

Report on the existing needs and knowledge gaps of secondary school teachers regarding climate change and

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Introduction

Climate change stands out as the most significant challenge in the 21st century, comprising various interconnected subsystems. Food systems emerge as a major contributor to this crisis, with one-third of global greenhouse gas (GHG) emissions originating from the food sector. The European Green Deal outlines four key focus areas for the Green Transition, with sustainable food systems being one of them. Food systems encompass the interconnected systems and processes that impact nutrition, food, health, community development, and agriculture. The Food Sector stands out as a primary contributor to climate change, emphasizing the necessity for envisioning and designing it in more sustainable ways. Initial results from an extensive new study (Marks, et al., 2022) have unveiled that the impact of climate change on the well-being of young people is more severe than anticipated. This underscores the conclusion that new forms of human capacities will be essential to achieve sustainable futures within the limited boundaries of our planet and school education is the initial step in cultivating these capacities, underlining the importance of working towards that goal.

Through proper education, young individuals will not only acquire knowledge about the nutritional aspects of food products, but also develop essential competencies to lead the transformation of food systems, influencing all three components of these systems. In this regard, the importance of Food Literacy education is growing, emphasizing the knowledge and comprehension of how food choices impact health, the environment, communities, and the overall state. This recognition positions Food Literacy education as a crucial tool for fostering behavioral changes essential for transitioning to sustainable food systems.

Schools face the challenge of providing comprehensive knowledge about climate change and its interconnected subsystems, as well as promoting awareness of sustainable living, consumption, and behaviour (EC, 2019). Consequently, sustainability and Food Literacy should be integral components of school curricula to facilitate the transition towards a Green Transition. Research, as indicated by GreenComp (2021), highlights that innovative methodologies and tools, such as Futures Literacy and systems thinking, possess proven capabilities in building essential competences for the 21st century. These approaches should be further leveraged to transform young individuals into critical thinkers, ultimately leading to a systemic change in current food systems.

This document is a report of the survey conducted among 103 high school teachers in 5 countries as a part of the European project “EduNUT - Futures Literacy on Food Nutrition and Sustainable Food Systems for School Education”, supported by the EU Erasmus+ KA220-SCH - Cooperation partnerships in school education. The project aims to train and empower students and teachers on the topics of sustainable food systems, as one of the 4 pillars that will support the European goal for a Green Transition. The main objective of the conducted survey was to identify and consider the existing needs and knowledge gaps of high school

teachers, on the topics of climate change education and specifically sustainable food systems, related to Food Systems and Futures Literacy.

The analysis of the results will facilitate the development of educational materials and training programs for teachers. These initiatives aim to foster the development of students' future-oriented skills, stressing system thinking, and expanding their knowledge, skills, and attitudes towards changing consumption habits.

Methodology

The survey was conducted in five European countries: Estonia, Poland, Italy, Greece and Iceland in October 2023. The CAWI (ang. *Computer-Assisted Web Interview*) technique was used to conduct diagnostic survey and collect quantitative data with the main objective to identify and consider the existing needs and knowledge gaps of secondary school teachers, on the topics of climate change education and specifically sustainable food systems, related to Futures Literacy. The elaborated questionnaire consisted of three parts, referring to respondents' state of knowledge, experience in teaching and competencies.

The survey involved 103 teachers from secondary schools, who are implementing environmental education and providing courses which are compatible with the project's subject matter (i.e. STEM). Those surveyed represented mainly the following areas of education: environmental education, climate change education, food systems, food production, food quality, new trends in nutrition, health promotion, waste management, biology, geography, natural sciences and geography.

The majority of respondents were female (61%). Men comprised 36% of all respondents (Figure 1).

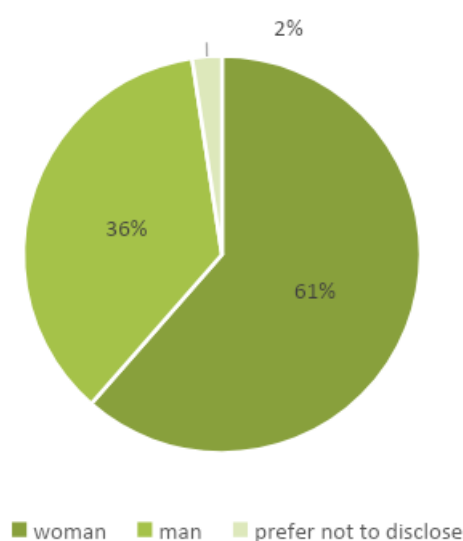


Figure 1. The structure of respondents by gender

Source: own elaboration based on conducted survey.

The structure of respondents by country (Figure 2) indicates that 25% survey participants come from Poland, 24% each are residents of Estonia and Greece, 20% come from Italy and 6% from Iceland.

