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Successes with Reversing the Negative Student Attitudes Developed in Typical Biology Classes for 8th and 10th Grade Students

Esme Hacieminoglu
Necmettin Erbakan University, TURKEY
Mohamed Moustafa Ali
Alexandria University, EGYPT
Fulya Oztas
Selcuk University, TURKEY
Robert E. Yager
University of Iowa, USA

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The purpose of this study is to compare changes in attitudes of students about their study of biology in the classes thought by five biology teachers who experienced an Iowa Chautauqua workshop with and two non-Chautauqua teachers who had no experience with any professional development program. The results indicated that there are significant differences in student attitudes in favor with students of the five biology teachers who experienced of a full year of experiences an Iowa Chautauqua workshop.

Keywords: attitudes, interest, constructivist teaching

INTRODUCTION

Student attitudes are factors which affect learning in school science as well as being an outcome of instruction and an important indicator of science learning (Lester, Garofalo & Kroll, 1989). Developing positive attitudes toward science regardless of individual differences has been one of the purposes of science education for many researchers (Arısoy, 2007; Ali, Yager, Hacieminoglu, & Caliskan, 2013; Azizoğlu & Cetin, 2009). To indicate science teaching and its' effect on attitude focuses on the degree students are positive about their experiences with science. Attitude is defined as "feelings, beliefs and values held about the enterprise of school science, science and the impact of the science on society" (Osborne, 2003, p.1050).

It has been shown in that positive student attitudes have been reported to increase achievement in science and produce interest in scientific careers. Research

Correspondence: Esme Hacieminoglu,
Elementary Science education, Faculty of Education, Necmettin Erbakan University, Turkey.
E-mail: ehacieminoglu@gmail.com
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results indicate that there is a correlation between achievement and positive attitudes concerning school science (Cukrowska, Staskun & Schoeman, 1999). Students who have positive attitudes concerning school science has been focused tend to perform better than those who have negative attitudes; students who achieve highly have more positive attitudes than those who are low achievers (Beaton, Mullis, Martin, Gonzalez, Kelly & Smith, 1996).

There has been much interest in measuring student attitudes concerning their interest in science and their expressed use of it outside of school over the past 25 years. And yet, Recent reports continue to indicate that student attitudes regarding science in school worsen the longer students are enrolled in grades K-16 (George, 2006; Osborne, Simon, & Collins, 2003). Many reports concerning student attitudes regarding their school science began after the inclusion of "attitude" indicators in addition to the typical focus on traditional content comprising the Third Assessment of Science by the National Assessment of Educational Progress renewed interest in such negative reactions to school science have been noted after the 1996 release of the National Science Education Standards (NSES, NRC, 1996). Noteworthy are efforts related to projects emanating from the National Science Teachers Association (NSTA, 1992). These include Project Synthesis --a major NSF supported research project that attracted worldwide interest! Many projects in Iowa concerning professional development of teachers occurred after the NAEP attitude items were released. They were used as part of the evaluation in the NSTA Chautauqua Professional Development Project, the NSTA Scope, Sequence, and Coordination Project (SS&C) (Yager & Weld, 1999), Volume 3 of the NSTA "What Research Says to the Science Teacher" (Harms & Yager, 1981) and the more recent Title IIa Projects in 2003. This is a report of the use of some of the NAEP attitude items which have been used by teachers and researchers in Iowa in 2008.

State of the literature

- Studies regarding student attitudes toward science continue to indicate that student attitudes regarding science in school worsen the longer students are enrolled in grades K-16.
- Both organized professional development program for teachers and long-term studies are needed to develop affective domain such as attitude.
- The Iowa Chautauqua Program is unique by involving teachers as full partners in the reform efforts and at numerous sites across the entire state. Another unique feature was the yearlong effort beyond the summer workshop for teacher professional development that typically results only in teachers reporting opinions and perceptions following the workshop.

Contribution of this paper to the literature

- This is a report of project involving five biology teachers who were successful beginning teachers in a Chautauqua workshop focusing on changes in the attitudes of their students concerning their study of biology. Also involved two non-Chautauqua teachers serve as a control group when studying the impact of Iowa Chautauqua Professional Development for a three year period.
- The five biology teachers continued to enabling changing student attitudes and the perceived usefulness of biology experiences through the three years.
- The results were useful for realizing that systematic and long-term effort should be launched to develop an attitude towards science.

