Article

Awareness of Sustainable Development Goals among Students from a Chinese Senior High School

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Abstract: Education is an essential component of the Sustainable Development Goals (SDGs). Through a questionnaire survey among students from a Chinese senior high school, this study measured the self-reported knowledge, sources of information, learning situations, priorities, the impact of personal life and career planning with respect to the SDGs to understand their cognition, learning motivation and social readiness. The results show that students' knowledge and information sources in relation to the SDGs are limited, and there is no significant difference between boys and girls in relation to their knowledge of the SDGs, the source of information, the learning level of the SDGs, impact of personal life on the SDGs and career planning related to the SDGs. It is also shown that students have a better understanding of the number of the SDGs and the countries to which the SDGs are addressed and students receive information about the SDGs via formal education and traditional media. Regarding the penetration of the SDGs in course subjects, Chinese and native culture, foreign language, biology and geography have included all the SDGs. Through an analysis of responses and popularity rates, gender equality, quality education, reduced inequalities, no poverty, zero hunger, good health and well-being are shown to be the students' priorities with higher attention rates. Gender equality, quality education, clean water and sanitation are the top three goals in relation to which students consider that their personal life can have a greater impact. Students prefer to adopt the SDGs (decent work and economic growth, quality education, industry, innovation and infrastructure, sustainable cities and communities) as their personal career choice in the future. Suggestions for improving the implementation of Education for Sustainable Development (ESD) include comprehensive formal and non-formal education, publicity and curriculum integration to promote learning about the SDGs. A model of ESD in the school surveyed is presented for practical application. Based on this research, guidance and suggestions are provided to enhance students' awareness, knowledge and competencies in relation to sustainability and to encourage student engagement in global sustainable development.

Keywords: senior high school students; SDGs; ESD; questionnaire survey; sustainable development

1. Introduction

As the overarching paradigm of the United Nations (UN), sustainable development pursues a balanced development of environmental, social and economic goals to improve the quality of life for the future generation [1]. The 70th Session of the United Nations General Assembly outlined 17 Sustainable Development Goals (SDGs) [2], a guiding framework for further global development from 2015 to 2030 after the expiration of the Millennium Development Goals (MDGs) [3,4], in an effort to sustain the well-being of both humankind and the planet [5,6]. The fourth goal (Goal 4: Quality Education) highlights the importance of education in global sustainable development [7,8]. This goal is crucial to achieving all other goals and aims to "ensure inclusive and equitable quality education and promote lifelong learning opportunities for all" [9]. From this perspective, Goal 4 implies that everyone around the world will be able to achieve lifelong active learning

and high-quality education by 2030 [10,11], and aims to improve knowledge, skills and competencies [12]. Since the era of internationalization, students should be able to consider alternative global views from domestic as well as international perspectives [13]. It is the responsibility and duty of education institutes, schools, teachers and instructors to guide students to become world citizens and contribute to global sustainable development [14]. However, most of the studies on SDG awareness have been aimed at adults or college students, while limited open literature to date has explored the understanding and awareness of the SDGs among high school students, especially Chinese students. Apart from that, recent studies have shown that most of the activities that aim to achieve the SDGs are carried out in universities [15], while senior high school students lack an awareness of sustainable development [16,17]. Therefore, educational institutes and educators need to guide students to monitor global issues and foster their sustainability consciousness [18]. Education for Sustainable Development (ESD) aims to enlighten people's consciousness on sustainable development through future education, including natural resources protection, sustainable consumption, global citizenship education, gender equality, etc.; thus, it aims to make a substantial contribution to the achievement of the SDGs [19]. As a member of the UN, China should and is willing to actively respond to the SDGs, fulfill common responsibilities and specific responsibilities based on national conditions [20]. According to a previous study [21], nearly 90% of the Chinese people held a supportive attitude towards the SDGs. The awareness of the SDGs among Chinese high school students should be also further learned and enhanced.

This study was conducted in Beijing No.35 High School International Department, which is used as an example. Through a questionnaire survey with 328 students, the study aimed to understand students' self-reported knowledge, their information sources for the SDGs, the learning situation, their attention priorities and the impact of their personal lives and career choices on the SDGs. Based on the outcomes, guidance and suggestions are provided for further ESD application to develop students' awareness, knowledge and competencies in sustainability and promote the students' engagement in the sustainable development of the world. This article bridges the gap in the existing literature regarding the awareness of the SDGs among Chinese high school students and lays the foundation for the in-depth implementation of ESD in Chinese senior high schools.

2. Theoretical Background

2.1. Sustainable Development Goals: The Blueprint to Achieve a More Sustainable Future for Both Humanity and the Planet

The world has been involved in sustainable development for decades [22], even before sustainable development was officially defined [23]. An increasing consensus is being reached that sustainability is a global issue and thus needs a global response [9,24]; therefore, all ethnicities, groups and countries are obligated to face this challenge and make changes [23]. Established in 2000, the MDGs mapped out 8 goals and 21 targets with the central objective to "eradicate extreme hunger and poverty" by the end of 2015 [25]. The world has progressed in poverty eradication, universal education, health care and other fields after decades of international cooperation [26,27]. In order to transfer the momentum of the MDGs and complete the remaining tasks [3,4] with more focus on the collaborative, comprehensive and sustainable development of the economy, society and environment [28], a new global plan to navigate humanity toward a more sustainable path was developed during the UN Conference on Sustainable Development (Rio + 20) in Rio de Janeiro, Brazil, in June 2012 [9]. As part of a three-year effort involving UN Members, encompassing millions of people from all over the world [9], at the United Nations General Assembly in September 2015 the leaders of 193 countries unanimously adopted the 2030 Agenda for Sustainable Development and proposed establishing the SDGs [26]. The universal, transformational and inclusive SDGs (see Table 1 [9]) describe the major development challenges for humanity and express the overall objectives and directions in a certain area [22]. Targets are relatively specific items to be achieved under a given goal [9]. The

goals and targets will stimulate action over the 15 years following their development in 2016 in areas of critical importance for humanity and the planet [29].

Table 1. The 17 Sustainable Development Goals (SDGs) [9].

Serial Number	Description
Goal 1	No Poverty—End poverty in all its forms everywhere.
Goal 2	Zero Hunger—End hunger, achieve food security and improved nutrition and promote sustainable agriculture.
Goal 3	Good Health and Well-Being—Ensure healthy lives and promote well-being for all at all ages.
Goal 4	Quality Education—Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.
Goal 5	Gender Equality—Achieve gender equality and empower all women and girls.
Goal 6	Clean Water and Sanitation—Ensure the availability and sustainable management of water and sanitation for all.
Goal 7	Affordable and Clean Energy—Ensure access to affordable, reliable, sustainable and clean energy for all.
Goal 8	Decent Work and Economic Growth—Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.
Goal 9	Industry, Innovation and Infrastructure—Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.
Goal 10	Reduced Inequalities—Reduce inequality within and among countries.
Goal 11	Sustainable Cities and Communities—Make cities and human settlements inclusive, safe, resilient and sustainable.
Goal 12	Responsible Consumption and Production—Ensure sustainable consumption and production patterns.
Goal 13	Climate Action—Take urgent action to combat climate change and its impacts.
Goal 14	Life below Water—Conserve and sustainably use the oceans, seas and marine resources for sustainable development.
Goal 15	Life on Land—Protect, restore and promote the sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.
Goal 16	Peace, Justice and Strong Institutions—Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels.
Goal 17	Partnerships for the Goals—Strengthen the means of implementation and revitalize the global partnership for sustainable development.

The aim of the SDGs is to secure a sustainable, peaceful, prosperous and equitable life on Earth for this and future generations [9,22]. All countries subscribing to the 2030 Agenda, as well as their populations and organizations, need to recognize their responsibilities and take urgent action to achieve sustainable development [9]. In order to realize the SDGs, it is necessary to enhance students' awareness of sustainable development and the SDGs [16,30]. Integrating ESD into the curricula and textbooks in upper secondary education is one approach to realizing the SDGs [9], as it can ensure that young people learn not only basic skills but also transferable competencies [31], such as critical thinking, problem solving, advocacy and conflict resolution that will support them in becoming responsible global citizens [32].

In China, the emergence of sustainable development can be traced back to the 1990s [33]. Later, the government proposed the Scientific Outlook on Development as

its national development strategy in 2003, setting sustainable development as an official discourse [34]. Consistent with the national strategy, the focus on ESD has been regarded as a key element to achieve sustainability [17]. Therefore, the government has initiated various forms of programs and activities to connect and support sustainable development.

