

FACTORS THAT DISCOURAGE STUDENTS TO MAJOR IN BASIC NATURAL SCIENCES: THE CASE OF KOTUBE COLLEGE OF TEACHER EDUCATION

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ABSTRACT: *The paper has the purpose of identifying how seriously students avoid Basic Natural Sciences as major fields, identify those background variables that could influence students not to consider the sciences as major fields and, importantly, point out what factors contribute towards the swing away of students from the sciences. The sample consists of students who studied science while in high school and now are either in the Science fields or Non-Science fields where no science courses are being offered. Analysis of the data gathered through a questionnaire and the students' files in the Record Office of the Registrar, KCTE, reveals that the problem is indeed very serious and that students avoid Basic Natural Sciences because of problems related to the way they perceive the study condition, the subject matter, and certain variables related to themselves. Implications are discussed and recommendations are forwarded to alleviate the problem.*

1. INTRODUCTION

Science is a cumulative and endless series of empirical observations which result in the formulation of concepts and theories, both concepts and theories being subject to modification (Collette, 1973: 3). It is a procedure of inquiry. Just as reading is a fundamental instrument for

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exploring whatever may be written, so science is a fundamental instrument for exploring whatever may be tested by experiment and observation.

The study of science is directed towards ennobling man's life, lifting it up from the sphere of mere physical existence and leading the individual towards freedom. The increasing dependence of human societies for their advancement on the applications of science and technology has a deeper and broader significance for science education than the production of skilled manpower to utilize available natural resources (Gillbert and Lovegrove, 1972:62).

According to Gilbert and Lovegrove, the tasks of science education in any society are to promote scientific literacy, enable school graduates to cope up effectively with their natural environment, prepare effective citizens and provide children with the opportunity to develop critical thinking.

Science education is meant to make life simple; if so, who should study science? This is clearly a psychological question. It can only be explored at those ages in which pupils are allowed some freedom in their choice of a subject. Solomon (1986) argued that since the first of these occurs at puberty, it is often boys, achieving only very slowly that progress towards a confident self-image, who choose the science option. He also argued that there was some evidence that the girls choosing science were more matured than others, as indeed they might need to be in the face of the stereotype of the male scientists.

A person who studies science should have scientific attitude: the willingness to wait for a conclusive answer, the skepticism that requires intellectual restraint and maintenance of doubts. John Head (cited in

Solomon, 1986:437) argued that science students were more likely to agree with sentences like "I am more interested in things than people" "I would rather learn about a country's geography than its people", while non-scientists agree more strongly with statements like "I enjoy talking with friends about personal matters".

Hodson and Reid (1988) suggested that science education should be given for all students so that well-qualified scientists, technologists and engineers could be recruited from them. The current UNESCO slogan is also "science for all". Although UNESCO suggests the need to have more students in Science fields, the present generation seems to have developed hatred towards science and tend to escape its clutches both in developed as well as developing countries.

In Britain today there are constant plea to get more pupils, of both sexes, but particularly more girls to science, as choice for science is strongly sex stereotyped (Kelly, 1988). According to the data published by the U.S. Office of education, the percentage proportion of students who choose to join Basic Natural Sciences is by far less than those joining Social Science, Business and Commerce (Fischer, 1971:68). Gillbert and Lovegrove (1972:40) showed that the proportion of students joining Basic Natural Science fields in Kenya are less than the proportion of students joining Non-Basic Natural Science fields. The attitude of students towards Basic Natural Science at Addis Ababa University was explicitly indicated by the work of Belay et al. (1991). According to their findings, the proportion of students who choose to join Basic Natural Science fields was by far less than those who choose to join Non-Basic Natural Science fields. According to the data from the Record Office at Kotebe College of Teacher Education (KCTE) in the last three academic years (1992-95), it is only less than 15 percent of the students among those who were

assigned to study at the college by the Commission for Higher Education (CHE) that showed interest to join Basic Natural Science fields (Students' File in the Record Office of the Registrar, hence forth, SFROR 1992-95, KCTE).

