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Examination of Students' Perceptions of the Selection of Science Subjects in High School Credit System and Their Reasons for Selection

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Abstract

We investigated and analyzed students' perceptions of their choice of science subjects in the high school credit system and the reasons for their choice. To achieve this, the selection of science subjects was investigated for the second year of S high school over the past three years. Students selected an average of 1.54 science subjects, and it was found that the rate of selection of science subjects was gradually increasing by year. Students chose high in the order of life science I, earth science I, chemistry I, physics I, etc. in the science subject group. Students who wish to enter the natural and engineering fields chose life science I, chemistry I, physics I, etc., while, students who wish to enter the humanities society chose society and culture, life science I, ethics and thought, etc. On the other hand, the reason for choosing science subjects was 'related to college admission', followed by 'aptitude and interest', 'career and real life help', etc. physics I, chemistry I, etc., were high in the subjects selected according to the 'related to college admission'. The subjects selected according to 'aptitude and interest' were high in life science I, earth science I, etc. Physics I, chemistry I, etc. are recognized as subjects necessary for college entrance, and life science I, earth science I, etc., are found to be related to their interests and aptitudes.

Keywords: *high school credit system, group of science subjects, science subject selection, related to college admission*

1. INTRODUCTION

As the professional world changes rapidly with the advent of the Fourth Industrial Revolution and artificial intelligence (AI), various changes are also taking place in the teaching-learning process and methods of the digital generation. In addition, rapid changes are taking place in social structural aspects, such as changes in the demographic structure due to low birth rates, widening the educational gap due to social inequality, etc. In order to cope with this rapidly changing professional and social environment, the Ministry of Education introduced the 'High School Credit System,' a new talent training system that will lead the future society [1]. The Ministry of Education announced a plan to apply the 'high school credit system' step by step from the first grade in 2023 and then apply it to all grades in 2025. As a result, various administrative and financial support have been provided so far, such as strengthening teacher competency, operating research institutes, creating a school space for the high school credit system, and so on.

The high school credit system is a system in which students choose courses according to their career and aptitude based on basic literacy and essential academic background and graduate after obtaining credits for

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subjects that have reached the completion standard. The most important part of the high school credit system is focused on the growth of each student, and the purpose of this system is to ensure that all students receive the education they want according to their career and aptitude. In other words, it is an educational program that supports students to become self-directed and active learners through education that acquires meaningful knowledge and designs career paths [2].

According to an in-depth interview and perception survey of teachers operating the high school credit system, there is a limit to the establishment of the high school credit system due to lack of meaningful career guidance for students, formation of consensus with students and parents, etc. [3]. According to previous studies, factors such as guaranteeing school autonomy for the establishment of the high school credit system, connection with local communities, recognition of teachers' authority over classes and evaluations, introduction of absolute evaluation, and suitability of completed subjects in college majors were important factors in the establishment of the high school credit system [4-6]. The reason for the subject selection was found to be the area of hope for college entrance, the relationship with one's aptitude and interest, and etc., taking the highest priority [7]. As a result of a study focusing on the case of research schools in Seoul, the conditions for completing the subject, graduation requirements, grade evaluation and follow-up measures, etc., were also important factors in the selection of subjects [5, 8]. In previous studies of the high school credit system, factors such as whether students and parents have a consensus on the high school credit system, whether students have the right to choose subjects according to their career and aptitude, etc., were found to be important factors influencing the establishment of the high school credit system, and more research is urgently needed.

In a study of students' perceptions of the operation of the 2009 revised science curriculum and the choice of science subjects, students suggested that professional education programs should be developed to improve science because they perceive it negatively [9-11].

The selection-oriented curriculum implemented from the 7th curriculum had limited supply and demand from teachers, and the meaning of student selection was limited to course selection rather than subject selection [12]. Prior to the high school credit system, students had a narrow range of self-directed course choices, but in the high school credit system, students had a significant range of choices to choose their own course. Therefore, under the high school credit system, it is very important how students perceive each subject in their subject selection, and research on the perception of their subject selection is urgently needed.

