

Factors Affecting Science Track Choice of Korean High School Students

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(1986년 11월 5 일 받음)

I. INTRODUCTION

Gains in science knowledge, positive attitudes toward science, and pursuit of science-related careers are important outcomes of science education. These outcomes are considered to be important in both developed and developing countries. In Korea, where natural resources are very scarce, development of science and technology has been one of the highly emphasized areas of education(Han et al., 1983).

However, Korea is still far below the standard of other developed countries in its manpower in science and technology. For example, while the numbers of scientists per 10,000 people were 27 in the U.S. and 24 in Japan in 1978, it was still only 4 in Korea even in 1982 (Han et al., 1983). The country also expects and increased shortage of scientists in the future(Han et al., 1983).

Therefore, the Korean government has made some efforts to improve science education in recent years. Among these are (1) emphasizing inquiry learning and laboratory activities in order to help the students to develop interests in science and to develop the ability of reasoning and problem solving in the industrialized society of the future ; (2) conducting special education

for gifted students in science schools; (3) encouraging the development of science laboratory facilities and equipments; and (4) sending science teachers overseas to familiarized them with the techniques and procedures of inquiry learning and experimental learning.

However, these efforts cannot produce desirable results unless many students what to study science and pursue science-related careers. Thus, understanding the reasons why students choose or avoid science is considered as one of the foremost tasks for educational planners and science educators. Nevertheless, there has not been any research done in this area in Korea. In the United States, too, this area is felt to be one of the much needed areas of research(Welch, 1985). Therefore, this study is an attempt to investigate the reasons for the student choice and avoidance of science through an empirical survey in Korea.

II. REVIEW OF LITERATURE

One category of the factors that affect science choice encompasses the influence of significant others upon the student's decision making. Noeth et al.(1984) and

Auster and Auster(1984) found that parents exert major influence on American college student's career decision. Albemarty and Davis(1979) found this to be true for Canadian high school students. Pollack(1981) also found that parents were highly influential to the enrolling group in science, whereas the parents of not-enrolling group had little influence.

Teacher also seems to be a significant factor. Basow and Howe(1979) report that teachers play an important role in the career choice of college students. Louwerse (1981) also provides evidence that some students of grade 9 to 12 continue in science because of their positive feelings for science teachers. Kahle and Lakes (1983) believe that teachers might have a significant and positive effect on girl's science attitude, experience, and career choice.

Peer groups are also reported to influence students' attitude toward science, science career choice, and course selection (Auster and Auster, 1984, Vollmer, 1983; Talton and Simpson, 1985). According to Yale (1966), high school students tend to follow their peers in taking more popular courses.

Career goal is perceived to be an important reason for selecting science courses(Pollack, 1981 ; Daramola, 1982). However, the difficulty of the subjects often turns students away from science career. Pollack (1981) and Daramola (1982) note that the perceived difficulty of science courses played an important role in the decision of the not-enrolling science group. Ormerod (1980) found that girls' preference and avoidance of the subjects were related to the perceived difficulty more than were boys' preference and avoidance. Hofstein and Welch (1984) also found that students' attitude can change in a negatiave direction as a result of the change in their perception of the increased difficulty of the science courses in the secondary schools compared to those in junior high schools.

On the other hand, the belief that the students hold regarding their science ability can affect their science career pursuit. The sense of competence in science was a central variable in science enrollment in Deboer's (1984) study. Gilmartin et al.(1976) also suggest that

the factors that lead to the underrepresentation of blacks in science careers are their lack of abilities and achievement in mathematics and science. However, after studying eighth-grade black students' science career preference, Jacobowitz (1983) asserts that mathematics achievement does not account for a significant proportion of the variance in science preference. He suggests, instead, that early adolescent's science career preference is related to interests rather than realistic assessment of mathematics or science achievement.

III. THE SURVEY

In Korean high schools, students are expected to select either the liberal arts track or science track at the end of the first year(which is equivalent to the 10th grade). Then from the second year on, students in these two tracks receive different types of education, the science track receives more science courses while the liberal arts track receives more liberal arts courses. Even the college entrance exams are different for these two tracks. Therefore, the students' career choice is virtually decided in high school. For this reason, the present study surveyed the Korean 10th graders regarding their reasons for selecting science or liberal arts track.

