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Article

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Research Article

Present issues and efforts to integrate sustainable development goals in a local senior high school in Japan: A case study

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ABSTRACT

In this paper, we investigate the present situation and issues concerning efforts to integrate sustainable development goals (SDGs) education into the curriculum of a Japanese senior high school. We observed the implementation of SDGs-relevant courses for one year and conducted a questionnaire survey to grasp the teachers' attitudes toward SDGs education. Based on these data, we identify the difficulties related to SDGs education, such as discrepancies of interest in SDGs between teachers and students, teachers' lack of knowledge about SDGs, and so on. We also note the positive impacts of collaboration among local stakeholders during the course of raising teachers' understanding and attitudes toward SDGs education.

1. Introduction

Education is widely recognized as one of the most important tools for achieving sustainable development (SD). It can encourage people to develop knowledge and awareness of SD and change their behaviors, so that they act in ways that address the sustainability challenges facing humanity. The importance of SD education was internationally accepted at the United Nations Conference on Environment and Development, held in Rio de Janeiro, Brazil, in 1992, with the inclusion of an action plan in Chapter 36 of the conference's Agenda 21 (United Nations, 1992). The United Nations (UN) Decade of Education for Sustainable Development (DESD) was announced during the World Summit on Sustainable Development in 2002, 10 years after the introduction of ESD, in 1992, and DESD began in 2005 and ended in 2014. After these efforts to promote ESD, the UN launched sustainable development goals (SDGs) at its 2015 Sustainable Development Summit, held in New York (United Nations, 2015). The importance of education on these issues has increased as the concept of SDGs became more widespread.

The UN's SDGs contain 17 global goals as shown in Fig. 1 that serve as a "blueprint to achieve a better and more sustainable future for all" (United Nations, 2015). There are 169 targets for the 17 goals, with each target representing a vision for the world that should be attained for SD. Many countries are trying to integrate the SDGs into their school curriculum to achieve the SDGs. Japan is no exception, and the Japanese government's new curriculum is planned to be implemented to develop human resources that contribute to a sustainable society (MEXT, 2019a). This is the first time for the Japanese government to state that fostering human resources to create a sustainable society in its schools' curricula. However, since the SDGs addresses a wide range of themes, it is considered that many issues will be occurred for integrating the SDGs into the schools' curricula. For example, Kioupi and Voulvoulis (Kioupi & Voulvoulis, 2019) pointed out that the ambiguity of measuring education efforts is an issue to conduct the SDGs education, and they were able to propose a framework to overcome by identifying this issue. Therefore, it is important to identify the issues for integrating SDGs education into

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Fig. 1. UN's sustainable development goals (United Nations, 2015).

schools' curricula.

Currently, a small number of senior high schools have already conducted the SDGs integrated courses prior to implementing the government's new curriculum in Japan. For example, Fredriksson et al. (Fredriksson et al., 2020) insist that international collaboration is one feature of Japanese SDGs education from their case study targeted two UNESCO Associated Schools, that are supported by the Japanese Ministry of Education, Culture Sports, Science, and Technology (MEXT). On the other hand, it is unknown that the efforts of the SDGs education in the non-UNESCO Associated Schools. Most Japanese senior high schools belong to the non-UNESCO Associated Schools, and it is considered that there are relatively few opportunities for international cooperation among stakeholders, such as senior high schools in foreign countries.

Since "Leave no one behind" is the key concept of the UN's SDGs, the SDGs refer to both local and global issues. It is considered that the effort of the SDGs education in non-UNESCO Associated Schools will play an important role to achieve the SDGs. And all of the students are required to be well-grounded and prepared to tackle the challenges presented by society. This study investigates the implementation of an SDGs education in one Japanese non-UNESCO Associated senior high school. We apply a descriptive exploratory approach to answer the question that what is the present issues and efforts of a Japanese non-UNESCO Associated senior high school to integrate the SDGs into its curriculum?

We chose a school that actively engaged with the UN's SDGs from among the few senior high schools integrating the SDGs into their course in Japan. First, we identify the difficulties associated with the course by observing the output of students and conducting a questionnaire survey of the school's teachers. We also compare the teachers' attitudes toward SDGs education before and after the course was introduced, to examine the ideas related to overcoming its difficulties.

The structure of this paper is as follows: Section 2 introduces related research, while Section 3 explains the data collection methods and the characteristics of the school targeted in this paper. Section 4 presents and discusses the results obtained from the collected data. Finally, we discuss a recommendation for increasing the effectiveness of SDGs education while overcoming the identified difficulties and conclude in Section 5.

2. Literature review

Recently, education has become an important research topic for environmental and sustainability research and practices, as the importance of SD education has increased since the launch of the UN's SDGs. Most related studies to our paper are investigating the present status and issues related to SD in education on SDGs-relevant topics in various countries. Cebrián et al. (Cebrián et al., 2015), working at the UK's University of Southampton, conducted semi-structured interviews to examine what factors inhibit the promotion of ESD. They found that a lack of understanding and knowledge were among the inhibiting factors for promoting ESD. Mróz et al. (Mróz et al., 2020) conducted a questionnaire survey to explore the current situation and issue of the inclusion of SDGs-relevant topics,

高校生主体のイベントで白石市活性化を図る

14 I 群地方創生 ライフゼミ2班

Names of students in this group

- 1. 目的または動機**

白石市の活性化が進んでいる現状やそれに伴う市の発展の力を期待したいと思ったため。白石市のササニシキは過去に自主として販出されている。そこで、私たち高校生が主体となり、ササニシキという市の魅力を発信することにより、市の活性化を図りたいとイベントを企画することにした。また、このイベントを通じてササニシキ、白石市について詳しく知る機会を提供したい。
- 2. 方法**

①日本一に輝いたことのある白石市のササニシキをPRするイベント「ササニシキ」を行い、白石市の魅力を発信する。(白石名物の肉餃子とついでに農産品を販売) ②地場おこしのイベント等にスタッフとして参加し、市の取組みに貢献する。 ③SNSを活用し私たちの活動を告知し、関心を持ってもらう。 ④イベント内でアンケートを実施し、ササニシキなどの人々の関心を確認する。
- 3. 結果**

・県外からの方も含め、約230名がイベントに参加。(日本観光協会のガイドラインにて算出) ①ササニシキを使った肉飯の売場(追加販売含め121食)および、商品化に成功。 ②イベントを定期的に開催してほしいとの声(おもしろい市場の職員、来場者) ③SNSを活用しイベントの内容や活動について周知できた。(イベント当日のアンケート結果より) ④また、TV(日本、台湾)、新聞、市の広報など多数のメディアに私たちの取り組みを取り上げて頂いた。
- 4. 考察**