2.2. Education for Sustainable Development: A Fundamental and Key Approach to Achieve the SDGs

According to the report published by the UN, the past decade has witnessed a significant increase in school enrollment and in educational opportunities at all levels, especially for girls [35]. Nevertheless, about 260 million children were still not in school in 2018, accounting for nearly one-fifth of the global school-age population [35]. More than half of children and adolescents worldwide do not meet the minimum literacy and numeracy requirements [35]. Primary education enrollment in developing countries has reached 91%, but 57 million children remain deprived of education [35].

The United Nations Educational, Scientific and Cultural Organization (UNESCO), as the UN specialized agency for education, asserts that education is a human right for all throughout life and is the foundation on which to drive sustainable development [9]. Quality education can improve social and economic status [36], but it is also the key to eliminating poverty [30]. Therefore, education helps to reduce inequality and achieve gender equality [30]. In addition, education enables people everywhere to live healthier and more sustainable lives [36,37]. Education is also vital to promote tolerance among people and contributes to a more peaceful society [36].

"Education can, and must, contribute to a new vision of sustainable global development". UNESCO clearly recognized the significance of education in sustainable development in 2015 [38,39]. In addition to SDG 4, several other SDGs cover a number of specific goals and indicators related to education [9] (e.g., Goals 1, 2 and 5: to eradicate poverty and hunger, people need to increase their economic potential via education; meeting all learners' needs in education fosters gender equality [30]). Education is not only an integral part of sustainable development, but also a critical factor in promoting it [9].

Goal 4 aims to "ensure inclusive and equitable quality education and promote lifelong learning opportunities for all", and its specific targets are illustrated in [40]. Since 1992, UNESCO has promoted ESD, which refers to the totality of actions taken by people to improve the sustainability competencies of learners [41]. ESD is clearly stated as part of Target 4.7 of the SDG on education: "By 2030, ensure that all learners acquire knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture's contribution to sustainable development [9]", which will facilitate learning about all the SDGs. ESD shifts the focus from teaching to learning [42], underlining an action-oriented [43], transformative pedagogy with interdisciplinary as well as transdisciplinary formal and informal learning [44]. ESD suggests pedagogical approaches and learning topics related to each of the 17 SDGs to achieve learning objectives comprising cognitive, social-emotional and behavioral objectives and key competencies that will enable learners to realize the SDGs [9].

The focus on ESD has increased in the daily practices of schools [45]. ESD in schools is transformative and learning-oriented [42], from learning to know, learning to be, learning to do and learning to live together, to learning to transform oneself and society [46,47]. ESD can be effectively promoted by key actions, such as establishing the awareness, meaning and scope of ESD; reorienting curricula, teaching and learning; capacity building; synergizing ESD with other "adjectival" educations [48]; providing ESD resources and materials; and engaging in international and regional cooperation [49]. Eight characteristics within schools lead to ESD effectiveness: sustainable leadership, resources, pluralistic communication, supportive relations, collective efficacy, adaptability, democratic decision making and a shared vision [50]. Based on the above-mentioned features, key actions and characteristics, Figure 1 proposes a framework of ESD in schools.
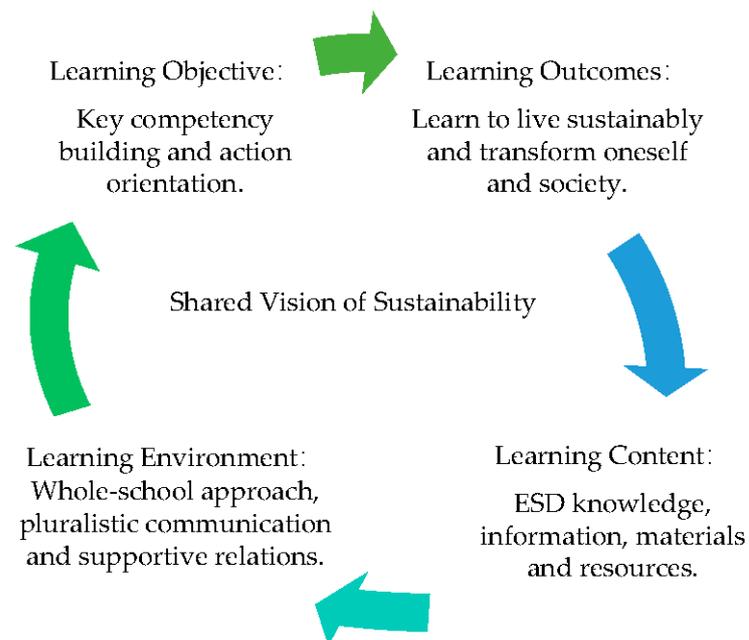
Figure 1. The Framework of ESD Implementation.

It is difficult to specify the criteria to measure ESD or to define its success, but in order to ensure its effectiveness, research should not avoid exploring these essential questions [51]. Although some studies have investigated the relationship between SDGs and education, senior high school students' understanding of the SDGs has not been clarified [52].

Sustainability competencies—a critical target of ESD—encompass the overall cognitive abilities and skills as well as the motivational, volitional [51] and social readiness required to address sustainability-related problems and to individually and collectively promote sustainable development [41]. To understand the competencies of senior high school students, cognition, motivation and social readiness concerning the SDGs should first be explored.

2.3. Awareness of the SDGs among Senior High School Students: Insufficient in Knowledge, Yearning for Sustainability Education

Goal 4, Quality Education, was ranked among the top concerns in the MY World 2030 survey (https://myworld2030.org/, accessed on 28 March 2021), a global citizen survey on the SDGs to investigate how people prioritized the SDGs [53]. The results were broadly in line with the main findings of another global survey on the SDGs [54]. During the investigation, responses from the private sector and political and public administration (3250 respondents) rated education and research organizations as the second "most relevant partners for achieving the SDGs" [36]. In addition, educational and research institutions are considered to be the most valuable driving forces for the achievement of the SDGs by establishing partnerships in accordance with SDG 17 [54].

The awareness and knowledge of the SDGs among senior high school students will be limited if education or intervention is lacking [16,55]. While ESD is popularized and implemented all over the world, research on its effects and effectiveness is rare [56]. In order to foster the sustainability competencies of senior high school students and to measure the effectiveness of ESD, the existing knowledge level and cognition should be investigated to further develop educational theory and behavior.

Although China has created a policy environment where sustainable development is the guiding principle, China does not have an official ESD national action plan or policy [57]. The aim of this case study was to understand the Chinese students' awareness of the SDGs including their existing knowledge and information sources in relation to the SDGs as well as the influencing factors such as grade and gender. Students' SDGs learning

level and the integration of the SDGs into different course subjects were also investigated. Additionally, the study aimed to understand the students' attention priorities regarding the SDGs, the impact of their personal lives on the SDGs and future career choices related to the SDGs. This article bridges the gap in the existing literature regarding the awareness of the SDGs among Chinese high school students. Based on the research outcomes, guidance and suggestions are provided for further application education in the school surveyed to develop students' awareness, knowledge and competencies in relation to sustainability and to encourage them to engage in global sustainable development. Suggestions for ESD in the school surveyed are also discussed.

3. Research Design

In the present study, a questionnaire survey based on previous studies [52,56] was used to ask senior high school students in one school in Beijing, China, about their individual concerns and priorities among issues related to the 17 SDGs. The questionnaire consisted of eight parts (see Table S1). The objective of the first part was to collect the demographic information of senior high school students (Q1–Q3). The second part was about students' self-reported knowledge of the SDGs (Q4.1–Q4.4), and the third part pertained to the information sources of their SDG knowledge (Q4.5–Q4.8). In the fourth part, students were asked about the involvement of the SDGs in their courses as well as the corresponding subjects (Q5.1–Q5.17). The promotion of the SDGs in different subjects was analyzed in the fifth part (Q6.1–Q6.14). Students were then asked about the impact of their personal lives on the SDGs in the sixth part (Q7.1–Q7.17), which was followed by individual priorities among the SDGs (Q8.1–Q8.17) in the seventh part. Lastly, students were asked about career planning related to the SDGs (Q9.1–Q9.17) in the eighth part.

