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THE PERFECT EXCHANGE: THE EVOLUTION OF FIELD STUDIES AND THE GERACE RESEARCH CENTRE

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ABSTRACT

Science education in the United States changed drastically in the 1960s, and I was a part of that change, both as a student and a teacher. My life was influenced by these changes in educational theory, and I implemented several scientific programs utilizing these concepts, especially that of field studies. Due to criticisms and concerns, even by academically accrediting agencies, about the value of field and off-campus studies, I undertook to design a questionnaire and interview students and faculty attending the San Salvador program in the mid-1970s. The results of this study will be described, as well as some of the present day theories about learning, which prove the value of field education. Recent investigations into the costs of field and off-campus studies will be discussed in light of the low costs at the Gerace Research Centre and its operational philosophy of a “perfect exchange”.

INTRODUCTION

Science education prior to the 1960s consisted primarily of memorization and rote learning, with minimal laboratory experiences. Specimens were brought into the lab for natural history studies, but few field trips were taken with students. It wasn't until the launching of Sputnik by the Soviet Union in 1957, and the resulting emphasis placed on the need for improving science education, that any real changes were made. This happens to be the time when I personally was just starting to teach high school science, so I was at the forefront of this drastic evolutionary change in how science was going to be taught in the United States.

DISCOVERY APPROACH

The new ideas of the inquiry driven curriculum or learn by discovery approach, which is the way most of you learned science, is still the driving force in present day science education. What developed in the 1960s was an alphabet soup of programs, all of which are still in use, such as: the Earth Science Curriculum Project (ESCP), the Physical Science Study Committee (PSSC), and the Biological Sciences Curriculum Study (BSCS).

Since I was taking graduate level courses in the sciences towards my Master's, all of which were sponsored by National Science Foundation, I was in the forefront of these new teaching ideas. And since I was already teaching Earth Science and Physics using many of the new ideas, I was tapped by the State of New York to begin teaching the ESCP and PSSC programs to undergraduate science education majors at Alfred University and to science teachers in that area of New York State.

One major change in science education was the way questions were asked of the students. Instead of asking the students to memorize formulas and then give data to plug into those formulas, we asked them to understand how a concept worked, which required them to understand the formula. One example is the formula for density being equal to mass divided by volume. Previously, when students were asked to determine density they were given figures for mass and volume, and then directed to plug the values into the formula. In the new science, the students might be asked a question, for example: “What can be done to change the density of water?” Thus the entire concept needs to be understood in order to answer

the question, not just the memorization of a formula.

The other change in science education was the concept of learning by doing. Students were taken into the field to observe and collect specimens, which were then identified and students read about them and their ecological relationships. Thus field studies truly began, as students started looking at lakes, ponds, rivers and streams. And what is important was that they began to see that so many of these bodies of water were polluted as they were catchment basins for effluents from agricultural and industrial enterprises. All of which led me into the next phase of my life.

FINGER LAKES INSTITUTE

Since I was new at Alfred University, I was asked by my mentor, Dr. Dan Sass, to accompany him on a field trip aboard a research vessel, the Lake Diver IV (Fig. 1), operated by the College Center of the Finger Lakes (CCFL), a consortium of nine colleges and universities in central New York State. I truly learned a lot during that trip, but I also got involved in assisting the captain in making much needed repairs to the boat and the various pieces of scientific equipment on board the vessel as the day progressed. Based on this experience, Dan recommended me to the CCFL as a candidate for director of a newly developed program called the Finger Lakes Institute (FLI).



Figure 1: R/V Lake Diver IV

The basis of the new FLI was the Lake Diver IV, located on ice free Seneca Lake. The CCFL had recently acquired the vessel and want-

ed to utilize it for scientific research. At that time three of the CCFL member colleges, Alfred University, Elmira College, and Hobart/William Smith Colleges, were funding the vessel, as scientists from these institutions were the only ones using it. As Director of the program I soon realized these colleges couldn't generate the funding needed to keep the FLI going, so I needed to expand the program. I saw the potential of this resource as a teaching tool for both high schools and colleges. Thus began my first experience in designing field study programs, and assisting in the evolution of science education using the new "learn by doing" model.