This study aims to find out the tendency of general high school students to choose science subjects and to find out the relationship between students' career choices according to the tendency to choose subjects. In particular, after specifically investigating the reasons why students who chose chemistry I chose this subject, we intend to provide implications for inducing the successful settlement of the high school credit system.

2. RESEARCH METHODS

2.1. Object of study

The study related to subject selection was conducted from March 2021 to September 2023, targeting second-year students at S high school in Gyeongnam. The study was conducted on 342 students in 2021, 345 students in 2022, and 331 students in 2023. The survey on career hope was conducted on 230 second-year students in 2022, and 65 students who chose Chemistry II were surveyed to find out the reason for choosing science and social inquiry subjects in detail.

S high school is a general high school that is leveled in the city area and has large apartment complexes around the school and is highly accessible, so it is preferred by parents. S high school operates a leading high school credit system from 2020 to 2023, and students are completing an optional curriculum that considers individual career paths and aptitudes.

2.2. Science and Social Exploration Subjects

Second-year students at S High School, which operates a leading high school credit system, can choose a

total of three subjects in the science and social elective group for one year. Students can choose three out of nine subjects, including physics I, chemistry I, life science I, earth science I, economics, society and culture, ethics and thought, east asian history, and world geography, and each subject will complete six units during the first and second semesters of the second year.

The operation of the high school credit system at S High School teaches career and academic design step by step so that students can choose subjects that suit their career path and aptitude. Students' career aptitude is identified through career tests during career activities of creative experience activities, self-directed search for career information, and the demand for elective subjects is investigated twice. Based on the results of the demand survey, the school decides the courses opened in consideration of the supply and demand of teachers, the conditions of the school, etc., and determines the elective subjects through a final survey.

2.3. Questionnaire Survey

The questionnaire was revised and supplemented in a total of 4 stages based on the previous inspection tools [11]. First, through literature research, cases on why students choose science and social inquiry subjects in the 2009 and 2015 revised curriculum were collected. Second, after categorizing and reviewing each reason, a draft questionnaire was developed. As a third step, the questions were revised and supplemented through seminars with two experts in science education and three teachers in science and social fields with more than 10 years of experience in the field. Finally, after conducting a preliminary survey of five second-year students of S high school in 2023, which is subject to application, the final revision and supplementation were made based on the results.

The completed questionnaire was targeted at students who chose Chemistry II in 2023, and the reasons for choosing science inquiry subjects were investigated. The survey was conducted immediately after the semester began in March 2023, and students were asked to write down the names of the three subjects they selected and choose the reason for choosing each subject from the view. In particular, even if various reasons were duplicated, they were asked to select the factors that had the greatest influence on the subject selection. Of the 73 students who chose Chemistry II, 65 questionnaires were collected and analyzed, excluding 8 who did not agree or participate in the questionnaire. The reasons for the subject selection are shown in Table 1.

Table 1. The reason for choosing the subject

Division	Reason
a	related to college admission
b	aptitude and interest
c	career and real life help
d	easy and good for grades
e	burdensome subject
f	my favorite teacher is in charge
g	the recommendation of parents or friends
h	Others

2.4. Research questions

This study studied the tendency of students to choose science and social inquiry subjects in the high school credit system and the reasons for choosing each subject. In particular, the correlation between 'university enrollment hope' and subject selection was studied, and the following research questions were established.

First, what is the tendency of students to choose science and social inquiry subjects in the high school credit system?

Second, does the field of hope for college affect the subject selection?

Third, what is the reason for choosing science subjects?

