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Knowledge of Sustainable Development Goals among future biology and chemistry teachers

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ABSTRACT

In the context of increasing human impact on nature and society, it is becoming increasingly important to raise awareness of the principles of sustainable development, defined as development that meets the needs of the present without compromising future generations. Sustainable development encompasses social, economic and environmental dimensions, and the unequal distribution of resources is a major obstacle to achieving balance. The seventeen Sustainable Development Goals (SDGs) can be divided into three groups: environmental, social and economic. In accordance with UNESCO guidelines, sustainable development was included in the Croatian curriculum as a cross-curricular topic in 2019. At the Department of Biology at the Faculty of Science in Zagreb, the course *Sustainable Development in Teaching Natural Sciences* enables students to understand all aspects of sustainable development. The aim of this paper is to analyze the initial knowledge about the 17 SDGs of the university's integrated undergraduate and graduate students in biology and chemistry education who participate in the Sustainable Development in Teaching Natural Sciences course. The analysis of the KWL (Know, Want to know, Learn) tables showed that students are generally familiar with most of the SDGs, but are less informed about SDG 11 and SDG 17. These results show that a stronger focus on the economic and social dimension of sustainable development in teaching is needed and that it is important to integrate sustainable development topics into higher education in order to achieve the goals of education for sustainable development through the vertical of the education system.

Keywords: *education for sustainable development; inequality; sustainability; cross-curricular topic; sustainable development*

INTRODUCTION

Given the increasing impact of human activity on nature, the environment and society, there is a growing need to raise awareness of the principles of sustainable development. Sustainable development is defined as development that meets the needs of the present without compromising the ability of future generations to meet their own needs (WCED, 1987). This concept takes into account the availability of natural resources and the human impact on them and the environment, including the social, economic and environmental dimensions (Garašić et al., 2023). Often this term is misinterpreted as referring exclusively to environmental issues, overlooking the fact that many environmental problems and various social and economic inequalities arise from social and economic activities.

In 2015, the members of the United Nations (UN) adopted the so-called 2030 Agenda for Sustainable Development (UN, 2015). This agenda is based on 17 goals for sustainable development, known by the abbreviation SDGs (Sustainable Development Goals), which are to be achieved by 2030. These goals are the following: No poverty (SDG 1), Zero hunger (SDG 2), Good health and well-being (SDG 3), Quality education (SDG 4), Gender equality (SDG 5), Clean water and sanitation (SDG 6), Affordable and clean energy (SDG 7), Decent work and economic growth (SDG 8), Industry, innovation and infrastructure (SDG 9), Reducing inequalities (SDG 10), Sustainable cities and communities (SDG 11), Responsible consumption and production (SDG 12), Climate action (SDG 13), Life below water (SDG

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14), Life on land (SDG 15), Peace, justice, and strong institutions (SDG 16), and Partnerships for the goals (SDG 17) (UN, 2015). The seventeen SDGs can be divided into three groups that take into account the three fundamental dimensions of sustainable development. The first group are environmental or ecological goals, then social goals, and economic goals (García-González et al., 2020; see Figure 1).

The main UN organization for education, science and culture, UNESCO (United Nations Educational, Scientific and Cultural Organization), points out that education is a key tool for achieving sustainable development. For this reason, the United Nations Decade of Education for Sustainable Development (UN DESD) 2005–2014 was proclaimed in the early 2000s, with the main aim of integrating the principles of sustainable development into all aspects of education and learning. In accordance with UNESCO guidelines, the topic of sustainable development was included in the Croatian curriculum in 2019 as a cross-curricular topic (MPT) that runs through all vertical education cycles (MZO, 2017).

Research shows that students recognize the importance of education for sustainable development and consider it necessary to inform themselves about these topics (Dolenec and Pejnović, 2014; Garašić et al., 2016). A positive attitude towards sustainable development was also found among students and future teachers, and a correlation was also found between the level of knowledge about these topics and the willingness to teach them (Vukelić et al., 2018).