I designed a day long program called "a day aboard an oceanographic vessel". With the help of several grad students I set up a series of stations on board, where students would learn various sampling techniques, such as grabbing and coring bottom sediments, towing for plankton, water sampling using Nansen bottles, and depth soundings using fathometers. They would also use the onboard lab to analyze samples. I found this to be a very effective way of teaching students, who came away appreciating not only all the information the lake provided, but also learning how scientists actually collect the information they taught in classes.

The Finger Lakes Institute, located in Watkins Glen, was an ideal setting for the teaching of NSF sponsored courses for science teachers. I obtained a grant to build a shore based classroom building. The classroom, the Lake Diver IV, and the ability to lease rooms from a nearby seminary, gave the FLI the necessary facilities to offer summer courses. I was finally getting all my ducks in a row so the FLI could operate on a firm financial footing and accomplish many of the educational objectives I had set for myself.

But one of the most important aspects of the FLI was the scientific research that was able to be conducted on the pollution that had become so evident in the many lakes, rivers and streams of New York State. Using the Lake Diver IV, CCFL scientists and others from the Universities of Buffalo, Rochester, Syracuse and Albany could travel throughout the state via the Erie Barge Canal sys-

tem and enter not only the Finger Lakes, but also two of the Great Lakes, Lake Erie and Lake Ontario. I soon realized I needed more boats, so I was able to obtain two additional vessels from surplus for the FLI, the “Joy” (Fig. 2) and the “T-504” (Fig. 3). I am proud to say that much of the early research concerning the pollution of these various bodies of water by both industrial dumping and agricultural run-off was accomplished through the FLI. By disseminating this research, many laws were passed and clean-up began, and while I must admit I thought I would never see it, the lakes did return to life.



Figure 2: R/V Joy



Figure 3: T-Boat

RISE OF MINI-SEMESTERS

In early 1970 the President of Alfred University came to me and said he was counting on me to help Alfred succeed with the new mini-semester scheme he had just instituted. It seems

he and the other Presidents of the CCFL member colleges had met as the CCFL Board of Directors and decided to change their academic calendars to include mini-semester. This was a new concept in higher education at that time, and the CCFL Board felt this would allow them to better provide opportunities for their students since they hoped to allow students from one college to attend mini-semester programs at another CCFL member college.

The big problem, however, is that the presidents decided on instituting mini-semester without first discussing the idea with their faculty. Needless to say, this radical change in the college academic calendar caused major dissension among the faculties. I am sure you can imagine history or English professors questioning how they could implement any of their curricula into a mini-semester format. To us today, such mini-semester are common, but in 1970 they were something completely new and different. In fact, in the early 1970s there were many calls for evaluations and reviews of such non-traditional programs, including those from various academic accrediting agencies.

For me, such mini-semester offered a unique opportunity for scientific field studies. With the mandate from Alfred's president, I set about designing a program for January 1971, but I certainly didn't want to spend a month aboard the Lake Diver IV on the lakes and waterways of New York State in the middle of winter (Fig. 4)



Figure 4: Winter on Deck of Lake Diver IV

I therefore set about obtaining another large vessel from US Government surplus, an open launch

from an aircraft carrier, which was located in Norfolk, Virginia.

Knowing that this boat lacked an engine, and having seen a large, 671 marine diesel engine on display at Alfred Ag-Tech, I discussed the situation with the Ag-Tech faculty. They were very willing to donate the engine and to work along with me and some of their best students to put the vessel into operating condition. We thus all traveled to Norfolk, installed the engine, and then motored the open launch through the Intercoastal Waterway to New York City, and then up the Hudson River and through the Erie Barge Canal system to Seneca Lake. Once in Watkins Glen I began building a deck and wheel house on the launch (Fig. 5), resulting in a live-aboard research vessel that could house approximately 14 students. By the fall of 1970 we were transporting the vessel back through the Intercoastal Waterway, to Miami, Florida. The students who were to take part in a January mini-semester came aboard after Christmas and we motored south through the Florida Keys to Key West.

