdisciplinary concepts. Their experiences may provide an initial exposure to college as an education goal for some middle school students who may have been socioeconomically disadvantaged or have experienced home environments where family members had limited educational background and opportunities. We also observed that middle school gifted and talented students participating in this teaching series experienced enhanced self-esteem and goal setting, realizing that it may be "ok" to be "smart" as a way of demonstrating interest and intelligence among a peer group. This may be particularly important in school settings where gifted and talented students progress through academic programs in classes with student peers of widely varying intellect and ability.

Experience # 2, 3: Middle school students were introduced to the behavioral sciences and to concepts of humane handling and care of animals in laboratory and field experiments, with the realization that advancing knowledge in this area benefits all species. The SLEI questionnaire responses suggested that middle school sixth grade students were enthusiastic about the presence of college student teachers. Eighty percent (8/10 students) of middle school students chose a highly positive response to the statement, "I enjoy working with older students."

Most students (9/10 students) most enjoyed working with animal behavior and maze testing. The one student who preferred the Weschler Digit Span Memory Test also noted that it was sometimes harder for her to memorize numbers with distractions, but that she wanted to have more time to pursue the "memory game" with the college students. When queried, middle school students requested additional animal studies, picture games, and other experiments. Afterschool workshop participants also had a robust and positive experience, featuring guided field experience, and direct comparison of their data to that obtained earlier by college students.

There were few areas in the presentations that the students disliked or commented on. In most cases, comments addressed sentence syntax or structure, and indicated that they should be easier for them to understand the questions for which they were being asked to provide a response. Younger middle school students had a more difficult time providing in-depth responses to the instrument, and questions were answered more superficially.

Specific middle school student comments were as follows:

- "I learned about how different people, religions, cultures, and countries view animals";
- " I liked listening to the whale sounds on the tape";
- " I learned a lot about Hinduism and about Sea World and caged animals";
- "[I learned] the relationship between real life animals and characters";
- " I learned about how animals can be represented by artistic symbolism. I also learned that there are many books written about animals...because I thought that it was interesting. I never realized before that animals can be so important to so many people in other countries, and I thin(k) that we take for granted how good we have it and don't really realize how we a(re) hurting the animals and their environment";
- " I learned their are many different kinds of pollutants, and that it could make a big difference just to recycle one thing";
- " Since I already knew about the communicating chimpanzees, I learned a lot about the dolphins. I learned how they used echo-location to find their way around the ocean. I find it also pretty amazing how they can point out objects to one another efficiently [without verbal communication]... I liked how they had a little experiment ready to give us an idea of how dolphins describe objects."

Overall, there were very few items that the middle school students disliked; there were critical comments about the amount of time that the college students were available (too short), their physical appearance in some instances, about some hands-on activities that they did not enjoy, such as drawing, or about not having enough hands-on activity in the presentation.

Discussion

There were several benefits of this collaboration. Middle school students benefited by learning directly about undergraduate study. The college students who worked with middle school students were interested in them, and this attitude and positive interaction might help middle school students who were involved in the project to view college education in a positive light. Having the benefit of student teachers that were closer to their age may be important as a means of making education seem more attainable. Participating in a "cool" project that involved college students was also a positive social motivating factor among middle school students. This is an especially important factor in the socialization of gifted and talented students who sometimes must project an effect that de-emphasizes their natural attributes if they are not congruent with the values of the environment in which they live and study [3]. Cooperative learning also reinforces self-esteem in a positive fashion for these students [4,5,9,10,11]. Finally, middle school students had an opportunity to perform experiments, create knowledge, formulate opinions, and critically evaluate their view about potentially controversial topics [1,4,6,7,12-15]. These types of activities may be especially important in educating middle school girls [9,10,15-19]. Previous studies have documented that using problem solving science inquiry coupled with positive social experiences in math and sciences have a long lasting impact [15,17,18,19]. Further, future course selection, continued participation in science and mathematics education, and selection of careers in these areas by adult women are positively affected by experiences in this middle school developmental period. It is possible that other students will also gain from exposure to these types of experiences.

College students were able to work in groups and create experimental approaches to illustrate topical areas of interest. They also experienced the cognitive, and experiential, effort involved in teaching. An emphasis using inquiry–based pedagogy that involves students as being responsible, active constructors of their own learning has been shown to be effective in educating community and liberal arts college students [7,12]. Students also benefited by working with middle school students in that they received significant support and positive feedback from their work from these younger students.

Producing a developmental–, age–, and grade–appropriate assessment instrument or rubric for evaluating changes in student content knowledge that would reflect this type of intervention would be helpful in assessing this type of collaboration. The SLEI was originally developed to assess student cohesiveness, open-endedness, integration, rule clarity, and material environment in high school biology students [8], and could be further adjusted or replaced with another instrument to more precisely assess student academic progress. Cost recovery for anticipated expenses is crucial. The challenges that we experienced in developing this series of collaborative teaching experiences involved the following: 1) incorporating middle school block scheduling and transportation into college class scheduling periods, and maintaining commitment from college students to perform additional independent work outside of class contact hours; 2) obtaining funding and transportation for middle school student trips to college campuses, as well as college student and equipment transportation to the middle school; 3) developing administrative support, such as obtaining a bus and driver, parent volunteers, food for students on the trip, and provision of substitute teaching staffing for middle school faculty, with appropriate release and insurance form signature; and, 4) maintaining informed consent, with parental knowledge of this program, as well as a restriction on information technology use among students whom are minors.