3. RESEARCH RESULTS

3.1. Trends in the Selection of Science and Social Exploration Subjects in the High School Credit System

The results of the selection of science and social inquiry subjects of second graders of S High School over the past three years (2021-2023) were investigated, and the results are shown in Figure 1. It was found that 2nd-grade students selected an average of 1.54 science subjects, and an average of 1.46 social subjects were selected. The percentage of science inquiry subjects selected was 46.5% in 2021, 52.6% in 2022, 54.7% in 2023, etc., and it was found to be gradually increasing by year. On the other hand, the proportion of choosing social inquiry subjects was found to be gradually decreasing.

According to a previous study, the average percentage of science course selection among second-year high school students was 2.4 [13]. In schools that adopt the intensive completion system, students can choose four general elective courses, but S High School, which operates the high school credit system, selects three general elective courses, so there is a slight difference in elective courses.

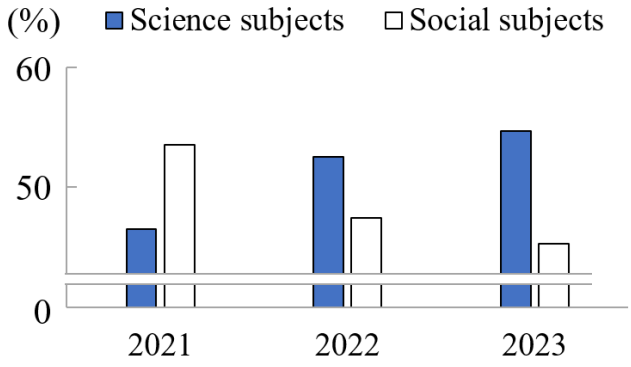

Figure 1. Percentage of selection of science and social inquiry subjects by year (%)

The percentage of choices for each subject in the scientific and social fields of students was investigated, and the results are shown in Figure 2 by year. Students chose life science I (53.4%) the most in the science subject group, followed by earth science I (38.4%), chemistry I (35.9%), physics I (25.9%), etc. By year, the selection rate for subjects such as physics I, chemistry I, life science I, economics, etc., is generally increasing, while the selection rate for subjects such as earth science I, society and culture, world geography, etc. is decreasing. These findings were similar to those of previous studies [13].

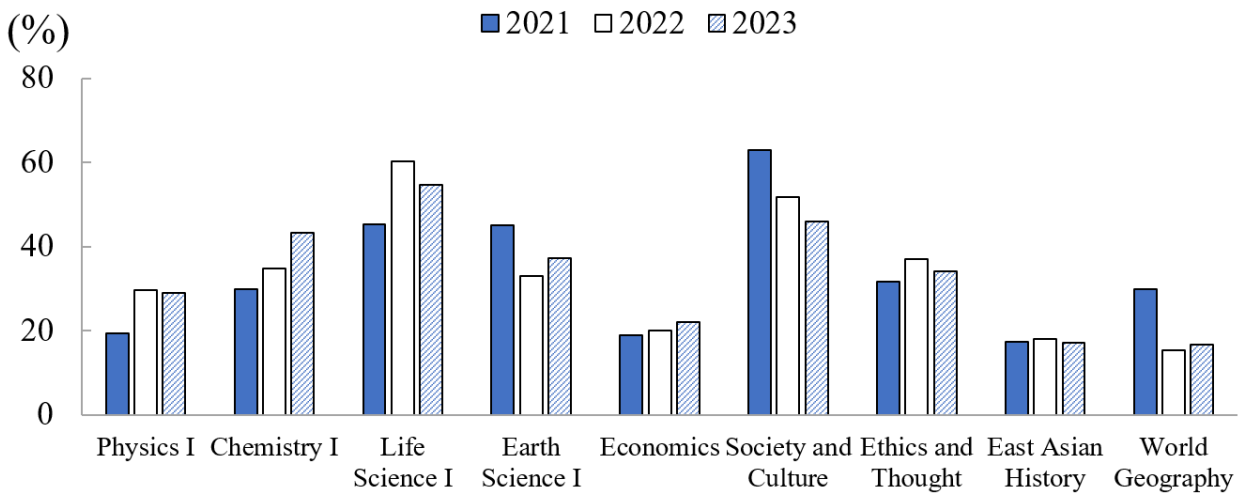

Figure 2. Percentage of each subject's choice among science and social inquiry subjects by year (%)