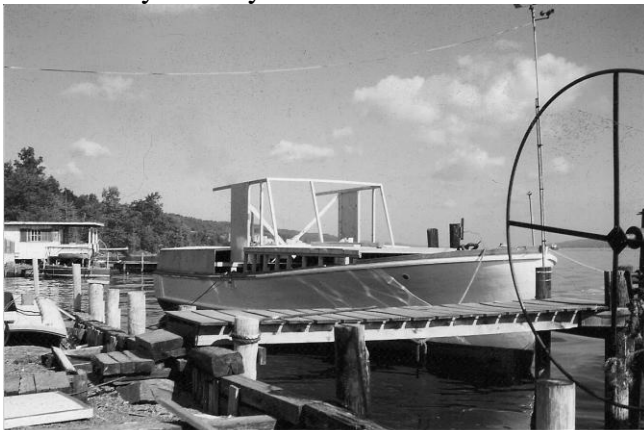


Figure 5: Building R/V Searcher 1

While this was a great deal of fun for me and the students, and I feel a very worthwhile educational experience, I am afraid we had some difficult times when we had to share marina space with million dollar yachts. Not only were such academic programs being questioned by traditional educators at our home campuses and by accrediting agencies, but we were having social problems with normal Americans as well. You need to realize that this was during the height of the “hippie” era. Our college students were dressing

uniquely, and behaving in ways that many people considered inappropriate to say the least. While I didn’t see anything all that bad happening among our students, I am sure that to the outsider the fact that young men and women were living together on the same boat was scandalous, even though they had separate quarters (Fig. 6). I knew that if we were to offer future, mini-semester field study projects, something different would need to be designed.



Figure 6: R/V Searcher 1 in Florida Keys

SAN SALVADOR

Thus it was fortuitous that Dan Sass, when he came to Florida to help with the course, brought my mail from Alfred University, among which was an advertisement for a facility on San Salvador Island, Bahamas, that was ideal for the establishment of a school (Fig. 7). This, of course, led me to develop a field station for the CCFL, which is now known as the Gerace Research Centre.



Figure 7: Dan Sass & Me in Florida Keys

San Salvador provided the setting that met the colleges' mini-semester objectives by providing a learning environment which differed substantially from the academic year (Fig. 8).

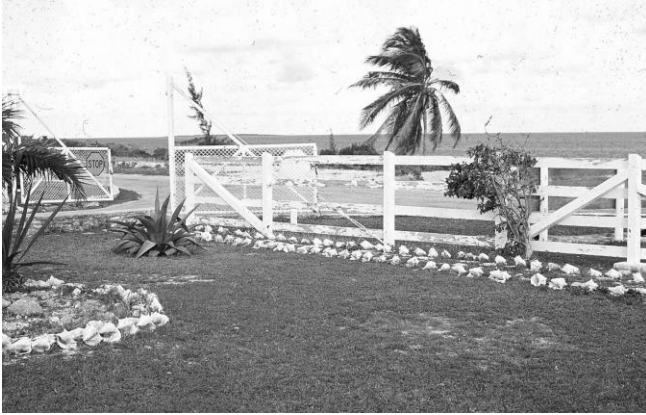


Figure 8: Naval Base on San Salvador in 1971

The presidents of the participating colleges designed the first program. They trained their faculty in the open-ended concept of teaching, where the role of the teacher was to assist the student, direct his learning by inquiry and at times, withhold help; gearing his/her response to the student's needs in a way that the student would be the discoverer.

The theme the presidents selected for the initial program was to achieve an understanding of man-land-sea-history relationships on the island. Students were instructed in research methods and techniques, to conduct preliminary surveys of the island to define suitable topics for further investigation. To support the theme, courses in archaeology, botany, cultural anthropology and marine zoology were offered. Moreover, each individual student was encouraged to develop a cultural interaction with the island people wherever possible. Thus, six purposes guided the activities at the field station:

1. to develop an appreciation for natural resources and environmental relationships
2. to develop an understanding of another culture
3. to instruct students in research methods and techniques
4. to develop a closer student-faculty relationship in a living-learning situation

5. to set an atmosphere where students can learn at their own pace with individualized instruction
6. to develop a better understanding of oneself and one's role in a society through a close living-learning situation.