3.1. The Subjects

By the time the survey was administrated, the students had already submitted their application for one of the two tracks mentioned earlier. Therefore, the Ss were selected through a stratified sampling with the track choice and sex variables taken into consideration. A total of 109 Korean high school students participated in the survey. There were 60 males and 49 females. Of the 60 males, 29 were science track applicants and 31 were liberal arts applicants. Of the 49 females, 24 had applied for the science track, whereas 25 had applied for the liberal arts track. Thus, there were 53 science-track applicants and 56 liberal arts track applicants.

3. 2. Instruments

The instrument used in the survey was a questionnaire that contained several open-ended questions. The questions included (1) why they decided to choose their track, (2) who advised them to make such a decision, and (3) what advantages and disadvantages they expect from their track during the high school years, at college entrance exams, and after college graduation (See Appendix A).

3. 3. Procedures

The questionnaire was prepared and sent to the researcher's friend in Korea, who was teaching at a high school in Daegu City. The teacher then made photoduplications of the questionnaire and administered it to the students. The Ss were asked to complete the questionnaires at the end of an hour long class period. The results were then sent back to the researcher. It took about three weeks for the correspondence to be completed.

VI. THE RESULTS

Since the questionnaires consisted of open ended questions that allowed multiple responses for each of the questions, strict comparisons of one type of responses with another type do not seem possible statistically. Therefore, the results presented below should be viewed as relative ones as far as the numerical values are concerned.

4. 1. Reasons for Track Choice

When asked to state reasons why they had chosen the science or liberal arts track, the Ss gave various reasons. Following are six major categories of reason given by the Ss: (1) career, (2) college major, (3) aptitude, (4) competency, (5) interests, and (6) influence of others. Each factor is briefly discussed below.

4.1.1. Career

The career-related reason was the dominant reason for science-track applicants. While only 14 applicants (25%) of the liberal arts track listed career-related reasons for their choice, as many as 42 applicants (79%) of the science track indicated that job was one of their reasons. An interesting difference between the science track and liberal arts track applicants is their perception of the job prospect. While 26 science-track applicants indicated a bright job prospect for their reason, no liberal arts applicant gave such a reason. Sex made no difference in the science track group in this respect. Of the 42 applicants mentioned above, 23 were males and 19 were females.

4.1.2. College Major

Although college major is ultimately related to career, many Ss listed college major as a separate reason. There were 47 responses that could be categorized as reasons related to college major. Of these, 25 came from science group, and 22 came from liberal arts group.

As in the case of the career-related reason, college-related reasons also showed a difference between science group and liberal arts group. That is, while 15 of the 25 responses from the science group were related to the "wider variety of choice of major area" or "easiness to go to college in this area," no such responses came from the liberal arts group.

Therefore, the career-related reasons and the college-related reasons together reveal an important pattern regarding the students' decision making; the science track attracts students with a brighter job prospect and wider variety of choice. In other words, science-track applicants are more interested in the practical values of their future than liberal-arts-track applicants.

4.1.3. Aptitude

Aptitude-related reasons show a sharp contrast between the science group and the liberal arts group. For example, while only 16 applicants (30%) of the science group listed their aptitude for science as their

reason for the choice, as many as 33 applicants(56%) of the liberal arts group indicated that their aptitude for liberal arts was the reason for the choice. This suggests that the liberal arts group is more internally motivated than is the science group. Earlier, we noted that science group was oriented toward the practical values of their future career and college major.

4.1.4 Competency

The competency factor was related to the Ss' ability in mathematics and science. While only one male applicants of the science track indicated their being "good" at mathematics and/or science as a reason for their choice of science track, 18(10 males and 8 females) applicants of the liberal arts track indicated their being "poor" at mathematics and/or science as a reason for their choice of liberal arts. On the other hand, there were only 4 applicants of the science group who indicated that their being "poor" at liberal arts was the reason for the choice of the science track. This means that many students are avoiding the science career because of their perceived weakness in mathematics and science subjects.

4.1.5. Interests

Somewhat related to the competency factor is the interests factor. A total of 56 responses were classified in this category. The interests factor can be divided into two subcategories: positive interests and negative interests. For example, positive interests in mathematics and/or science would lead the Ss to the science track. On the other hand, negative interests in mathematics and science would drive the Ss to choose the liberal arts track.