Since the 2008/2009 academic year, the Department of Biology at the Faculty of Science, University of Zagreb has offered the elective course *Sustainable Development in Teaching Natural Sciences* for students. The course enables students to understand all aspects of sustainable development, including teaching strategies on this complex topic and practical application of acquired knowledge (PMFZG, 2023). As part of the course, students are familiarized with the three dimensions of sustainable development, with a focus on the environmental component.

The aim of this paper is to analyze the baseline knowledge of students attending the course *Sustainable Development in Teaching Natural Sciences* at the integrated undergraduate and graduate studies of Biology and Chemistry education at the Department of Biology at the Faculty of Science, University of Zagreb, in relation to the 17 SDGs. By analyzing the baseline knowledge, it is possible to identify deficits in students' (pre-service teachers') knowledge of specific SDGs, based on students' self-assessment at the beginning of the semester, before they attended the course lessons. Insight into these results could indicate which sustainable development goals need to be taught and discussed more in the earlier stages of the educational cycle within the vertical.

METHOD

This study utilized KWL tables, which students filled out during the seminar for the course *Sustainable Development in Teaching Natural Sciences*. The acronym KWL stands for „Know“, „Want to know“, and „Learned“, representing the three columns that students complete before, during, and after lessons on specific topics. This technique aims to guide students' learning effectively (Jerbić-Zorc et al., 2018). Initially, students fill in the first column (K) to indicate what they already know about the topic. They then complete the second column (W), highlighting what they want to learn. Finally, in the third column (L), they document what they have learned at the end of the lesson (Jerbić-Zorc et al., 2018).

In this study, the KWL tables were used during selected lessons of the *Sustainable Development in Teaching Natural Sciences* seminar, where each student presented a specific sustainable development goal while their peers completed KWL charts for the other goals based on these presentations. The

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topics covered included all 17 UN Sustainable Development Goals. This study focuses solely on the responses from the „Know“ (K) column to evaluate students' pre-existing knowledge of each goal prior to the lesson.

The study examined the existing knowledge of 23 biology and chemistry students (pre-service teachers) across all 17 Sustainable Development Goals. Responses were aggregated into a single Excel spreadsheet for analysis, where they were coded for both qualitative and quantitative assessment. This coding process was conducted separately for each sustainable development goal, allowing for the identification of knowledge gaps. Data processing was carried out using Microsoft Office Excel 2016 (Microsoft Corporation, 2016) and Statistica 10 (Statsoft Inc., 2013). When analyzing the most frequent answers given by students for each Sustainable Development Goal, the most frequent answers were those that were ≥ 13%. The Kruskal-Wallis test was employed to compare the variety of responses regarding students’ knowledge of specific Sustainable Development Goals. This statistical analysis helped to determine whether significant differences existed in students’ initial knowledge levels concerning these goals prior to instruction.

RESULTS

No poverty (SDG 1)

In 41% of the responses, students acknowledged that poverty is a significant issue in many countries worldwide, emphasizing that it encompasses not only a lack of financial resources but also a deficiency in basic human needs, such as access to health care and education. The second most common insight, found in 25% of the answers, highlighted the vast disparities in living standards globally, noting that African and Asian countries, often labeled as underdeveloped, are disproportionately affected by poverty. The third most frequent realization involved students recognizing the contributions and efforts of various charitable organizations and the UN in addressing global poverty. Additionally, students provided less common insights, including the connection between high birth rates and poverty, the relationship between poverty and access to health care, and the observation that poverty also exists within their own country (see Table 1).

Zero hunger (SDG 2)

In 47% of the responses, students expressed awareness that a significant number of people die each year from hunger, particularly in Africa and Asia. Many also recognized the crucial role of charitable organizations in addressing this issue, linking factors such as war and disease to the rise in global hunger. In less common responses, students noted that food must be accessible to everyone, that agricultural development and economic progress are vital for reducing hunger, and that substantial disparities exist in food availability between countries (see Table 2).