The problem of enrollment in a Science Department is more serious with female students. No one female student has graduated, for example, from the Science Departments for at least the last six years in KCTE (SFROR, 1992-95, KCTE).

This may be because the choice for Science is strongly sex stereotyped (Kelly, 1988) and that science is perceived as hard, masculine, complex concrete, and intellect based (Weinreich-Haste, 1979 cited in Colley, 1995: 346).

Gibson (cited in Miller, 1970:203) pointed out that at universities in Britain the failure rate in science has been increasing by just over 2 percent annually and now stood over 30 percent. It may follow that as the shortage of science graduates becomes worse there will be a further corresponding increase in the shortage of science teachers, followed by still more serious lack of applicants for undergraduate science places; and so the vicious downward spiral will gather momentum of its own.

The basic question here is, therefore, why do students avoid studying science or what are the factors affecting students' attitude towards science thereby pushing them away from the fields of science?

According to Hodson and Reid (1988), many pupils have negative attitude toward Science because of the contemporary Science curricula which need to be improved: science begins too late and for many ends too soon; many courses have too much contents; others have contents

that are too difficult and too abstract; some courses make little, if any, attempt to deal with philosophical, historical, social, economic, moral and ethical issues; there is too little integration of the sciences within themselves and with other disciplines; too little attention is paid to individuality of learning needs and individuality of responses.

The second possible factor may be the methodology used to teach science and lack of the trained science teachers. In this connection, Gilbert and Lovegrove (1972:62) argue that the major problems that face science teaching in Africa include at least four points: (1) the poor training of teachers in science, (2) the rigid adherence to the syllabus, (3) the worship of paper qualifications, and (4) learning by rote.

The kind of philosophy of education that students develop may also play an important role (Hoy, 1972:9). Naturally students raise questions about themselves and the kind of education which they think can fit their beliefs, needs and values. If students are ill-prepared to develop confidence in themselves by developing their own philosophy of education, then, they tend to rely on other influential sources and information available in their vicinity for making vocational choice.

Issues of prestige associated with the field of study and the occupation accompanied by the field could be the fourth possible factor which could contribute towards the negative attitude of students towards Basic Natural Sciences; because these issues are major points of discussions among students as indicated by Miller (1970:203).

Last but equally important factor could be students' lack of adequate information about vocational choice. In the absence of adequate information as a result of absence of vocational guidance and orientation in Colleges, students are left to conform to stereotypes

which senior students develop about academic fields in college but such stereotypes are not always very close to the reality (Beardsle and Dawd, 1962:600).

So far attempts have been made to show as to what existing literature say about the factors that lead students to develop negative attitudes towards science and thereby avoid choosing it as a major field of study. It is evident, however, that the importance of these factors may vary across countries and institutes. The specific realities in which colleges and universities operate cannot be assumed to be the same. Difference in culture, philosophy of education, economic situations etc. result in differences as to how the above factors shape students' choice of science as a major field. In this regard, no research has been conducted so far particularly in KCTE to find out what and how factors influence students not to consider science as a major field. The present paper aims to fill in this gap.

2. STATEMENT OF THE PROBLEM

As it has been indicated in the ongoing discussion, since long time, for reasons to be identified, the tendency of students seems generally to avoid Basic Natural Sciences even at KCTE and hence there is a need to investigate these problems at some length specifically raising the following questions.

- (a) How serious is the problem?
- (b) What background differences exist between students who choose to study or avoid to study the Basic Natural Sciences?

2.1 Student themselves as a factor

The following questions are raised under this factor: Is it because

- a) students are not well-conscious of what science can and cannot do (students do not understand and appreciate the true nature of science)?
- b) student feel that they cannot construct meanings of what they observe or is it because they are reluctant to accept or believe what they have learnt?
- c) students believe that the payment for science personnel does not commensurate with the work they perform and the rigorous they pass through while studying science in the college?