After selecting one subject from the science subject group, the ratio of the other two subjects selected from the science and social subject group was investigated, and the results are shown in Figure 3. Students who primarily chose physics I selected the remaining subjects in the order of chemistry I (68.6%), life science I (61.7%), etc. Students who primarily chose chemistry I selected other subjects in the order of life science I (74.8%), physics I (49.6%), etc. Students who primarily chose life science I selected chemistry I (50.2%), society and culture (38.6%), etc. Students who primarily chose earth science I selected society and culture (41.9%), life science I (37.3%), etc. in order.

According to previous studies on the status of completion of science elective courses, applicants for engineering and science colleges had a high rate of completion for physics I and chemistry I, while applicants for life science and health sciences had a high rate of completion for life science I and chemistry [14]. As such, it was found that students completed many science subjects in consideration of the college entrance system they wanted in the selection of science subjects.

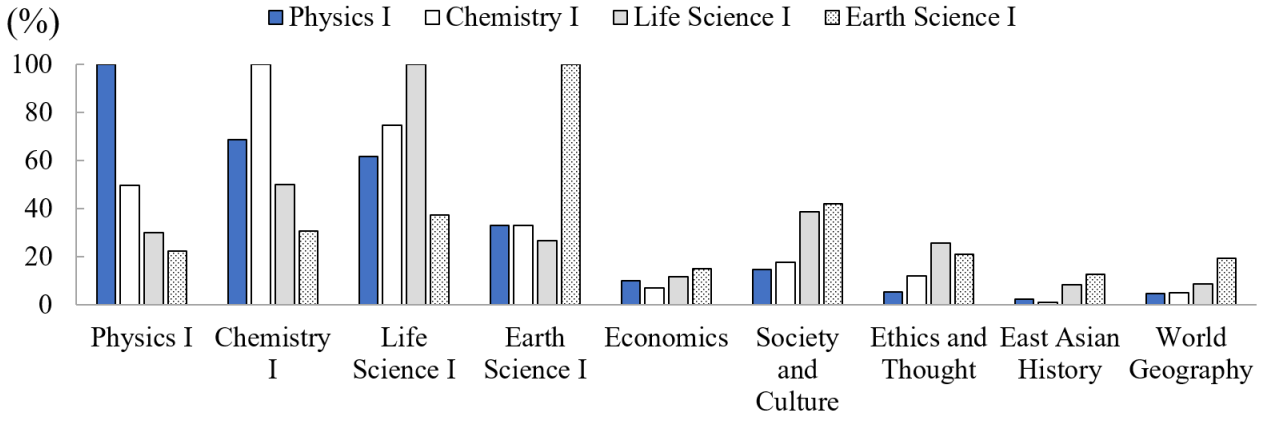

Figure 3. After selecting one subject in the science course, the percentage of the remaining two subjects selected in the science and social inquiry course (%)

3.2. The effect of the field of hope to go to college on the selection of subjects

The tendency to select science and social subjects according to the field in which one wishes to enter university was analyzed, and the results are shown in Figure 4. Students who wanted to enter the natural and engineering fields selected in the order of life science I (76.6%), chemistry I (64.0%), physics I (53.2%), and others, while the percentage of social studies subjects selected was relatively low. Students who want to enter the humanities and social sciences field selected in the order of society and culture (79.1%), life science I (53.7%), ethics and thought (50.7%), etc.