Good health and well-being (SDG 3)

Regarding health and well-being, the majority of students (23%) highlighted the connection between financial conditions, state organization, and the quality of health care. They acknowledged the progress made so far while emphasizing the need for further advancements. A common observation was the association of poor hygiene and environmental conditions with the spread of infectious diseases. Other, less frequent responses included the importance of raising awareness about overall human health to improve quality of life, the impact of the COVID-19 crisis on health care progress, the challenges posed by a shortage and uneven distribution of medical professionals, and the link between vaccine availability and disease prevention (see Table 3).

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Quality education (SDG 4)

When asked, „What do I know about the goal of quality education?“, 35% of students identified the unequal access to and quality of education as a significant problem. Many mentioned the importance of addressing education for girls and ensuring free access to education for all. In other, less common responses, students pointed out that while primary education in Croatia is compulsory and free, it still incurs costs for books, transportation, and materials. They discussed the benefits of technological advancements alongside the challenges of unequal access to technology. Additionally, students recognized that education significantly affects quality of life across various aspects – health, material wealth, and psychological well-being. They identified war and poverty as major barriers to educational access and quality, and emphasized the importance of having qualified educators and safe working conditions for the advancement of the education system (see Table 4).

Gender equality (SDG 5)

When asked about gender equality, students most frequently expressed the belief that women are generally oppressed compared to men, acknowledging that inequality exists globally but varies significantly between countries. They highlighted the disparity in salaries, noting that women often earn less than men for the same work. In less common responses, students emphasized the goal of achieving gender equality, the perception of household chores as primarily female responsibilities, the issue of violence against women, and the progress made through legislation. They also noted the lack of women in leadership positions, suggested the introduction of gender-neutral language, and recognized the discrimination faced by LGBTQ individuals (see Table 5).

Clean water and sanitation (SDG 6)

Regarding sustainable development and the topic of drinking water and hygienic conditions, students frequently pointed out the issues of water scarcity and poor hygiene. Many linked these challenges to the spread of various diseases. Additionally, students often mentioned the importance of drinking water and potential solutions, particularly in relation to impoverished and underdeveloped regions. In less common responses, they acknowledged the problem of irresponsible water management, noted that even developed countries face challenges with water scarcity, emphasized Africa as a region particularly affected by these issues, and connected the problems to climate change and global warming (see Table 6).

Affordable and clean energy (SDG 7)

In response to the question, „What do I know about the goal of affordable and clean energy?“, 25% of students recognized the importance of energy and demonstrated familiarity with both renewable and non-renewable energy sources. They articulated the advantages of utilizing renewable energy. Common responses included an awareness of the dangers associated with non-renewable energy sources and the need for energy conservation, along with the necessity of educating the public on these issues. In less frequent responses, students highlighted the lack of energy, particularly electricity, in various parts of the world, with a specific emphasis on Africa. They also discussed the challenges of accessing renewable energy sources, their limitations, and the need to explore alternative, more affordable solutions (see Table 7).

Decent work and economic growth (SDG 8)

When asked about the goal of decent work and economic growth, students frequently highlighted their awareness of issues such as cheap labor, exploitation, high unemployment, and the neglect of human dignity in the workplace. In less common responses, they addressed concerns related to child

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exploitation, wage inequality, and the disconnect between income and living expenses, noting that employment does not always provide a path out of poverty. They also emphasized that the issue of dignified work exists in developed countries, particularly affecting impoverished regions in Africa and Asia, as well as women, who are often the most vulnerable. Students linked economic growth to social progress, recognizing both its positive and negative implications, while acknowledging their own limited attention to the topic (see Table 8).

