Sustainability Awareness Report

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1. Introduction - Project Context

- ➢ Erasmus+ Strategic Partnership Project

- ➢ Duration: 31.12.2022 – 30.05.2025

- ➢ Focus: Strategic Development of Students' Sustainability Competencies in Engineering Sciences

- ➢ Objective: The Delivery of New Content to Existing Engineer Curricula And Modules that aim to:

  - ▪ Encourage Eco-friendly and Innovative Teaching and Learning Activities,

  - ▪ Raise Sustainability Awareness among Students & Staff, and

  - ▪ Increase Competencies and Skills in the Fields of Sustainability and Engineering

1. Introduction - Contributions of EFEU Project

Reduce the carbon footprint of partner universities

➢ Develop a Harmonised Tool and Methodology to Calculate Carbon Footprint of Partner Universities

➢ Conduct a Carbon Footprint Assessment of Each University's Campus

➢ Implement Sustainability Awareness/Mobility Survey

Support European HEIs on their way to carbon neutrality

➢ New Content to Existing Engineering Curricula and Modules

➢ Implement Eco-friendly and Innovative Teaching and Learning Activities

➢ Raise Sustainability Awareness among Students & Staff

➢ Increase Competencies and Skills in the Fields of Sustainability and Engineering

Strengthen European universities' social responsibility

➢ Raise the Sustainability profile of Higher Education Institutions

➢ Create Research Opportunities

➢ Engender International Cooperation

➢ Generate Knowledge-transfer Opportunities

1. Introduction – Sustainable Development Goal

➢ **SDG 4 Quality Education**

  ➢ Target 4.7:
  By 2030, ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture's contribution to sustainable development.

  ➢ SDG 4 is understood to be a critical goal that must be achieved in order for the other 16 SDGs to be achieved.

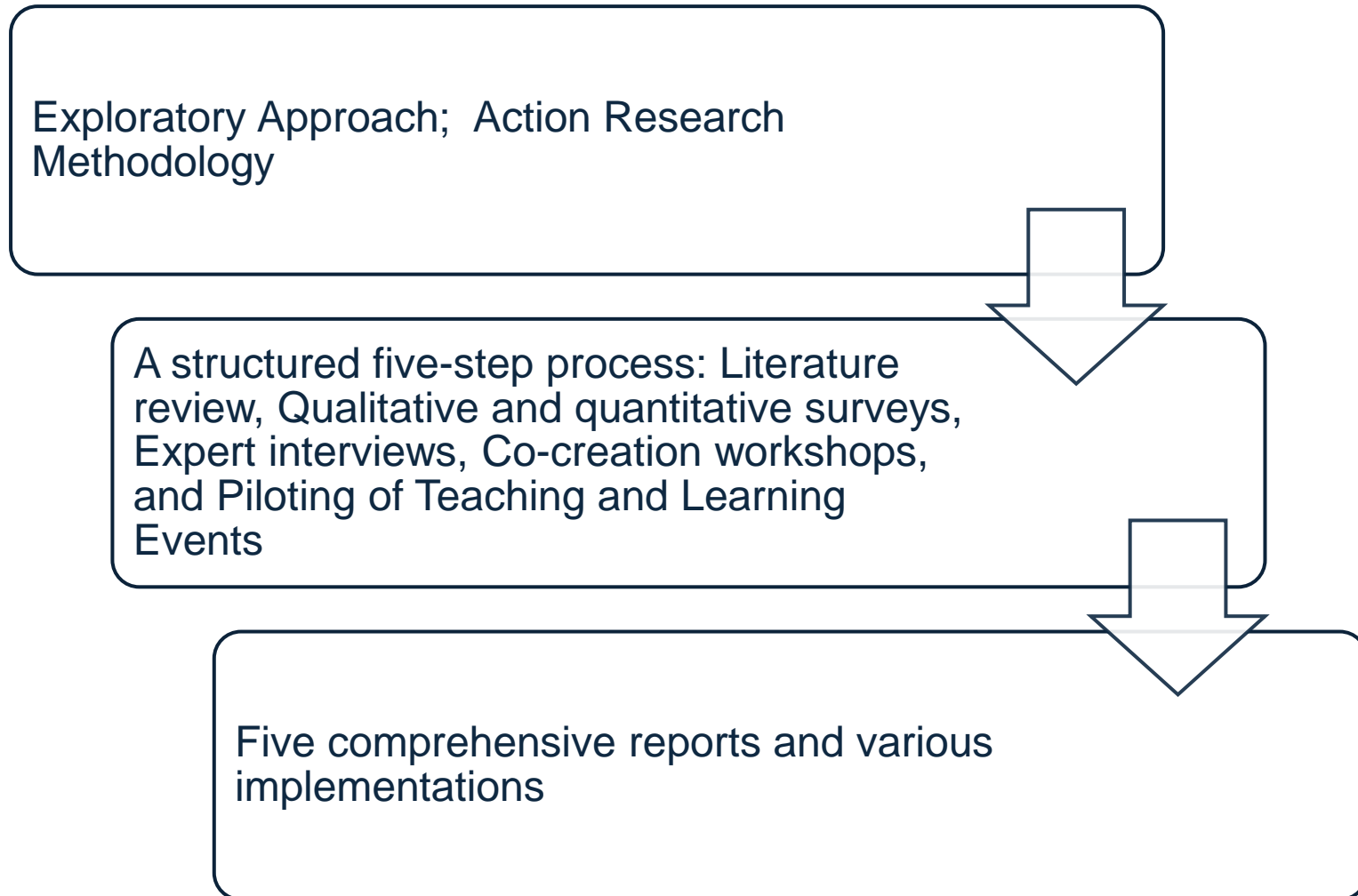# 1. Introduction - Role of Higher Education Institutions

- ➢ Foster a sustainability mindset by helping users develop the knowledge, skills and attitudes to think, plan and act with empathy, responsibility, and care for our planet

- ➢ Incorporate the SDGs into their (graduate and undergraduate) teaching and research

- ➢ Become society-transforming agent, contributing to fulfilling the 2030 Agenda

- ➢ Implement policies, educational programs, modules, and practices that promote sustainability
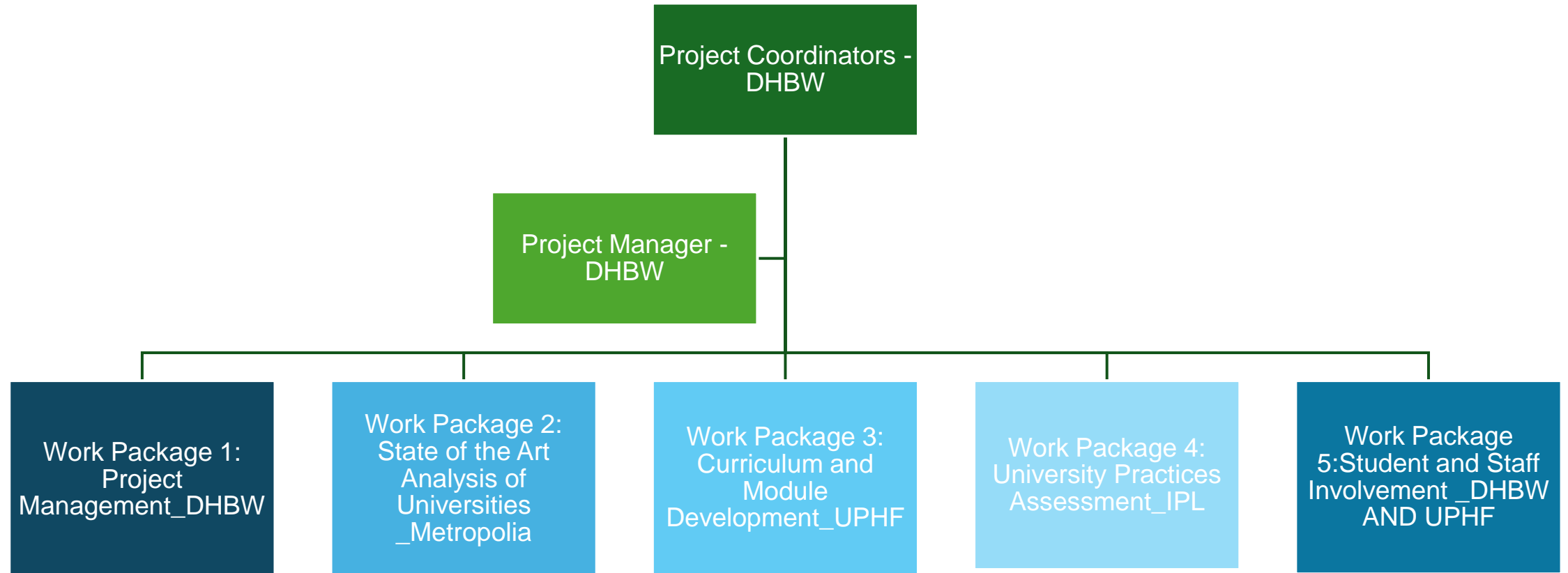
1. Introduction - Problem Definition