Twenty-five responses from the science group indicated the positive interests in science, whereas 15 responses from the liberal arts indicated positive interests in liberal arts. Thus, 40 responses(71%) out of 56 are considered to be positive interests. Negative interests were also observed in both groups. There were 6 responses from the science group that indicated negative interests in liberal arts, whereas 10 liberal arts track ap-

plicants said that their dislike of science subjects and mathematics was their reason for the choice of the liberal arts track.

4.1.6. Influence of Others

The influence of others also emerged as one of the major factors in the decision making of the Ss. A total of 28 responses comprised this category. Of these, the influence of parents was the dominant reason with 23 responses(82%). Here again, we can see the external motivation playing an important role in the applicants of the science track. For example, while 21 responses of the science track(i. e., 40% of the science track applicants) indicated the influence of others as their reason, only 7 responses of the liberal arts track(i.e., 13% of the liberal arts track applicants) were attributed to the influence of others. The influence of parents was especially strong on the male applicants of the science track; 12 male applicants of the science track indicated the parental influence, as opposed to 6 females. In contrast, only 3 males (as opposed to 2 females) of the liberal arts group listed the parental influence. Therefore, as is the case with several other factors, science-track applicants seem more externally and practically motivated than do liberal arts track applicants in their decision making.

4. 2. Advantages/Disadvantages During High School and at College Entrance Exams

When the Ss were asked to list the advantages and disadvantages they associate with the group they chose, they gave responses that showed interesting differences between the science group and liberal arts group.

4.2.1. Choice of College Departments

One of the advantages that the science group expected was that there would be a wider variety of choice in college major departments(21 responses). The opposite was perceived as a disadvantage of the

liberal arts group; 17 liberal arts track applicants indicated that fewer choices of college department was a disadvantage for their group.

4.2.2. Classroom Atmosphere

Some female Ss were concerned with the classroom atmosphere during their high school years (i.e., the second and third year of high school). Seven female Ss in the science group indicated that a good classroom climate would be an advantage of their group while 6 females and one male in the liberal arts group expected a bad classroom climate as their disadvantage. It seems many students believe that science group is more hard working than liberal arts group.

4.2.3. Easiness/Difficulty of Studying

By far, the most agreed-upon advantage and disadvantage seem related to the easiness and difficulty of studying. Obviously, the liberal arts group believe that their advantage is easiness of studying and getting high scores both in school and at college entrance exams. For example, 47 (31 male and 16 female) responses of the liberal arts group centered around the easiness of studying and getting good grades. In contrast, only 9 (7 male and 2 female) responses of the science group indicated a similar point as their advantage.

Naturally, the difficulty of studying and getting high scores was felt to be the disadvantage of the science group. A total of 58 responses of the science group centered around the difficulty of studying and getting high scores in high school and at college entrance exams. In contrast, only 6 responses of the liberal arts group were about such a difficulty.

4.3. Advantages/Disadvantages After College Graduation

Career-related advantages and disadvantages were a great concern of the Ss in both groups. A bright job prospect was regarded as a definite advantage that the science-track applicants expected after college education. A total of 38 (27 male and 11 female) responses of

the science group indicated that a good job prospect was their advantage, while only 5 (4 male and 1 female) responses of the liberal arts group indicated so. In contrast, 35 (30 male and 5 female) responses of the liberal arts group worried about the poor job prospect after college graduation, while only 4 male responses of the science group worried about a similar problem.

However, when aptitude was concerned in relation to job, the liberal arts group showed more confidence and expectation than the science group. For example, 14 (7 male and 7 female) responses of the liberal arts group expected that they would be able to find a job that will fit their aptitude. In contrast, only 4 (2 male and 2 female) responses of the science group expected a similar prospect. These results again suggest that science-track applicants chose their track out of external and practical motivation while the liberal arts applicants were more internally oriented and chose their track with their own competence and aptitude taken into consideration.

4.4. Influences of Others

When the science-track Ss were asked to specifically name the people who encouraged or hoped that they choose the science track, mother emerged as the most influential person with 29 (18 male and 11 female) responses, followed by father (28 responses), friends (25 responses), brother (17 responses), other relatives (15 responses), teacher (14 responses), and sister (14 responses).