・多くの人にササニシキを食べ、関心を持ってもらう機会を提供することができた。(約6割の来場者はササニシキ以外の米を日常的に食べている) ①私たちの実施したイベントの告知は来場者になり良い影響を及ぼしたと考える。
- 5. 結論**

①白石産ササニシキの知名度はまだ低く、これら大きな注目を集めることができるポテンシャルを秘めている。 ②ササニシキについて市の内外に発信し、まだまだ少数の人にしては十分な魅力を伝えることができ、効果を実感した。 ③今後、今回のようなイベントを継続して行うことにより市の魅力も継続的にPRでき、さらなる活性化を期待できる。 ④イベントを通じて白石市をPRすることは有効である。(市の広報による宣伝も有効であった)
- 6. 今後の課題、謝辞**

①本年度以降も定期的にイベントを開催し、SNS等での発信はもちろん、今回のイベントの実績、ササニシキについて発信していく必要がある。 ②今後の展開において、イベント開催も、観光客や地元住民の関心を持ってもらう。私たちの意向に即して企画の協力や、白石市の観光局の方(関係なし)協力の下、地方創生対策の目下推進されている「ふるさと納税」の活用も検討したい。また、今回の活動を通じて、白石市の人々の関心や、白石市をPRする活動の重要性も改めて認識できた。また、今回の活動を通じて、白石市をPRする活動の重要性も改めて認識できた。また、今回の活動を通じて、白石市をPRする活動の重要性も改めて認識できた。

a) Group a)

そのゴミ、本当にごみですか? ~私たちのリユースとリサイクルで未来へ...1~

25 Names of students in this group

II 群持続可能ゼミ3班

- 1. 目的または動機**

①3Rの普及・再認知 → “まず”白高生に知ってもらい、少しずつ3Rの輪が広がっていく ②3Rの意識の醸成につなげる / 有名なものか知らない → 「3Rが知られていないかつ 生活になじみ深いもの」を調査、紹介 ③グループA → リユース × 「制服」 ※企業タイアップ ④グループB → リサイクル × 「ゴミ電算機」
- 2. 方法**

グループA
①お知らせプリント
②クラス掲示
③Twitter → 動画
④制服、体操着など使わなくなった衣類を多く使用する製品の回収 / 委託
⑤活動資金 ※ 募金に送るための活動案

グループB
①クラス掲示
②羽毛布団やブランケットなど衣類を多く使用する製品の回収 / 委託
③GreenDownProjectに参加
- 3. 結果**

○回収できたもの
グループA
・量販店(プレザー / ノズン) 計1セット
・家庭用(上下 / 靴) 計1セット
→ 合計買い取り金額: ¥700

グループB
・回収した品物
→ 合計買い取り金額: ¥700
- 4. 考察**

Q1:なぜ回収車が来なかった?
Q2:自分たち / 参加した人たちが “世界に貢献できた” という 実感はあったのか? 考えたか?
Q3:活動の報、対象を広げるには?
- 5. 結論**

グループA
○改善が必要な点
→ 私たちの考えも参加者が少なかった
→ 認知してもらい続けるための方法の確立
→ 回収期間の設定 → 3月~6月? (今年後半)
○良い方向に作用した点
→ 私たちの活動が、さくらや仙台産がSDGsへ本格的に乗り出すためのきっかけになることができた。
→ 高校生が、ひとつの団体を動かした!

グループB
○改善が必要な点
→ 告知方法 → クラス内掲示の他にも組み合わせて
○良い方向に作用した点
→ “GreenDownProject”という、新しい切り口の発見
- 6. 今後の課題、謝辞**

①回収に対する手配や参加する個々の意識的な活動の少なさをどうするか(活動の意義と目的)
②参加に依存することの多い活動は以下に即入るべきか
③継続的な活動、高校生の金銭管理 → 望ましいか? → 金銭面が必要な活動を提案(するしかないのか?)
④ “如何に子供が伝わるか、如何に大人を巻き込むか?”
⑤ “高校生の実感、熱量をどう大人に伝えるか?”
⑥ “如何に子供が伝わるか、如何に大人を巻き込むか?”
⑦ “高校生の実感、熱量をどう大人に伝えるか?”
⑧ “如何に子供が伝わるか、如何に大人を巻き込むか?”
⑨ “高校生の実感、熱量をどう大人に伝えるか?”

b) Group b)

河川の水質調査 ~水質を維持する大切さを世界へ伝える~

50 Ⅳ群 自然科学 省エネ・循環型社会ゼミ 2班

Names of students in this group

- 1. 目的と動機**

①白石市の川は綺麗なのかを知る → 県庁環境対策課の調査に参加
②白石市下流域の汚染の原因を究明 → 大河原中の水質調査結果で、大河原を流れる白石川は汚いという結果がでた
③動機を世界に広げたい → 河川の汚染の原因と改善方法を世界と共有し、水質汚染への対策の意義を世界に広げる
- 2. 方法と結果**

調査1 指標生物調査
※指標生物 → 水質階級 (汚れ具合) を判断するために利用できる生物

水質階級	水質階級 I (清潔な水)	水質階級 II (やや汚れた水)	水質階級 III (汚れた水)	水質階級 IV (とても汚れた水)
指標生物	コオロギ アザシロコガ ヒメコガ ヒメコガ	コオロギ アザシロコガ ヒメコガ ヒメコガ	アザシロコガ ヒメコガ ヒメコガ ヒメコガ	アザシロコガ ヒメコガ ヒメコガ ヒメコガ

調査結果
白石川: 水質階級 III (汚れた水)
沢堀川: 水質階級 II (やや汚れた水)
- 3. 考察と結論**

以上の結果から、大河原を流れる川の水質が悪いことが分かった。浄化センターでのwより、家庭排水や工場排水が川に流れていないというところから、農薬や生活排水の流出、土壌侵食による汚染が考えられる。しかし、浄化していない排水を違法に川に流している可能性なども否定できない。
- 4. 今後の課題**

①水質汚染 → 大規模汚染の具体的な原因を特定する。
②定期的な川の水質調査を継続する。
③環境問題について考えるきっかけとなる動画を制作する。
④環境問題について考えるきっかけとなる動画を制作する。
⑤環境問題について考えるきっかけとなる動画を制作する。

c) Group c)

Fig. 2. Students' outcomes for the final presentation.