Students who wish to enter fields such as computers, telecommunications, machinery, metals, electric/electronic, etc. completed a lot of physics I in high school, while those who wish to enter fields such as energy, materials, chemical engineering, etc., completed chemistry I in high school [15]. In addition, it was found that professional workers (admissions officers, secondary school teachers, graduate students) recommended physics I and chemistry I as high school subjects required in the university's science and engineering field [16]. This trend was similar to previous research results [14]. According to recent previous studies, high school students choose life science I and chemistry I as their internal subjects, and earth science I and life science I as their elective subjects for the SAT [13].

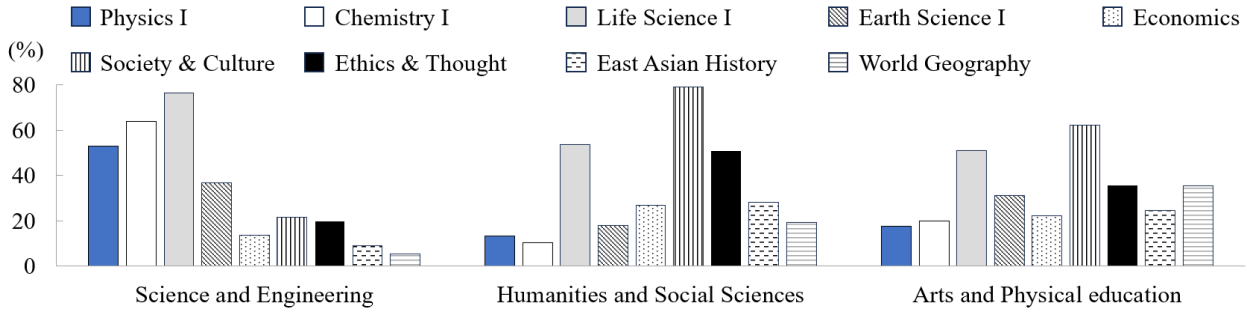

Figure 4. Percentage of science and social studies subjects selected by field of interest in college (%)

The selection of science and social inquiry subjects by detailed field of college entrance (natural science, engineering, medicine, education, humanities, society, arts and sports, etc.) was investigated, and the results are shown in Figure 5. Students wishing to enter college in fields such as engineering, medicine, natural science, etc., were found to have selected many subjects such as physics I, chemistry I, life science I, etc. This trend is believed to be due to the fact that physics I and chemistry I subjects are relatively widely used as basic knowledge in engineering majors, and life science I and chemistry I are relatively widely used as basic knowledge in medical majors. In particular, students who wish to enter the humanities, social studies, arts, and sports fields chose life science I and earth science I relatively more. This trend shows similar results in previous studies [17].

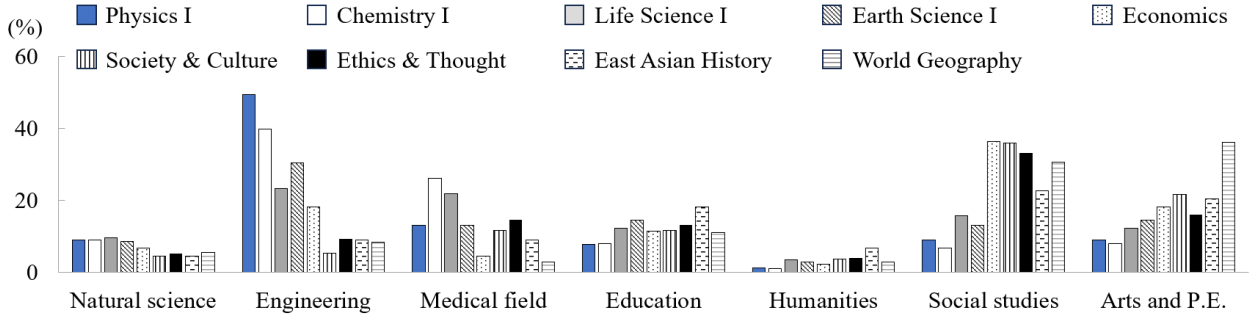

Figure 5. The percentage of science and social inquiry subjects selected by detailed field of college application (%)

3.3. Reasons for choosing science inquiry subjects

In the high school credit system, students actively choose science and social inquiry subjects according to their career and aptitude. Since students' voluntary choice of subjects greatly influences their learning outcomes, the reasons for choosing science inquiry subjects were investigated, and the results are shown in Figure 6.