The courses in archaeology, botany and marine zoology were very successful, but the anthropology course caused problems with the local people, who did not like to be studied. The CCFL presidents should have been forewarned when they heard that the Peace Corp had been asked to leave the Bahamas, as the locals did not like to be told what to do. Bahamians are very proud people.

However, the second year the CCFL presidents not only expanded upon the science courses, but included several social science and humanity courses in the curriculum, including nursing, music, art, and education. These all were failures in one way or another. The nursing students inspected the lunch boxes of the school children, causing once again problems with the local population. The education students, who were supposed to be student teaching in the local schools, were found to be keeping diaries critiquing the local teachers. And the music and art students spent most of their time on the beach, playing music and drawing, which caused resentment among the other students, who were busy in the field every day.

We then moved these types of courses to other islands in the Bahamas, but similar problems arose there. I knew the four CCFL schools that were using the field station were not able to keep such a large facility in operation. I needed to expand the program to other colleges and universities, so I immediately contacted my many friends in New York who had utilized the Finger Lakes Institute. This helped, but we needed even more business if we were to continue.

VALUE OF FIELD STUDIES

In order to advertise, I felt there was a need to be able to prove that a course offered at a field station in a foreign country, like the Bahamas, was truly academically worthwhile, and would

have a positive effect on the students taking such a course. In this way I could advertise not only the availability of the field station on San Salvador, but I could also provide statistical data showing that such courses were educationally sound and benefited the students in many measureable ways. While today we are aware that field courses are worthwhile and benefit the students in many ways, in the early 1970s many in academia, including accrediting agencies, questioned such courses.

VALUE OF FIELD STUDIES

To this end I developed a questionnaire which I gave to all of the students coming to the field station during the 1975-76 school year. It was administered when they arrived and again before they left the island. The questionnaire had four categories: Academic, Social, Relations with the Natural Environment, and Personal (Fig. 9). These reflected the uniqueness of the San Salvador Program, an academic situation emphasizing the emersion of oneself in a single course in a close living-learning relationship between student and faculty.

A total of 108 students took the pre-test and post-test, and the scores were compared by means of a "t" test to ascertain their significant differences. The entire test and each of the four sections of the test were analyzed. The results of the "t" test for the entire questionnaire revealed a significant amount of change between the pre-test scores and the post-test scores at the .05 level of probability, with the pre-test scores being lower than the post-test scores. This also proved true for each of the four major areas of the questionnaire.

To help identify any extraneous variables in the questionnaire design, and to gather more data about the factors causing any changes as a result of their experiences on the island, personal interviews were set up with some of the students and the faculty. These interviews were open-ended, with the organizational structure being only the four major areas of the questionnaire: academic, social, relations with the environment, and personal.

In summary, academically the students found that the San Salvador experience gave them a greater desire to learn and encouraged them to make better use of their time. Several of the students indicated they would become science majors, and those who had been weak students back home had become better students and had developed an interest in science.

Socially the students had learned to get along with and cooperate with others; found they had a greater respect for other peoples' views and a greater need to be with other students; and found they had a comradeship with the entire class and not just a few friends.

As for being in another environment with a different culture, the students found they benefited from the experience but had little interaction with the local people. They found the lack of development on the island was the major difference. They no longer took for granted things like electricity, indoor plumbing, and hot water. They felt they appreciated things more and that Americans wasted too much.

The faculty interviews revealed in all cases that the students were being affected in a most positive way by the San Salvador experience. But unlike the comments made by the student interviewees, who were content to describe changes taking place, the faculty discussed the reasons they felt were behind the changes they observed in their students. The primary factor having an effect on the students, as seen by the faculty, was the interrelationship between a unique academic situation and a close living-learning environment. It was seldom possible for a faculty member to describe student changes in terms of academic or social factors only, but rather the inter-play between these two was seen as the cause for student change.

A GOOD STUDENT

The most important thing in the San Salvador program, as seen by both faculty and students, was for a participant to be a "good student." This

San Salvador Characteristic Inventory

Name _____ Course taken on San Salvador _____

The following scale consists of a list of characteristics describing what a student should attain on San Salvador. You are asked to rate yourself on each of the characteristics. Some of these characteristics will be more pertinent and meaningful to you than others. Therefore, the ideal position for you on each characteristic will vary.