Industry, innovation and infrastructure (SDG 9)

When discussing Industry, innovation, and infrastructure (SDG 9), students most often (in 21% of responses) acknowledged the importance of industrial development, infrastructure, and innovation for improving human life and raising living standards. They frequently emphasized the benefits of innovative, environmentally friendly industries and products, while also recognizing that traditional industries are major polluters. Students pointed out that many underdeveloped countries lag significantly in this area, with some lacking basic internet access. In other, less common responses, they discussed the negative impacts of the COVID-19 pandemic and natural disasters on industry, the necessity for substantial investments in industrial and infrastructure development, and the rapid advancements in these sectors, particularly in developed nations. They also connected innovation to industrial and infrastructure development, acknowledging both its positive and negative effects (see Table 9).

Reducing inequalities (SDG 10)

When asked about the goal of reducing inequality, students most commonly stated their familiarity with various forms of inequality and the need for efforts to mitigate these disparities, although they expressed skepticism about the possibility of completely eradicating inequality. Many pointed out the pronounced divide between the rich and the poor, as well as national and racial inequalities. They often highlighted disparities in access to and quality of education and healthcare. In less frequent responses, students addressed gender inequality and recognized progress made in reducing it compared to the past (see Table 10).

Sustainable cities and communities (SDG 11)

Regarding sustainable cities and communities, students most frequently (28% of responses) noted that cities are significant sources of pollution and high energy consumption, which negatively impacts health. They also expressed awareness of ongoing urbanization and centralization processes, recognizing the issue of overcrowding in cities and emphasizing the need to guide urban development toward sustainability. In less common responses, students identified social challenges in urban areas, such as insecurity, homelessness, and poorly maintained neighborhoods. Some admitted to a lack of concrete knowledge on the subject, acknowledging that creating sustainable cities requires substantial financial investment (see Table 11).

Responsible consumption and production (SDG 12)

When asked about responsible consumption and production, students commonly stated their awareness of excessive production and the need to balance production with consumption. They frequently mentioned waste and recycling issues as potential solutions, as well as concerns related to overconsumption and food waste. In less frequent responses, students highlighted problems like plastic overuse, discarding clothing, excessive water consumption, unequal food distribution, and unsustainable industrial practices. They acknowledged their limited information on the topic but outlined ways individuals can contribute to responsible resource consumption (see Table 12).

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Climate action (SDG 13)

In response to the question „What do I know about the response to climate change?“, students most often (33%) cited the harmful effects of climate change on all forms of life on Earth. They frequently emphasized the importance of government involvement in various initiatives to combat climate change, noting that discussions about climate change are becoming more prominent, including in educational settings. Many students believed that human activities have a significant impact on climate change. In less common responses, they highlighted the role of activism in addressing climate change, referencing figures like Greta Thunberg, and discussed issues such as deforestation, fossil fuel consumption, and waste. They also pointed out the inadequacy of current efforts and the need for greater participation from major polluters and developing countries (see Table 13).

Life below water (SDG 14)

In response to the question „What do I know about SDG 14?“, students most frequently (22% of responses) cited the issue of large-scale water pollution. Other responses accounted for less than 13% each. Many students expressed awareness of the problem of plastic waste in water and its detrimental effects on aquatic life. They noted that three-quarters of the Earth's surface is covered by water, highlighting that many marine organisms are threatened by pollution. In less common answers, students particularly emphasized the impact of plastic waste on marine life, such as turtles, as well as the issue of coral bleaching. They reiterated that 75% of the Earth is water-covered and mentioned various organizations dedicated to preserving marine life and biodiversity. Additionally, students pointed out that aquatic ecosystems are home to numerous organisms whose survival is threatened by human activities, including oil spills, overfishing, and pollution. They also addressed concerns like water acidification, global warming, and climate change, underscoring the importance of water for life on Earth and the crucial role of phytoplankton as primary oxygen producers (see Table 14).

Life on land (SDG 15)

When asked about the goal of life on land (SDG 15), students predominantly highlighted the issue of deforestation, identifying humans as a significant threat to terrestrial life. In less frequent responses, they noted the extensive coverage of forests on land and their ecological importance, as well as the effectiveness of various organizations working to preserve terrestrial life. Students cited waste management as a major problem affecting life on land and emphasized the need for solutions. They also raised concerns about species endangerment and extinction, the importance of conserving biodiversity, and the detrimental impact of habitat conversion for tourism, industry, and transportation. Additionally, they acknowledged their understanding of the biological aspects of life on land (see Table 15).