➢ Engineers are indispensable agents in driving the sustainable development of societies (Abd-Elwahed and Al-Bahi, 2020). Therefore, it is imperative to incorporate sustainability education into university curricula, particularly for engineering students, due to the vital role engineers play in enabling SD. To ensure partner universities are delivering learning that is effective at advancing sustainability within the engineering fields, it is essential that opinions on the quality of the curriculum, knowledge of key sustainability themes, behaviour/practices and perceptions/attitudes of students and staff be determined.

➢ The analysis of the results will facilitate the optimisation of efforts at the partner universities to improve the standards, performance, offerings, and ethos related to sustainable education.

2. Methodology - EFEU Methodology

Exploratory Approach; Action Research Methodology

A structured five-step process: Literature review, Qualitative and quantitative surveys, Expert interviews, Co-creation workshops, and Piloting of Teaching and Learning Events

Five comprehensive reports and various implementations
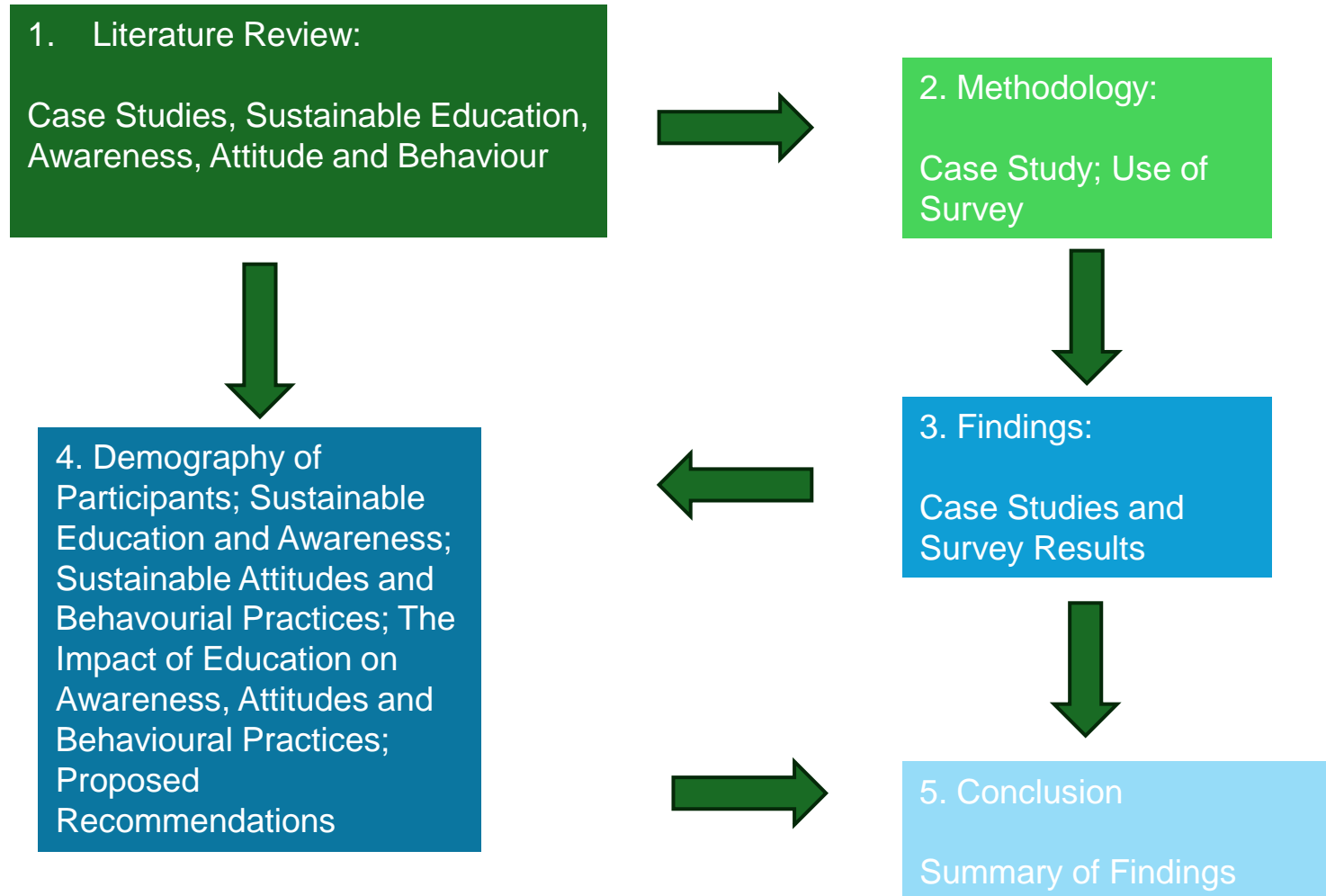
2. Methodology - General proceedings - EFEU Team

2. Methodology - Development of the EFEU Sustainability Awareness Report

2. Methodology: Development of the EFEU Sustainability Awareness Survey

Use of prevalent themes in the literature: sustainable education and awareness, behaviour/practices, and attitudes/perceptions.

Insights and feedback of the project team members, whose backgrounds and experience with sustainability helped with the editing and finalising of the questions.

The survey consisted of both quantitative and qualitative questions.

First part: to determine the socio-demographic background of participants,
Second part: to verify experience/knowledge related to sustainability,
Third part: to substantiate awareness level/knowledge of key sustainability concepts,
Fourth part: to gather data on the perceptions and practices related to climate change and sustainability.

Survey developed in English and translated into the languages of the project partners.

Available online via the Questionpro platform.
Survey was first tested with staff members from each partner university. The feedback was integrated to improve its usability and ensure its effectiveness.

Distribution via E-mail, intranet notification, and digital signage.
Participate from January 23rd, 2024 to March 4th, 2024.

Analysis: Questionpro/ Microsoft Excel

3. Literature Review and Objectives

Definition of Awareness/Knowledge

- The term "awareness" is used to imply a level of knowledge gained empirically through one's perceptions (Ziadat, 2010).

- Knowledge, on the other hand, goes beyond awareness and involves a deeper understanding of a subject through the result of learning, study, and experience (Cambridge University, 2024).

Education for Sustainable Development

| ESD | Training/Awareness | Skills | Behaviour | Attitudes; Values |

Dimensions of Education for Sustainable Development

- Education for Sustainable Development (ESD) is focused on several dimensions: sustainable knowledge, behaviours, attitudes and awareness (Tschannen-Moran and Woolfolk-Hoy, 2001; Filho et al., 2016; Filho, 2017; Jeong et al., 2020).

## Sustainable Education and Awareness

- Understanding the levels of knowledge that different groups of people possess concerning the severity of environmental problems and how they respond to or interact with their environment (Ziadat, 2010).