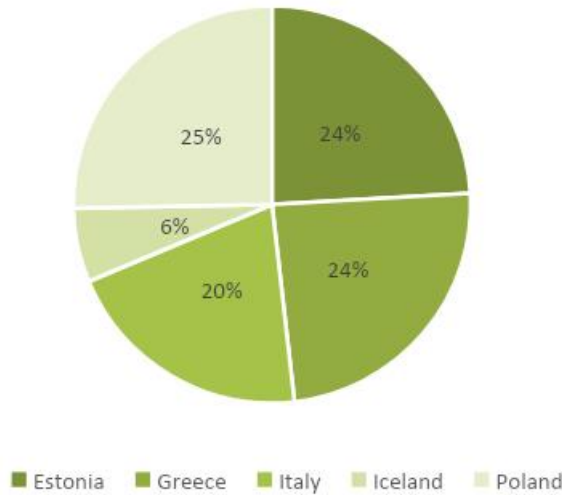


Figure 2. The structure of respondents by country

Source: own elaboration based on conducted survey.

The dominant age group of respondents is 35-44 years (35%). 24% of teachers are 24-34 years old, 22% of survey participants are 45-54, 13% of respondents are 55-64 and 6% are 65 and more (Figure 3).

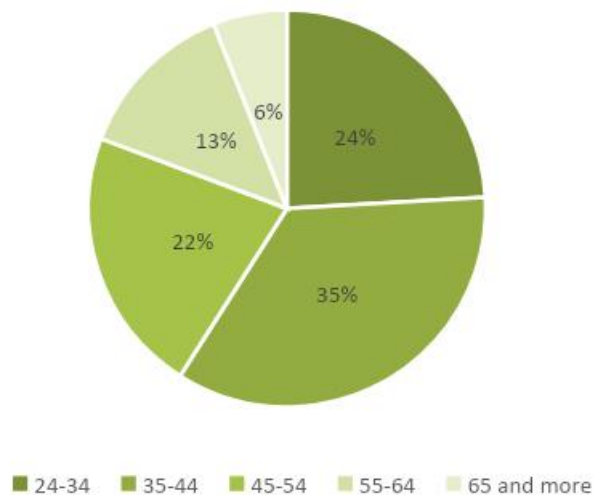


Figure 3. The structure of respondents by age

Source: own elaboration based on conducted survey.

Analysing the job seniority (Figure 4), it can be concluded that the largest group of respondents are with more than 20 years of professional experience. 20% of teachers have 6-10 years of job seniority. Two groups of respondents constitute 18%: one with less than 5 years of job seniority, and another with 11-15 years of job seniority. The smallest group of respondents (12%) has 16-20 years of job seniority.

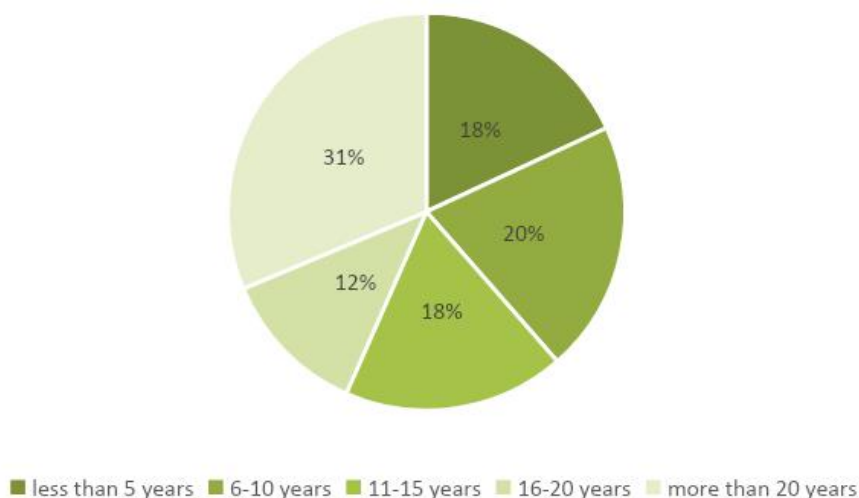


Figure 4. The structure of respondents by job seniority

Source: own elaboration based on conducted survey.

Research results

The respondents assessed their knowledge in the field of climate change and sustainable food systems as very average (Figure 5). On a five-point scale, they rated the highest their knowledge of food habits (with the average of answers on the level of 3.6) and climate change (3.5). The lowest rates (average of 3.1) were provided for the knowledge of sustainable production.