As for the reason for choosing science exploration courses, students chose the most in the order of 'related to college admission (46.2%), 'aptitude and interest (25.1%)', 'career and real life help (8.7%), etc. These results are not only consistent with the purpose of introducing the high school credit system, but also show that subject selection is a very important factor for students to enter college. On the other hand, in the previous curriculum, it was found that students had limited choice of subjects that fit their career path and interest [18-19].

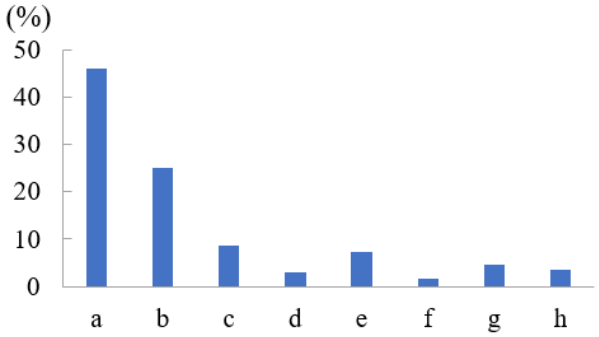

Figure 6. Reasons for choosing a science subject (a: related to college admission, b: aptitude and interest, c: career and real life help, d: easy to get grades, e: easy subject, f: favorite teacher is in charge, g: parents and friends recommendation, h: etc.)

The reasons for selection for each subject among science subjects were investigated, and the results are shown in Figure 7. The reason for choosing physics I (73.5%), chemistry I (52.3%), life science I (41.5%), etc. was high in 'related to college admission'. The reason for choosing life science I (30.2%), earth science I (26.9%), and chemistry I (24.6%) was high in 'aptitude and interest'. The reason for choosing earth science I (26.9%) was that 'easy subject' was the highest. Therefore, students recognize that subjects such as physics I, chemistry I, etc. are essential for college entrance, and life science I (30.2%) and earth science I (26.9%), etc. are related to their interests and aptitudes.

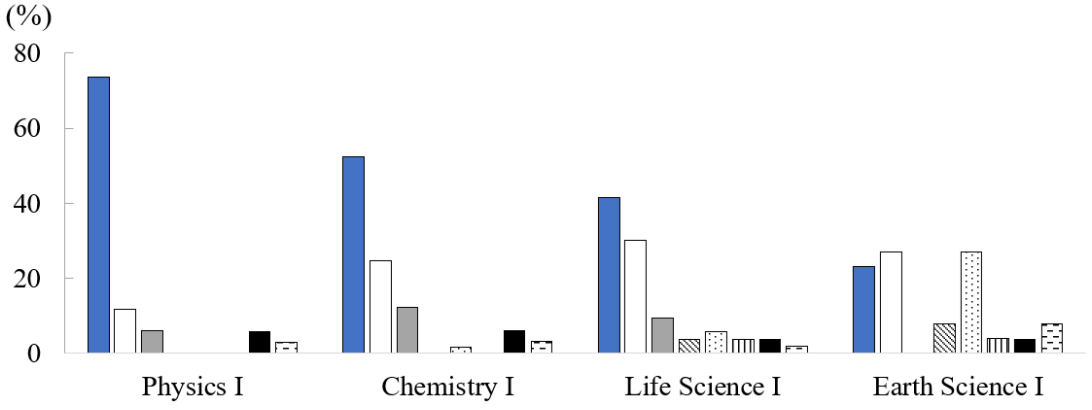

Figure 7. The ratio of the reasons for selecting each subject among science inquiry subjects (physics I, chemistry I, life science I, earth science I) (%). (■: related to college admission, □: aptitude and interest, ■: career and real life help, ▨: easy to get grades, ▩: easy subject, ▥: favorite teacher is in charge, ■: parents & friends recommendation, ▩: etc.)