- Help professional educators understand, quantify, and establish educational environmental awareness programs to better address societal challenges (Jeong et al., 2021).

3. Literature Review and Objectives

Definition of Attitudes

- Attitudes reflect a person's cognitive and affective evaluation of a given object, behaviour, or situation and partially guide behaviour (Bozorgparvar, 2018; Kim et al., 2013).

- Environmental attitudes are a psychological tendency expressed by evaluating the natural environment with some degree of favour or disfavour (Milfont & Duckitt, 2010).

- Another related concept is sustainable attitudes, which refers to how individuals and groups perceive and prioritise sustainability in their daily lives and decision-making processes.

Contributing Aspects to Formation of Attitude
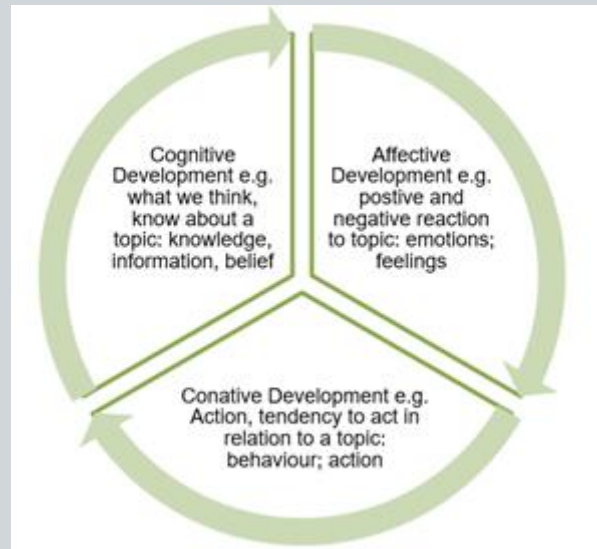
Contributing Aspects to The Formation of Attitude (Bakanauskas et al., 2020)

Environmental Attitude

- Beliefs, concerns, and values. recognised as core elements in attitudinal measures.by Milfont & Duckitt (2010).

- The findings of Watling and Zhou (2011), Andersson et al. (2013), and Mifsud (2012), Tang (2018) support the notion that education and knowledge are instrumental in forming positive attitudes towards sustainability. However, other researchers such as Collado et al. (2020) and Jackson et al. (2015) argued that although education aims to improve environmental attitudes, results indicate that it is failing to have an impact or detectable correlation.

- Environmental attitude-behaviour gap has also attracted considerable attention among behavioural and cognitive scientists. Although many studies have been undertaken, we do not yet fully understand the mechanisms causing this discrepancy (Gifford & Chen, 2017; Wyss et al.,2022). These researchers underscore the importance of further studies in fully comprehending this complex relationship

3. Literature Review and Objectives

Definition of Sustainable Behaviour	Aspects of Sustainable Behaviour	Sustainable Behaviour

Definition of Sustainable Behaviour

- Pro-environmental behaviour (PEB), also known as green, sustainable, or environmentally friendly (eco-friendly) behaviour, is defined as behaviours in which individuals take protective actions toward the environment (Lee and Khan, 2020).

- Behavioural practices are related to values systems and social, cultural, and demographic factors of individuals, education is identified as a significant determinant by several researchers, such as (Hamid et al., 2014 and Čiarnienė et al., 2020)

Aspects of Sustainable Behaviour
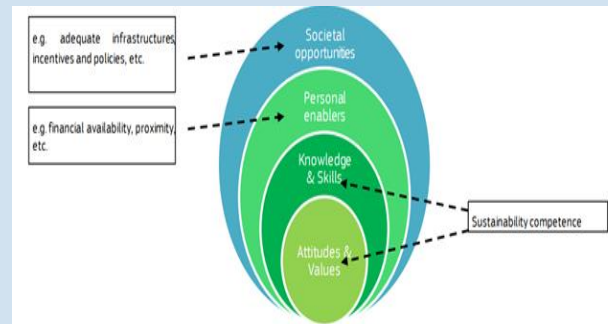
Sustainability Competences and Context for Sustainable Behaviour Performance (Rieckmann, 2012)

Sustainable Behaviour

- A common assumption is that unsustainable behaviours are primarily driven by a lack of knowledge of the underlying societal costs of such behaviour (Singh et al., 2016).

- However, Grilli and Curtis (2021) explained that although quantitative analysis of behaviour change interventions and outcomes shows that education and awareness are the most common behaviour change methods, these methods have the lowest success rate in the studies that they were examined.

- pro-environmental attitudes do not always foster or translate to pro-environmental behaviour. The disconnect between attitude and behaviour highlights the need to identify some of the barriers to achieving sustainable behavioural change. The barriers to sustainable behaviour, according to Blake (1999), can be categorised into three types: individual barriers, responsibility and practicality.

3. Literature Review and Objectives

Research Gap/Further Research

- Limited evidence is available on the quality and efficacy of the initiatives implemented by HEIs under ESD and GAP programmes in terms of knowledge, competences, attitudes, values, and behaviour (Rieckmann, 2018).

- Many studies have been undertaken, we do not yet fully understand the mechanisms causing this discrepancy (Gifford & Chen, 2017; Wyss et al.,2022). These researchers underscore the importance of further studies in fully comprehending this complex relationship.

- To effectively affect behaviour, it is vital to determine the limiting factors and if these can be addressed to facilitate more sustainable practices. This notion is supported by (Dabija et al., 2017), who argued that literature focused on understanding the causes and impacts of key factors, including their linkages (environmental, education, social, etc.) in building sustainable behaviour, should be a focal area in curricula of universities all around the world.

Concluding Remarks

- Even though the relationship between knowledge, attitude, and behaviour is not necessarily linear, some studies, such as those by Roth (1992), Sia et al. (1986), and Hsu (2004), propose that individuals' attitudes and environmental behaviours reflect their environmental knowledge.

- Despite the conflicting findings, it is widely recognised that higher education institutions are important places to develop the necessary perceptions and behaviour among future professionals towards SD, which ultimately paves the way for humanity to achieve the goals of SD (Michael et al., 2020).

Study Objectives

- To facilitate improvement in the quality of sustainability offerings at the partner universities and address some of the identified gaps in research

1. Determine the sustainability awareness level of students and staff by evaluating knowledge and familiarity, attitudes and behavioural practices related to sustainability

2. Facilitate the optimisation of efforts at the partner universities aimed at improving the standards, performance, offerings, and ethos related to sustainable education

3. The study will also be used to verify the hypothesis that higher educational levels have a positive impact on awareness, attitude, and behavioural practices.

4. Results: Case Studies

Duale Hochschule Baden-Württemberg/DHBW	IPL	Metropolia University of Applied Sciences	UPHF
Stuttgart, Germany	Leiria, Portugal	Helsinki, Finland	Valenciennes, France
DHBW Stuttgart Campus: Three faculties (Management & Economics, Engineering and Social Work); 7600 enrolled students and 460 full-time employees.	Five faculties and accommodates 13,000 registered students and 1,600 employees.	16,400 students and 920 staff members, consisting of four campuses	Le Mont Houy Campus accommodates around 11000 registered students and over 1200 full-time employees
The technical faculty of DHBW Stuttgart, with approx.100 full-time employees (FTEs) and 1790 enrolled students, was used as the case study.		The Myllypuro Campus, the university's largest campus, was selected for this study. 6000 registered students; 500 staff members	

4. Results: Demographics

DHBW: 264
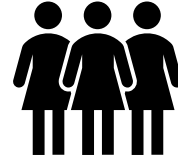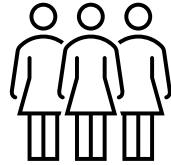
Metropolia:
181

Total Attempted Surveys: 855
Completed Surveys: 714

IPL: 128

UPHF: 141

4. Results: Demographics

Background of Participants

Legend:
- 1st year
- 2nd year
- 3rd year
- 4th year
- 5th year
- Master's student
- PhD candidate
- Full-time lecturer
- Visiting/Part-time lecturer
- Administrative/Supporting staff
- Other