Peace, justice, and strong institutions (SDG 16)

In response to the question „What do I know about SDG 16?“, students predominantly acknowledged the importance of the efforts made by states, institutions, and organizations, including the UN. They emphasized the need for stronger, faster, and more equitable action. Many students noted that peace is not universal and expressed skepticism about the possibility of fully achieving peace and justice worldwide. In less frequent responses, students highlighted the problem of violence, particularly the impact on children who are victims of conflict and war. They argued that without addressing this goal, it is impossible to achieve other sustainable development objectives, linking the fight against violence to efforts aimed at reducing inequality. They identified the pursuit of material wealth as a factor disrupting peace and justice, viewing bribery and corruption as significant barriers to achieving true

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justice. Students underscored that justice is foundational to any society and reflects the moral conscience of its citizens, while also addressing issues related to migrants. They emphasized that justice and peace are essential for a dignified life and for fostering an inclusive society, noting that the epidemiological measures taken during the COVID-19 pandemic disrupted peace and security globally (see Table 16).

Partnerships for the goals (SDG 17)

When asked about the importance of partnerships in achieving goals, students most often (38% of responses) recognized their significance in addressing major global challenges. However, 19% of students indicated that they were unfamiliar with the topic, citing issues such as cheap labor and irregular markets. In less common responses, students stressed the importance of partnerships during crises, such as earthquakes and the pandemic, highlighting the benefits that poorer and developing countries gain from cooperation with wealthier nations. They also pointed out the relationship between technological development and partnerships, noting that countries today are increasingly interconnected and supportive of one another (see Table 17).

Results of the statistical analysis of students' responses to the question "What do I know?"

The median number of responses to the question regarding students' knowledge of specific Sustainable Development Goals (SDGs) is highest for SDG 7 (Affordable and clean energy) and SDG 10 (Reducing inequalities), with a median exceeding 8 (Figure 2). Conversely, students provided the fewest responses (3 or fewer) regarding their knowledge of SDG 16 (Peace, justice, and strong institutions) and SDG 17 (Partnerships for the goals). Statistical analysis revealed that the differences in the number of responses among the various SDGs were not significant (Kruskal-Wallis test: $H(16, N = 146) = 20.086$, $p > 0.05$) (Figure 2).

DISCUSSION, CONCLUSIONS AND DIDACTIC SIGNIFICANCE

For discussion, the Sustainable Development Goals (SDGs) are categorized into three groups based on García-González et al. (2020): environmental, social, and economic goals. Figure 1 illustrates these categories. Interestingly, prior research among biology and chemistry student teachers shows that sustainability is most often associated with environmental issues, while economic dimensions are the least represented (García-González et al., 2020; Burmeister and Eilks, 2013). However, the current study suggests that participants are aware of all dimensions of sustainable development, likely influenced by the topics presented to them.

Environmental goals

Environmental goals resonate strongly with biology and chemistry students, as reflected in their familiarity with SDG 6 (Clean water and sanitation), 13 (Climate action), 14 (Life below water), and 15 (Life on land). While KWL tables reveal students' self-assessed knowledge, they do not accurately measure understanding. Therefore, further research is needed to gauge actual knowledge levels on these topics.

It’s important to note that misconceptions about environmental issues are common (Butler et al., 2014). For instance, research by Herman et al. (2017) found that only 14% of science teachers in Florida correctly defined climate change, with just 4% in Puerto Rico. In contrast, Czech teachers showed a better understanding (Miléř et al., 2012). Despite recognizing the harmful effects of climate change, only 6% of students acknowledged the lack of accountability for major polluters, and about 10% were aware of specific human impacts like deforestation and fossil fuel use. These findings highlight the

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urgent need to enhance climate education and collective action. Interestingly, students expressed a desire to learn how they can contribute to achieving environmental goals, indicating their readiness to engage. They also recognized the role of activism, citing figures like Greta Thunberg. This underscores the media's influence in promoting sustainable development, as studies show a complex relationship between environmental awareness and activism, with media playing a crucial role (Dono et al., 2010; Boulianne and Ohme, 2021).