The study was conducted in the International Department of Beijing No.35 High School in Beijing, China where students are from different provinces and middle schools in China with distinct backgrounds, which represented the students across the country to a certain extent. Students completed the questionnaire anonymously online through WenJuanXing (https://www.wjx.cn/index.aspx, accessed on 7 April 2021). Data were further processed and analyzed with Statistical Product and Service Software Automatically (SPSSAU) [58]. Multiple statistical tests were conducted. Reliability and discriminant analysis [58–60] were used to measure the validity of the questionnaire and to identify whether the questionnaire contents could effectively differentiate between categories [61]. A descriptive analysis was carried out to reveal the composition of the sample of respondents and the overall results of the responses [62]. An analysis of variance [58,63–67] of gender and grade was conducted to investigate the differences in the awareness of the SDGs among students. Weight analysis [58,68,69] was used to reveal important issues, showing students' attention to basic knowledge of the SDGs as well as information sources and disclosing the situation of the penetration of the SDGs in different subjects, the impact of students' personal life on the SDGs and their career planning relating to the SDGs. Considering the multiple-choice questions regarding subject penetration with the SDGs and students' attention priorities in relation to the SDGs, an analysis of the response rate and popularity rate [58,60] was performed to determine the selection proportion of each item, which revealed the importance of certain items. Path analysis, as an extension of multiple linear regression models, analyzing intricate variable relationships, was applied to explore the relationship between various variables and best-fitting models for theoretical development and practical application [70]. A total of 328 valid questionnaires were collected. The students were informed of the purpose of the research and signed informed consent forms. The research questions in this study included: (1) Is the improved questionnaire valid for measuring SDGs awareness of high school students? (2) What are the differences in SDGs awareness between different genders and grades? (3) What are the students' self-reported knowledge level and information sources of SDGs? (4) What is the students' learning level with respect to SDGs, and what is the degree of penetration of SDGs in course subjects? (5) What are the students' priorities to SDGs, how do the personal lives of the students affect

SDGs, and how will students plan careers related to SDGs? (6) How should the model of ESD for the school surveyed be built? These questions were linked to the research objectives, which were as follows: (1) Develop and implement an effective tool to measure senior high school students' awareness of the SDGs. (2) Investigate whether there are differences in the awareness of the SDGs between different grades and genders. (3) Understand the cognitive level and information sources of the students with respect to the SDGs. (4) Understand the learning performance of students and the corresponding course subjects integrated with the SDGs. (5) Understand the social readiness of the students with respect to the SDGs through students' attention priorities, the impact of personal lives as well as career choices relating to SDGs. (6) Provide suggestions for implementing ESD in senior high school.

4. Analysis and Findings

4.1. Questionnaire Reliability, Discriminant Analysis and Descriptive Analysis

A reliability analysis effectively measures the validity of the questionnaire [61], and a discriminant analysis further identifies whether the questionnaire contents can effectively differentiate between categories [58–60].

As reported in Table 2, the reliability coefficients were greater than or equal to 0.9, which indicated that the reliability of the questionnaire in this research was very high. The Corrected Item Total Correlation (CITC) values were higher than 0.4, which shows that there was a good correlation between the constructs, further indicating the high reliability of the questionnaire. In sum, with a high level of reliability, the data can be used for further analysis.

Table 2. Cronbach's Alpha of Each Construct (*n* = 328).

Construct	Theme	Corresponding Questions	Cronbach's α
C1	Self-Reported Knowledge of SDGs	Q4.1–Q4.4	0.95
C2	Source of Information	Q4.5–Q4.8	0.90
C3	Learning Level of SDGs	Q5.1–Q5.17	0.97
C4	The Impact of Personal Life on SDGs	Q7.1–Q7.17	0.98
C5	Career Planning Related to SDGs	Q9.1–Q9.17	0.96

Table 3 shows the results of the item analysis of the five constructs. A *t*-test was conducted to compare the differences. Both high- and low-scoring groups showed significance for all five constructs ($p < 0.05$), indicating that the five constructs were effective and appropriate with good differentiation ability and should be retained.

Table 3. Item (Discriminant) Analysis of Each Construct.

Construct	Theme	Group (M ± SD)		t (CR)	p
		Low Score ($n = 88$)	High Score ($n = 88$)		
C1	Self-Reported Knowledge of SDGs	1.64 ± 0.72	4.13 ± 0.81	−21.59	0.00 **
C2	Source of Information	1.72 ± 0.75	4.08 ± 0.78	−20.46	0.00 **
C3	Learning Level of SDGs	2.08 ± 0.83	3.18 ± 0.82	−8.82	0.00 **
C4	Impact of Personal Life on SDGs	2.95 ± 1.03	4.32 ± 0.69	−10.36	0.00 **
C5	Career Planning Related to SDGs	2.78 ± 0.95	3.91 ± 0.75	−8.72	0.00 **

** $p < 0.01$.

A descriptive analysis was carried out to reveal the composition of the sample of respondents and the overall results of the responses [62].

In China, education in senior high school lasts for three years, from grade 10 to grade 12. The distribution of the students' ages, genders and grades is shown in Table 4. According to Table 5 and Figure 2, the mean scores of C4 (The Impact of Personal Life on SDGs) and C5 (Career Planning Related to SDGs) were higher than the median value "3" (5-point scale), while the values of C2 (Source of Information), C1 (Self-Reported Knowledge of SDGs) and C3 (Learning Level of SDGs) were lower than 3. The mean score of C3 ranked the lowest.

Table 4. Demographics: Percentage and Quantity ($n = 328$).

Demographic Factor	Percentage (Quantity)
Age	
15	10.67% (35)
16	33.23% (109)
17	29.57% (97)
18	25.30% (83)
19	1.22% (4)
Gender	
Male	50.91% (167)
Female	49.09% (161)
Grade	
10	31.10% (102)
11	36.28% (119)
12	32.62% (107)

Table 5. Mean and Standard Deviation of Each Construct.

| Grade	Gender	C1 Self-Reported Knowledge of SDGs	C2 Source of Information	C3 Learning Level of SDGs	C4 The Impact of Personal Life on SDGs	C5 Career Planning Related to SDGs
10	Male	2.57 ± 1.30	2.59 ± 1.28	2.69 ± 0.81	3.41 ± 1.02	3.22 ± 0.90
	Female	2.83 ± 1.06	2.90 ± 0.99	2.55 ± 0.81	3.41 ± 0.76	3.25 ± 0.79
	Total	2.70 ± 1.19	2.75 ± 1.15	2.62 ± 0.81	3.41 ± 0.90	3.24 ± 0.84
11	Male	3.34 ± 1.07	3.39 ± 1.05	2.73 ± 1.00	3.47 ± 1.03	3.39 ± 0.94
	Female	3.04 ± 1.04	3.09 ± 0.93	2.81 ± 0.62	3.45 ± 0.85	3.27 ± 0.73
	Total	3.19 ± 1.06	3.23 ± 1.00	2.77 ± 0.82	3.46 ± 0.93	3.32 ± 0.83
12	Male	2.95 ± 1.27	2.93 ± 1.20	3.00 ± 1.02	3.56 ± 0.94	3.25 ± 0.79
	Female	2.81 ± 1.18	2.87 ± 1.12	2.99 ± 0.99	3.58 ± 0.91	3.17 ± 0.80
	Total	2.89 ± 1.23	2.90 ± 1.16	3.00 ± 1.00	3.57 ± 0.92	3.22 ± 0.79
Total		2.94 ± 1.17	2.97 ± 1.12	2.80 ± 0.89	3.48 ± 0.92	3.26 ± 0.82
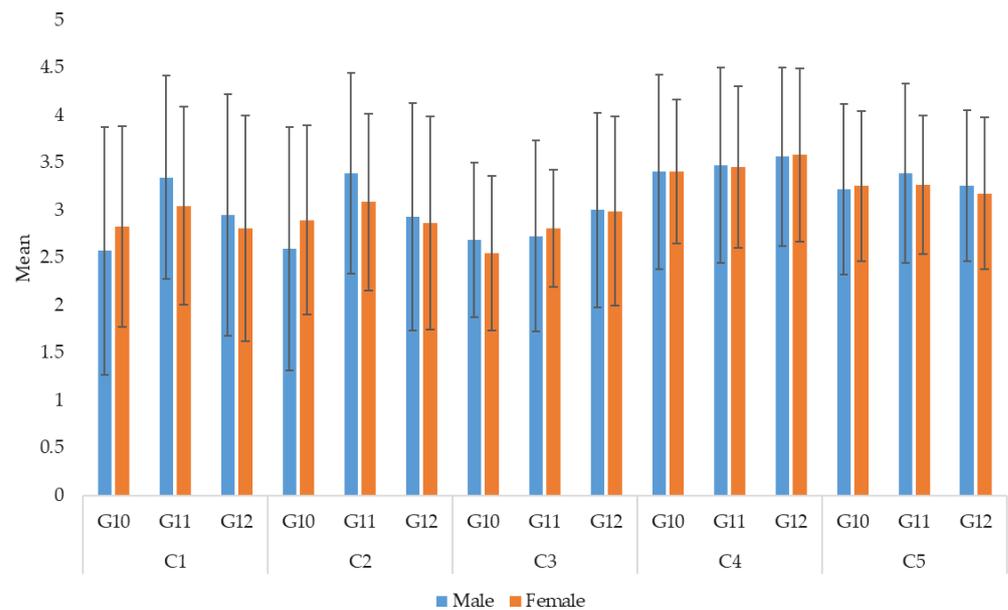
Figure 2. Histogram of the Mean and Standard Deviation of Each Construct.