The scale is divided into 9 equal parts, with 9 being equivalent to “most like me” and 1 being equivalent to “least like me.”

Indicate by an (x) mark in the first row the point on the scale which best describes you at the present time on each characteristic. Be realistic and objective.

Academic Characteristics

- | | | |
|-----|---|-------------------|
| 1. | I attend all school classes and I am on time. | 1 2 3 4 5 6 7 8 9 |
| 2. | I come to class prepared for the work scheduled. | 1 2 3 4 5 6 7 8 9 |
| 3. | I am alert and attentive in class and listen to other class members' discussions. | 1 2 3 4 5 6 7 8 9 |
| 4. | I participate in class discussions. | 1 2 3 4 5 6 7 8 9 |
| 5. | I have an open mind and consider other points of view. | 1 2 3 4 5 6 7 8 9 |
| 6. | I have an interest in the subject matter of the course I am taking on San Salvador. | 1 2 3 4 5 6 7 8 9 |
| 7. | I understand the objectives of the course. | 1 2 3 4 5 6 7 8 9 |
| 8. | I have a positive attitude and I am enthusiastic towards learning. | 1 2 3 4 5 6 7 8 9 |
| 9. | I am determined and study and work hard. | 1 2 3 4 5 6 7 8 9 |
| 10. | I read the texts and references assigned and use other available sources. | 1 2 3 4 5 6 7 8 9 |
| 11. | I do additional work for personal satisfaction. | 1 2 3 4 5 6 7 8 9 |
| 12. | I evaluate myself often – my course work and my long range goals. | 1 2 3 4 5 6 7 8 9 |
| 13. | I do my best on all assignments. | 1 2 3 4 5 6 7 8 9 |
| 14. | I interrelate course content with other courses. | 1 2 3 4 5 6 7 8 9 |
| 15. | I get to know my instructors and their philosophies. | 1 2 3 4 5 6 7 8 9 |
| 16. | I ask my instructors for help when I need it. | 1 2 3 4 5 6 7 8 9 |
| 17. | I respect my instructors. | 1 2 3 4 5 6 7 8 9 |

- | | | |
|-----|--|-------------------|
| 18. | I cooperate with instructors. | 1 2 3 4 5 6 7 8 9 |
| 19. | I feel confident in developing a research project and carrying it through. | 1 2 3 4 5 6 7 8 9 |

Social Characteristics

- | | | |
|----|--|---------------------|
| 1. | I discuss course topics and my ideas with other students. | 1 2 3 4 5 6 7 8 9 |
| 2. | I easily make friends with others in my class. | 1 2 3 4 5 6 7 8 9 0 |
| 3. | I form my own opinions but respect other students' points of view. | 1 2 3 4 5 6 7 8 9 |
| 4. | I am willing to alter my style of dress if it is offensive to the society in which I am living. | 1 2 3 4 5 6 7 8 9 |
| 5. | I try to understand people who live in a life style different from my own. | 1 2 3 4 5 6 7 8 9 |
| 6. | I am at ease when in the presence of people of another race. | 1 2 3 4 5 6 7 8 9 |
| 7. | I am tolerant of people with social life styles different from mine. | 1 2 3 4 5 6 7 8 9 |
| 8. | I feel that my college faculty and administrators are looking out for my welfare. | 1 2 3 4 5 6 7 8 9 |
| 9. | I am honest and trustworthy because my integrity with others has a greater value than the goods procured by being dishonest. | 1 2 3 4 5 6 7 8 9 |

Relations with the Natural Environment

- | | | |
|----|---|-------------------|
| 1. | I am willing to sacrifice certain conveniences for the benefit of the natural environment. | 1 2 3 4 5 6 7 8 9 |
| 2. | I understand recycling and that old things are not to be disposed of just because they are old. | 1 2 3 4 5 6 7 8 9 |
| 3. | I have an understanding of land/man/sea interrelationships. | 1 2 3 4 5 6 7 8 9 |

Personal Characteristics

- | | | |
|----|--|-------------------|
| 1. | I know myself and know how I will react to most situations. | 1 2 3 4 5 6 7 8 9 |
| 2. | I know how to balance my time between working and relaxing. | 1 2 3 4 5 6 7 8 9 |
| 3. | I have confidence in my physical ability to withstand long periods of endurance. | 1 2 3 4 5 6 7 8 9 |
| 4. | I feel I have a great deal of self reliance. | 1 2 3 4 5 6 7 8 9 |

Figure 9: Questionnaire

value of being a good student was important to the individual student in viewing himself, was important to the faculty member in viewing his students, and was important to the students in viewing each other. In other words, it was the basic, underlying theme of the San Salvador experience.