- 1st year 27%
- 2nd year 20%
- 3rd year 24%
- 4th year 5%
- 5th year 3%
- Master's student 4%
- PhD candidate 1%
- Full-time lecturer 12%
- Visiting/Part-time lecturer 0%
- Administrative/Supporting staff 3%
- Other 1%

4. Results: Experience/Awareness/Knowledge

67% of staff:
Experience with sustainability related projects or teaching sustainability-relatedsustainability related topics
Top campus_Metropolia: 84%

39% of staff:
Knowledge of sustainability Competences frameworks
Top campus_IPL: 52%

Staff's specialisation
Science & Technology: 43%
Environment: 20%

32% of staff:
Students' skillset meet the sustainability demands of the job market:
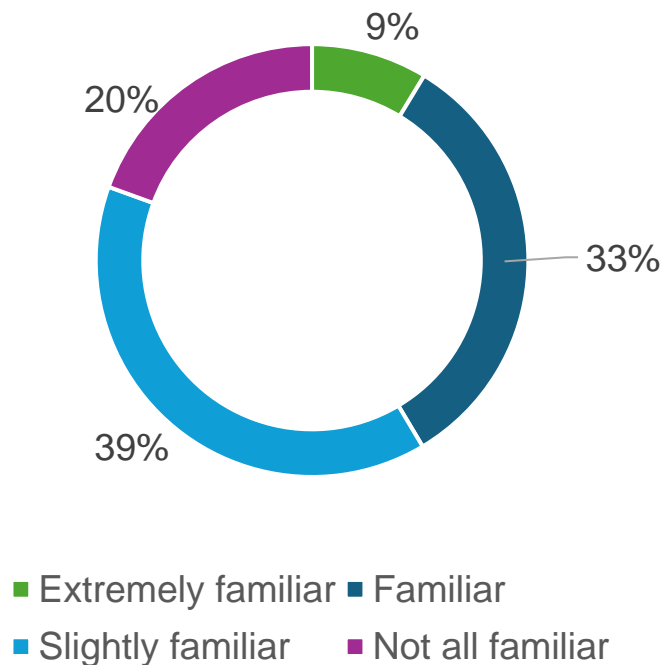Top campus_IPL: 52%

51% of participants:
Satisfied with academic training related to sustainability and sustainable development.

Top campus_Metropolia: 59%
Student vs. staff: 51%: 51%

4. Results: Familiarity with Key Concepts

Familiarity with Key Concepts related to Sustainability and Climate Change

- Extremely familiar
- Familiar
- Slightly familiar
- Not all familiar

Participants were most familiar with the greenhouse gas effect, with over 80% confirming being extremely familiar or familiar with the concept, compared to 64% with SDGS and 41% with the three core sustainability elements.

Statement	Extremely familiar	Familiar	Slightly familiar	Not all familiar	Overall
The three core elements of Sustainability/Sustainable Development	62	234	279	139	714
	8.68%	32.77%	39.08%	19.47%	100.00%
Sustainable Development Goals	78	385	212	39	714
	10.92%	53.92%	29.69%	5.46%	100.00%
Greenhouse Gas Effect	218	380	106	10	714
	30.53%	53.22%	14.85%	1.40%	100.00%

4. Results: Familiarity with Key Concepts According to Participants' Background

	Concepts		
	Three Core Elements of Sustainability/Sustainable Development	Sustainable Development Goals (Goals)	Greenhouse Gas Effect
Background			
DHBW-Stuttgart	33% (N = 87)	53% (N = 140)	85% (N = 225)
IPL	54% (N = 69)	61% (N = 78)	82% (N = 105)
Metropolia	37% (N = 67)	75% (N = 136)	86% (N = 156)
UPHF	52% (N = 73)	77% (N = 109)	79% (N = 112)
Student	40% (N = 245)	64% (N = 396)	84% (N = 516)
Staff	51% (N = 46)	68% (N = 61)	83% (N = 75)

IPL most familiar with the three concepts of sustainable development/sustainability (54%), UPHF was most familiar with SDGs (77%), and Metropolia was most familiar with the greenhouse gas effect (86%).

Both students and staff familiar with the greenhouse gas effect and least familiar with the three core elements of sustainability/sustainable development.

4. Results: Knowledge related to Climate Change; Causes
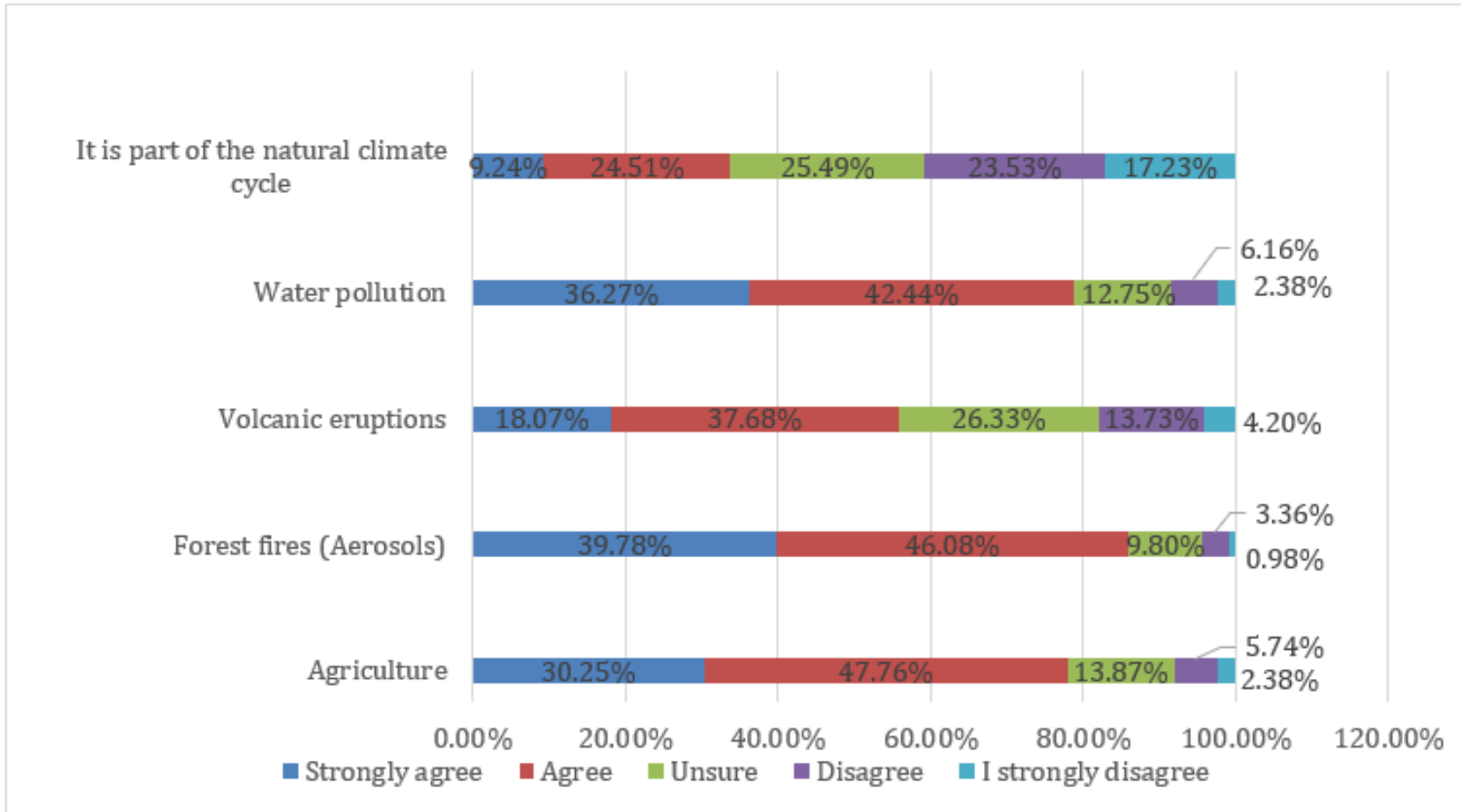
Respondents demonstrated a good general understanding of factors contributing to climate change, as most participants correctly identified agriculture, forest fires, and volcanic eruptions as activities that lead to climate change.