4.2. Analysis of Variance of Gender and Grade

There was no significant difference in the awareness of sustainable development between boys and girls in senior high school [16]. To confirm this finding, an analysis of the variance of gender was conducted.

The homogeneity test of variance [58,63–65] is used to test whether there are significant differences in the variability (standard deviation) of data in each group. As shown in Table 6, there were no significant differences in the responses for C2 (Source of Information), C3 (Learning Level of SDGs) or C5 (Career Planning related to SDGs) between genders ($p > 0.05$). This means that the data for these three constructs had consistent variation between genders, so it met the requirement of the Analysis of Variance (ANOVA). In contrast, the responses for C1 (Self-Reported Knowledge of SDGs) and C4 (Impact of Personal Life on SDGs) were significantly different between genders ($p < 0.05$), which means that the data variation for these two constructs was inconsistent between different gender groups. Therefore, a nonparametric test was performed for these constructs.

Table 6. Test of Homogeneity of Variances of Gender.

| Construct | Theme | Gender (SD) | | *F* | *p* |
		Male (*n* = 167)	Female (*n* = 161)		
C1	Self-Reported Knowledge of SDGs	1.25	1.09	4.05	0.05 *
C2	Source of Information	1.21	1.01	3.57	0.06
C3	Learning Level of SDGs	0.96	0.82	0.80	0.37
C4	The Impact of Personal Life on SDGs	0.99	0.84	6.31	0.01 *
C5	Career Planning Related to SDGs	0.87	0.76	3.37	0.07

* $p < 0.05$.

An independent sample *t*-test [58,64–66] was used to study the difference in the responses for the three constructs C2 (Source of Information), C3 (Learning Level of SDGs) and C5 (Career Planning related to SDGs) between genders. The data in Table 7 reveal that there were no significant differences in the above constructs between genders ($p > 0.05$).

Table 7. Independent *t*-test on Gender.

Construct	Theme	Gender (M ± SD)		*t*	*p*
		Male (*n* = 167)	Female (*n* = 161)		
C2	Source of Information	2.98 ± 1.21	2.96 ± 1.01	0.16	0.88
C3	Learning Level of SDGs	2.81 ± 0.96	2.78 ± 0.82	0.37	0.71
C5	Career Planning Related to SDGs	3.29 ± 0.87	3.23 ± 0.76	0.59	0.56

Table 8 indicates the gender differences in the responses for C1 (Self-Reported Knowledge of SDGs) and C4 (The Impact of Personal Life on SDGs) under the nonparametric [58,66,67] Mann–Whitney test. Neither of them was significantly different between different genders ($p > 0.05$).

Table 8. Nonparametric test on Gender.

Construct	Theme	Gender Median (P$_{25}$, P$_{75}$)		Mann–Whitney *U*	Mann–Whitney *z*	*p*
		Male (*n* = 167)	Female (*n* = 161)			
C1	Self-Reported Knowledge of SDGs	3.00 (2.0,4.0)	3.00 (2.0,3.5)	13308.00	−0.16	0.87
C4	Impact of Personal Life on SDGs	3.29 (3.0,4.0)	3.29 (3.0,4.0)	13441.50	−0.00	1.00

A previous study compared the self-reported knowledge of the SDGs between different grades of college students [52]. There has also been sustainability research that has focused on students of grades 6, 9 and 12 [45]. However, there are few studies on SDG awareness between different grades of senior high school. Hence, exploring the differences in SDG awareness among grades of senior high school students is indispensable.

The outcomes in Table 9 reveal that the responses of students in different grades for C2 (Source of Information), C3 (Learning Level of SDGs), C4 (Impact of Personal Life on SDGs) and C5 (Career Planning Related to SDGs) ($p > 0.05$) did not significantly differ, which satisfies the prerequisites of ANOVA. In contrast, there was a significant difference in the responses for C1 (Self-Reported Knowledge of SDGs) among grades ($p < 0.05$). Hence, the nonparametric test was used to analyze the difference in C1 responses.

Table 9. Test of Homogeneity of Variances on Grade.

Construct	Theme	Grade (SD)			*F*	*p*
		10 (*n* = 102)	11 (*n* = 119)	12 (*n* = 107)		
C1	Self-Reported Knowledge of SDGs	1.19	1.06	1.23	3.24	0.04 *
C2	Source of Information	1.15	1.00	1.16	2.63	0.07
C3	Learning Level of SDGs	0.81	0.82	1.00	1.48	0.23
C4	Impact of Personal Life on SDGs	0.90	0.93	0.92	0.45	0.64
C5	Career Planning Related to SDGs	0.84	0.83	0.79	0.15	0.86

* $p < 0.05$.

Table 10 shows the results of the one-way ANOVA [58,63–65], which was used to investigate the differences in the responses for four constructs between three grades. There were no significant differences in the responses for C4 (The Impact of Personal Life on SDGs) or C5 (Career Planning Related to SDGs) ($p > 0.05$). However, there were significant differences in the responses for C2 (Source of Information) and C3 (Learning Level of SDGs) ($p < 0.05$) between grades. Specifically, for C2 (Source of Information), the grade had a significance level of 0.01 (F = 5.62, $p = 0.00$). The detailed differences were as

follows: the mean score for C2 in grade 11 was higher than those in both grades 10 and 12. The difference in the responses for C3 (Learning Level of SDGs) between grades had a significance level of 0.01 (F = 4.92, p = 0.01); the specific difference was that the mean score for C3 in grade 12 was higher than that in grade 10.

Table 10. Analysis of Variance on Grade.

Construct	Theme	Grade (Mean ± Std. Deviation)			*F*	*p*
		10 (*n* = 102)	11 (*n* = 119)	12 (*n* = 107)		
C2	Source of Information	2.75 ± 1.15	3.23 ± 1.00	2.90 ± 1.16	5.62	0.00 **
C3	Learning Level of SDGs	2.62 ± 0.81	2.77 ± 0.82	3.00 ± 1.00	4.92	0.01 **
C4	Impact of Personal Life on SDGs	3.41 ± 0.90	3.46 ± 0.93	3.57 ± 0.92	0.89	0.41
C5	Career Planning Related to SDGs	3.24 ± 0.84	3.32 ± 0.83	3.22 ± 0.79	0.51	0.60

** $p < 0.01$.

Furthermore, the Brown–Forsythe ANOVA [58,66,67] was conducted to study the differences in scores for C1 (Self-Reported Knowledge of SDGs) among different grades, and the results are in Table 11. The level of significance of C1 was 0.01 (Brown F = 4.89, p = 0.01); the specific difference was that the mean score for C1 in grade 11 was higher than that in grade 10.

Table 11. Brown–Forsythe Analysis of Variance on Grade.

Construct	Theme	Grade (Mean ± Std. Deviation)			Brown *F*	*p*
		10 (*n* = 102)	11 (*n* = 119)	12 (*n* = 107)		
C1	Self-Reported Knowledge of SDGs	2.70 ± 1.19	3.18 ± 1.06	2.89 ± 1.23	4.89	0.01 **

** $p < 0.01$.

4.3. Weight Analysis of SDG Self-Reported Knowledge and Information Sources

In the weight analysis results [58,68,69] on SDG self-reported knowledge and information sources, the more students that chose higher values in constructs 1 and 2, the more important the item. This highlights the research value of ESD implementation in senior high school.