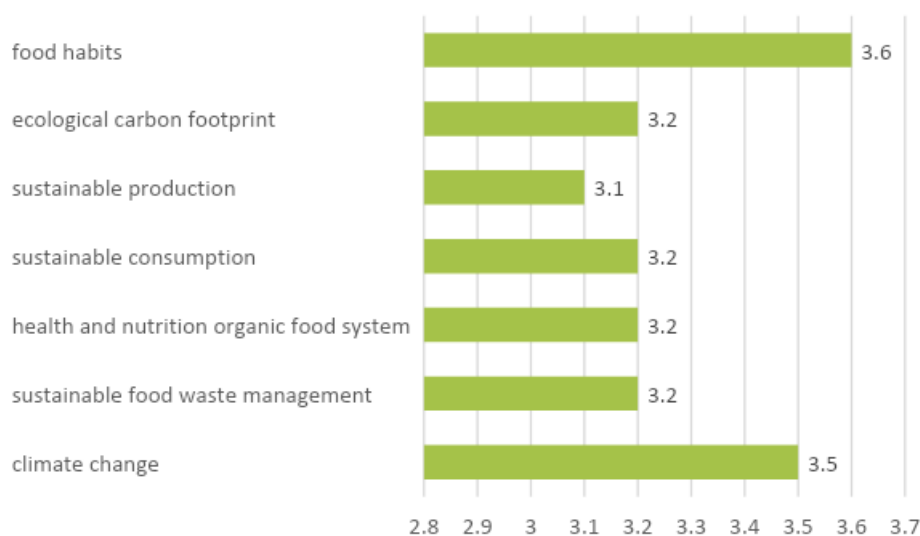


Figure 5. The level of knowledge in the field of climate change and sustainable food systems

Source: own elaboration based on conducted survey.

Taking into account the answers of respondents by country, it can be noted that the knowledge of climate change was rated the highest in Estonia (3.6) and the lowest in Iceland (3.2). The knowledge of respondents in terms of sustainable food waste management was evaluated the highest in Italy (3.4) and the lowest in Iceland (2.8). The knowledge of health and nutrition, organic food systems, and sustainable consumption received the highest grades in Italy (3.5 and 3.6) and the lowest in Greece (2.9 each). Sustainable production knowledge got the best rating in Italy (3.4) and the worst in Iceland (2.6). Teachers in Italy evaluated their knowledge on ecological carbon footprint the highest (3.5) and in Poland the lowest (2.9). The knowledge of food habits scored the highest in Italy (4.1) and the lowest in Iceland (2.8). The Italians rated their general knowledge in the field of climate change and sustainable food systems the highest and Icelanders the lowest.

Table 1. The level of knowledge in the field of climate change and sustainable food systems by country

Knowledge field	Estonia	Greece	Italy	Iceland	Poland
climate change	3.6	3.5	3.4	3.2	3.5
sustainable food waste management	3.1	3.2	3.4	2.8	3.2
health and nutrition organic food system	3.1	2.9	3.5	3.0	3.4
sustainable consumption	3.5	2.9	3.6	2.6	3.2
sustainable production	3.1	2.8	3.4	2.6	3.2
ecological carbon footprint	3.4	3.1	3.5	3.2	2.9
food habits	3.5	3.4	4.1	2.8	3.7

Source: own elaboration based on conducted survey.

Only 21.5% of the respondents (from 5 countries) participated in any training in the field of climate change and/or sustainable food systems. The highest percentage of high school teachers participating in training on this topic was recorded in Greece (45.0%), while the lowest was in Poland (9.5%). In the other countries (Estonia, Italy, and Iceland) this percentage ranged from 14% to 20% (Figure 6).

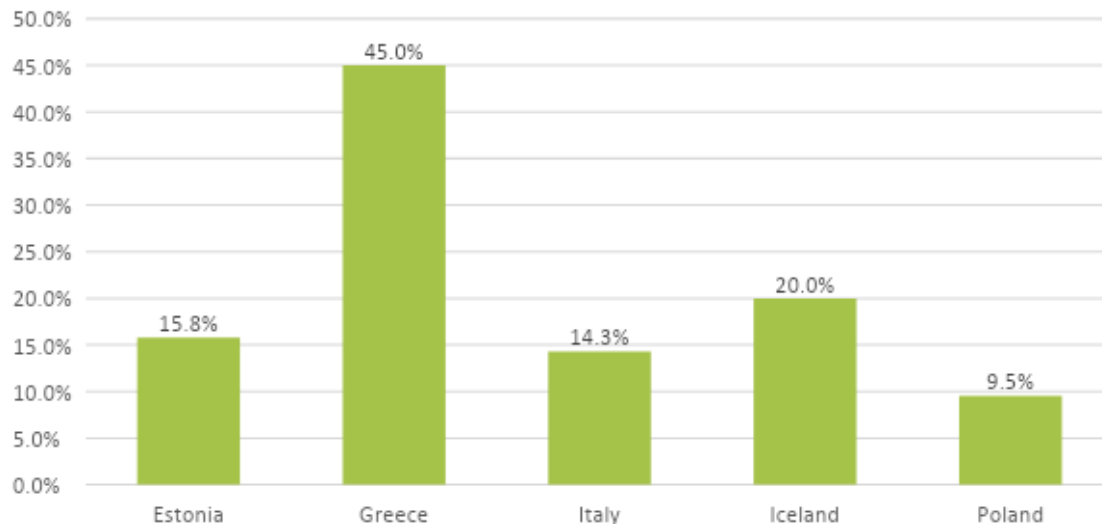


Figure 6. The participation of respondents in trainings related to climate change and/or sustainable food systems

Source: own elaboration based on conducted survey.

In terms of the areas in which teachers would like to broaden their knowledge, they indicated the following subjects the most frequently: renewable energy sources; low-emission strategies in areas such as public transport, energy efficiency; protection of natural resources and landscape values; carbon footprint; “green architecture”; food waste; energy efficiency as well as importance of local food production (Fig. 7).