Results concerning the remaining environmental SDGs – specifically SDG 6 (Clean water and sanitation), SDG 14 (Life below water), and SDG 15 (Life on land) – show that many students recognize the connections between water scarcity, poor hygiene, and various diseases, as well as the issues of water pollution and plastic waste. They acknowledge deforestation and view humans as a significant threat to life on land. However, it is concerning that few students identify water scarcity and hygiene issues as major problems, especially in underdeveloped regions. Additionally, only a small percentage recognize the challenges developed countries face regarding drinking water availability and the connection between water scarcity and climate change. This suggests a lack of awareness about the broader implications of these issues. Moreover, only a limited number of students mention the threat to species and the importance of biodiversity for aquatic and terrestrial life. While they express concern about pollution, they appear insufficiently informed about the specific challenges related to conserving water resources and ecosystems. This indicates a need for better education on the ecosystem services essential for sustainable resource management in the face of global challenges (La Notte, 2024). Therefore, it is crucial to enhance education for young people, especially future science teachers, enabling them to make informed decisions and raise public awareness. This is vital for bridging the gap between decision-makers and citizens, ensuring youth participation in water resource decision-making, a recognized global issue (Araya and Kabakian, 2004).

Social goals

A well-structured society is essential for individual well-being and quality of life, making it vital to raise awareness of social sustainable development goals (SDGs) (Wang and Ke, 2024). Among these, SDG 16 (Peace, justice, and strong institutions) and SDG 17 (Partnership for the goals) are particularly notable. Previous studies indicate that students often lack knowledge in these areas (García-González et al., 2020; Bezeljak et al., 2020). For example, 20% of students were unfamiliar with the term „partnership for the goals“, and over half expressed curiosity about its meaning. Similarly, many students struggle to connect peace and justice with sustainable development, as shown by their questions about the relevance of these topics.

SDG 11 (Sustainable cities and communities) also stands out. While some students express limited knowledge, many show a desire to learn more about this topic, suggesting that it is relatively unfamiliar, particularly compared to Spanish students who report greater awareness (García-González et al., 2020). In contrast, students are more knowledgeable about SDG 2 (Zero hunger), SDG 3 (Good health), SDG 4 (Quality education), SDG 5 (Gender equality), and SDG 7 (Affordable and clean energy). However, only a small percentage recognize that food should be universally accessible or that agricultural development is crucial for reducing hunger. Although 47% are aware of hunger-related mortality in Africa and Asia, only 5% believe food should be available to all, and merely 8% see the role of agriculture in addressing hunger. This gap suggests a lack of awareness of global challenges and the mechanisms behind hunger, as noted in World Bank reports (World Bank, 2015). Furthermore, while 16% of students acknowledge the role of charities and the UN, they often overlook local responsibilities

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regarding food availability. This underscores the need for enhanced education that links global and local hunger issues, promoting a systematic approach to solutions, as discussed by Holley and Mason (2019). Integrating these topics into curricula could foster deeper reflection and engagement, similar to initiatives like the *Food for Thought* program in the U.S., which has effectively incorporated food and hunger discussions into education (NCEE, 2021).

The results regarding the third Sustainable Development Goal (SDG 3) on health and well-being reveal that most students recognize the link between inadequate government regulation, poverty, and poor healthcare access. This awareness likely stems from their experiences with Croatia's healthcare system. However, fewer students understand that the COVID-19 pandemic has hindered healthcare progress and exacerbated the unequal distribution of medical professionals. This suggests a local focus in their thinking, with less consideration of global health challenges, including the pandemic's impact elsewhere. While the 2018 PISA survey indicated that Croatian students performed well in assessing local and global issues (OECD, 2020), our findings highlight the need for enhanced education in higher education about health and its social and environmental determinants. By fostering greater awareness of global health issues, future educators could become more proactive in promoting health both locally and globally.