The Iowa Chautauqua Program was first funded by NSF in 1982 and continued in a variety of venues through 2005. The program is unique by involving teachers as full partners in the reform efforts and at numerous sites across the entire state. Another unique feature of the yearlong effort – beyond the summer workshop for teacher professional development that typically results only in teachers reporting opinions and perceptions following the workshop. Such assessment efforts rarely use information collected from students indicating specific results of actual trials of new procedures in terms of successes and failures. Results also include continuing interactions and/or involvements with Action Research projects with students of the teachers enrolled. The Iowa Chautauqua Model for Professional Development of K-12 Science Teachers constituted features over one full year.

I. **Leadership Conference** **Early June (10 days)**

Participants: 30 of the most successful teachers for meeting NSES Goals in past Chautauquas

a. Review of NSES Less and More Emphasis conditions
b. Differences of approaches for PreK-4, 5-8, 9-12 classes
c. Importance of adding investigations that indicate degrees of successes

II. **New Teacher Conferences** **June, July**

a. Organizing three to five month long Chautauqua workshops across Iowa annually for three grade levels for each site
b. Staff: Teacher Leaders for elementary; middle school, and high school groups
c. Planning a 5-10 day lesson to match the NSES recommendations for the More Emphasis features with specific plans for use and assessment in the fall

III. **Fall Short Course (3 days)** **October**

a. Report on successes and failures with students in the planned 5-10 day workshop
b. Plan for a 4-6 week New Module using the most successful features that were noted during the 5-10 day lesson plan from the summer
c. Plans for assessing results: pre and post data

IV. **Spring Short Course (3 days)** **April**

a. Report on teaching/learning results
b. Plans for changes needed in instruction
c. Data indicating successes in the Six Domains
d. Selection of new Teacher Leaders for Leadership Conference for next summer

The results of summer workshops are typically reported at 3 day short courses usually in October and again in April after an even more extensive trial period. Many Chautauqua sites remain active over the following two years. Successes are measured regarding what teachers do in the classroom/ laboratory and the effects of such actions on student learning. Almost every cycle at each site results in the identification of the most successful teachers and an invitation to them to help with the instruction at other sites involving new teachers and schools. Often such "Lead Teachers" at a given site are involved for a full three year experience.

Chautauqua efforts continued with the NSTA Scope, Sequence, and Coordination (SS&C) efforts which were funded for involvement of all 7 through 10 teachers in 20 Iowa school districts from 1990-1997. Additional support over this time period involved funding from the National Science Foundation (NSF), the U.S. Department of Education, Iowa Utilities Association, local industries, Iowa Title IIa, and local boards of education. A basic feature has been the involvement of teachers in continuing Action Research projects – sometimes four during a single year. Some of the studies have lasted for several years with collaboration of two or more Teacher Leaders. Many of these efforts have resulted in reports at regional, state, and national meetings. Many were used with new workshops for new teachers, often those active in teaching biology.

This is a report of one Action Research project involving five biology teachers who were successful beginning teachers in a Chautauqua workshop focusing on changes in the attitudes of their students concerning their study of biology, specifically in grades 8, and 10. Also involved were two non-Chautauqua teachers who were interested and agreed to help with this study and to serve as a control group when studying the impact of Iowa Chautauqua Professional Development for a three year period. The five biology teachers continued to enabling changing student attitudes and the perceived usefulness of biology experiences now and in

the future. The results were useful in changing the teaching in the classrooms of the two control teachers, especially after their involvement with this study.

The purpose of this study was to compare five biology teachers who had experience organized professional development program with those from students in two classrooms where teachers who had experienced no major efforts to improve student attitudes concerning biology for students in grades 8 and 10. The main research questions framing this study are:

1. How do results concerning attitudes of biology content included in classrooms of Chautauqua teachers compare with those from the two teachers who did not experience any organized professional development program in 8th, and 10th grades?
2. How do results concerning usefulness of biology content included in classrooms of Chautauqua teachers compare with those from the two teachers who did not experience any organized professional development program in 8th, and 10th grades?

METHODS

All data were collected at the beginning of the school year and again at the end of the first semester (for most schools starting at the end of August with the first semester ending at the end of December). Similar data were collected three years later with sample sections taught involving the same five partner teachers at the same grade levels as illustrated in Table 1. The same instruments and class observations were collected from the two teachers without Chautauqua experiences.

The data available indicate starting points for a school year and the end points at the end of the first semester. The same actions were repeated three years later. Indication of changes over the three year period were noted for any changes in student attitudes and their views regarding the usefulness of their biology study when considering its use in daily living, encouragement for further study, and for considering science and/or technology careers!

The two non-Chautauqua teachers taught one section of life science students in grade 8 and biology in grade 10. These two teachers for the non-Chautauqua sections were quite content with traditional teaching approaches and never participated in any Chautauqua efforts or any other sustained professional development program. It is fair to say they followed a ridged curriculum that matched the textbooks used.