especially sustainable management of natural resources (SMNR), in the curricula of lower and senior high schools in Poland. They found that teachers with more pedagogical experience were more likely to incorporate SMNR into their curriculum of general subjects. They also noted that preparations for the maturity exam, the most important test that paves the way for students to study at a university, is one of the critical elements that inhibit teachers and students from taking up SMNR issues in their courses. Valor et al. (Valor et al., 2020) examined the relationship between the adoption of sustainable consumption and the seven competences, such as self-regulation, love of learning, kindness, appreciation of beauty, humility and modesty, leadership, and perspective, at universities in Spain. They also demonstrated that developing moral competences through education encourages students to adopt sustainable consumption habits. In the United States, ESD has historically been associated with environmental education and has evolved into a field that encompasses issues such as climate change, biodiversity, and poverty, among others. These are discussed in core subjects like science, social studies, and geography. Another approach to teaching SD is through the whole-school approach, which results in “green school” or “eco-school” certifications (Hopkins, 2013). Although the contributions of education toward SD are widely recognized in many of the world’s countries, education related to the UN’s SDGs still have many challenges, due to their complexity and ambiguity.

Some previous studies have examined effective methodologies to increase the performance of the SDGs education. Nousheen et al. (Nousheen et al., 2020) offered a course to 30 pre-service teachers in Pakistan aimed at developing their basic knowledge of sustainability. They found that the course increased students’ awareness of environmental, societal, and economic issues. Ateskan and Lane (Ateskan & Lane, 2018) regard the inclusion of systems thinking skills as an important competency of teachers for ESD and found that the professional development program they led for 39 in-service teachers in Turkey contributed to the reinforcement of their systems thinking skills for SD. Boarin et al. (Boarin et al., 2020) compared the curricula of architecture departments of three universities in different countries to identify the differences in their implementations of sustainability education. They also reported on the results of a questionnaire survey given to students and emphasized the necessity of collaborating with external professional tutors, such as design studios of architecture. Killian et al. (Killian et al., 2019) found positive outcomes not only for students, but also for partner organizations and the business school, university, and teaching team. In the Philippines, Tan and Vicente (Tan & Vicente, 2019) proposed combining collaborative learning and experimental learning approaches by referring to a student-centric learning approach. They reported on several advantages related to collaborations between experimental and collaborative learning. Fredriksson et al. (Fredriksson et al., 2020), working in Japan and Sweden, also noted that international cooperation with other organizations in other countries, not only in senior high schools, but also with other stakeholders, such as non-governmental organizations and private companies. While Fredriksson et al. (Fredriksson et al., 2020) examined two UNESCO Associated schools in Japan, the present study examines a course for SDGs education in a non-UNESCO Associated school in Japan. It is difficult to observe the efforts of non-UNESCO Associated schools because there are only a small number of Japanese senior high schools that include SDGs-relevant topics in their curricula. This study introduces the present situation and efforts made by one school that has aggressively embraced SDGs education. Here, we discuss the advantages of their efforts and the future direction of SDGs education based on our results.

3. Methodology

3.1. Sample

The Japanese government is planning to implement the government’s new curriculum guideline, which aims to develop human resources that contribute to a sustainable society, from 2022. Since it was before the implementation, only a small number of senior high schools conducted the SDGs integrated courses. We investigate a non-UNESCO Associated school because its efforts of the SDGs education is not sufficiently investigated, despite its large number of schools. Japan is home to just 216 UNESCO Associated Schools (Asia-pacific cultural ctr. for UNESCO, 2019), while the total number of high schools is 4887 (MEXT, 2019b).

We selected one non-UNESCO Associated school that is aggressively providing courses related to SDGs education ahead of other senior high schools. Our targeted school is located in a rural city with a population of about 33,730 (as of 2019) in the Tohoku region, Japan; it has approximately 900 students aged 15–18 years. In this senior high school, the SDGs education started in 2018. Several teachers, including the principal of this school, recognized the importance of integrating SDGs into their courses and they played a central role to create and manage this course. This course aims to develop human resources who are physically and mentally sound, contribute to local communities and nations, and can lead the global society from a global perspective. This purpose is originally and uniquely defined by this school since the beginning of this course.

This school’s SDGs education has adopted a student-centered learning approach, and it is known as the “integrated study course.” We observed and collected data from this class from April 2019 through January 2020. First- and second-year students, ages 15–17, were enrolled. The class was proceeded by student-centered group work, and the students were divided into 57 groups according to their interests and social relationships. Students were allowed to make decisions about their groups’ sizes and membership by themselves. The sizes of groups varied from 2 to 10 people each.

Every group was required to find SDGs-relevant issues on their own at the beginning of the course (April 2020) and to identify a solution for their chosen SD goals by the end of the course (January 2020), with the support of the course teachers. Each group could choose its preferred survey method, such as conducting an internet survey, fieldwork, questionnaire, experiment, and so on. All groups were required to report their findings in the form of a poster presentation at the end of January 2020 (Fig. 2). The poster presentation for each group included: a stated research motivation, the sustainability challenge on which they focused, a proposed solution for the raised social problem, methodology, information source(s), and results. Students were also required to identify at least one of the SDGs related to their topic.

In all, 34 teachers participated in the class, and another supported the activities of several groups. Since this course on SDGs was

positioned as an integrated study course, teachers supported students' activities, regardless of the subject they typically teach. Their specialties were general education subjects, such as mathematics, social studies, science, and so on. This was the second time for the school to offer the integrated study course since 2018.

We mainly focus on two elements, students' attitudes toward this SDGs course, and teachers' attitudes toward SDGs-relevant courses, including their interest in SDGs and the difficulties they faced in teaching the course. We collected quantitative data using the procedures detailed below.

3.2. Data collection process

3.2.1. Students' interest in SDGs

We received the data on which the posters, which are shown in Fig. 2, by all 57 groups were based. Fig. 2 shows the example of the three groups' outcomes at the final presentation. We assessed the students' interest in the SDGs from these files by listing the SDGs they described in their poster presentations. The SD goals are represented on the upper right side of the poster. We interpreted these goals as students' interests. For example, Group a) aimed to contribute to the achievement of Goal 11. As shown in the outcome of Group b) and c), some groups considered their proposal will contribute to more than one goal.

These outcomes contain the information of the data collected by each group and we also listed the most commonly used information sources when proposing their solutions. For example, Group b) and Group c) used the internet to get the information and its reference are listed on the lower right side of each poster. Group b) experimented to answer the question "How much used-clothing can be collected and reused?". This group uses social media, Twitter, as one of the methods to notify the collection of used clothing. This group also distributed flyers for the notification. Group c) conducted an interview survey to investigate the water quality of a river by visiting the office of the Miyagi prefectural office, which is the manager of the river. Furthermore, this group conducted fieldwork to check the water quality by themselves.