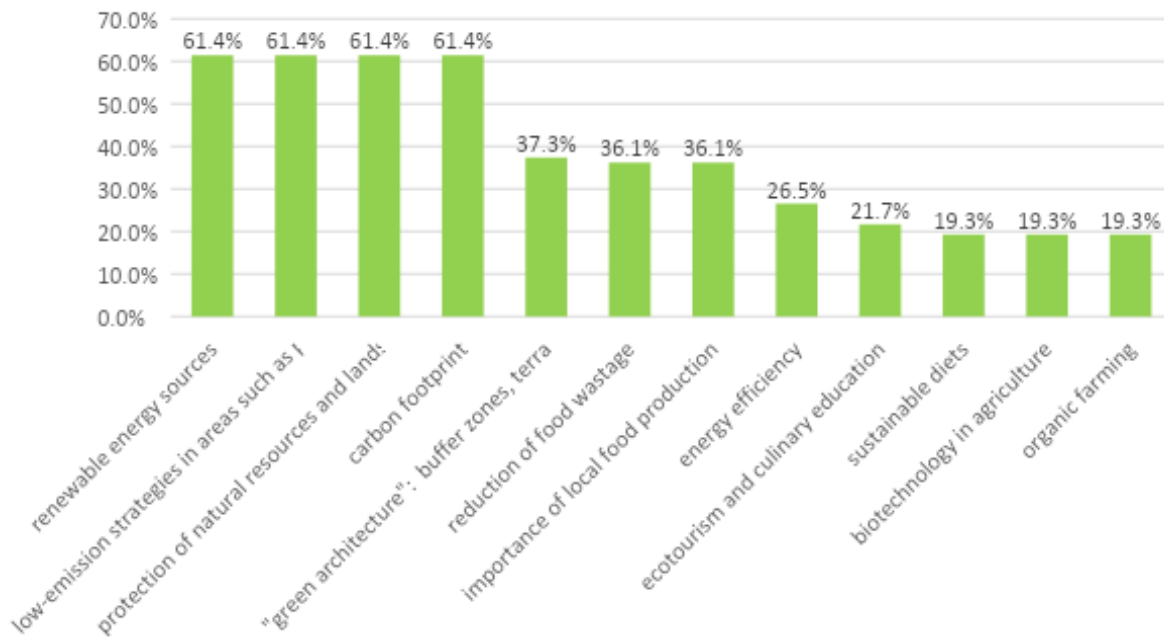


Figure 7. Aspects of climate change and sustainable food systems expected by the respondents to be included in training materials (%)

Source: own elaboration based on conducted survey.

Teachers most often indicated the following aspects: renewable energy sources; low-emission strategies in areas such as public transport, energy efficiency; protection of natural resources and landscape values; carbon footprint (61.4% of those surveyed). There was also high interest in the subject matter of "green architecture": buffer zones, terrace walls, ponds, water features (37.3% of those surveyed). Teaching materials taking into account aspects of reduction of food wastage (36.1%) and importance of local food production (36.1%) would also enjoy similar interest among respondents. Teachers would also like to gain knowledge on the subject of energy efficiency, 30% of those surveyed indicated this area. It should be also noticed, that following aspects of sustainable food systems were also considered by the respondents: ecotourism and culinary education (21.7%), sustainable diets (19.3%), biotechnology in agriculture (19.3%) and organic farming (19.3%).

The aim of the next question was to find out respondents' preferences regarding the teaching methods and techniques used and preferred for future use for conveying teaching content in the area of sustainable food systems. As the questions allowed for multiple choice, this resulted in ten response categories (Figure 8).