The results for SDG 4 (Quality education) show that most students acknowledge global disparities in educational access and quality. Many recognize the importance of gender equality in education, particularly regarding girls' access to schooling. However, few students identify the role of technology in enhancing educational quality or the challenges posed by unequal access to technological resources, as outlined in an OECD report (2015). Similarly, in relation to SDG 5 (Gender equality), students are aware of the systemic oppression women face compared to men and the global nature of gender inequality. They recognize wage disparities for similar work, aligning with findings from the World Economic Forum (WEF, 2023). However, less than 10% highlight issues such as violence against women, underrepresentation of women in leadership, LGBTQ discrimination, or the potential for gender-neutral language to promote equality. These findings suggest a need for more comprehensive education on quality education and gender equality, as students currently show a lack of empathy and information on these topics, which may hinder their engagement in addressing gender inequality (WEF, 2023).

Economic goals

The final group of Sustainable Development Goals (SDGs) addresses economic issues, encompassing five key goals. Students demonstrate a solid understanding of these topics and their impact on sustainable development. Research by García-González et al. (2020) highlights significant interest among students, particularly in SDG 1 (No poverty). However, it's concerning that they primarily focus on global poverty, with only 4% acknowledging its presence in their own country. This gap suggests a lack of awareness or disregard for local challenges, potentially hindering their social engagement and empathy towards those facing economic hardships (Borawska, 2017).

Students also express interest in the effects of the COVID-19 crisis on SDG 1, SDG 8 (Decent work and economic growth), and SDG 9 (Industry, innovation, and infrastructure). The pandemic's impact on the global economy was profound, evidenced by a 15% drop in industrial production in the early months (Deb et al., 2022) and declines in GDP, especially in tourism-dependent nations (Fernandes, 2020). Students particularly associate these issues with poorer countries in Africa, recognizing the links between poverty and economic growth.

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Regarding SDG 10 (Reducing inequalities) and SDG 12 (Responsible consumption and production), students display strong knowledge, as reflected in their responses in the KWL table. Many indicate a desire for statistical data and solutions related to sustainable development challenges in the „what I want to know“ (W) section. This interest underscores the importance students place on evidence-based argumentation regarding SDGs. While this is a positive trend, it is crucial to further educate them on data analysis techniques and the ethics of using and publishing data.

The findings indicate that students have a solid understanding of many Sustainable Development Goals (SDGs), particularly SDG 1 (No poverty), SDG 2 (Zero hunger), SDG 3 (Good health and well-being), SDG 4 (Quality education), SDG 5 (Gender equality), SDG 6 (Clean water and sanitation), SDG 7 (Affordable and clean energy), SDG 8 (Decent work and economic growth), SDG 9 (Industry, innovation and infrastructure), SDG 10 (Reducing Inequalities), SDG 12 (Responsible consumption and production), SDG 13 (Climate action), SDG 14 (Life below water), and SDG 15 (Life on land). However, they demonstrate limited familiarity with SDG 11 (Sustainable cities and communities) and SDG 17 (Partnership for the goals). While students grasp basic aspects of SDG 16 (Peace, justice, and strong institutions), they lack clarity on its relevance to sustainable development.

These results highlight the need for a stronger emphasis on economic and social aspects of sustainable development in educational practices. Students often express confusion regarding the connections between these topics and sustainability. To address this, educators should provide comprehensive explanations of sustainable development and its interrelated dimensions: environment, society, and economy. Additionally, students show insufficient awareness of economics and politics, underscoring the necessity for education that empowers them with knowledge about their rights and the principles of active citizenship. This awareness is vital for fostering their ability to influence their communities. Integrating these topics into higher education is crucial for promoting sustainable practices across all sectors, thereby advancing the overall goal of sustainable development.

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