However, nearly 80% of respondents mistakenly believed that water pollution contributes to climate change, while 33% perceived climate change as a natural part of the climate cycle

4. Results: Knowledge related to Climate Change According to Participants' Background

Cause of Climate Change	Background of Participants					
	DHBW (Total: 264)	IPL (Total: 128)	Metropolia (Total: 181)	UPHF (141)	Student (617)	Staff (90)
Agriculture	84%	66%	86%	67%	76%	90%
Forest Fires	86%	88%	85%	86%	85%	88%
Volcanic Eruptions	53%	60%	63%	48%	56%	57%
Water Pollution	72%	88%	81%	81%	78%	80%
Part of the natural climate cycle	27%	47%	34%	34%	34%	33%

Agriculture was recognised by over 65% of the participants for each campus (the most: DHBW-85%, the least: IPL-66%). Forest fires were widely recognised by all campuses (>85%). There appears to be a lack of understanding regarding the relationship between climate change and volcanic eruptions, with as low as 48% of participants (IPL) and as high as 63% (Metropolia) believing this factor contributes to climate change.

There was even less understanding of the impact of water pollution, with over 70% of participants across all campuses incorrectly identifying it as a contributor to climate change. When considering whether climate change is part of the natural cycle of climate change, the most significant number of participants who agreed came from IPL (47%), and the largest number who did not agree or were unsure was DHBW (73%).

The responses provided by students and staff showed that the differences were not significant, except for agriculture, with 76% of students and 90% of staff identifying this activity as a contributing factor to climate change.

4. Results: Knowledge related to Climate Change; Consequences
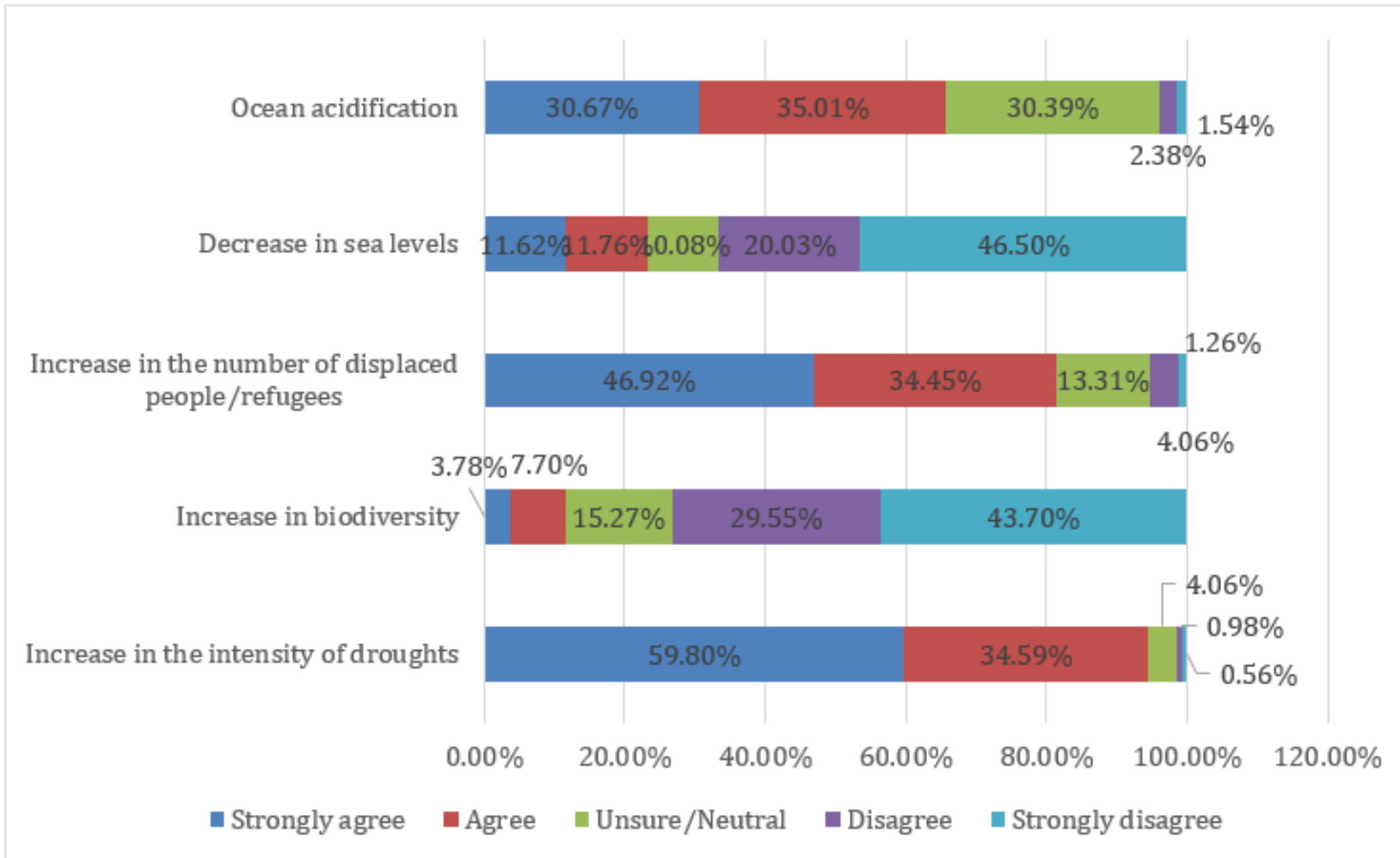
Responses suggest a sound understanding of the consequences of climate change.

Approximately 65% recognised ocean acidification, more than 80% identified displaced people/refugees, and over 90% stated that droughts' intensity was related to climate change.

However, 31% either agreed or were unsure whether climate change leads to decreased sea levels, and 12% believed climate change results in increased biodiversity.

4. Results: Knowledge related to Climate Change According to Participants' Background

Consequences of Climate Change	Background of Participants					
	DHBW (Total: 264)	IPL (Total: 128)	Metropolia (Total: 181)	UPHF (141)	Student (617)	Staff (90)
Increase in the intensity of droughts	96%	98%	91%	93%	95%	93%
Increase in Biodiversity	8%	11%	13%	17%	13%	2%
Increase in the number of displaced persons/refugees	85%	79%	85%	73%	80%	88%
Decrease in sea levels	18%	29%	19%	33%	24%	19%
Ocean acidification	65%	78%	56%	69%	65%	71%

The overwhelming majority across all campuses believed that climate change increases the intensity of droughts and the number of displaced people.

Most participants also saw ocean acidification as a consequence of climate change. Still, the numbers were lower, indicating some uncertainty about the impact of this activity on climate. The majority of participants were also clear that the increase in biodiversity and decreasing sea levels were not activities related to climate change.

The responses from students and staff showed very little difference.