Advance planning to serve curricular and content-specific course requirements for undergraduate faculty, and state-mandated curricular requirements for middle school faculty, are important and will assist in developing a fluid, interlocking teaching and learning experience for the respective student populations. Curricular change and implementation is not always easily anticipated, or accepted, by students or faculty. In Massachusetts, educational reform has resulted in the development of testing strategies, such as the Massachusetts Comprehensive Assessment System (MCAS), and curricular frameworks that require exposure of middle school students to proscribed content areas [13,14], which may occur at the expense of opportunities to engage in unstructured time or creative enterprise. MCAS testing will determine whether students graduate from the public educational system. Testing may also modify the extent of student preparation for further academic study. While standardized testing pressure is in many cases lessened on college campuses, there are still important areas of knowledge and content students need to know. However, there is more flexibility in developing means to address both content, and process of learning in college and in this particular institution. It may also be that college students participating in alternative, nontraditional classes are better able to integrate interdisciplinary content areas as a consequence of the emphases specific to this style of education. Inquiry of this type may benefit learners of all abilities and could be implemented in mainstream educational settings and student populations.

Conclusion

This was a positive experience for middle school and college students who were engaged in this project. Involvement of nontraditional college students and gifted and talented middle school students provided a unique setting in which to develop this initial project. One future goal is to introduce further refinements to allow comparative and quantitative analysis of educational outcomes. A collaboration of this kind may also be used as one component of a curricular program to address state and national educational learning standards [13,14]. These standards include "common core" breadth requirements spanning science, mathematics, and the humanities; science inquiry methods (making observations, generating a study question, gathering data using complex tools, analyzing results, communicating scientific ideas and demonstrating knowledge and understanding); and, specific subject content, such as microbiology, organ systems, population and ecosystems, and others. As a result of our experience, we anticipate that other educators in many different educational settings could successfully modify this form of project-based learning for use in their own classes. ■

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Bios

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TABLE 1: A SUMMARY OF TEACHING COLLABORATIVE PROJECT ORGANIZATION

ORGANIZATIONAL VARIABLES	***TEACHING EXPERIENCE # 1***	***TEACHING EXPERIENCE # 2***	***TEACHING EXPERIENCE # 3***
College Subject	Marine Biology & Aquatic Habitat/Environmental Science	Neurobiology: Learning and Memory	Cell Pathology: Bacteria and Viruses
# College Students	16 / 16 total matriculants; Required Participation	4 / 7 total matriculants; Voluntary Participation	3 / 3 total matriculants; Voluntary Participation
Middle School Subject Content	Under the Sea	How Learning Occurs	Genetic Engineering
# Middle School Students	20 students; 8^{th} grade only	13 students; 6^{th} grade only	13 students; 6^{th}, 7^{th} ,and 8^{th} grade
Overall Theme & Organization	Exploring Human & Animal relationships in Aquatic Environments *Teaching Group visits to MS:* 1: Animal Communication 2: Health and Medicine 3: Physical Sciences - pH 4: Humanities/Arts/ Politics	Memory Testing *Teaching Group visits to MS:* 1: Introductions 2: Experimental visit a: Maze testing b: Weschler test	Environmental Microbiology *Teaching Group visit to MS:* 1:Afterschool Group a: Introductions b: Poster Talks c: Field & wet lab
Student Peer Facilitator Present	Yes: Junior Student and class matriculant with completed science distribution requirements	No	No
Middle School Field Trip	Yes: Undergraduate colleges Natural History Museum	No	No
Timing	1998 Fall Semester	1999 Fall Semester	2000 Spring Semester

FIGURE 1

MODIFIED SCIENCE LABORATORY ENVIRONMENT INVENTORY (SLEI) ASSESSMENT TEST

Name______________________ Class______________________ Date____________________

Almost Never Seldom Sometimes Often Very Often

1. I get on well with students in this class.
2. I can follow my own interests in class.
3. My class has clear rules to guide my activities.
4. I can develop my own rules to guide my activities.
5. I have little chance to get to know other students in this class.
6. I am required to solve a given problem by myself.
7. My class is informal.
8. My classmates and I work together to solve problems.
9. Our problems are important to other people.
10. I can depend on other students for help during my class.
11. I work cooperatively in classroom sessions.
12. I decide the best way to proceed during class problem-solving sessions.
13. My problem–solving work is related to my ideas about science and technology.
14. I enjoy working with older students.
15. I feel that I have learned about science and mathematics through my work with college students.
16. Working with college students helped me to learn more about science and/or mathematics.
17. I can use what I learned from college students about science, technology, and mathematics outside of my classes.

Short Answer Questions:

18. The topic that we studied that I enjoyed the most was:
19. The topic that we studied that I enjoyed the least was:
20. What did you learn from working with the college students?
21. Can you describe what you did together with the other students?
22. What would you like to have more time to do with the college students?
23. Do you have any suggestions for future activities?

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