The weight analysis results in Figures 3 and 4 show students' attention to the basic knowledge and the information sources in relation to the SDGs.
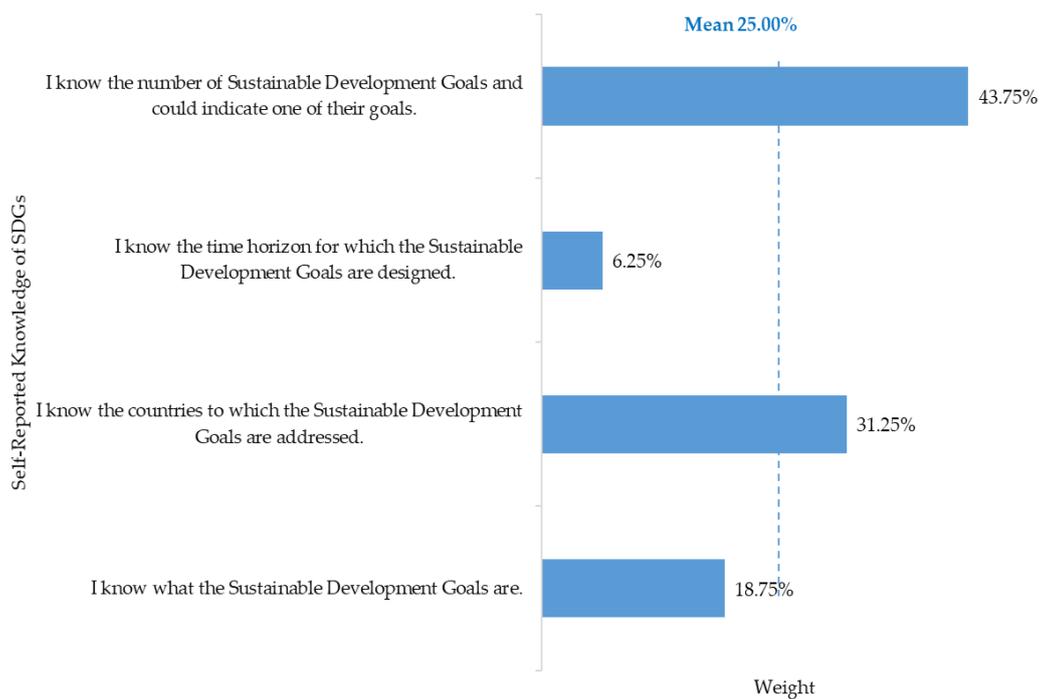
**Figure 3.** Bar Chart of Weights for Self-Reported Knowledge of the SDGs.
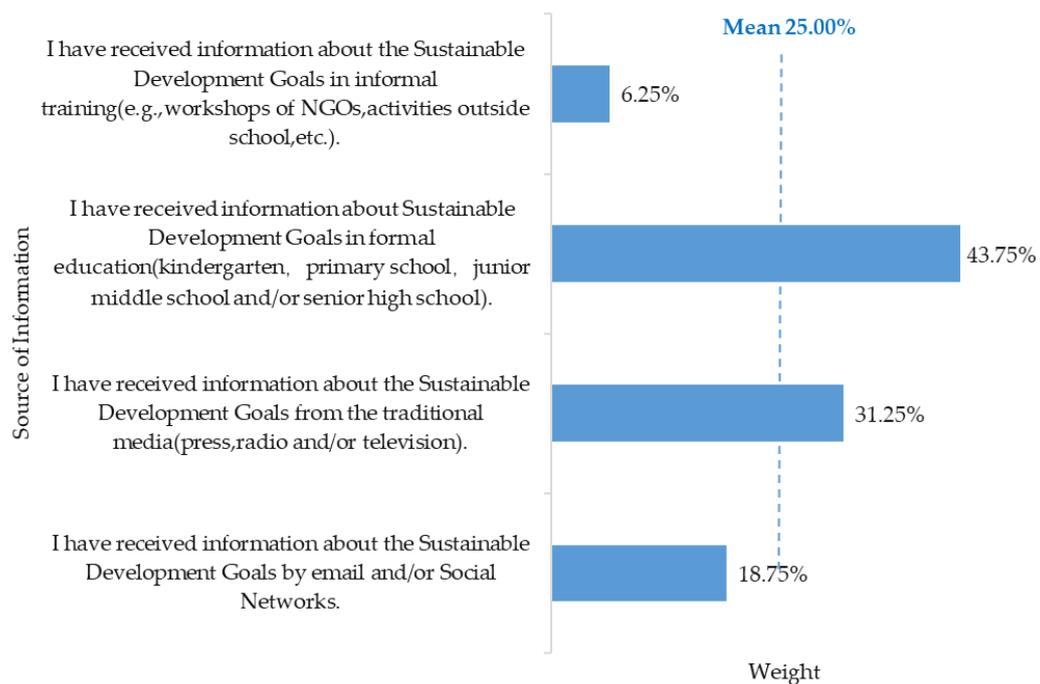
Figure 4. Bar Chart of Weights for Source of Information.

4.4. Analysis of Response and Popularity Rates and Weights on SDG Learning Level and Penetration in Course Subjects

An analysis of the response rate and popularity rate [58,60] was performed on the multiple-choice questions to determine the selection proportion of each item. The results reveal the importance of certain items.

The Chi-square Goodness-of-Fit Test was used to analyze whether the distribution of the responses was uniform. The results indicated a significant difference (chi = 175.49,

$p = 0.00 < 0.05$) in the selection proportion of items, which can be further compared to the response rate and popularity rate. According to Figure 5, the response rate and popularity rate of SDG penetration were significantly higher in biology, chemistry, geography, technology and laboratory courses, politics and economics and physics.
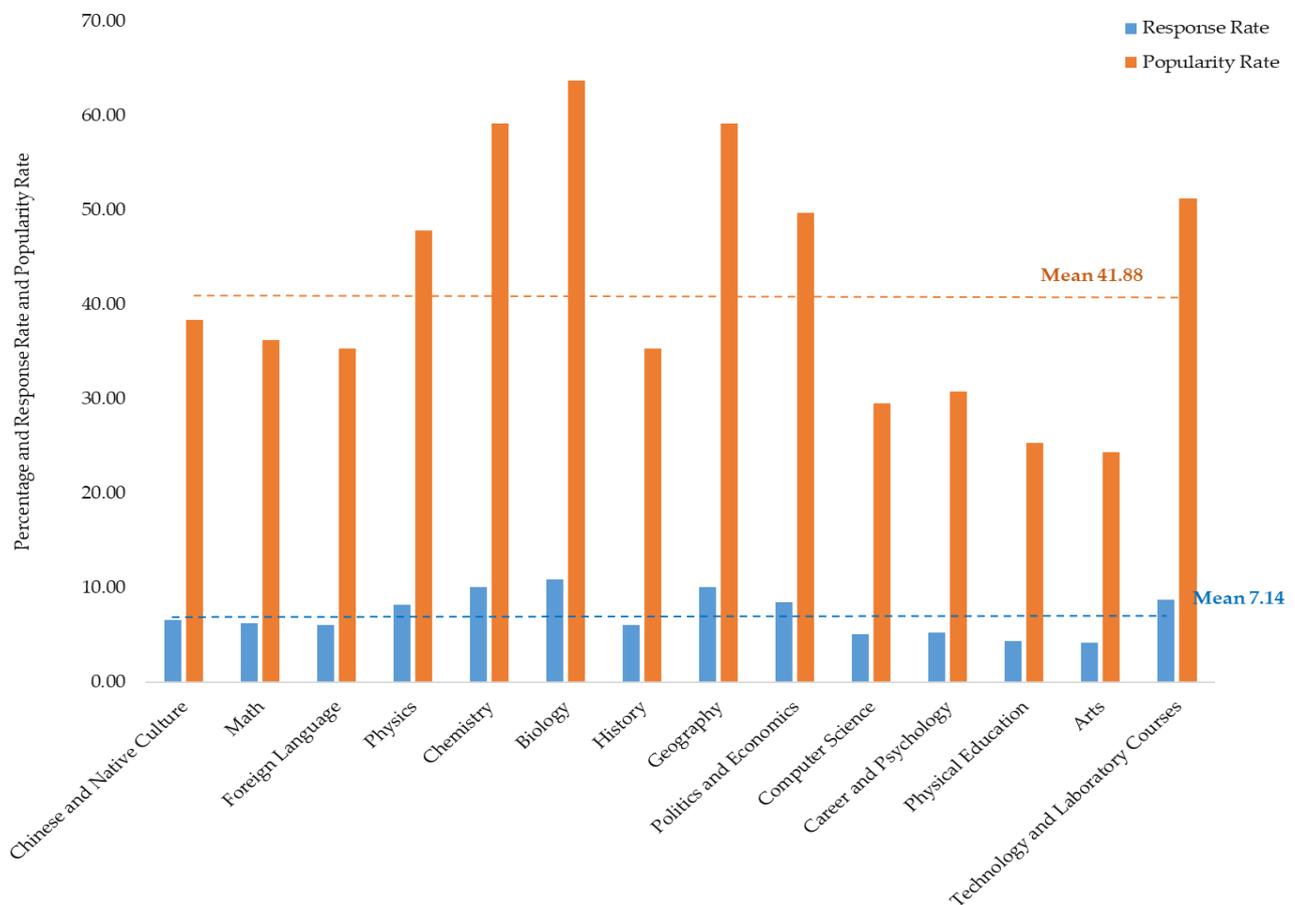
Figure 5. The Histogram of the Response Rate and Popularity Rate of SDG Subject Penetration.