We found 94% of the groups targeted regions in Japan, and almost all of the groups targeted areas in the city where the school is located. The other 6% of groups focused on a foreign region, such as East Asia.

3.2.2. Teachers' attitudes toward SDGs education

Quantitative data were collected using a questionnaire survey designed to investigate teachers' attitudes toward SDGs education at the school. The questionnaire was sent via postal mail on March 31, 2020. In all, 34 teachers responded, a 100% response rate. We received their completed questionnaires via postal mail by April 23, 2020.

First of all, the questionnaire asked for demographic information, including age, gender, subject taught, and class in charge before the questions about the attitudes toward SDGs education. The respondents' ages ranged from 26 to 65, and the average age was 45.1 years. Four teachers declined to provide their age. There were 22 males (67%) and 11 females (33%); one respondent did not report their gender. The teachers were in charge of general subjects taught in all Japanese schools, such as mathematics, Japanese language,

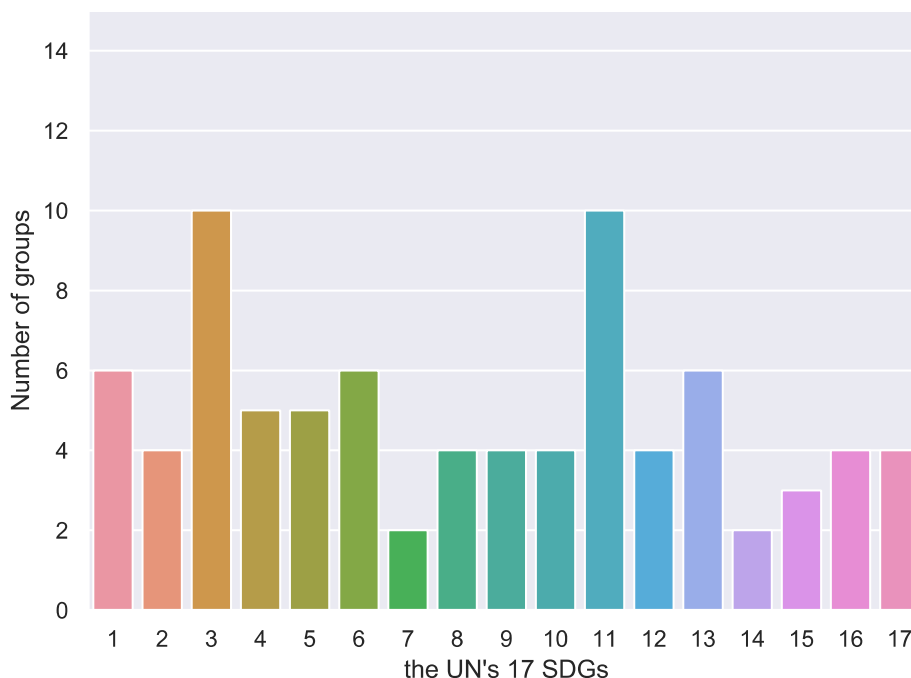


Fig. 3. The number of groups addressing topics related to each SD Goal.

social studies, science, and so on. Since this course is positioned as one focused on integrated studies, teachers supported students' activities, regardless of their typical subject.

The questionnaire consisted of 15 items ranked on a five-point Likert-type scale (1 = strongly disagree, 5 = strongly agree) and open-ended questions. The items in the survey can be classified as follows:

- Questions 1–5 asked the teachers' attitudes toward the implementation of SDGs-relevant courses before the start of this course.
- Questions 6 and 7 asked about any difficulties they faced during the implementation of the SDGs-relevant course.
- Questions 8–10 asked about how to improve the contents of the course, from the perspective of cooperation with outside stakeholders.
- Questions 11–15 asked the teachers' attitudes toward the introduction of SDGs-relevant courses after this course.

4. Results and discussion

4.1. Students' interest in SDGs

At the beginning of the course, each group tried to find a sustainability challenge that related to the SDGs and to examine possible solutions. They raised various challenges, such as regional stagnation due to population decline, gender inequality, educational inequality among countries, and so on. Many groups cited multiple SDGs, with most choosing to focus on one to four goals. Many groups recognized that solving a problem requires the consideration of multiple perspectives, and many efforts may contribute to addressing several goals.

Fig. 3 shows the number of groups that addressed topics related to each goal in the SDGs. We can see that each goal of the SDGs was addressed by at least two groups. The SD goals most commonly addressed were Goal 3, Good Health and Well-Being, and Goal 11, Sustainable Cities and Communities; each of these goals was addressed by 10 groups. Most of the groups that addressed Goal 11 examined solutions for regional stagnation in the city where the school is located. They reported that they wanted to revitalize the city by developing new ideas based on traditional culture, buildings, or local foods made with local products. These efforts reflect the problems faced all over Japan, and which are especially serious in rural areas, due to the country's declining birthrate, aging population, and declining population. The least-addressed SDGs were Goal 7, Affordable and Clean Energy, and Goal 14, Life Below Water. Only two groups addressed each of these topics.

Fig. 4 shows the number of information sources cited by the groups; these addressed the five most popular SD goals among them. Each goal was addressed by six or more groups and their information sources are represented in Fig. 4. The groups addressing Goals 3 and 11 mainly used fieldwork and questionnaires to collect their information. For example, groups that addressed Goal 11 used various information sources, but especially social media (e.g., Twitter and Facebook), interviews, and questionnaires. The other groups mainly used the internet or books. The groups that targeted the local area had an advantage when working to solve regional issues. Because their targeted fields were located close to their school, thus they can easily access their fields or contact outside stakeholders, such as local government officials or local companies.