For the liberal arts group, father was most important with 21 (13 male and 8 female) responses, followed by friends (17 responses), mother (16 responses), brother (10 responses), teacher (9 responses), sister (8 responses), and other relatives (3 responses). These results again indicate that science-track applicants were under the influence of their family members more than the liberal arts track applicants. This is also evidenced by the number of the students who indicated "Self" as the decision maker. While there were 29 (17 male and 12 female) responses of the liberal arts group that indi-

cated "self" as the decision maker, there were only 14(8 male and 6 female) such responses from the science-track group.

V. IMPLICATIONS AND CONCLUSION

The data collected from the students suggest that science-track applicants and liberal arts track applicants were remarkably different in their motivations, expectations, and other factors influencing their decision making. The science-track applicants were mostly "driven" to choose their track by their family members in order to obtain the materialistic benefit of the future even though they themselves expected difficulties of studying and getting good scores. The liberal arts applicants, on the other hand, seem to make their decision with more weights on their own aptitude and competency, even when they admit a poor job prospect for the future. And yet, they were hopeful that they would find a job that will fit their aptitude. They also seem to be on their own when they made a career choice.

These findings provide some important implications for educational planners and science educators in their efforts to improve science education. First of all, if we admit that aptitude is important in academic and professional success, efforts should be made to identify the student scientific aptitude in early years so that the students can pay more attention to their potentiality. Since science education and science-related professions can benefit more from those who possess such aptitude, knowing the student aptitude seems important for the future of science education.

Then a more active measure should be taken to inform the students of the wide variety of science-related careers so that they can aim for a job that will fit their aptitude, instead of simply being attracted to science track for superficial, materialistic benefits. This kind of knowledge will enable the students to develop more internal motivation for their career choice.

Thirdly, mathematics and science education should innovate the teaching methods and strategies so that

more students can find the subjects easier, more exciting, and enlightening. If they can overcome the inhibition caused by their perception of difficulty, fewer students will turn away from the science track than they do now.

Finally, science education would also benefit from enlightening the entire society in relation to science, science education, and science-related careers. Since it was found that family members play an important role in the students' career choice, informing the parents about science-related careers would bring forth more desirable results.

In conclusion, science educators and educational planners of Korea should broaden their perspective and endeavor to incorporate a variety of measures and activities to improve the science education of Korea, some of which have been suggested above.

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Appendix A

QUESTIONNAIRE ON CAREER-TRACK CHOICE

This questionnaire is to find out what factors influence the career-track choice of high school students. Your responses will not be used other than statistics purposes, and your anonymity is guaranteed. Your frank responses will be most appreciated.

Place a mark(X) where relevant or write in your responses.

1. My sex: Male () Female ()
2. I ... going to college.
 - a. am ()
 - b. am not sure about ()
 - c. am not ()
3. I applied for ... track.
 - a. humanities ()
 - b. science ()
4. The reasons why I applied as 3 above are: (Write in as you have.)
 - a.
 - b.
 - c.
 - d.
5. The person(s) who advised or wanted me to apply as 3 above is/are:
 - a.
 - b.
 - c.
 - d.
6. If I belong to the track class I applied for, I expect there will be such good things (advantages) as follows during my high school years and at college entrance exams:
 - a.
 - b.
 - c.
 - d.
7. The career area that I applied for will bring me the following good things after I graduate from college:
 - a.
 - b.
 - c.
 - d.

8. If I belong to the track class I applied for, I expect there will be such bad things (disadvantages) as follows during my high school years and at college entrance exams:
- a.
 - b.
 - c.
 - d.

9. The career area that I applied for will bring me the following bad things after I graduate from college:
- a.
 - b.
 - c.
 - d.

Appendix B

진로 결정요인 설문지

이 설문은 고교생의 진로 결정에 영향을 주는 요인들이 무엇인지 알아보기 위한 것입니다. 여러분의 응답내용은 통계목적 이외에는 사용되지 않을 것이며 설문은 여러분의 이름을 적지 않는 무기명으로 솔직하게 응답하여 주시기 바랍니다. 다음에 설문들의 해당사항에 0표를 하거나 적당한 응답을 기입하십시오.