4. Results: Attitudes Related to Climate Change and Sustainability
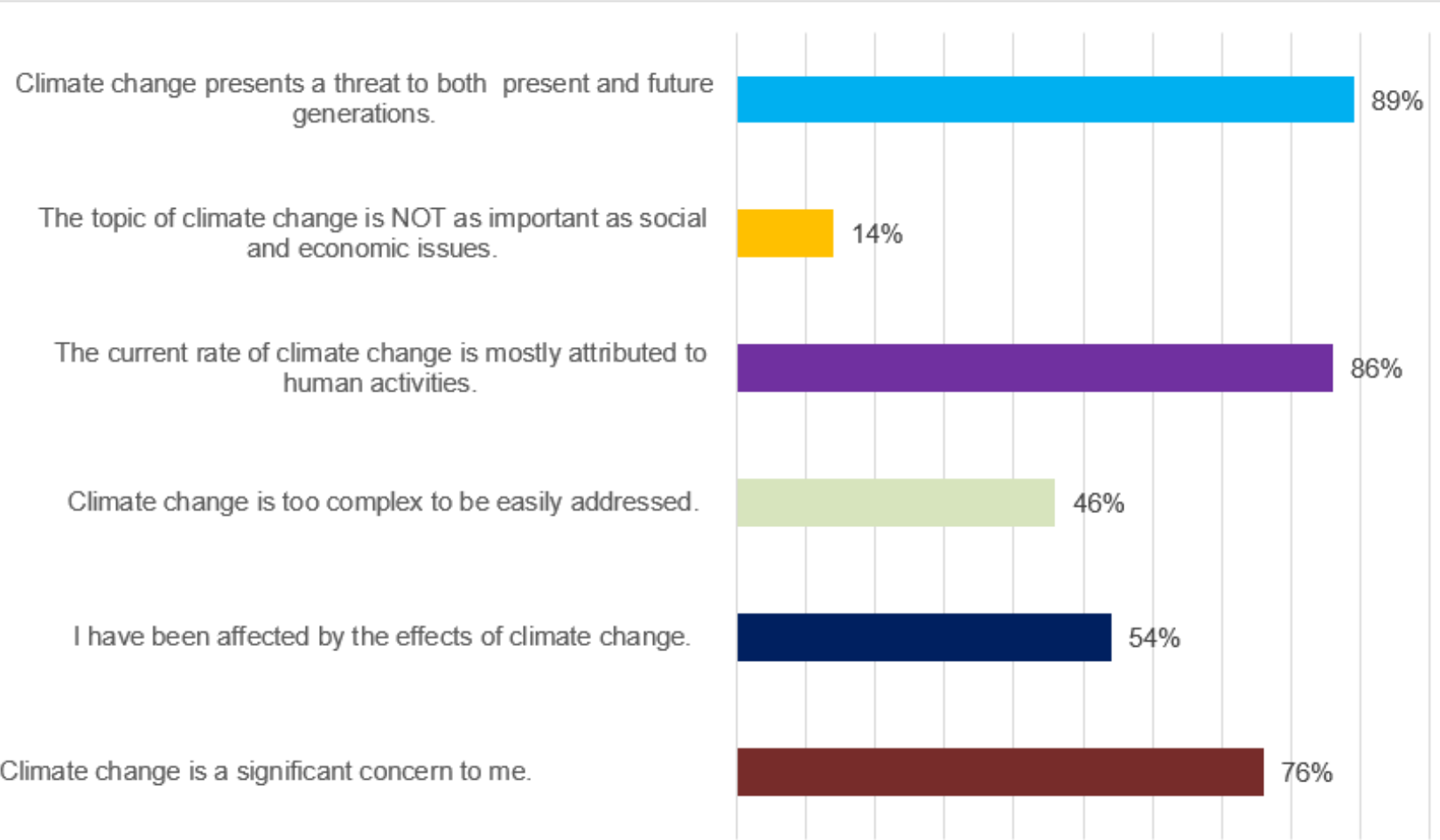
76% of participants saw climate change as a significant concern, even though only half of the respondents had been affected by climate change. There was cautious optimism about combating or addressing climate change, with 46% seeing the topic as too complex to be easily addressed.

According to 86% of respondents, the current rate of climate change is primarily attributed to human activities, which directly contradicts sentiments expressed by 33% of participants who believed that climate change is part of the natural climactic cycle.

Nearly 90% of participants saw climate change as important as social and economic issues. This is in line with most participants (89%) seeing climate change as a threat to both present and future generations.
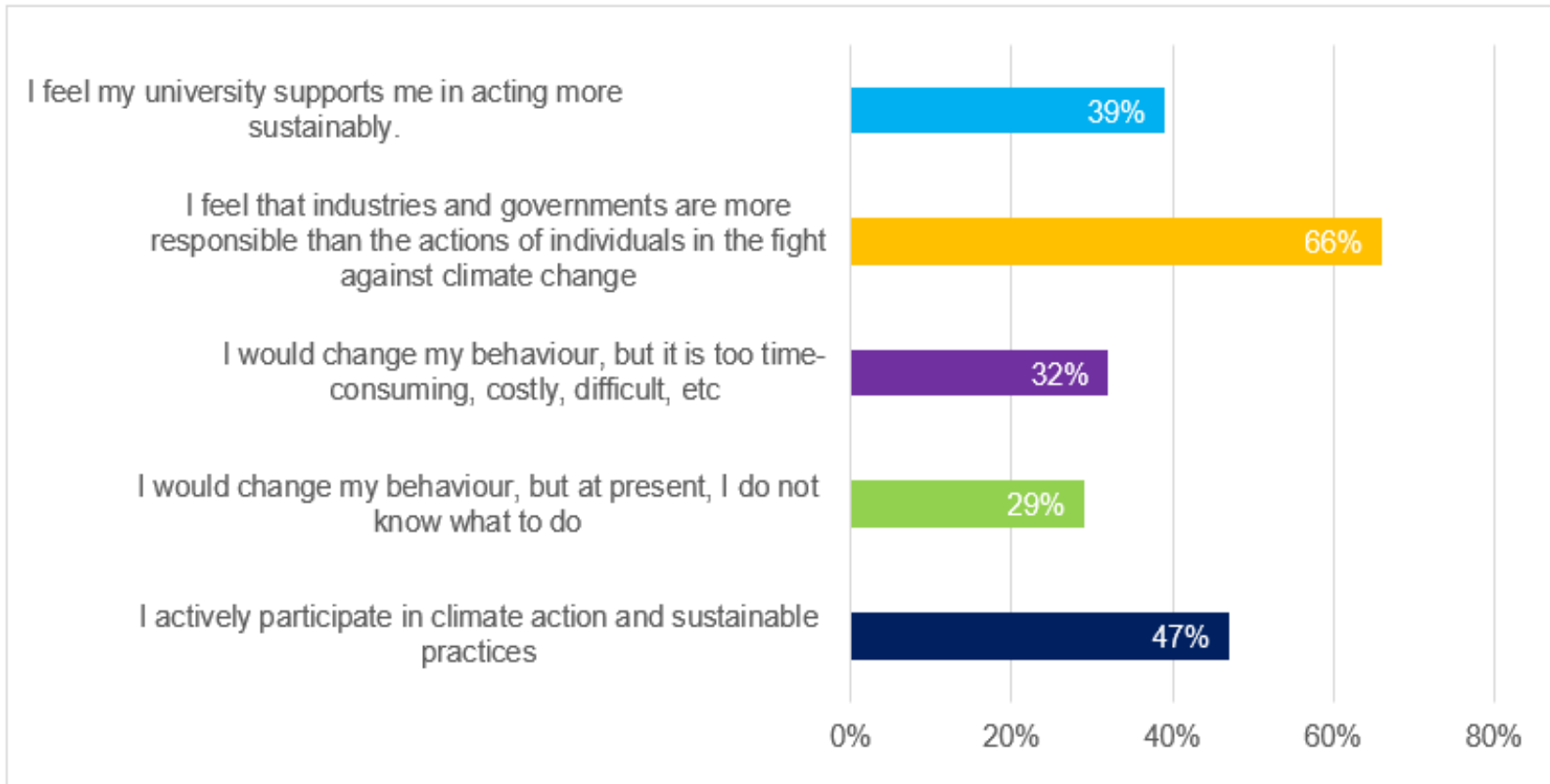
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4. Results: Attitudes Related to Climate Change and Sustainability According to Participants' Background

Assertions	Background of Participants					
	DHBW	IPL	Metropolia	UPHF	Student	Staff
Climate change is a significant concern to me.	76%	87%	69%	76%	74%	91%
I have been affected by the effects of climate change.	63%	43%	57%	43%	52%	66%
Climate change is too complex to be easily addressed.	54%	47%	29%	45%	44%	44%
The current rate of climate change is mostly attributed to human activities.	90%	88%	83%	80%	85%	94%
Climate change is NOT as important as social and economic issues.	14%	9%	14%	16%	15%	7%
Climate change presents a threat to both present and future generations.	93%	91%	83%	83%	63%	72%

When assessing the participants' perceptions, views, and attitudes according to the background of participants, there were few noteworthy revelations.