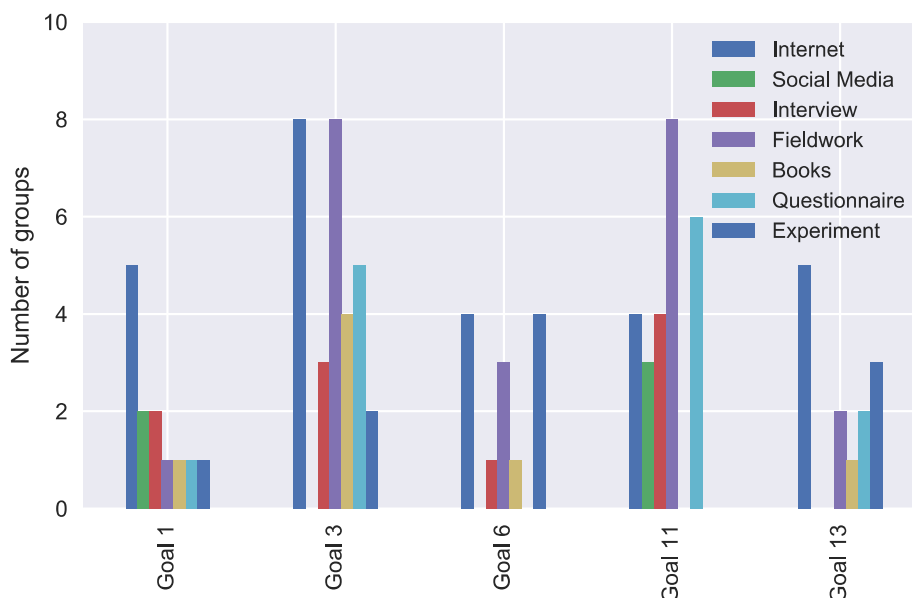


Fig. 4. Relationships among the six most-often addressed goals and the information resources cited by the groups addressing them.

4.2. Teachers' attitudes toward SDG-relevant courses

4.2.1. Teachers' attitudes before the course

We asked teachers about their knowledge of SDGs before the beginning of the course; the results are shown in Table 1. Table 1 shows the descriptive statistics from the answers to questions Q1–Q4, which represent teachers' attitudes toward the implementation of SDGs-relevant courses before the start of the course. Question 1 asked, "I knew about the SDGs before the start of this course." No teacher answered "strongly agree" with the statement that they had sufficient knowledge about SDGs for this question. Most teachers (35.2%) answered "agree," which indicates they knew little about the SDGs. More than half of teachers (55.9%) reported that they did not know about the SDGs; 23.5% did not know about them at all, while 32.4% did not know much about them. This reflects the teachers' lack of confidence when initially implementing the SDGs-relevant course.

Questions 2 and 3 asked about teachers' attitudes toward the SDGs-relevant course as shown in Table 1. The average score on Question 2 was 3.35, indicating that a fair number of teachers had a positive attitude about the implementation of the course. The average score for Question 3 was high, at 4.21. This demonstrates that almost all of the teachers thought SDGs education was a good opportunity to foster students' comprehensive competences. The average score for Question 3 was relatively higher than that of Question 2, perhaps because, although the value of the SDGs as course material was acknowledged by almost all of the teachers, they may have been reluctant to recommend the course to students, given their lack of knowledge about the SDGs.

The correlation matrix of scores among Questions 1–4 is described in Fig. 5. We found a positive correlation between the scores on Questions 2 and 3. Teachers who regarded SDGs as suitable course material for fostering comprehensive competences tended to recommend that their students participate in the class. There was also a positive correlation between Questions 1 and 4, its correlation coefficient is 0.55 as shown in Fig. 5. Question 4 asked teachers about their incorporation of SDGs-relevant topics in their general subjects prior to teaching this course. These responses confirm that those teachers who had incorporated SDGs into their own classes had greater knowledge of SDGs in general.

We also found a positive relationship between teachers' ages and their responses to Question 4, as shown in Fig. 6. Here, we report only a scatter plot of teachers' ages and the scores from this question, due to the lack of complete age data (i.e., although all teachers answered Question 4, four teachers did not indicate their age). As teachers' ages increased, they tended to incorporate them into their general subject courses. This finding is consistent with Nousheen et al. (Nousheen et al., 2020), who found a positive correlation between teachers' years of experience and the incorporation of SDGs-relevant topics.

4.2.2. Difficulties and efforts during the course

Questions 6 and 7 assessed the difficulties teachers faced during the implementation of the course. Question 6 asked "I faced NO difficulties during this course.", and its average score was 1.58 with $N = 33$ respondents. The average rating on this question was low; 60.6% of teachers faced many difficulties, 24.2% faced a few difficulties. By contrast, only 3% of teachers indicated that they faced no difficulties, and no teachers "strongly agreed" with the statement. The remaining 12.2% of teachers answered "neutral". Thus, many teachers had faced difficulties during the course.

The reasons for many teachers' difficulties are outlined in Fig. 7, which represents the results of Question 7. Most teachers (58.8%) reported a lack of SDGs knowledge. Almost half (41.2%) reported having no confidence to teach about SDGs and insufficient time for teaching. That the same number sensed a lack of student motivation for the topic. This may be caused by fierce competition among students to gain admission to the best universities, and this course was not considered a useful one, in terms of preparing for university entrance exams. Fredriksson et al. (Fredriksson et al., 2020) and Mróz et al. (Mróz et al., 2020) reported similar problems, as noted in Section 2.

To overcome these issues, the school observed in this study implemented a unique effort; it promoted cooperation with outside stakeholders, such as university professors, local government officials, and so on. The results of this effort are assessed in Questions 8 and 9. Question 8 asked about the usefulness of these collaborations for teaching this course; that was "I think the collaboration among stakeholders was useful for this course." More than half (58.8%) of the teachers strongly agreed with the value of collaboration, while 20.6% agreed with it. Only 2.9% disagreed and had a negative view of collaborating with other stakeholders. However, no teacher strongly disagreed with it. And the remaining 17.7% were answered "neutral."

Fig. 8 shows the advantages of the collaboration; 76.9% of the teachers found an advantage in hearing others' opinions, noting their new and different perspectives; 65.4% felt that the collaboration enabled students new opportunities for fieldwork that could not be provided by the school, and 53.8% felt that the collaboration increased students' motivation.

Question 10 asked the 26 teachers who answered positively (strongly agree or agree) in Question 8 about which stakeholders they considered the most effective. Fig. 9 shows that 51.8% reported university professors or laboratories as being the most effective stakeholders for collaboration. This is likely because students visited universities to conduct interviews and surveys, and they were able

Table 1
Descriptive statistics from Q1–Q4.