2.2 Their views regarding subject matter issue as a factor.

The following questions are raised under this factor: Is it because

- a) science education is not considered to have economic and social importance?
- b) too much stress is believed to be experienced while studying Natural Sciences?
- c) Natural Science courses are considered to have too many contents which are too abstract and difficult to understand?
- d) the existing Natural Science courses are not viewed as problem solving (i.e. that they are not solvable)?
- e) the Natural Science courses offered in the college are not found to be stimulating students to go to scientific vocations?
- f) students believe that they are redoing demonstrations and cook-book exercises to reconfirm previously known facts, but do not feel encouraged to do original work?

2.3 Study condition as a factor.

The following questions are raised under this factor: Is it because

- a) students feel that there are no enough facilities to study science in the college?
- b) instructors are considered as unqualified and have outdated science background?
- c) students experience certain practical problems that cost (time, energy, money) only because they are studying science?

In short this paper has the objective of identifying the seriousness of the problem of avoiding science as a major field at KCTE, the background variables that could possibly make students choose or avoid science as a major field. An attempt is made to determine how far the above factors contribute in forcing students avoid science in KCTE.

3. METHODOLOGY

Under this section the sample and sampling procedure and instruments used in data collection are discussed.

3.1. Sample and sampling procedure: the sources of the data are students pursuing in the diploma programme (2 years) at KCTE and who were in the science fields while they were in high schools and also who are:

- i. still in Natural Science fields in the college which constitute group one (G1), and

- ii. now in the Non-Natural Science fields where no Science courses are being offered (Amharic, English and Business Education) that constitute group two (G2).

In KCTE, there are four departments in the Basic Natural Science fields: Mathematics, Chemistry, Physics and Biology. As it has been indicated previously, the major objective of this research is to investigate the factors affecting students not to consider Natural Science fields in KCTE as a major field of study. Department of Mathematics is not selected as a sample source because there is sufficient evidence suggesting that Mathematics can be considered as a major field to reasonable proportion unlike other Natural Sciences fields. The total number of students admitted into the college to be assigned into the 11 departments in the diploma Programme, for example, are 233, 281 and 302 in the three academic years (1992-95) respectively (S F R O R, 1992-95 KCTE). It is expected that an average of 21, 25 and 27 students should choose each department if all departments are attracting students equally.

The number of students who chose to join Mathematics Department in the three academic years are 24, 21 and 20 respectively. These proportions are close to the above expected averages implying that Mathematics is indeed attracting students to the extent that other Non-Natural Science fields do. Therefore, Mathematics Department is not considered as a sample. Accordingly, for group one, respondents are taken from the remaining departments. There are 36 students who are currently enrolled in the three

departments (Biology = 24, Chemistry = 10, Physics = 2). All of them are considered in the present research. As to the second group, 50 percent of the 62 students who are currently enrolled in the departments where no science courses are being offered were science students while they were in high school. All of them (31 students) were considered in the present paper.

3.2. **Method of data collection:** two methods of data collection were used. Questionnaire and students' file available in the registrar office at KCTE. A questionnaire was prepared in Amharic and distributed to all the 36 students in Group one and all the 31 students in group two. All except 2 have filled and returned the questionnaire. The questionnaire consists of open-ended and close-ended items. The content of the questionnaire included the following issue:

- i. Background information (e.g. age, sex, place of high school education and grades on certain subjects of the ESLCE).
- ii. Possible factors influencing students for choosing science fields (the students themselves, their views about the subject matter and the study conditions).
- iii. Problems faced by natural science students at the college (lack of facilities, the nature of the courses offered, course load and time constraint).

Information obtained from unstructured interview with an official in the registrar's office KCTE was also used to supplement available documented materials.

4. RESULTS AND DISCUSSION

4.1 Magnitude of the Problem:

Faculties and Colleges of Teacher Education are now selecting prospective teachers from among the least academically talented population applying for admissions. The decline in academic skill evident in the applicants pool extends from enrolled freshmen to graduating seniors who majored in Teacher Education. The best teachers do not choose to enter the teaching profession upon graduation from college, even after they are trained and certified to be teachers. Of necessity, education faculties and teacher education colleges are the least selective because students do not want to join teaching professions (Pigge, 1985).