A weight analysis [58,68,69] is used to reveal important issues. The higher the weight of the dark gray bars in Figure 6, the more the students learned about SDGs in the corresponding subject. The weights of 8 of the 17 goals were higher than the average. Figure 6 shows the penetration of the SDGs in different subjects, and the results show that Chinese and native culture, foreign language, biology and geography all included the SDGs. Politics and economics had incorporated 15 goals. The proportion of SDG penetration in subjects was different between the goals.
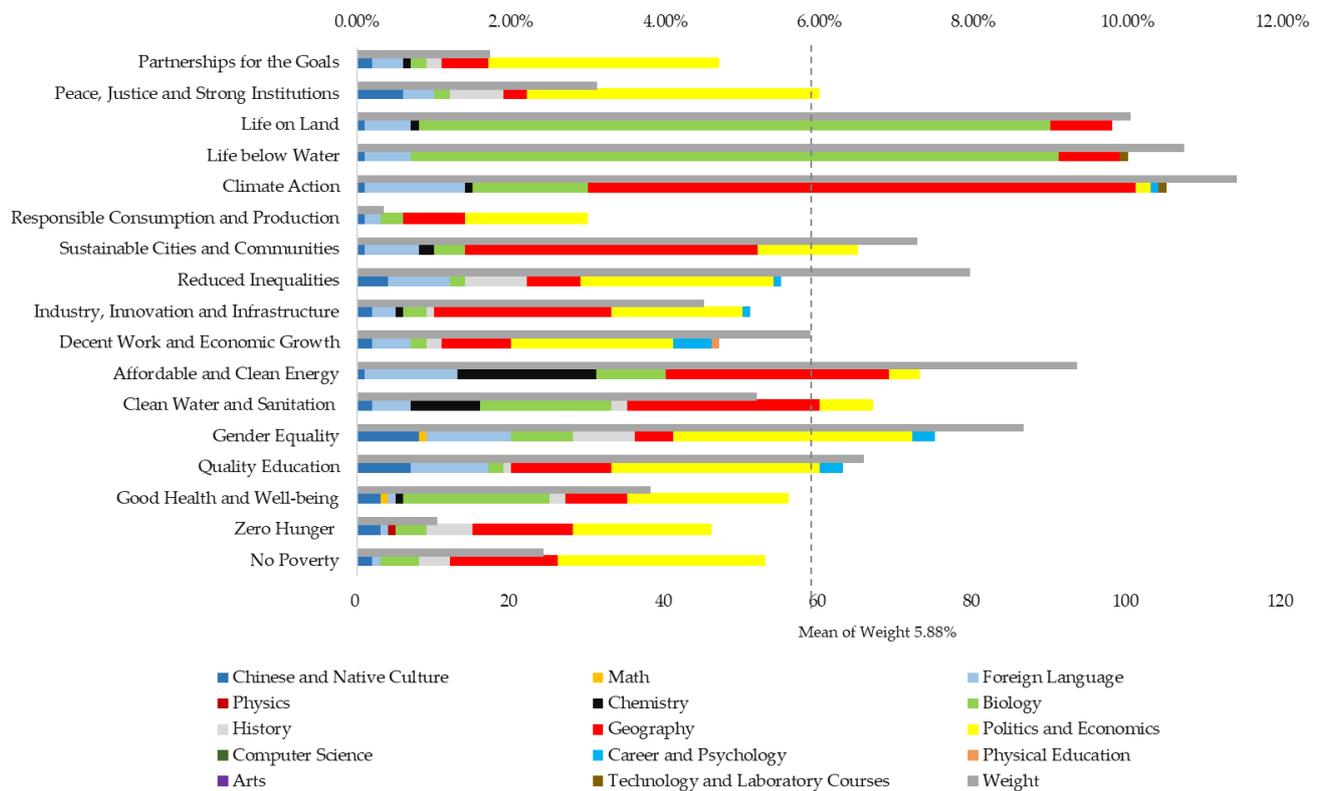
Figure 6. Bar Chart of Weights for the Penetration of the SDGs in Different Subjects.

4.5. Analysis of Response and Popularity Rates and Weights for Priorities, Impact of Personal Life and Career Planning Related to SDGs

An analysis of the response rate and popularity rate [58,60] was performed on the multiple-choice questions to determine the selection proportion of each item. The results reveal the importance of certain items.

The Chi-Square Goodness-of-Fit Test was used to analyze whether the proportion of multiple-choice responses was evenly distributed. The results indicated significant differences (chi = 147.98, p = 0.00 < 0.05), which can be further compared to the response rate or the popularity rate. In particular, the response rate and popularity rate of gender equality, quality education, reduced inequalities, no poverty, zero hunger, good health and well-being were significantly higher shown in Figure 7.

A weight analysis [58,68,69] is used to reveal important issues. As shown in Figure 8, the weights of eight SDGs exceeded the mean. Gender equality, quality education, clean water and sanitation were the top three. The higher the weight, the greater the impact of personal life on the SDG. The three goals with the lowest weights were partnership for the goals; no poverty; and peace, justice and strong institutions. The lower the weight, the smaller the impact of personal life on the SDG.