Items	N	Mean	SD
Q1 I knew about the SDGs before the start of this course.	34	2.56	1.19
Q2 I wanted to recommend that my students take this SDG course.	34	3.35	1.00
Q3 I thought the SDGs was a suitable subject for developing students' comprehensive competences.	34	4.21	0.87
Q4 I had already incorporated SDG-related topics in my own courses.	34	2.32	1.30

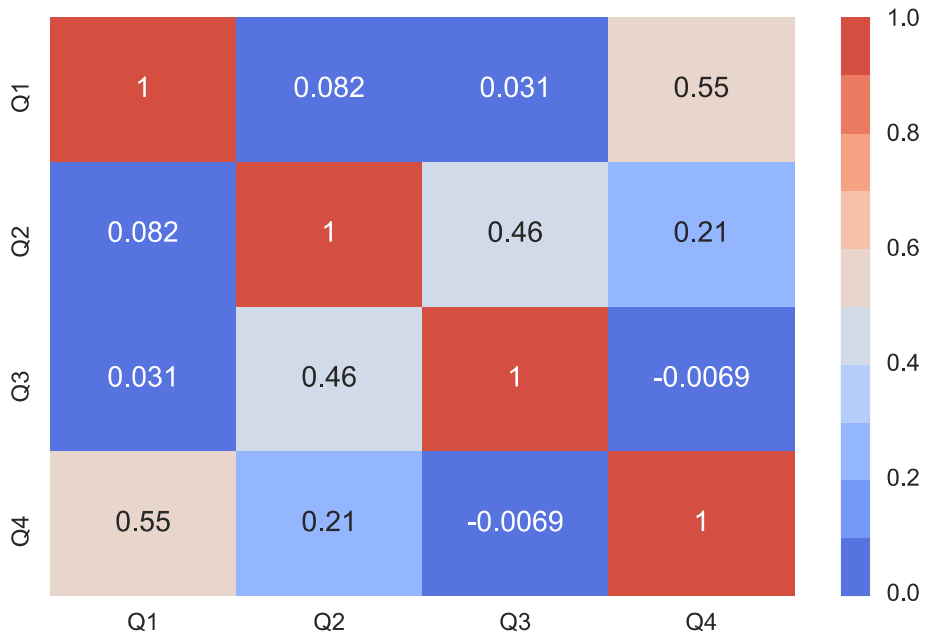


Fig. 5. Correlation matrix between scores of questions about attitudes before the course.

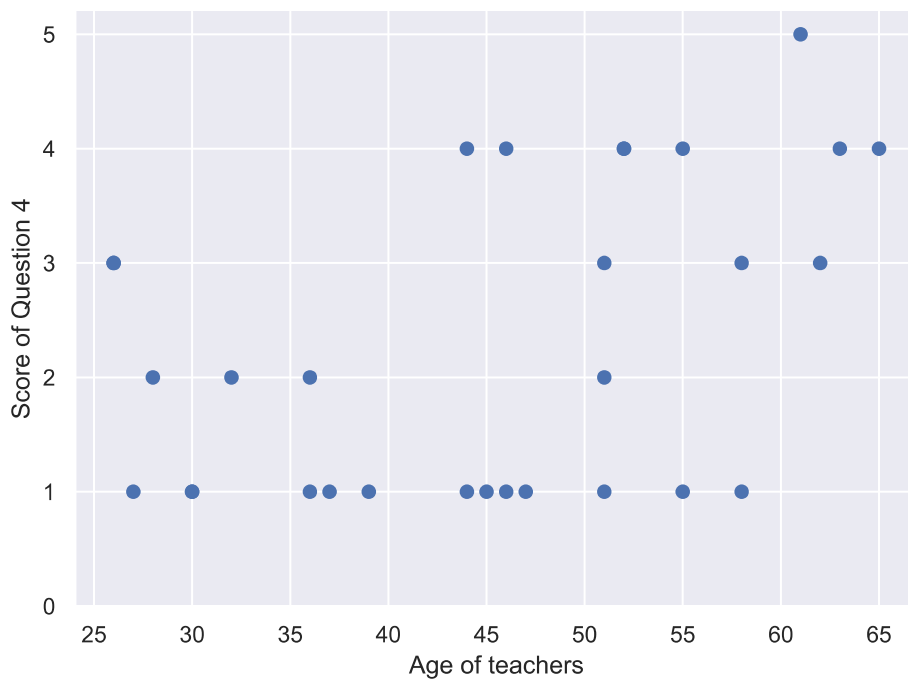


Fig. 6. Relationship between teachers' ages and answers to Question 4 (The incorporation of SDGs-relevant topics in their own courses.).

to get useful feedback from professors. We also believe that these collaborations with stakeholders have the possibility of leading to employment after graduation, which could increase students' motivation.

4.2.3. Teachers' attitudes after finishing this course

Questions 11–15 asked about teachers' attitudes toward SDGs after finishing this course. The descriptive statistics of these questions are shown in Table 2. Question 11 said, "I deepened my understanding of SDGs through this course." All teachers answered this question, and its average score was 3.94. Most (79.4%) of the teachers answered "strongly agree" or "agree," indicating that the course

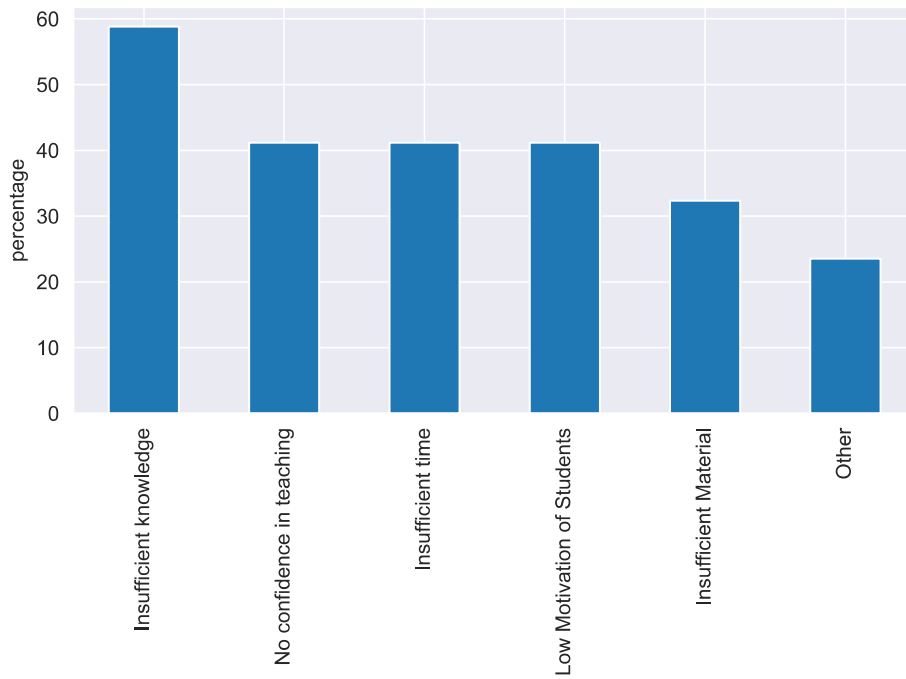


Fig. 7. Difficulties teachers faced during the course (answers to Question 7).