The problem is even serious with science education. Kotebe College of Teacher Education is training teachers in the diploma (2 years) and degree (4 years) programs. At present, there are 11 departments in the college. The total number of students assigned by the CHE to study at KCTE in the diploma programme in three academic years (1992-95) are 233, 281 and 302 respectively (SFROR, 1992-95, KCTE). If each department has a fairly comparable chance of being selected as a major field, then the number of students applying for each of the 11 departments should, therefore, be 9.1 percent (21, 25, and 27 respectively) on the average. This means that if every thing goes well, out of the total of 816 students in the three academic years, 219 (26.8%) students must have chosen the three Basic Natural Science Departments. But as indicated on Table 1, only 102 (12.5%) students chose to join these departments. [Note here also that students in all the departments in the three years are males]. This shows how seriously students are indeed moving away from the science fields. As it can be

seen on the table, the problem is even worse in the case of physics Department. Throughout the three years this department seems to attract the minimum number of students.

Table 1: The proportion of students who chose to join the science departments at KCTE in the three academic years (1992-95)¹

Academic year	Total No. of Students who Joined the College	No. of students who chose Biology Dept. freq(%)	No. of students who chose Chemistry Dept. freq(%)	No of student who chose Physics Dept. Freq(%)	Total No. of students who chose to join the Science Depts. Freq(%)
1992-93	233	12(5.2)	15(6.4)	4(1.7)	31(13.3)
1993-94	281	21(7.5)	14(5.0)	3(1.1)	38(13.5)
1994-95	302	19(6.3)	11(3.6)	3(1.0)	33(10.9)
TOTAL	816	52(6.4)	40(4.9)	10(1.2)	102(12.5)

In responding to the interview questions, an official in the Registrar Office indicated that usually some departments have more applicants than they can accommodate. Students who are rejected by such departments will simply be assigned to some other departments where there are rooms. That is why the number of students enrolled in each of these departments usually exceeded the number of applicants. But when students are forced to join fields to which they felt no interest, they may decide to withdraw (Asmerom et al., 1989). A case in point may be that of the Physics Department (see Table 2).

As it can be seen on Table 2, the number of students who were forced to join this department in all the three years is almost twice the number of students choosing to study this field. It is also evident in this table

¹ Taken from SEROR, 1992-95, KCTE.

that the proportion of students withdrawing in each year is almost equal to the number of students who are forced to join this field. This may suggest that those students who are forced to join the field are withdrawing.

Table 2: Profile of the students in Physics Department in three Academic Year (1992-95)²

Academic year	Students chose to join freq(%)	Students enrolled freq(%)	Students withdrawing freq(%)	Students dismissed freq(%)
1992-93	4(1.7)	14(6.0)	7(3.0)	3(1.3)
1993-94	3(1.1)	11(3.9)	6(2.1)	1(0.4)
1994-95	3(1.0)	9(3.0)	6(2.0)	1(0.3)
Total	10(1.2)	34(4.2)	19(2.3)	5(0.6)

In short the table shows how serious the problem is at KCTE, where a department exists to teach two or three students in the diploma programme. It seems that it is only because of the strong faith in education that the college is running the program in this meager economy.

4.2 Profile of the Subjects

A breakdown of the respondents who completed the questionnaire indicates that there is no female among the Natural Science students and out of 31 students only 5(16.1%) are females among the Non-Natural Science students (see Table 3). As the record at KCTE indicates no female student has graduated from Biology, Chemistry or Physics Departments since 1992 (SFROR, 1992-95, KCTE). In this connection it has been generally shown that there is an imbalance between female and male students in institutions of higher learning in

² Taken from SEROR, 1992-95, KCTE.

Ethiopia(Tsigie, 1991). This is even serious in Basic Natural Sciences (Hirute, 1986). As regards the ages, it ranges from 18-30, the mean age being 20.7 years. It can also be seen on Table 3 that age is not a factor for not choosing the sciences.