RESULTS

Tables 2 and 3 indicate results for the research question concerning "How do results concerning attitudes and usefulness of biology in the classroom of Chautauqua teachers compare with those from the two teachers who did not

Table 1. The varied class sizes for the five biology teachers and the two non-Chautauqua teachers

Five Teachers with Chautauqua Experiences					Two Non-Chautauqua Teachers			
	Year One		Three Years Later		Year One		Three Years Later	
Teachers	**8th***	**10th****	**8th***	**10th****	**8th***	**10th****	**8th***	**10th****
1	22	21	19	21	18	20	18	20
2	11	11	14	12	23	14	19	17
3	19	19	21	24				
4	31	22	24	21				
5	24	23	18	17				
Average	21.4	19.2	19.2	19	20.5	17	19	18.5

**Life Science Teachers*
***Biology Teachers*

Table 2. Percentages of student interest concerning biology courses for five biology teachers who had experienced an Iowa Chautauqua workshop compared with two non-Chautauqua teachers

		Fall		Spring	
Interest		**8th**	**10th**	**8th**	**10th**
Control Group	Positive	48	30	18	17
	Netural	43	49	41	43
	Negative	9	21	41	40
Experimental Group	Positive	48	56	58	61
	Netural	52	42	42	39
	Negative	0	2	0	0

Table 3. Percentages of usefulness concerning biology courses for five biology teachers who had experienced an Iowa Chautauqua workshop compared with two non-Chautauqua teachers

		Fall		Spring	
Usefulness		**8th**	**10th**	**8th**	**10th**
Control Group	Daily Living	36	28	29	15
	Further Study	69	53	52	47
	Potential Career	21	19	19	15
Experimental Group	Daily Living	61	64	51	84
	Further Study	82	91	88	91
	Potential Career	39	62	40	44

experience any organized professional development program in 8th, and 10th grades?"

The results included as Tables 2 and 3 indicate the percentages of students' reactions to interest in and usefulness of biology of the two teachers who had never been enrolled in a Chautauqua Workshop or any other professional development workshps. The five teachers who were successful beginning teachers in a Chautauqua workshop focusing on changes in the attitudes of their students concerning their study of biology, specifically in grades 8, and 10. While the five biology teachers in the experimental group continued to enabling changing student attitudes and the perceived usefulness of biology experiences, two control group teachers were quite content with traditional teaching approaches and never participated as part of the Chautauqua efforts or any other sustained professional development programs. It is fair to say they followed a ridged curriculum that matched the textbooks used.

In the experimental group, student interest in studying biology, in terms of its being fun and exciting, increased by the end of the spring semesters. For example, only 48%, and 56%, of 8th, and 10th grade students in the fall semester indicated that they had positive attitudes towards studying biology. This percent increased to 58%, and 61%, in the spring of the same year. There were no students with negative attitudes towards studying biology for both semesters. There were slightly little change of results for student interest in studying biology were observed in the students reported as having "neutral" interest in biology from fall semester to spring semester. In the control group, the same pattern of results for student interest in studying biology were observed in the students reported as having "neutral" interest in biology. While student positive interest towards studying biology decreased by the end of the spring semesters, negative interest towards studying biology increased at the same semesters. For example, only 48%, and 30%, of 8th and 10th grade students in the fall semester indicated that they had positive attitudes towards studying biology. This percent decreased to 18%, and 17%, in the spring of

the same year. On the other hand only 9%, and 21%, of 8th and 10th grade students in the fall semester indicated that they had negative attitudes towards studying biology. This percent increased to 41%, and 40%, in the spring of the same year. The difference between experimental and control group with respect to positive and negative attitude towards studying biology can be seen in the table 2.

The data indicate that there is a lack of interest among many students who study biology where traditional classroom settings usually start with an externally directed curriculum (or textbook) in which students are sitting and listening, watching demonstrations, and taking notes. These findings raise many questions about the relevance of what is taught and the way by which biology is taught.

In the control group, student perceptions of the usefulness of biology for potential careers seem to be more stable than their perceptions of the usefulness of biology for daily living and further study. For example, the data collected in the fall indicate that 8th and 10th grade students describe biology classes as useful for potential careers (21% and 19%). This percent decreases by the end of the spring semester to 19% and 15% for the same students. Data collected from 8th grade students about their perceptions of the usefulness of biology indicate that 36% and 28% of the 8th and 10th grade students reported biology as useful in their daily lives. This percent decreased by the end of spring to 29% and 15%. The same patterns were observed their perceptions of the usefulness of biology as further study.