1. 나의 성별 : (남) (여)
2. 나는 대학진학을 : 할 계획이다() 모르겠다()
안할 계획이다()
3. 나는 [(문과반) / (이과반)]에 지원하였다.
4. 내가 위에 3번과 같이 지원한 이유는 다음과 같다. (있는 대로 기입)
가.
나.
다.
라.
5. 나에게 위의 3번과 같이 지원하라고 권고하거나 희망한 사람은 다음과 같다. (예 : 아버지, 형님, 오빠, 담임선생

- 남, 과목선생님, 친구, 동등)
- 가. 나. 다. 라.
6. 내가 지원한 반에 속하게 되면 고교 재학중과 대학입시에
서 다음과 같은 좋은 점(유리한 점)이 있을 것 같다. (중요한 차례대로 기입)
가. 나.
다. 라.
 7. 내가 지원한 분야는 대학 졸업후 나에게 다음과 같은 좋은 점이 있을 것 같다.
가. 나.
다. 라.
 8. 내가 지원한 반에 속하게 되면 고교재학중과 대학입시에
서 다음과 같은 나쁜 점(불리한 점)이 있을 것 같다. (중요한 차례대로 기입)
가. 나.
다. 라.
 9. 내가 지원한 분야는 대학졸업후 나에게 다음과 같은 나쁜 점이 있을 것 같다.
가. 나.
다. 라.

Appendix C

1. REASONS WHY I DECIDED TO CHOOSE THE SCIENCE/HUMANITIES TRACK

	T	S	M	S	F	H	M	H	F		T	S	M	S	F	H	M	H	F
A. Occupation	56	23	19	8	6	42	14	31	25	B.College Major	47	12	13	7	15	25	22	19	28
-My desired occupation is here.	30	8	8	8	6	16	14	16	14	-For my future major	32	5	5	7	15	10	22	12	20
-This area has a brighter job prospect.	26	15	11	0	0	26	0	15	11	-A wider variety of choice of major area	12	7	5	0	0	12	0	7	5
										-Easier to go to college of this area	3	0	3	0	0	3	0	0	3

	T	S	M	SF	HM	HF	S	H	M	F
C. Aptitude	49	10	6	21	12	16	33	29	20	
-It seems to fit my aptitude.	45	9	6	18	12	15	30	25	20	
-People say it fits my aptitude.	4	1	0	3	0	1	3	4	0	

D. Competency	30	5	1	16	8	6	24	21	09	
-Poor at humanity subject	4	4	0	0	0	4	0	4	0	
-Competent in humanity subjects	6	0	0	6	0	0	6	6	0	
-Good at math	1	1	0	0	1	1	0	1	0	
-Poor at math	12	0	1	7	4	1	1	7	5	
-Poor at math and science	7	0	0	3	4	0	7	3	4	

E. Interest and Preference ...	56	15	16	15	10	31	25	30	26	
-Interested in this area	19	5	8	5	1	13	6	10	09	
-Enjoying studying this area	21	7	5	5	4	12	9	12	09	
-Not interested in math and science	7	0	0	4	3	0	7	4	3	
	3	3	0	0	0	3	0	3	0	
-Not interested in liberal arts	3	0	3	0	0	3	0	0	3	
-Dislike literatures	3	0	0	1	2	0	3	1	2	
-Dislike math										

F. Influence of Others	28	14	7	4	3	21	7	18	10	
-Influence of parents	23	12	6	3	2	18	5	15	8	
-Influence of other people around me	3	2	0	0	1	2	1	2	1	
	2	0	1	1	0	1	1	1	1	
-Influence of teacher										

II. PERCEIVED ADVANTAGES/DISADVANTAGES DURING HIGH SCHOOL OR COLLEGE ENTRANCE EXAM

	T	S	M	SF	HM	HF	S	H	M	F
A. College Entrance	49	16	9	14	10	25	24	30	19	
-To enter the desired department	11	2	2	5	2	4	7	7	4	
-A lot of choices of department	21	14	7	0	0	21	0	14	7	
-Few choices of department	17	0	0	9	8	0	17	0	8	
B. Easiness/Difficulty of studying	120	38	29	37	16	67	53	75	45	
-Easy for getting high scores or studying	56	7	2	31	16	9	47	38	18	

	T	S	M	SF	HM	HF	S	H	M	F
-Difficult in getting high scores or studying	64	31	27	6	0	58	6	37	27	