If places of high school attendance of the subjects may mean anything, (see table below) 82.4 percent of the respondents who remained to be in science fields in the College and 54.8 percent of those who have shifted away from science have done their high school education in villages and small towns. The proportion of students who have learnt in villages and small town and have continued with the science option are more than those who have learnt in villages and small towns and have shifted away from science in the college.

Table 3: Background of the Respondents (sex, age, place of high school attendance)

ITEMS	Group 1		Group 2	
	Freq.	%	Freq.	%
Sex				
male	34	100	26	83.9
female	-	-	5	16.1
Total	34	100	31	100
Age				
18-20	13	38.3	15	48.3
21-25	18	52.9	14	45.2
26-30	3	8.8	2	6.5
Total	34	100	31	100
Place of high school education				
Cities & big towns	6	17.6	14	45.2
Small towns & villages	28	82.4	17	54.8
Total	34	100	31	100

The possible explanation for the difference in proportion could be that students from the "remote" parts of the country may not have "advice"

from senior students, since there are only few students joining the College from that part of the country who could give them some sorts of orientation (Habtamu, 1992).

As regards ESLCE GPA, t-test of the differences between the mean ESLCE GPA of the two groups indicates that there is a statically significant difference ($t = 4.04$, $d_f = 63$, $P < 0.01$). This suggests that students who studied science in high school but changed their choice while entering the college might undertake such a decision partly because they might doubt their performance in these fields.

Table 4: Respondents' ESLCE GPA in Biology, Chemistry and Physics.³

	N	Mean ESLCE GPA	Standard deviation
Group 1	34	2.79	0.37
Group 2	31	2.63	0.41

4.3 Why do students avoid majoring in Basic Natural Sciences?

4.3.1. Students themselves as a factor

The first logical question to be investigated is "why do students at high school level choose the Natural Science area and then shift away from it in the college"? When the subjects were asked to give reason/s as to why they joined the Natural Science field high school; 79.4 percent of

³ ESLCE GPA is calculated by considering grades in Biology, Chemistry and Physics subjects of the ESLCE, because the purpose is to see if the students performance on these subjects might have influenced the choice.

the Natural Science and 74.2 percent of the Non-Natural Science respondents gave interest as their main reason. But when they were asked to rate their appreciation about science while they were in high school and at present, only 41.1 percent of the Natural Science and 45.2 percent of the Non-Natural science respondents claimed to be conscious of what Science can and cannot do while they were in high school.

This shows that students do not seem to have an understanding and appreciation of science while they were in high school. Of course, as one may logically expect, the appreciation for science has increased among the natural Science students from 41.1 percent to 50 percent while it is decreasing among the Non-Natural science students from 45.2 percent to 22.6 percent after they join the college.

John Head (cited in Solomon 1986:437) argued that an individual with scientific attitude prefers to discuss about matter than personality and about a country geography than its population. The subjects were asked about this point. In line with Head's argument, more respondents in the Natural Science area (82.4%) than in Non-Natural Science area (64.5%) have preferred to discuss about a country's geography than its people and about matter than personality. This suggests that the students who are choosing science departments have more scientific attitude than those who have shifted away from Natural Science fields; it is also suggested by Head.

Science is a study about the real world. But to study the real world we need to introduce something which are not part of the world of our sense impression and whose existence is proved only in effect e.g. electron, electric field (Drive and Bell, 1986). Students should have mental pictures of these imaginative constructions for a real

understanding of the Natural Sciences; otherwise it becomes rote memorization. 41.2 percent of the Natural Science and 45.2 percent of the Non-Natural Science respondents have admitted to have the problem of visualizing things like an electron and an electric field.

The issue of remuneration of science personnel was also raised to the subjects; assuming that this may also be a factor affecting students not to major in Basic Natural Sciences. The majority of the respondents (97.1% of the Natural Science and 58 1.% of the Non-Natural Science) suggested that the payment for science personnel does not commensurate with the work they perform and the rigorous they have to pass through while in the college. As one may expect, the proportion of the Natural Science students who said that the payment is less is more than the proportion of the Non-Natural Science students. But the majority of both groups have agreed that the payment for science personnel does not commensurate with the work they perform and the rigorous they have to pass through while studying science.