The relationship between the reasons for choosing science inquiry subjects (physics I, chemistry I, life science I, and earth science I) and the fields of hope for college was investigated, and the results are shown in Figure 8. The fields desired to enter college were divided into natural science (Nat.), engineering (Eng.), medicine (Med.), education (Edu.), humanities (Hum.), society (Soc.), arts and sports (Art.), and so on. The students who chose physics I were highest in the order of engineering (50.0%), natural science (14.7%), and so on. The reasons for choosing this subject were 'related to college admission' (73.5%) and 'aptitude and interest' (11.8%). The students who chose chemistry I were highest in the order of engineering (36.9%), medicine (15.4%), etc. The reasons for choosing this subject were 'related to college admission' (52.3%), 'aptitude and interest' (24.6%), and so on.

Students who chose life science I showed high desire to enter the school in the order of engineering (32.7%), medicine (18.2%), and so on. The reasons for the selection were 'related to college admission' (40.0%), 'aptitude and interest' (30.9%), etc. The students who chose earth science I were highest in the order of engineering (34.6%) and natural science (19.2%). The reasons for selection were 'easy subject' (26.9%), 'aptitude and interest' (26.9%), etc. in order. According to previous research results, the reason for choosing earth science I is interesting and easy [20]. On the other hand, it was found that students who wish to study medicine have a clear vision for their desired job and choose subjects that are highly relevant to their future in advance [21].