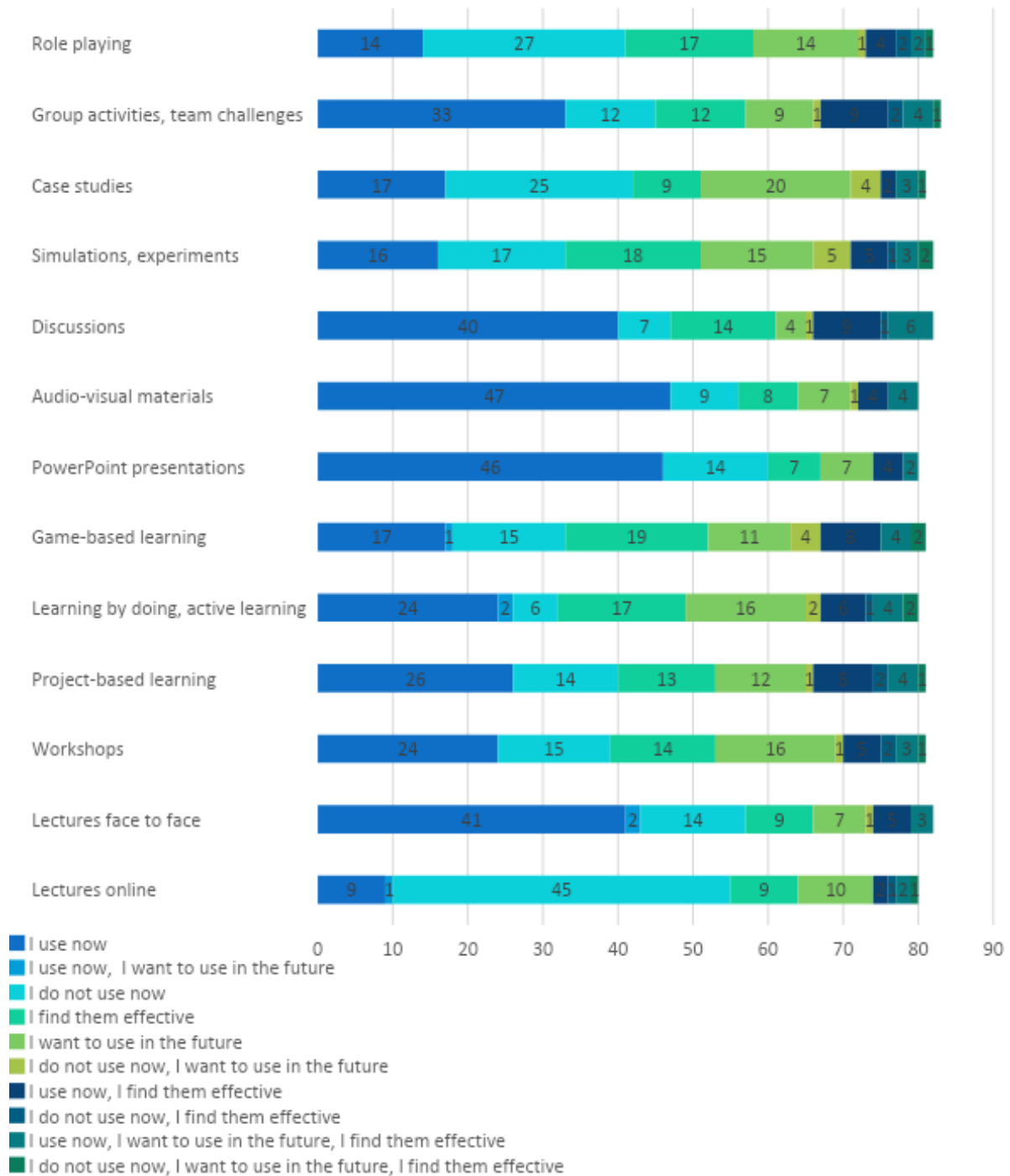


Figure 8. Respondents' answers on the used and preferred future teaching methods in the area of sustainable food systems

Source: own elaboration based on conducted survey.

From the visualisation of the data, it can be seen that about half of the respondents (more than forty, out of those surveyed), currently use traditional teaching methods and techniques: *audio-visual materials* (46%), *Power point presentations* (4%) and *face to face lectures* (40%). *Discussions* (39%) and *group activities and team challenges* (32%) are also very popular. More modern learning techniques such as *role playing*, *simulations*, *experiments* *game-based learning* are currently used by 14, 16 and 17 of the all respondents. The least popular at the moment are *online lectures*, the use of which was reported by only 9 out of all surveyed respondents.

From the point of view of the ongoing project, it is important to find out respondents' preferences for the use of teaching methods and techniques in the future in the area of sustainable food systems. Most respondents reported that they would like to use case studies (20), learning by doing, active learning (16), workshops (16) and simulations , experiments (15) in the future.

Responses such as game-based learning (19), simulations experiments(18) and role playing (17) received the most indications regarding the effectiveness of teaching methods and techniques. Discussions, group activities, team challenges, game-based-learning and project-based learning were among the methods currently used with a high level of effectiveness, but their percentages in this compilation of responses were low at 9, 9, and 8 and 8 respectively.

Knowing these preferences can be of significant value in designing courses on sustainable food systems. Combinations of other responses such as: "I use now, I want to use in the future, I find them effective", "I don't use now, I find them effective", " I don't use now, I want to use in the future, I find them effective" were only reported by single respondents and therefore cannot provide guidance for course design.

The respondents were also asked to indicate their competencies they want to improve. The surveyed teachers would like to improve the following competences the most (Fig. 9): system thinking (79.5%), strategic action (44.6%), anticipatory thinking (39.8%), personal involvement (39.8%), critical thinking and analysis (32.5%), interdisciplinary work (32.5%), communications and use of media (26.5%), interpersonal relations and collaboration (26.2%), responsibility and ethics (21.7%) and empathy and changing perspective (20.5%). These results indicate the need to include educational content in teaching and training materials that will enable teachers to deepen such competencies.