In the experimental group, there were no stable change regarding perceptions of the usefulness of biology for potential careers, daily living and further study for both grade levels from fall semester to spring semester as that of in control group.

Data collected from experimental group for both 8th and 10th grade students about their perceptions of the usefulness of biology for potential careers, daily living and further study had significantly higher percentage than those of the control group. Namely; in control group student perceptions concerning the usefulness of biology for potential careers, daily living and further study for 8th and 10th grade students for fall and spring semester increased in the experimental groups for 8th and 10th grade students in the same semester. In control group only 36% and 48% of 8th and 10th grade students in fall semester, and 29% and 15% of 8th and 10th grade students in the spring semester perceived their biology classes to be useful for daily living. This percent increased for the students in experimental group, as 61% and 64% of 8th and 10th grade students in fall semester, and 51% and 84% of 8th and 10th grade students in the spring. With respect to further study, in control group only 69% and 53% of 8th and 10th grade students in fall semester, and 52% and 47% of 8th and 10th grade students in the spring semester perceived their biology classes to be useful for further study. This percent increased for the students in experimental group, as 82% and 91% of 8th and 10th grade students in fall semester, and 88% and 91% of 8th and 10th grade students in the spring. Regarding the potential career perceptions, in control group only 21% and 19% of 8th and 10th grade students in fall semester, and 19% and 15% of 8th and 10th grade students in the spring semester perceived their biology classes to be useful for potential career. This percent increased for the students in experimental group, as 39% and 62% of 8th and 10th grade students in fall semester, and 40% and 44% of 8th and 10th grade students in the spring.

DISCUSSION

The Chautauqua Professional Development Model is successful in helping teachers to become more student-centered. They model the nine areas emphasized for improving teaching in the National Science Education Standards; these features include:

1. Understanding and responding to individual student interests, strengths, experiences, and needs.
2. Selecting and adapting curriculum.
3. Focusing on student understanding and use of scientific knowledge, ideas, and inquiry processes.
4. Guiding students in active and extended scientific inquiries.
5. Providing opportunities for scientific discussion and debate among students.
6. Continuously assessing student understanding.
7. Sharing responsibility for learning with students
8. Supporting a classroom community with cooperation, shared responsibility, and respect.
9. Working with other teachers to enhance the science program. (NRC, 1996, p. 52)

Student perceptions concerning the usefulness of biology are related to their interest in studying biology. Unless students are able to see the usefulness of biology in their daily lives and for further study, the chance of their being disinterested in biology grows. Others (George, 2006; Haselhuhn & Andre 1997) reported that students who perceive science to be useful are more likely to be enrolled in additional science subjects.

A fall in the number of those who indicated biology and technology as potential careers may be related to the decline of student interest in science which affects the success of a country's economy. For example, Leyden (1984) reported that fewer than 1.2% of high school graduates are interested in scientific careers. In England and Wales Barmby, Kind, and Jones (2008, p.1075) voiced "there has been a 41% fall in numbers of students continuing study of Advanced-level science between 1985 and 2006". Moreover, the decline of interest in continuing the study of biology is important for any society trying to raise the level of its scientific literacy of its citizens (Osborne, Simon, & Collins, 2003).

Such classroom settings as those in the classrooms of the two control teachers pay no attention to the interests of students, which in turn eliminates their motivation and logically seems to be responsible for the increasing negative attitudes about biology study. Since student perceptions of science are strongly influenced by their experiences in science classrooms, it is important for students to be more active participants in their learning rather than being passive recipients as in traditional settings. Moreover, unless students are able to see the usefulness of science in daily lives and for further study, the chance of their being disinterested in science grows (George, 2006). Haselhuhn and Andre (1997) have reported that students who perceive science to be useful are more likely to be enrolled in additional science subjects.

CONCLUSIONS

In conclusion, a positive image of biology in student minds can prevent the decline in student enrollments in science classes while also increasing science popularity among students. This may in turn result in students making positive decisions about choosing science as a future subject for study as well as for.

Student attitudes are enhanced by teachers who are successful with a professional development project like Iowa Chautauqua which encourages all of the More Emphasis features contained in the National Science Education Standards (NSES). Too often wonderful ideas are uncovered in professional development programs – but often not put into practice in classrooms. The descriptions of the classrooms of the five Chautauqua teachers indicate well the NSES facets of change advocated in the standarts.

The standards indicate ways of supporting reform teaching and what it can do to improve the schools, the community, and the lives of students. Education should result in real changes as opposed to places where it is important to please the teacher and to work following his/her directions.

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