The most significant was that climate change was the greatest concern for IPL respondents (87%) and staff (91%)

4. Results: Behavourial Practices Related to Climate Change and Sustainability

I feel my university supports me in acting more sustainably. — 39%

I feel that industries and governments are more responsible than the actions of individuals in the fight against climate change — 66%

I would change my behaviour, but it is too time-consuming, costly, difficult, etc — 32%

I would change my behaviour, but at present, I do not know what to do — 29%

I actively participate in climate action and sustainable practices — 47%

47% of participants confirmed that they actively participate in climate action and sustainable practices. Interestingly, 32% of participants expressed uncertainty or neutrality when it comes to participating in sustainable practices. This number aligns closely with the percentage of participants who stated that they do not have adequate knowledge on how to change their behaviour (29%) or were unsure/neutral about having the required knowledge (32%) to behave sustainably. When considering if participants would change to more sustainable behaviour, 40% expressed that they were not limited by time, cost, or ease of implementation, whereas 32% expressed the opposite.

Participants also recognised the role of governments and industries in climate action, with 2/3 of respondents citing that these groups have more substantial influence than individual action in addressing the climate change issue.

Likewise, participants felt their universities could do a better job supporting more sustainable behaviour. Only 39% of participants affirmed that their universities were doing a satisfactory job.
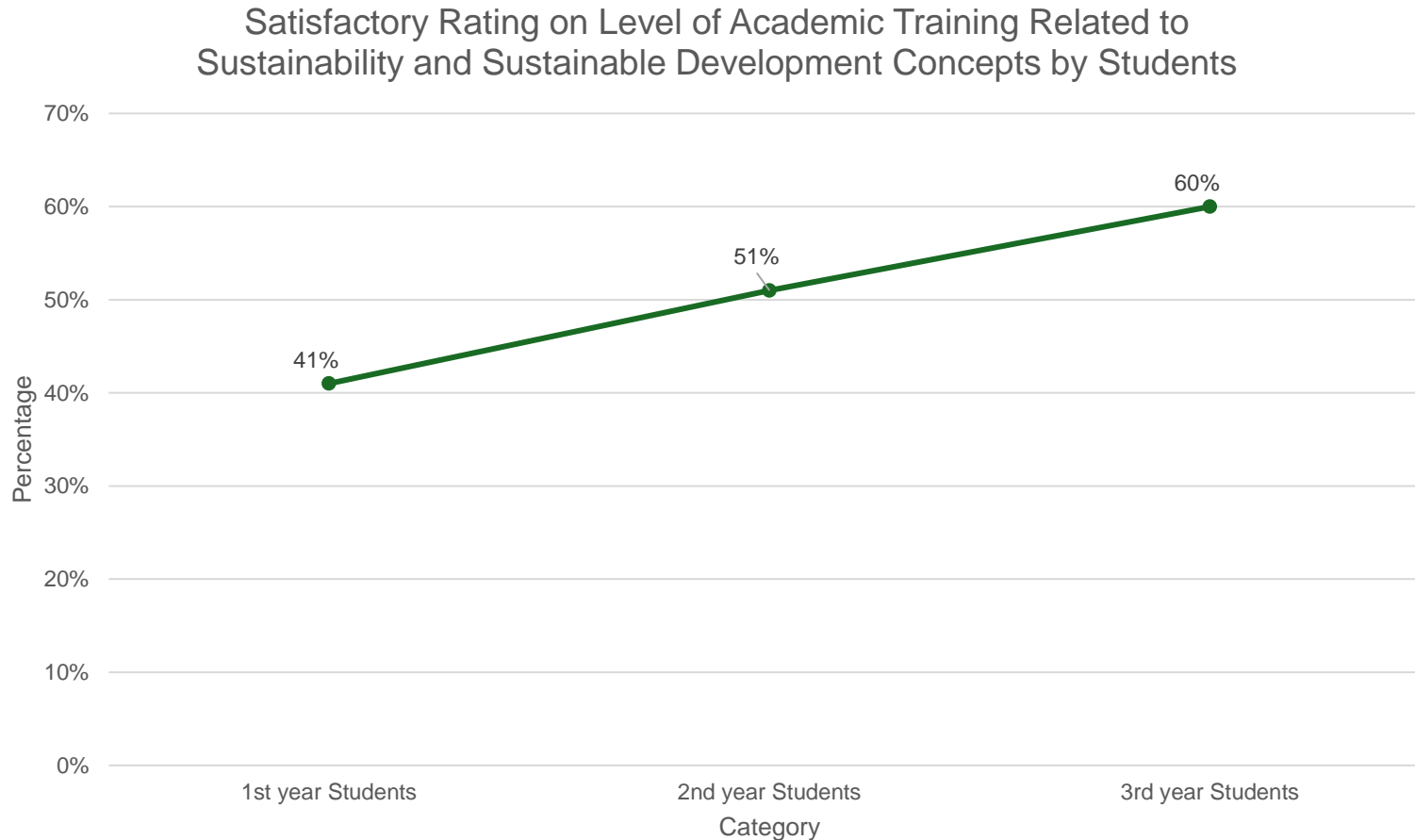
4. Results: Behavourial Practices Related to Climate Change and Sustainability According to Participant's Background

Assertions	Background of Participants					
	DBHW	IPL	Metropolia	UPHF	Student	Staff
I actively participate in climate action and sustainable practices	41%	54%	49%	49%	43%	66%
I would change my behaviour, but at present, I do not know what to do.	22%	37%	20%	45%	30%	19%
I would change my behaviour, but it is too time-consuming, costly, difficult, etc.	34%	26%	28%	38%	34%	19%
I feel that industries and governments are more responsible than the actions of individuals in the fight against climate change.	69%	58%	71%	60%	68%	51%
I feel my university supports me in acting more sustainably.	30%	51%	47%	34%	38%	44%

Participants from all campuses mostly agreed that industries and governments were more responsible in the fight against climate change than the actions of individuals. Participants from all campuses opined that they had adequate knowledge to change their behaviour, except UPHF, with 45% stating that they would change their behaviour but did not know what to do.

When looking at the differences between students and staff, the most significant observation was that staff was more active than students in climate action and sustainable practices (66%:43%). Additionally, students and staff expressed dissatisfaction with the sustainability offerings at their universities, but more so the staff (44%:38%). These results support the earlier sentiments expressed by participants regarding the need for supplementary training and the development of sustainability skills.