Even though the respondents in both groups said that they were interested in science and joined the field while they were in high school, since their appreciation for science is relatively low while they were in high school and at present, and since the majority of them reported to have problems of visualization and comprehension of intangible matters like electrons, and also as they indicated in their responses that the payment is not attractive, it seems that students themselves do have problems of readiness to get in to science fields. In fact, the majority of those students shifting to the Non-Natural Science

fields do show an added problem - that they tend to lack the necessary scientific attitude (see Appendix I).

4.3.2 Students' views of the subject matter as a factor

Appendix II depicts a series of items set up to elicit students' responses on subject matter related issues as possible factors coloring their decision to avoid sciences as major fields. The subjects were asked to indicate the preference of college students in general between Natural Science and Non-Natural Science fields. 76.5 percent of the Natural Science and 100 percent of the Non-Natural Science respondents said that students at the college level prefer to join the Non-Natural Science fields rather than the Natural Science fields. This question was further extended by an open-ended question to give the reason/s as to why most students preferred the Non-Natural science fields. Among the many reasons given the major ones are indicated as under:

- i. Science courses are difficult to understand
- ii. Science courses require too much time for practical work and report writings.
- iii. Science students are always working under stress.
- iv. In high schools science courses are not supported by practical activities
- v. Natural Science courses at high school do not stimulate students.
- vi. An average student can graduate from Non-Basic Natural Science departments; while even a bright student can be dismissed from Natural Science Departments.
- vii. Senior students usually wage psychological warfare on freshmen students about the hardship experienced by science students.
- viii. Most students join the college just to be able to graduate safely and earn a living.

- ix. Science courses are not being offered in such a way as to enable us solve our daily problem. We have not seen science in action.
- x. Science courses have too much mathematical treatments.
- XI. Students are asked to choose departments immediately upon arrival: no enough time is given to think as to what to choose.

From the reasons given, it seems that students tend to avoid majoring in Natural Science fields because of fear of the subject matter, working under stress, lack of adequate academic background, lack of philosophy of education and lack of proper orientation before making a choice of one's major field.

To shade light on students' views about the courses offered in the Natural Science fields, the Natural Science respondents were asked to rate the level of attractiveness of these courses. As indicated in Appendix II, it is only for about 20.6 percent of respondents that the courses are highly attractive. Moreover, although the majority of them (94.1%) responded that the courses they are taking are relevant for their future professional undertaking, of course this should not be a surprise, almost half of the respondents (41.2%) indicated that in their practical sessions they are redoing demonstrations and cook-book exercises only to reconfirm previously known facts. The implication here is that even the very students studying science fields in the college do report dissatisfaction about the subjects they are studying. This dissatisfaction may affect their readiness and willingness to adjust to the fields they are studying now. This is even more threatening to those students who were originally assigned to the science fields with out their choice. If these students are to talk out their dissatisfaction openly, as the case may be, other students will definitely prefer to remain far away from science fields. In the face of absence of vocational guidance and proper orientation programs in KCTE, one can imagine how damaging a role

this is to play in students choice of major fields, because senior students are usually credible sources of information in vocational decision making.

4.3.3. Study condition as a factor

The third important question to be investigated closely at some length is how far students choice of such academic fields as Basic Natural Sciences can be explained in terms of certain variables which are inalienable in studying the field. Summarized under Appendix III are responses of items relating to this issue.

To have a better picture of what the high schools from where the subjects came to join the college look like, they were asked to comment on the Laboratory facilities in their high school. Accordingly 58.8 percent of the Natural Science respondents and 51.6 percent of the Non-Natural Science respondents said that there were no laboratory facilities to study science in their high schools. Out of those individuals who responded positively to the previous question, 42.9 percent of the Natural Science and 33.3 percent of the Non-Natural Science respondents indicated that they did not get a chance to go to the Laboratory.