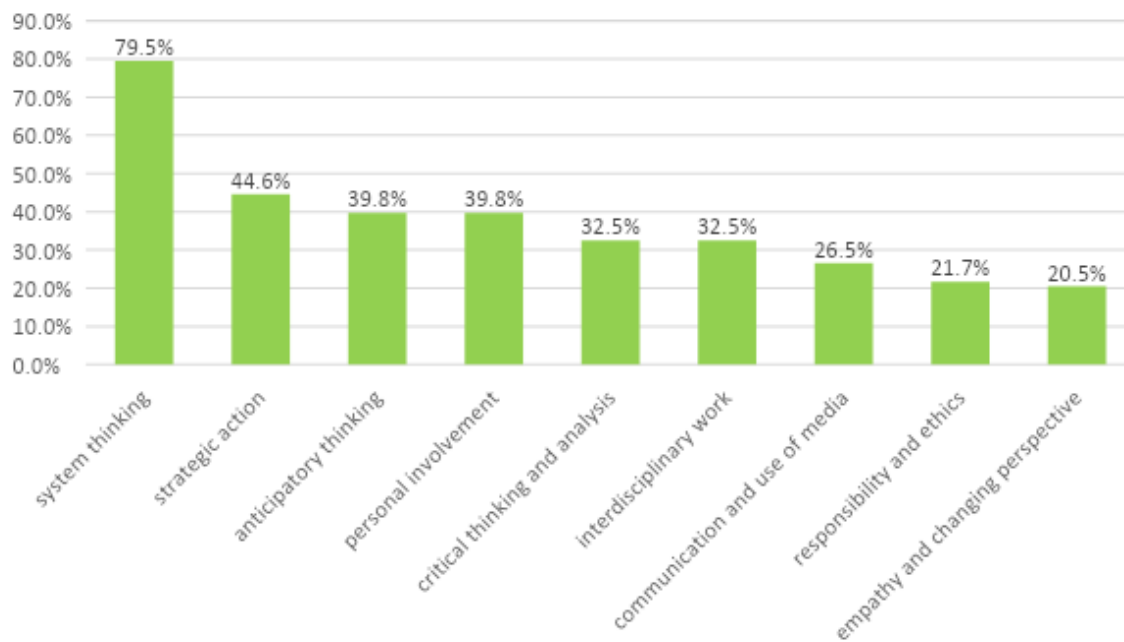


Figure 9. Respondents' indication on their competencies they would like to improve

Source: own elaboration based on conducted survey.

Those surveyed were also asked to indicate their primary sources of information on climate change and sustainable food systems. The most frequently used by the respondents sources of information are presented in the Table 2. Almost 70% of secondary schools teachers acquire their knowledge from news portals and information websites, while more than half of them (51.8%) from books and scientific publications. For 41% of the respondents, educational materials for students are the primary sources of information and at the same time 39.8% choose social media profiles (e.g. Twitter, LinkedIn) for this purpose. The sources of knowledge, indicated by about one third of respondents are also: local and national press (37.3%), webinars (34.9%), podcasts and radio broadcasts (31.3%). Every fourth teacher obtains the newest knowledge from international organizations and their publications (UN, UNESCO, FAO, etc. – 27.7%), television programs and documentaries (26.5%), expert and organizational blogs (22.9%) as well as coworkers, colleagues, and network contacts (22.9%). It is worth noticing that only 15.7% of them participate in online courses and conferences, which may point out an insufficient number of such sources or limited access to them.

Less frequently, those surveyed use remaining sources of information on climate change and sustainable food systems, namely: formal education (courses, lectures and studies), recommended by other teachers materials, books, courses; discussion forums and social groups as well as TV programs and documentaries. Those sources were indicated by less than 6% of teachers.

Table 2. Sources of teachers' information on climate change and sustainable food systems

Source of information	No of indications	% of all respondents
news portals and information websites	58	69.9
books and scientific publications	43	51.8
educational materials for students	34	41.0
social media profiles (e.g. Twitter, LinkedIn)	33	39.8
local and national press	31	37.3
webinars	29	34.9
podcasts and radio broadcasts	26	31.3
international organizations and their publications (UN, UNESCO, FAO, etc.)	23	27.7
television programs and documentaries	22	26.5
expert and organizational blogs	19	22.9
coworkers, colleagues, and network contacts	19	22.9
expert and organizational blogs	16	19.3
online courses and conferences	13	15.7

Source: own elaboration based on conducted survey.

In question 6, survey participants assessed their level of competences on a scale ranging from 1 to 5, where a rating of 1 signified no competence in the given area, and a rating of 5 denoted highly advanced competences (Table 3). The results show the average ratings provided by the respondents for individual competences. The respondents rated their competences level the highest in the areas of *empathy and change of perspective* (3.9), *interpersonal relations and collaboration* (3.9) and *critical thinking and analysis* (3.9). On the other hand, they rated their competence level lowest in the areas of *systems thinking* (3.0) and *anticipatory thinking* (3.1).

Table 3. Mean scores of the respondents' competences

Competences	Mean scores of the respondents' competences
Systems thinking	3.0
Interdisciplinary work	3.5
Anticipatory thinking	3.1
Justice, responsibility and ethics	3.8
Critical thinking and analysis	3.9
Interpersonal relations and collaboration	3.9
Empathy and change of perspective	3.9
Communication and use of media	3.7
Strategic action	3.2
Personal involvement	3.8
Assessment and evaluation	3.6

Competences	Mean scores of the respondents' competences
Tolerance for ambiguity	3.6
Futures literacy	3.4

Source: own elaboration based on conducted survey.