C. Aptitude	17	6	0	7	4	6	11	13	4	
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D. Expected Classroom Atmosphere.	15	0	8	1	6	8	7	1	14	
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-Will have a good classroom atmosphere	7	0	7	0	0	7	0	0	7	
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-Will have a bad classroom atmosphere	8	0	1	1	6	1	7	1	7	
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III. ADVANTAGES/DISADVANTAGES AFTER COLLEGE GRADUATION

	T	S	M	SF	HM	HF	S	H	M	F
A. Job Prospect	82	31	11	34	6	42	40	65	17	
-Easy to get a job	43	27	11	4	1	38	5	31	12	
-Difficult to get a job	39	4	0	30	5	4	35	34	5	

B. Aptitude	38	9	5	13	11	14	24	22	16	
-Can find a job my aptitude	18	2	2	7	7	4	14	9	9	
-Can find a job I like	15	4	2	6	3	6	9	10	5	
-Will be satisfied with my job	5	3	1	0	1	4	1	3	2	

IV. PERSONS WHO WANTED OR ADVISED ME TO APPLY FOR THIS TRACK

	T	S	M	SF	HM	HF	S	H	M	F
A. Father	49	15	13	13	8	28	21	28	21	
B. Mother	45	18	11	5	11	29	16	23	22	
C. Brother	27	9	8	7	3	17	10	16	11	
D. Sister	22	6	8	2	6	14	8	8	14	
E. Friends	42	13	12	7	10	25	17	20	22	
F. Teacher	23	7	7	6	3	14	9	13	10	
G. Self	43	8	6	17	12	14	29	25	18	

T: Number of responses made by the Total Group *

SM: Number of responses made by Science-track Males

SF: Number of responses made by Science-track Females

HM: Number of responses made by Humanities-track Males

HF: Number of responses made by Humanities-track Females

S: Number of responses made by the Science-track group

H: Number of responses made by the Humanities-track group

M: Number of responses made by the Male group

F: Number of responses made by the Female group

(* The number of responses do not necessarily coincide with the total number of the Ss, because the Ss were allowed to give multiple responses.)

요 약

한국 인문계 고교생들의 진로결정 요인

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과학교육은 학생들이 장차 과학·기술분야의 직업을 추구하도록 하는 것을 그 중요한 결실의 하나로 잡고 있다. 현재 한국은 과학과 기술의 발전을 교육의 주요목표의 하나로 삼고 있으며, 정부에서는 보다 많은 영재를 과학·기술분야로 유치하려고 여러가지 정책을 펴고 있다. 그러나 이러한 정책도 결국은 학생이 과학·기술분야로 모여들지 않으면 그 효과가 없게 된다. 그런 점에서 학생들이 어떤 이유로 과학·기술분야를 선택하는지 혹은 기피하는지 그 원인을 아는 것을 중요한 과제라고 할 수 있다.

본 연구는 과학 및 기술분야의 직업을 갖게 되는 데 결정적인 역할을 하는 고교생의 문·이과반 선택에 있어 그 진로 결정에 영향을 주는 제 요인들을 규명하는 데 목적을 두고 있다. 연구대상은 대구시내의 남·녀 고교 1학년생 109명(문과 56명, 이과 53명)이었으며 조사방법은 설문지법을 사용하였다.

조사결과는 학생들의 문·이과반 선택에는 장래직업, 대학전공, 적성, 학과목에 대한 능력, 흥미 선호도, 가족 및 주위의 권유 등이 주요요인임을 보여주고 있다. 그중 문과를 지원한 학생들은 대체적으로 자신의 적성, 이과과목에 대한 능력부족 인식, 내신 및 학력고사에서의 성적취득용이성 등 주로 자신의 내적 동기와 관련된 요인들을 들고 있는데 비해, 이과를 지원한 학생들은 밝은 직업전망, 가족 및 주위의 권유 등 외적인 동기도 큰 작용을 하고 있음을 보여 대조를 이루고 있다. 또 문과를 지원한 학생은 이과가 공부하기가 어렵고 성적을 올리기도 힘들어 이과를 기피한 경향을 보이는데 반해 이과 지원자는 문과를 기피하여 이과로 왔다는 응답은 별로 없는 점이 대조를 보였다.

본 논문은 이러한 결과가 던져주는 시사점과 과학교육의 개선책에 관한 제언을 제시하면서 결론을 맺고 있다.