This amounts to saying 76.5 percent of the Natural Science and 67.7 percent of the Non-Natural Science respondents, who claimed to be science students while they were in high school, did not get a chance even to see what a science Laboratory looks like, let alone use it. Unless there are motivated science teachers to use it, the mere existence of a Laboratory by it self does not mean anything. If these students have had the chance to see some simple experiments in the form of "fun with science" then their attitude towards science would have been

different today. Children learn happily when they are active and especially when they are creatively active. "No learning is complete, without being used actively" (Sharma, 1982:90). This underlines a purposeful activity of learning.

The currently enrolled Natural Science students were also asked to comment on Laboratory facilities and the quality of instructors in their departments. The majority of the students (58.8) showed their dissatisfaction about the adequacy of Laboratory facilities. This is pretty large number which can indicate that the college is not well-equipped with chemicals and equipment's. The response of the subjects also showed that 88.2 percent of them are satisfied with the quality and number of instructors in their department. This is unusual and surprising to see in a country where there is a shortage of skilled man power. The respondents (70.6%) complained about time constraint to study Basic Natural Sciences. The Natural Science respondents were given an open-ended question to describe the problems that they encountered in their studies. The following are some of the representative suggestions forwarded by the respondents:

- i. The expense incurred in procuring paper for writing laboratory reports.
- ii. Lack of laboratory jackets (aprons) in practical sessions.
- iii. Lack of a calculator.
- iv. Working under stressed condition, because of common courses in addition to the already bulky science courses.

In connection to this, it is worth presenting the opinion of a student:

Social science students take 15-18 contact hours; whereas, Natural Science students take most of the time 20 - 22

contact hours. Science students are forced to take some Social Science courses while Social Science students do not take Natural Science courses. In addition, we have at least two laboratory courses each semester which need to be reported; besides, practically it is impossible to study after spending three hours in a laboratory in the afternoons.

The attitude of the students not to major in science entails another very serious problem. If students' freedom of choice for a certain vocation is to be respected regardless of other factors, then there will be too many students joining certain fields and only few of them choosing others, resulting in excess manpower in the former case and shortage in the later. Many investigators have observed the discrepancies between the occupational preferences of students and the occupational distribution of the employed population. One of the vivid reports was based upon the announced choice of 1,058 boys and girls in the eighth grade of 35 public schools in Cincinnati, Ohio, as described by Dale (cited in Hoppack, 1963: 71).

...What Cincinnati would be like if these 8th grade students become the sole inhabitants of the city in the jobs of their choice, ten years from now? Health services would be very high, with every eighteen people supported by one doctor... it may be, however, that they would all be needed in a city that has no garbage disposal workers, no laundry works,, no water supply worker, since no one chooses to do that kind of work... the two bus-drivers ... will find that their customers get tired of waiting, and use the services of the sixty seven airline pilots .

Finally, the students were asked to give general comments on the type of preparation that a student should make to improve one's quality as a would be science student; the following are some of the representative comments:

- i. Good attitude towards science
- ii. Good preparation in science starting from lower grades
- iii. Moral and material preparation
- iv. Interest, ability, effort and tolerance
- v. Mathematical ability
- vi. Assign well-qualified teachers in lower grades and high schools; improve the methodologies for teaching science so that it will not be rote memorization
- vii. Make science courses more practical than theoretical.

5. CONCLUSIONS AND RECOMMENDATIONS

The problem of not choosing Basic Natural Sciences as a major field of study is so severe that only limited number of students are applying to join these fields. When students are forced to join the Basic Natural Science they seem to resort to withdrawal to the extent that some departments have only three or four students.

The currently enrolled science students are all males, mostly from the "remotest" parts of the country with relatively better ESLCE grades in Biology, Chemistry and Physics.

Students are not majoring in Basic Natural Sciences in the college because

1. of certain variables related to the experience of the students themselves while in high school and in the college as well. They feel that they lack an understanding and appreciation of the essence of the subject matter of the sciences. They also feel that the payment for science personnel does not commensurate with the work load, etc.
2. students perception of the subject matter as causing too much stress while studying, contents which are too abstract and difficult to comprehend, having experiments which are not innovative, courses which are non stimulating, etc.
3. of study conditions as a factor: The beliefs are that there are shortage of facilities and equipment to study science and that there are certain practical problems to be experienced (e.g. time constraint, working under stress, financial constraint for buying certain item, etc.) while studying sciences.