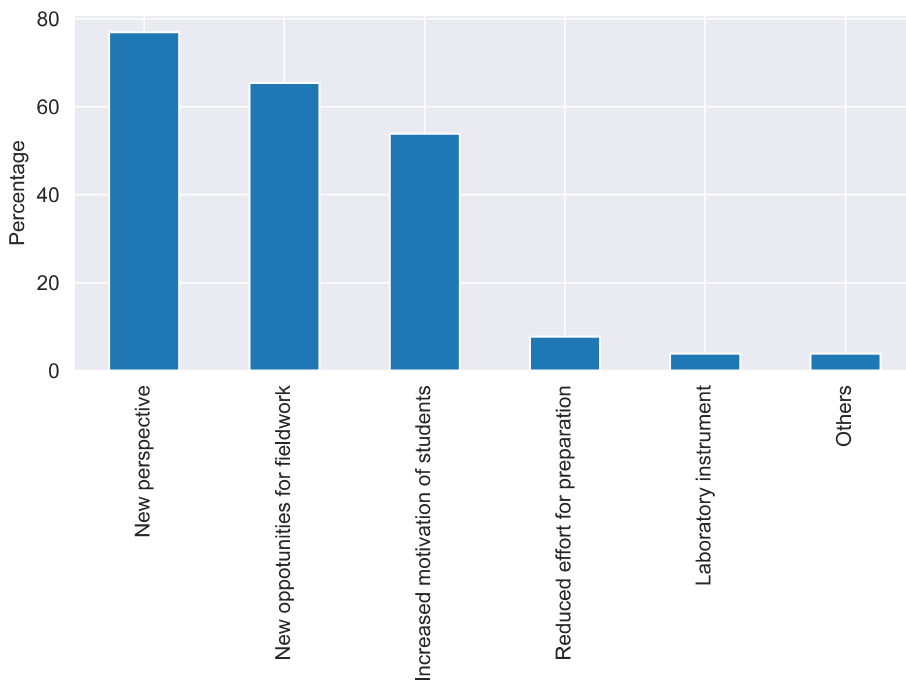


Fig. 8. Reported advantages of collaboration (answers to Question 9).

was helpful not only to students, but also to teachers, deepening their understanding of SDGs. Question 12 said, “I would like to encourage students to take the SDGs course by teaching it myself.” Most (70.6%) of the teachers answered “strongly agree” or “agree” to this question. Based on the replies to these two questions, we can say that teachers have a positive attitude toward continuing to teach this course.

Question 13 said, “Prior to teaching the course, I had not realized that I had already incorporated SDGs-relevant topics into my own classes.” In all, 33 teachers answered this question, and 39.4% of them replied with “strongly agree” or “agree.” By contrast, 36.3% of the

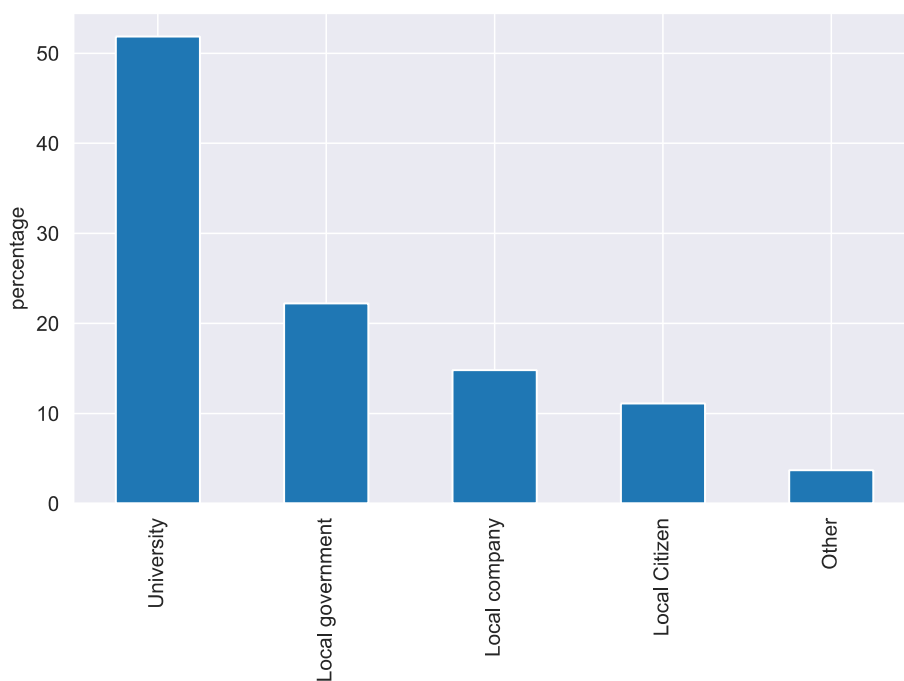


Fig. 9. Teachers' views of the most effective collaboration partners.

Table 2

Descriptive statistics from Q11–14.

Items	N	Mean	SD
Q11 I deepened my understanding of SDGs through this course.	34	3.94	0.68
Q12 I would like to encourage students to take the SDGs course by teaching it myself.	34	4.03	0.79
Q13 Prior to teaching the course, I had not realized that I had already incorporated SDGs-relevant topics into my own classes.	33	2.88	1.20
Q14 I will incorporate SDGs-relevant topics in my courses in the future.	33	3.94	0.95

teachers answered “strongly disagree” or “disagree.” Question 14 said, “I will incorporate SDGs-relevant topics in my courses in the future.” Again, 33 teachers answered the question, and 81.8% of them replied with “strongly agree” or “agree.”

Fig. 10 shows the correlation matrix among the scores for Questions 11–14, which reflect teachers' attitudes toward SDGs-relevant courses after teaching this course. There was a positive correlation between Questions 11 and 12. Interestingly, teachers who felt that they deepened their understanding of SDGs through this course (Q11) became more motivated to recommend that their students take the course (Q12). Further, Q14 was positively correlated with Q12 and Q13. The teachers who were already incorporating SDGs into their lectures were inclined to incorporate SDGs into their future courses. Moreover, the more teachers reported wanting their students to take the SDGs-relevant course, the more they reported planning to incorporate SDGs into their other future courses.