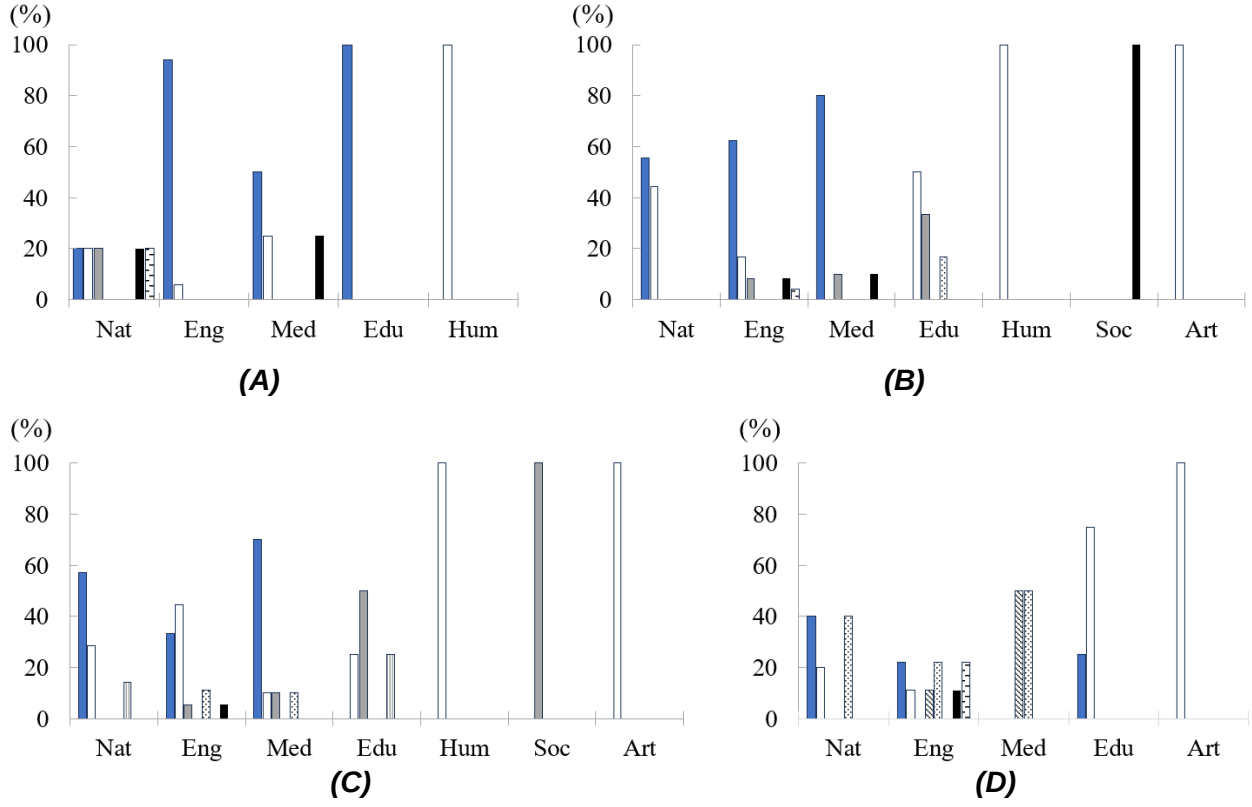

Figure 8. The relationship between the reasons for choosing science inquiry subjects (physics I (A), chemistry I (B), life science I (C), earth science I (D) and the fields in which one wishes to enter university. (■: related to college admission, □: aptitude and interest, ■: career and real life help, ▨: easy to get grades, ⁞⁞: easy subject, ▥: favorite teacher is in charge, ■: parents & friends recommendation, ▤: etc.)

4. CONCLUSIONS

Before the implementation of the high school credit system, we studied the selection of science and social subject groups and the tendency to select individual subjects in each subject group in leading schools of the high school credit system. In addition, the relationship between the choice of science and social studies subjects and one's career choice was studied.

As a result of selecting science and social inquiry subjects of S high school students over the past three years, the average number of science and social studies subjects was 1.54 and 1.46, respectively. The percentage of science subjects selected by year gradually increased from 46.5% in 2021 to 54.7% in 2023. On the other hand, the selection rate of social studies subjects decreased step by step. In the science subject group, the proportion of subject selection was high in the order of life science I, earth science I, chemistry I, physics I, etc. By year, the selection rate of subjects such as physics I, chemistry I, life science I, economics, etc., increased, while the selection rate of subjects such as earth science I, society and culture, world geography, etc. decreased.

As a result of analyzing the tendency to select subjects according to the desired field of university admission, students who want to enter the natural and engineering fields chose life science I, chemistry I, physics I, etc., while students who chose humanities and social sciences chose society and culture, life science I, ethics and thought, etc. In detail, students who chose subjects such as physics I, chemistry I, life science I, etc., were found to wish to enter engineering, medicine, etc. This trend is judged to be due to the fact that these subjects are used as basic knowledge in engineering and medical majors.

The reasons for selecting science inquiry subjects were 'related to college admission,' 'aptitude and interest,' and 'career and real-life help,' in order. The reason for "related to college admission" was that the selection of inquiry subjects such as physics I, chemistry I, life science I, etc., was high, and the reason for "aptitude and interest" was that the selection of subjects such as life science I, earth science I, chemistry I, etc. was high.

Therefore, students recognize that physics I and chemistry I are essential subjects for college entrance, and life science I and earth science I are related to their interests and aptitudes. These results are consistent with the purpose of introducing the high school credit system, and it was found that students' college entrance is an important factor in choosing science inquiry subjects.

After comprehensively considering factors such as whether they are helpful in entering college, whether they are suitable for their aptitude and interest, and whether they are related to their career path, students are choosing the right subjects for themselves in the high school credit system. On the other hand, some of the students surveyed had difficulty in choosing subjects because they did not decide on their college entrance or career path. Therefore, the results of this study will help select and complete science exploration courses under the high school credit system, and will also contribute greatly to the stable settlement of the high school credit system.

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