The San Salvador program was intensive, individualized, and field research oriented. A student spent most of his or her waking hours out in the field observing and collecting specimens, in the laboratory studying them, and in lectures learning about them. The very nature of the San Salvador experience, which was total involvement in one's work, resulted in this emphasis on being a "good student."

To discuss further the concept of being a "good student" as it related to the social setting, the faculty went on to describe the social relationships among the students as they saw them. Students who were good students back on the home campus but who were often not socially accepted by most of their peers, became the ones most socially accepted on San Salvador, since they obtained the faculty's praise as being a "good student." Likewise, the students who were socially accepted back home but who were less academically oriented found that on San Salvador they were not as accepted socially unless they became a better student. Thus this social pressure altered their attitude towards learning and academic pursuits. Another example given by the faculty was the sports-minded student who back home was often a weak student. Because of the emphasis on field research in the San Salvador program students had to be able to endure a great amount of physical activity, like swimming and hiking. Thus the athlete often excelled in this type of learning experience and became a "good student" in the eyes of the faculty and thus in the eyes of his fellow students.

WHAT MOTIVATES US?

Over the years this same educational philosophy has guided what is now the Gerace Research Centre. I was pleased to read a newly published book that many educators are pursu-

ing as the "newest" theory to follow. The book, by Daniel Pink, is entitled "Drive: The Surprising Truth about What Motivates Us." His major premise is that we, as primates, are motivated to solve problems and investigate new things, not by the rewards we receive, but by our innate drive to actually want to solve problems. Maybe that is why and how I developed the GRC, since my mother-in-law always said that I "thrived on crises."

Pink supports his theory by describing an experiment that was actually done in 1949 with a group of rhesus monkeys. The monkeys were presented with a puzzle to solve, but were not given any instruction or rewards for solving the puzzle. Yet within a short time the monkeys had solved the puzzle and seemed to enjoy doing so. In other words, the joy of the task was its own reward.

Needless to say, this is exactly what we see happening in field education. Students and faculty as well, enjoy the learning that is taking place. They are motivated to succeed, not just by a reward for being a "good student", but by the joy of learning in a new and different environment. And we, as scientists, get joy out of solving the research problems we are pursuing. I really don't think Daniel Pink has hit on anything new, he has just summarized into a well written book, much of what we see every day in what is happening at the GRC.

THE PERFECT EXCHANGE

I recently read in the newspaper about how several colleges and universities are under investigation for the very high costs they charge students to take part in off-campus study programs, primarily those overseas. I couldn't help but think how the GRC has always kept its prices as low as possible in order to allow as many students as possible the unique opportunity to study and learn on San Salvador. This is all due to the "Perfect Exchange", which began when I realized that The Bahamas would benefit from having some of their high school graduates attend colleges and universities in the United States. I presented the proposition to the Baha-

mas Ministry of Education of granting tuition free scholarships for Bahamian students to study in the CCFL colleges and universities in exchange for the use of the facilities on San Salvador. Needless to say this “perfect exchange” has continued to this day, with many colleges and universities providing one or more such tuition scholarships in exchange for financial support for their students and their faculty researchers.

ACKNOWLEDGMENTS

I would like to thank Dr. Tom Rothfus, Executive Director of the Gerace Research Center, San Salvador, Bahamas, for inviting me as Keynote Speaker for the 14th Symposium on the Natural History of the Bahamas. I would also like to thank all of the symposium participants for so graciously listening to my memories and theories of field education. But most important, I would like to thank all of the hundreds of faculty and scientists, and the thousands of students, who have participated in the Gerace Research Centre through courses and research projects over these past 40 years. It is through them that the GRC continues to live and thrive.

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