Based on the finding of this study, the following may be forwarded to encourage admission into Basic Natural Science fields.

1. Students at elementary and high school level must be assisted in developing interest, ability, effort and tolerance for science learning. At high school level science courses must be supported by stimulating practical activities.
2. Upon arrival in the college proper orientation must be given to students.
3. Commensurable incentive must be given to science graduates.
4. Necessary material must be provided for science education.
5. Necessary measure must be taken to relieve the course load and time constraint.
6. The methodology for science teaching must be more practical and less theoretical.

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APPENDIX I

Responses of subjects on items constructed to identify if students themselves could be factors for not majoring in Natural Sciences.

ITEMS	Group 1		Group 2	
	Freq.	%	Freq.	%
What was your reasons for joining Natural Science field in high school?				
Interest in the subject	27	79.4	23	74.2
Attracted by good teachers	9	26.5	8	25.8
Influenced by friends and relatives	4	11.8	6	19.4
others	10	29.4	6	19.4
Your general understanding and appreciation of the real nature of Natural Science while you were in high school was:				
High	14	41.1	14	45.2
Moderate	16	47.1	14	45.2
Low	3	8.8	2	6.5
No response	1	2.9	1	3.1
Total	34	100	31	100
Your appreciation of Natural Science at present:				
High	17	50.0	7	22.6
Moderate	15	44.2	16	51.6
Low	2	5.8	8	25.8
Total	34	100	31	100
What issue do you prefer for discussion?				
About matter and a country's geography	28	82.4	20	64.5
About a person and a country's population	6	17.6	11	35.5
Total	34	100	31	100
Do you have a problem in comprehending intangible matters like an atom, an electron etc.?				
Yes	14	41.2	14	45.2
No	20	58.8	17	54.8
Total	34	100	31	100
How do you rate the salary of science graduates compared to their work?				
High	-	-	-	-
Average	1	2.9	13	41.9
Low	33	97.1	18	58.1
Total	34	100	31	100

APPENDIX II

Responses of subjects on items constructed to identify if their views on subject matter issues could be factors for not choosing Natural Science

ITEMS	Group 1		Group 2	
	Freq	%	Freq	%
In your opinion which department do students generally prefer to join in the college?				
Natural Science	8	23.5	-	-
Non-Natural Science	26	76.5	31	100
What do you think are the major reasons? (The responses are presented in the text)				
Total	34	100	31	100
Generally how do you rate the attractiveness of the courses being offered in your Department?				
High	7	20.6		
Moderate	21	61.8		
Low	6	17.6		
Total	34	100		
Do you think that the courses you have taken are relevant to you in the future?				
Yes	32	94.1		
No	2	5.9		
Total	34	100		
Do you think that in your practical sessions you are redoing demonstration and cook-book exercises only to reconfirm previously known facts?				
Yes	18	52.9		
No	14	41.2		
No response	2	5.9		
Total	34	100		

APPENDIX III

Responses of subjects to items related to the study condition as a factor for avoiding Natural Sciences as a major field.

ITEMS	Group 1		Group 2	
	Freq.	%	Freq.	%
Were there enough facilities (laboratories, equipment, chemicals) to study science in your high school?				
Yes	14	41.2	15	48.4
No	20	58.8	16	51.6
Total	34	100	31	100
If Yes, did you get a chance to go to see the Laboratory or to conduct experiments?				
Yes	8	57.1	10	66.7
No	6	42.9	5	33.3
Total	14	100	15	100
Do you think that there are enough Laboratory facilities to teach science in your department in the college?				
Yes	14	41.2		
No	20	58.8		
Total	34	100		
Do you think that there are enough and capable instructors in your department ?				
Yes	30	88.2		
No	4	11.8		
Total	34	100		
Do you have time constraint to study?				
Yes	24	70.6		
No	10	29.4		
Total	34	100		
What major problems do you experience in pursuing your study? (The responses are summarized in the text)				