In Question 15, we asked the teachers that “Which of the 17 SDGs do you think are the most important goals after teaching this course?” Fig. 11 shows the percentage of teachers who consider the goals of each SD Goal to be important. More than one-quarter of them (26.4%) consider Goal 13, Climate Action, to be important, and 20.6% consider Goal 1, No Poverty; Goal 3, Good Health and Well-Being; and Goal 7, Affordable and Clean Energy, to be important. Fig. 11 compares the interest of students, as shown in Fig. 3. We divided each number of groups in Fig. 3 by the total number of groups 57 and use the ratio of students' groups to compare the result from the teachers' questionnaire. By comparing the students' and teachers' levels of interest, we can see a clear difference between them. More teachers considered Goals 1, 7, 13, and 17 partnerships for the goals. We believe that the difference between the teachers' interest and the students' interest in these topics stems from their background knowledge.

5. Conclusion

In this paper, we conducted a descriptive exploratory analysis on SDGs education in a Japanese senior high school that is not affiliated with the UNESCO Associated Schools program and summarized the course's issues and features. We found that almost all teachers encountered difficulties during the course, mostly due to their lack of knowledge about the SDGs and the students' low motivation. However, collaborations with outside stakeholders deepened both students' and teachers' understanding of SDGs. Those teachers who reported a deepened understanding tended also to report a higher motivation to incorporate SDGs topics into their own

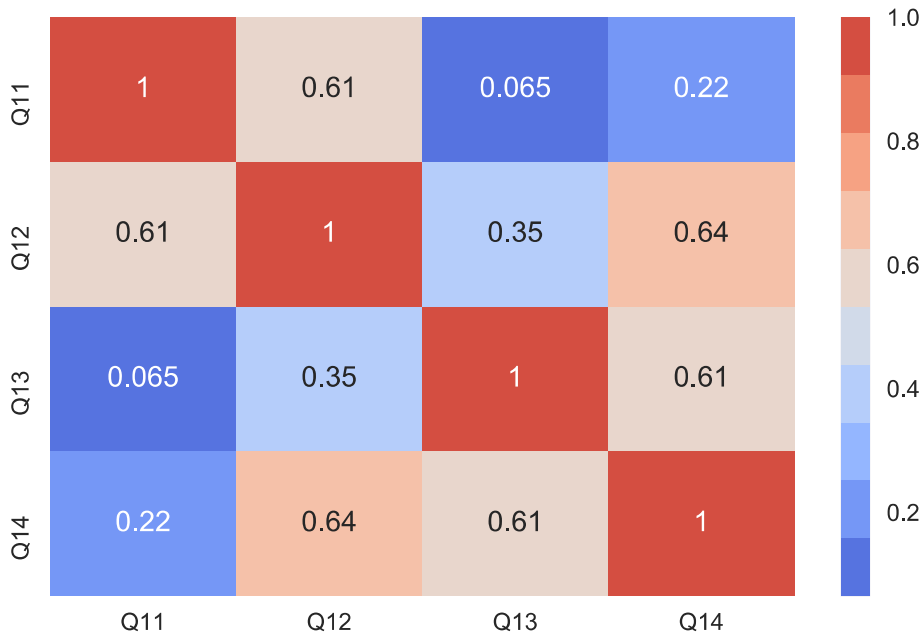


Fig. 10. Correlation coefficients matrix among scores on teachers' attitudes after teaching the SDGs course. Therefore, this SDGs course had a positive impact on the teachers' other courses and their intent to incorporate SDGs-relevant themes.

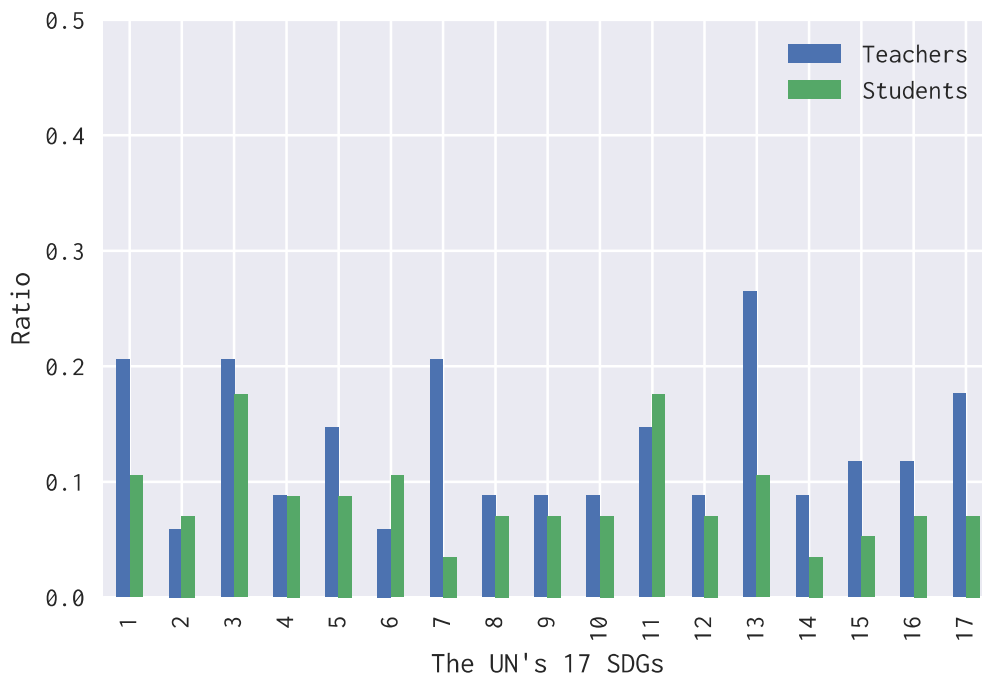


Fig. 11. Comparison of teachers' and students' interests in SDGs.

classes. Furthermore, we found that students' motivation increased when they were provided opportunities to collaborate with universities, local governments, and companies. Collaborating with university professors and local government officials seemed to motivate students, not only in terms of their progress in the course, but also for preparing for university and/or corporate entrance examinations. Therefore, collaboration with stakeholders can motivate teachers and students, and it has a positive impact on students to develop their skills for contributing to local communities and nations, from both local and global perspectives.

However, we also observed an interest gap between teachers and students. Although teachers tended to regard global issues as more important, students saw local issues as being more important and easier to address in this class. It might be necessary to assess and bridge

the gap between which SDGs students consider necessary to achieve and what the teachers see as areas of priority, regarding SDGs curriculum enhancement. The SDGs refer to both local and global issues, so learners need to be well-grounded and prepared to tackle the challenges presented by society.

Declaration of competing interest

None.

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