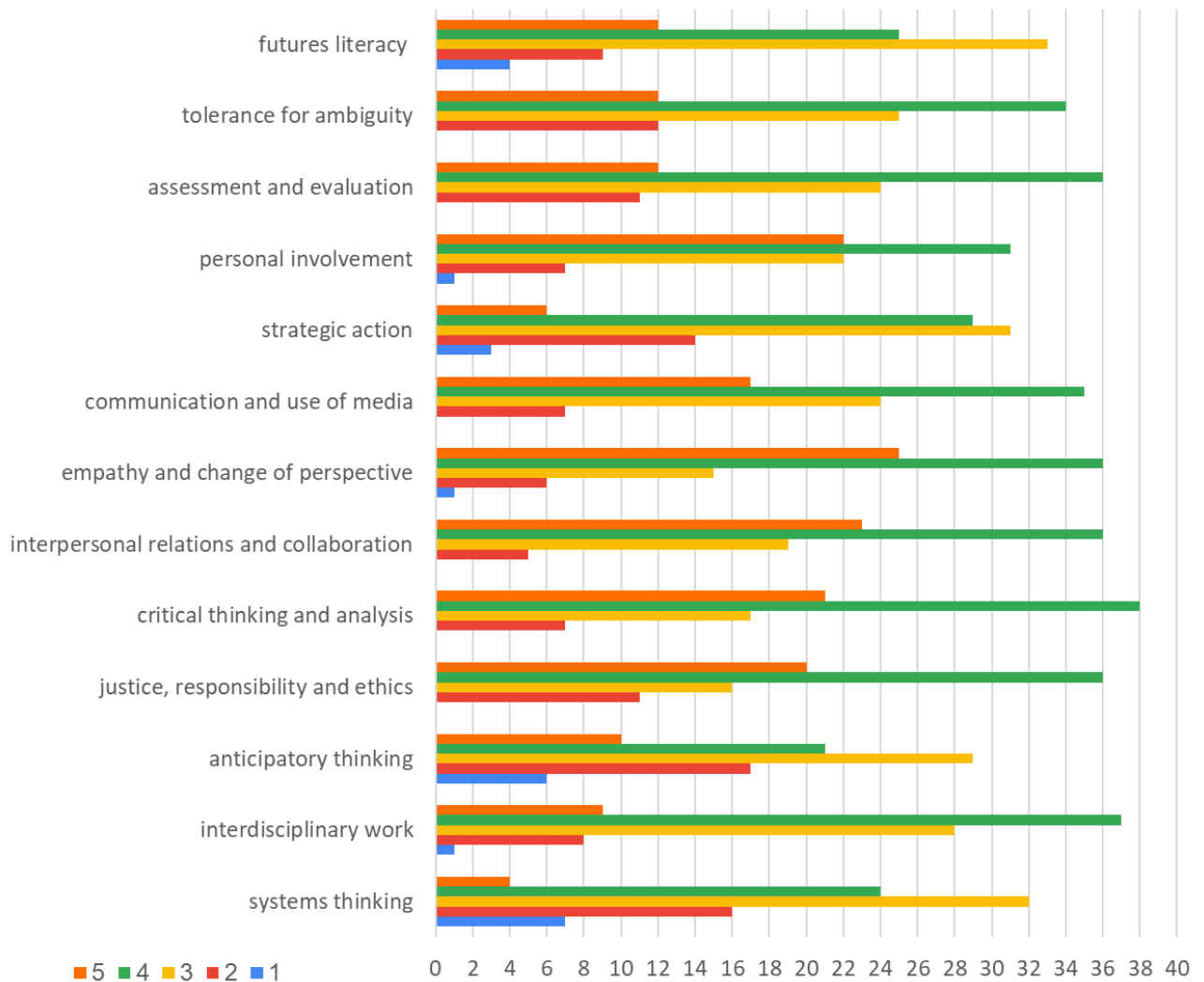


Figure 10. Respondents' answers on their level of competence

Source: own elaboration based on conducted survey.

Figure 10, on the other hand, shows the results of the respondents' competence assessments in each area. When analysing the figure, it can be seen that in the *area of futures literacy*, 12 respondents assessed their level of competence as very advanced and 25 respondents assessed their level of competence as advanced (4 on a scale of 1 to 5). On the other hand, 4 respondents stated that they had no competence in this area. On the other hand, in the area of *systems thinking*, only 4 respondents assessed their level as very

advanced, 24 as advanced and 7 declared a complete lack of competences in this area. In the area of *personal involvement*, 22 respondents assessed their level of competence as very advanced, 31 as advanced and one person stated a lack of competence in this area. In the area of *anticipatory thinking*, 10 respondents assessed their level of competence as very advanced (assessment 5 on a scale of 1 to 5). 21 respondents considered their level to be advanced and 6 respondents indicated a lack of competences. None of the respondents indicated a lack of competence in the areas of *tolerance for ambiguity, assessment and evaluation, justice, responsibility and ethics critical thinking and analysis, interpersonal relations and collaboration*.

In the last question, the teachers were asked to indicate the resources or forms of support would most assist them in educating about sustainable food systems (Table 4).