As shown in Figure 9, the weights of nine SDGs were greater than the average. Among the SDGs with the highest weights were decent work and economic growth; quality education; industry, innovation and infrastructure; and sustainable cities and communities. The higher the weight, the greater the willingness to adopt the corresponding SDG as a personal career choice in the future. The lowest three weights of SDGs were zero hunger, no poverty and life on land. The lower the weight, the lower the willingness to adopt the corresponding SDG as an individual career choice in the future.
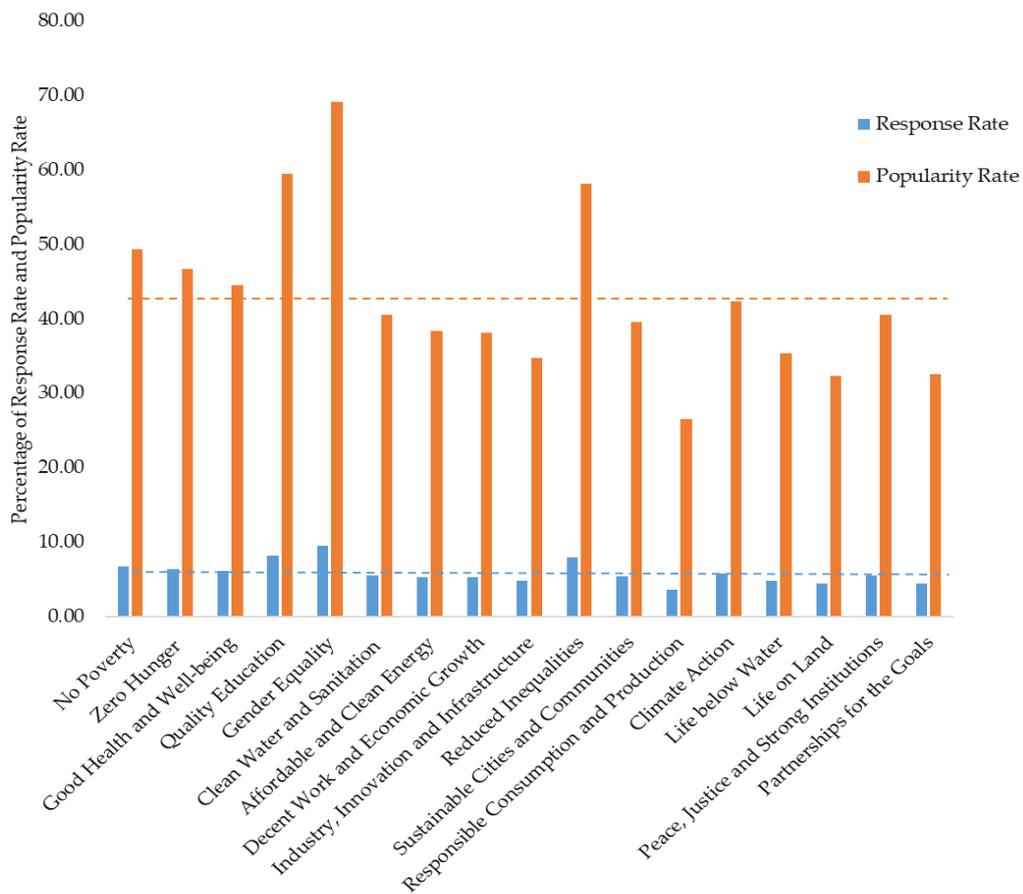
**Figure 7.** Histogram of Response Rate and Popularity Rate of Preference of the SDGs.
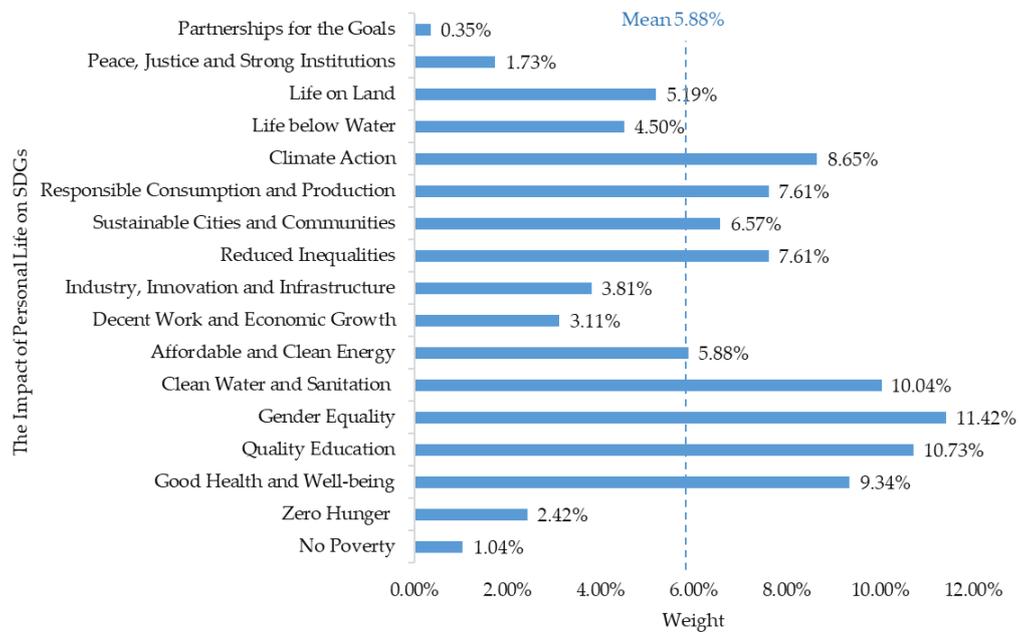
**Figure 8.** Bar Chart of Weights for the Impact of Personal Life on the SDGs.
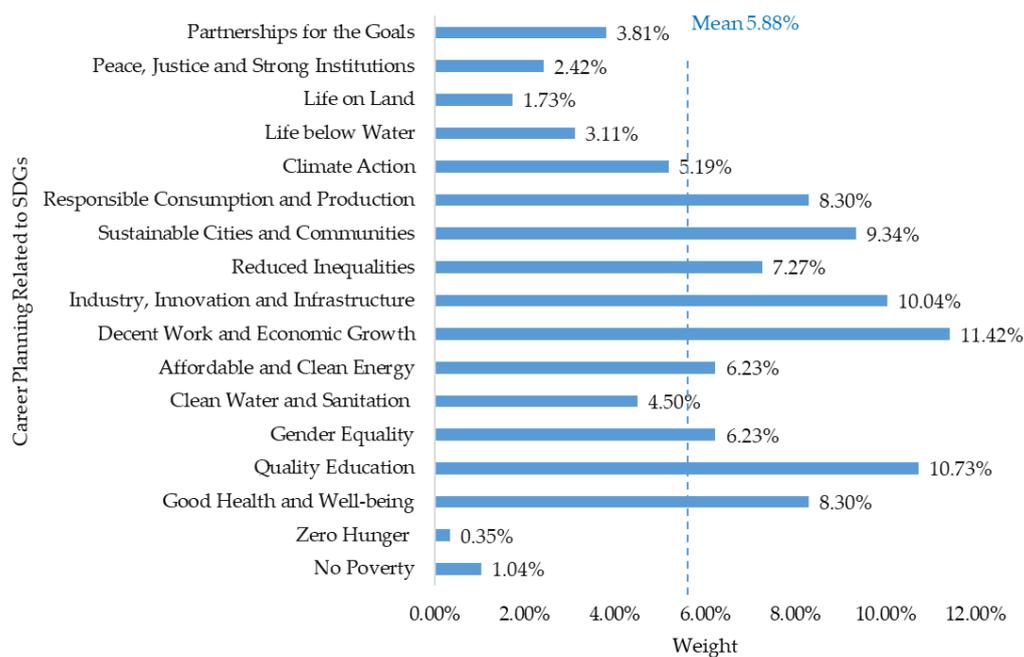
Figure 9. Bar Chart of Weights for Career Planning Related to the SDGs.

4.6. Path Analysis of ESD in the School Surveyed

The path analysis is an extension of the regression model and is used to test the fitting degree of the correlation matrix of two or more causal models that are being compared by the researcher, and the best-fitting models can be selected for theoretical development [70].

In the model shown in Figure 10 (χ^2/df = 2.10 < 3), the values of RMSEA and RMR were 0.06 and 0.03, respectively, which were less than 0.1. GFI, CFI, NFI and NNFI were all higher than 0.9. All indexes of the model were in the standard range, indicating a good fit.

To explore the relationship between different variables in this study, the standardized path coefficient and significance level were calculated through a path analysis. The relationships of the five constructs of ESD were concluded as follows: (1) The Impact of Personal Life on SDGs and Source of Information had a significant positive impact on Career Planning Related to SDGs. (2) Knowledge of SDGs had a significant positive impact on The Impact of Personal Life on SDGs and Source of Information. (3) Learning Level had a significant positive impact on Source of Information. (4) In terms of the co-variance (correlation relationship) between Knowledge of SDGs and Learning Level of SDGs, there was a significant positive correlation between them.

ESD can cultivate key competencies for sustainable development and SDGs [9]. The key competencies embody cognitive factors, which comprise the knowledge and thinking skills necessary to better understand the SDGs and the affective, volitional and motivational elements [9,38], which is in line with knowledge and information acquisition highlighted in the path analysis results. It is not suggested that key competencies are taught during ESD, but learners should be allowed to develop them based on their experience and reflection [9,38]. These model outcomes reveal that learning orientation and reflection for the Impact of Personal Life on SDGs were both learner-centered. Individuals are more resilient and can develop and apply career-related competencies most effectively after ESD [38,71], which is in keeping with the findings of the path analysis: through SDG information acquisition, learning, experience and reflection, people can be empowered to take action and actively contribute to advancing these goals.
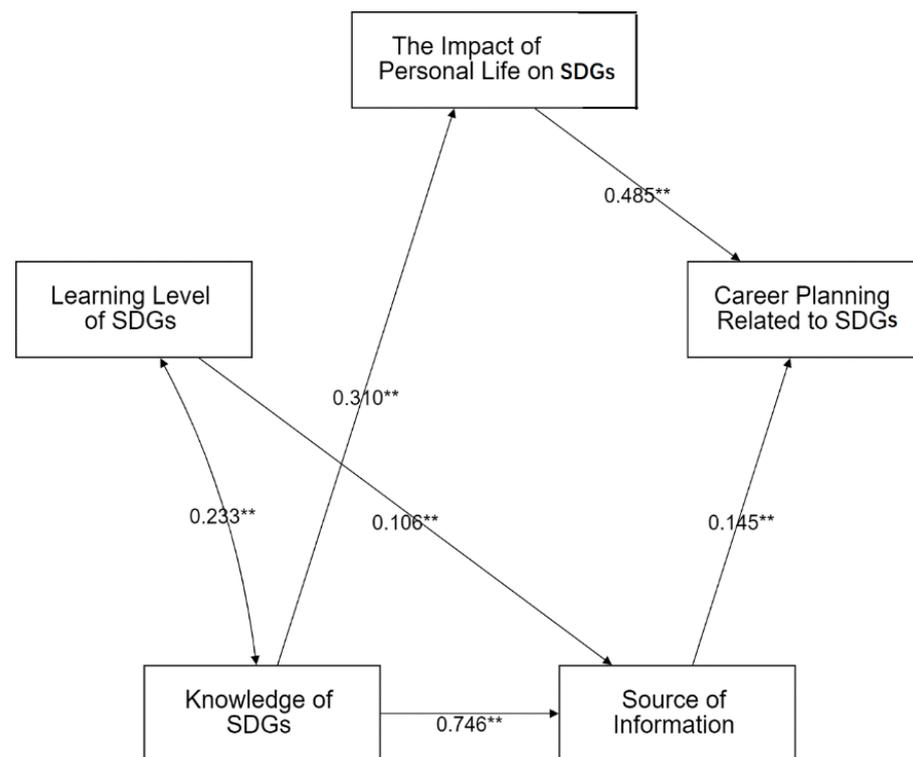
Figure 10. Pathway of ESD in the School Surveyed.

5. Suggestions and Discussion

5.1. An Improved Questionnaire for Measuring the Awareness of the SDGs among High School Students

The questionnaire in this study is an improved version based on previous studies [52,56]. The results of the reliability analysis and the discriminant analysis show that the questionnaire was effective and appropriate. It can be further used in the future to investigate senior high school students' cognitive levels, sources of information, learning motivations and social readiness with respect to the SDGs. The sample students who were from the International Department of Beijing No.35 High School come from different provinces and cities of China and they will go to colleges to study abroad instead of within China. They had different backgrounds, so they represented students across the country to a certain extent. However, the sample representativeness was still limited due to the numbers and sources. To improve it, follow-up research objects should be broadened and diversified. The same students in Beijing No.35 High School, as well as the students in other schools with distinct backgrounds and in different areas of China should become the respondents to increase the representativeness of the sample.

5.2. Grades 10 and 12 Require More Attention on ESD

There were no gender differences in the responses for any constructs, which is in line with a prior study [16] and implies that senior high school students are treated equally in ESD and the improvement of gender equality has been confirmed in most aspects [30].

Students in grade 11 are more adapted to senior high school life than those in grade 10, while they lack the same pressure to enter college as students in grade 12 [72]. Thus, grade 11 is an ideal stage with the highest level of SDG information acquisition and knowledge retention. It is suggested that ESD be intensified in grades 10 and 12 to enable students to continuously acquire knowledge and information about the SDGs.

The learning level of SDGs through subject teaching was highest in grade 12, which proves that ESD in the school surveyed is productive and effectively integrated into the curricula. However, the overall performance in learning SDGs in different subjects

was unsatisfactory, which suggests a need for ESD curriculum revisions and improved integration into teaching practices [73].

5.3. Specific Knowledge and Extensive Information Channels

ESD is not "one size fits all" [74]; it requires locally relevant interpretations and forms of instruction [75]. It is suggested that ESD be implemented according to the concerns and interests of senior high school students, and the promotion of the SDGs, especially specific knowledge that students lack, should be enhanced.

The findings of this study indicate that senior high school students received most of their information about the SDGs from formal education and traditional media. A whole-institution approach is a crucial strategy to advance ESD [9,76]. All levels and forms of education and media are encouraged to popularize the SDGs [77]. New media exposure and informal education such as extracurricular training and activities are also mechanisms of ESD delivery [78], which is particularly required to reinforce knowledge.

5.4. Raise Learning Level and Integrate ESD into the Curriculum

The results related to information sources and the self-reported knowledge of SDGs are not optimal, which is largely in line with global surveys [16,54]. Learning SDGs via the curriculum is the weakest area. In order to improve SDG cognition and the learning motivation of students, it is necessary to strengthen and further integrate ESD into the curricula of senior high school [9].

Eight SDGs, including climate action, life below water and life on land, have been learned to a great extent by senior high school students, while the remaining nine goals are less involved in subject courses, which suggests that more SDGs need to be learned, and ESD should be employed proactively as a holistic and system-wide approach [73]. Integrating ESD into the curricula needs to be further improved to involve more ESD-relevant learning contents, objectives and activities [75].

ESD is effectively integrated into the lessons of Chinese and native culture, foreign language, biology, geography and politics and economics. It is also essential to further incorporate the SDGs into other course subjects, including art, science and technology, to ensure that students understand all of the SDGs [79]. Biology, chemistry, geography, technology and laboratory courses, politics and economics and physics were the subjects that students considered to have integrated SDGs the most. Among them, chemistry, technology and laboratory courses and physics are not in the scope of the higher learning level of SDGs, which implies that educators have worked hard on these subjects because they are recognized the most by students.

From kindergarten to senior high school, ESD is integrated into the curriculum [80], with specific learning objectives, contents and outcomes identified in science, social studies and health and physical education [75]. ESD should not be considered adjectival education or an isolated subject [81]; it is intended to be a vital part of learning in core subjects such as math, sciences, social studies and languages [9]. Furthermore, cross-curriculum ESD can make significant contributions to the development of ESD to collaboratively work toward a more sustainable future [82].

5.5. Become Global Citizens with Sustainability Awareness

A comparison of the mean scores of the different constructs shows that students' responses for C4 (The Impact of Personal Life on SDGs) and C5 (Career Planning Related to SDGs) were positive, while those for C2 (Source of Information), C1 (Self-Reported Knowledge of SDGs) and C3 (Learning Level of SDGs) require improvement. This reveals that the students were more attentive to sustainability issues related to their personal lives and future careers, reflecting social readiness for sustainable development. On the other hand, the results for future career choices show that students mainly considered the SDGs from the perspective of their own development (e.g., decent work and economic growth were prioritized). Therefore, it is suggested that students be guided to care about others,

the environment and communities [83]. Moreover, all young people should acquire not only fundamental knowledge and skills via ESD but also key competencies in order to become responsible global citizens [32].

Gender equality, quality education, reduced inequalities and good health and well-being were common concerns of students when it comes to individual priorities, the impact of their personal lives on SDGs and career planning, most parts of which are consistent with the outcomes of the global survey [54]. It is worth noting that the students in the school surveyed also took gender equality and reduced inequalities into account. The findings suggest that promoting equality has theoretical and practical significance in secondary education in developing countries.

Life below water, life on land, peace, justice and strong institutions, and partnerships for the goals are the SDGs that students did not take into account in terms of individual priorities, personal life impact and career planning. These goals seem to be far from students' lives and studies, but they are of great value and significance in achieving sustainable development [84]. The above blind spots should be addressed in publicity efforts and ESD to promote the comprehensive realization of sustainable development [85]. In addition, ESD should empower and motivate students to become proactive global citizens who are capable of critical thinking and building a sustainable future [9,86].

5.6. Implement Learning of SDGs through ESD

ESD can facilitate the cognitive, socio-emotional and behavioral learning outcomes and sustainability competencies to promote all the SDGs [9,87]. The correlations of different factors related to the SDGs in Figure 10 demonstrate the ESD framework in the school surveyed. By using the modeling, the findings indicate that students' knowledge of the SDGs was the source, which shows that the school surveyed should strengthen the popularization of knowledge of the SDGs [88]. In addition, the Learning level of SDGs and the Knowledge of SDGs were positively correlated, and both had a positive impact on the Source Information, indicating the necessity to improve the learning level of students through integrating the SDGs with all disciplines [42]. Besides, the two variables, namely Impact of Personal Life on SDGs and Source of Information, also have an impact on ESD, so the training of SDGs knowledge through various channels cannot be ignored [78], and the connection between sustainable development education and personal life should be strengthened [89]. Finally, the paths all pointed to the student's career planning, which shows that ESD is closely related to students' personal development [90], which corroborates the significance of ESD.

From cognitive objectives (knowledge and information acquisition) and social-emotional objectives (self-reflection on the influence of individual life on the SDGs) to behavioral objectives (action to be taken to make career decisions about the SDGs), the concept and principles of ESD are presented in the model of this study, which highlights the proactive learning of SDGs to further sustainability [91].

The whole-school approach, which involves all aspects of school, including school management, resource consumption, community outreach, curriculum development and landscaping, has been regarded as the most effective approach to learning for sustainability [92,93]. In addition to the curriculum integration mentioned above, future research can also explore other aspects that are conducive to ESD advancement. Hence, each factor in the model of this study is worthy of further study to investigate its function in ESD.

6. Conclusions

Using a questionnaire survey, this study investigated the cognition, learning situation, personal concerns and social adaptation regarding the SDGs among senior high school students in one school in Beijing, China. The findings have implications for both theory and practice.

Taking this school as an example, it was confirmed that Chinese students have a limited understanding of the SDGs; therefore, greater efforts are required to improve their overall

awareness of sustainable development, information sources and knowledge. High school is the optimal period for students to master knowledge of the SDGs [42], and schools should take advantage of this time to implement ESD [94]. It is of equal importance for students to learn the SDGs during enrollment and graduation. Integrating ESD into the curriculum is one of the mechanisms with which to improve students' awareness of sustainable development [95]. In addition to formal education and traditional media, new media and extracurricular activities are also suggested to spread information about SDGs [96].

In practice, first, this study optimized a previous questionnaire, which can be used as an operational tool to investigate the awareness of the SDGs among students in the future. Second, this paper presented a model of ESD for the school surveyed, which reveals the important function of different subjects that integrate the SDGs [97]. Hence, it is particularly important to strengthen sustainability education with an interdisciplinary and transdisciplinary strategy [98]. Implementing ESD needs to be based on the advantages and strengths of subjects such as biology, geography, politics and economics.

ESD contributes to achieving the SDGs [9]. Senior high school students have a strong sense of sustainable development with regard to the SDGs related to their own rights and interests, which is a double-edged sword [99]. Educators and teachers should conduct ESD dialectically [100], make good use of students' primary interests and correctly orient young people's values [101], thereby supporting their development toward becoming qualified world citizens with a strong vision of sustainable development.

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