Table 4. Forms of support expected by teachers to support them in educating about sustainable food systems

Forms of support	No of indications	% of all respondents
educational materials	45	54.2
educational trips	43	51.8
interactive tools (applications, educational games, simulations)	43	51.8
expert support (consultations with specialists)	38	45.8
multimedia (access to films, documents, podcasts, etc.)	33	39.8
teacher training sessions	24	28.9
partnership projects (collaboration with local organisations, farmers, or businesses)	23	27.7
innovative technologies	23	27.7
hands-on workshops	21	25.3
webinars with practitioners	21	25.3
professional literature (access to research, publications, articles)	19	22.9
experience exchange platform	18	21.7

Source: own elaboration based on conducted survey.

The teachers expressed strong willingness to support the acquisition of their knowledge through various forms and sources. Over half of them would like to use educational materials (54.2%), educational trips (51.8%), interactive tools (applications, educational games, simulations -51.8%). For a significant part of the respondents, expert support (consultations with specialists) and the usage of multimedia (access to films, documents, podcasts, etc.) would also assist them in their education (45.8% and 39.8% respectively). Teacher training sessions would also be of great importance in acquiring knowledge on climate change and sustainable food systems, what was stressed by 28.9% of those surveyed. Approximately one quarter of secondary schools teachers would appreciate having their education supported by the following forms: partnership projects (collaboration with local organisations, farmers, or businesses – 27.7%), innovative technologies (27.7%), hands-on workshops (25.3%), webinars with practitioners (25.3%), professional literature (access to research, publications, articles – 22.9%) and experience exchange platform (21.7%). The respondents expressed less interest in improving their knowledge and skills through the usage of: ready-to-use lesson programmes, case studies, discussion panels with experts (arranging meetings with specialists where teachers could ask questions and expand their knowledge), financial support (grants or funds for purchasing materials, organising trips, etc.), opportunity for international collaboration (exchange programmes with teachers from other countries) and the opportunity to participate in competitions and projects.

Conclusions

The research carried out in the project partner countries made it possible to identify the areas in which the respondents would like to expand their knowledge, their preferred teaching methods and the competences that need to be strengthened.

Among the educators surveyed, a recurring interest surfaced in various facets of sustainability. Predominantly, teachers expressed a keen desire to expand their knowledge in areas such as renewable energy sources, low-emission strategies encompassing public transport and energy efficiency, preservation of natural resources, carbon footprint awareness, 'green architecture,' and strategies to curb food waste. Notably, 'green architecture' garnered considerable attention, followed closely by the significance of minimising food wastage and promoting local food production. Energy efficiency emerged as another focal point, drawing the interest of nearly a third of the respondents. Moreover, sustainable food systems piqued interest, particularly in aspects like ecotourism, culinary education, adopting sustainable diets, biotechnology in agriculture, and organic farming, showcasing a collective aspiration among teachers to delve deeper into these domains for enriching their educational material.

In the context of our ongoing project, understanding the preferences of respondents regarding teaching methods in sustainable food systems stands as a pivotal aspect. The majority of participants expressed a strong inclination toward employing case studies, hands-on learning through active participation, workshops, and simulations and experiments in their future teaching endeavours. Moreover, feedback highlighted game-based learning, simulations and experiments and role-playing as particularly effective methods for imparting knowledge, showcasing these approaches' perceived efficacy among respondents.

The insights gleaned from the survey among educators revealed a substantial aspiration to enhance various competencies.. Notably, system thinking emerged as the most sought-after competence, with a staggering majority of respondents expressing a strong desire to bolster this skill. Equally significant were aspirations toward developing competences in strategic action and anticipatory thinking showcasing a collective ambition among teachers to cultivate a holistic approach towards education. Moreover, the survey underscored the growing importance of personal involvement and critical thinking and analysis as pivotal skills educators are keen to refine. Additionally, the call for fostering interdisciplinary work reflects the evolving landscape of education, emphasising the need for integrated learning experiences. A substantial interest in improving communication techniques, media utilization and fostering interpersonal relations alongside collaboration was also evident. Furthermore, the survey highlighted educators' recognition of the significance of values such as responsibility and ethics and the capacity for empathy and shifting perspectives in shaping a comprehensive learning environment.

The teachers showed a strong eagerness to enhance their knowledge acquisition using diverse methods and resources. More than half expressed interest in utilising educational materials, educational trips, and interactive tools such as applications, educational games, and simulations. Moreover, a considerable portion of respondents highlighted the importance of expert support, seeking consultations with specialists, and the utilisation of multimedia resources like films, documents, podcasts, among others, as valuable aids in their educational endeavours.

In conclusion, the survey reveals educators' strong interest in sustainability across various areas, notably renewable energy, low-emission strategies, 'green architecture,' and sustainable food systems. They seek to enrich educational materials in these domains. Teaching method preferences emphasise a preference for case studies, active participation, workshops, and simulations. Educators aim to fortify competencies like system thinking, strategic action, and interdisciplinary work. They express eagerness to use diverse resources, from educational materials to expert consultations and multimedia tools, to enhance their educational practices.

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