4. Results: Relationship between Sustainable Education and Awareness, Attitude and Behavioural practices Among Students

Satisfactory Rating on Level of Academic Training Related to Sustainability and Sustainable Development Concepts by Students
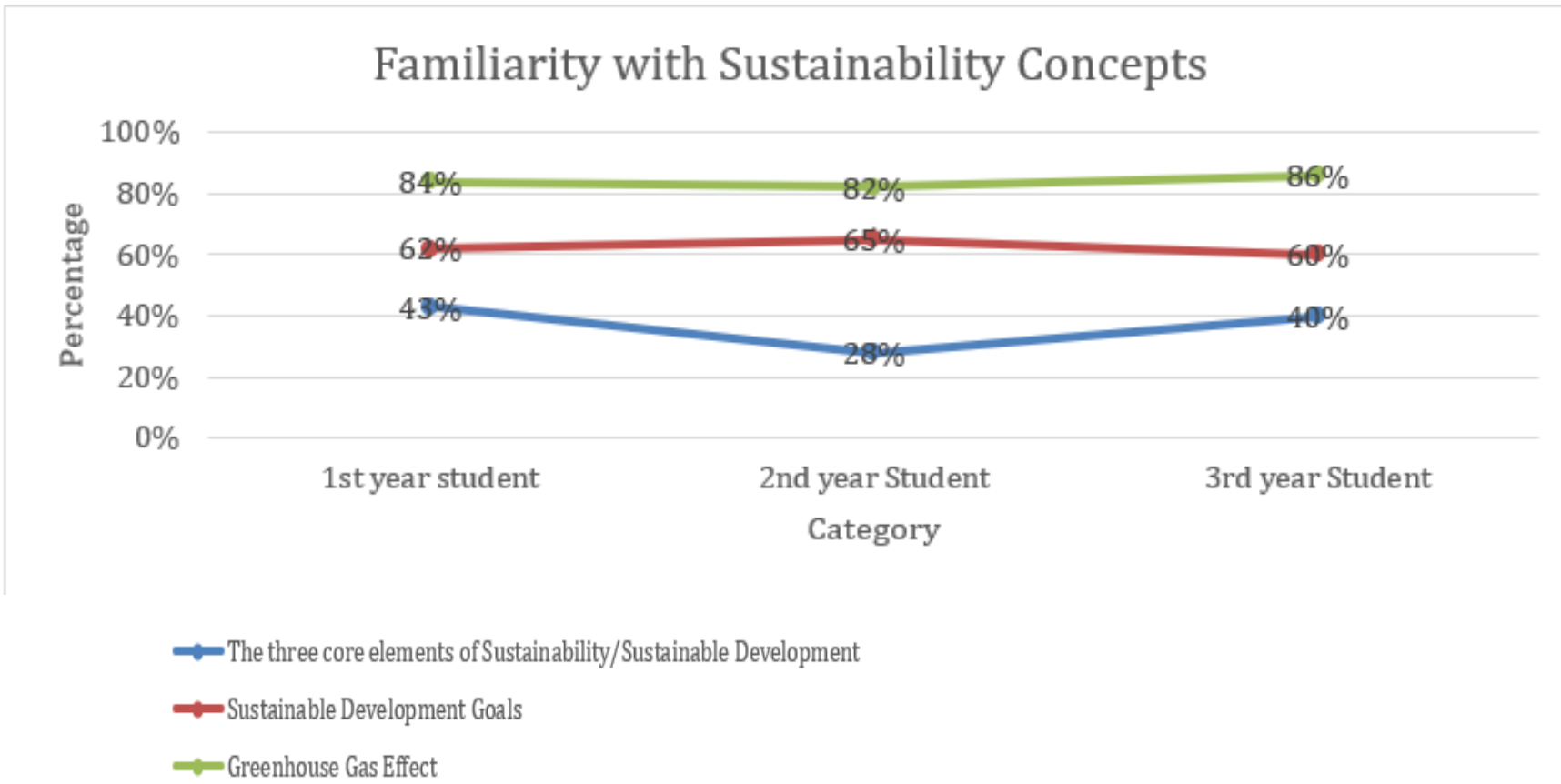

To determine if increasing educational levels impact students' awareness, attitudes, and behavioural practices, the student's educational level was compared to their views on their level of training and familiarity, perception, and behaviour related to sustainability and climate change themes.

First-, second- and third-year students were chosen as the focus group as they represented the majority of participants, and the bachelor's degree is a three-year program for several partner universities.

The data showed that as the students' education level increases, so does the satisfaction rate with their sustainability training. There was a 10% increase from year 1 to year 2 and a 9% increase from year 2 to year 3.
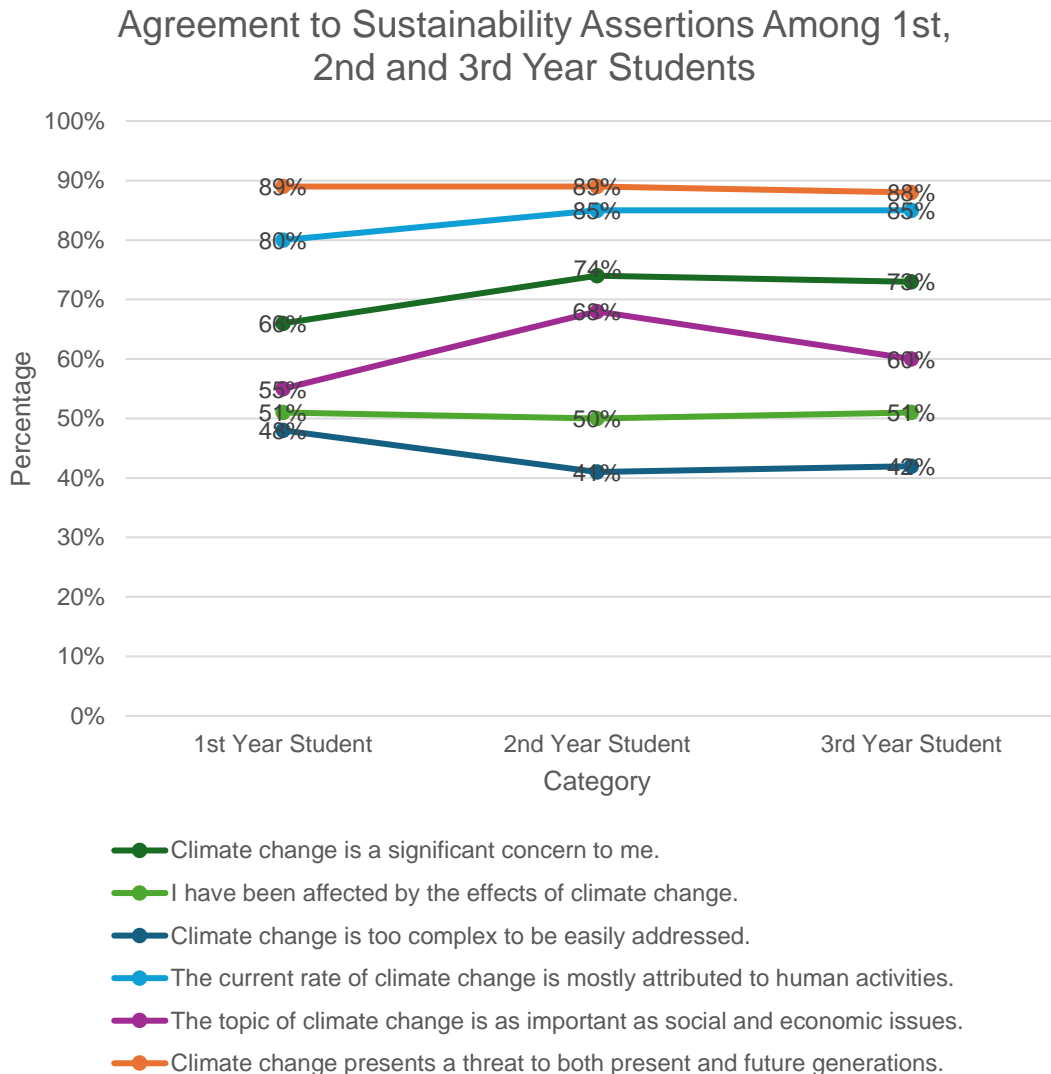
4.Results: Relationship between Sustainable Education and Awareness

Familiarity with Sustainability Concepts

- The three core elements of Sustainability/Sustainable Development
- Sustainable Development Goals
- Greenhouse Gas Effect

All categories of students are familiar with the greenhouse gas effect and relatively familiar with the SDGs. The three core elements of sustainability were the least familiar concept, with second-year students demonstrating the least familiarity.

The data also shows that familiarity with sustainability concepts did not increase with students' educational level.

4. Results: Relationship between Sustainable Education and Pro-Sustainable Attitudes

Agreement to Sustainability Assertions Among 1st, 2nd and 3rd Year Students

Chart showing percentage agreement across 1st, 2nd and 3rd Year Students:

- **Climate change is a significant concern to me.** (dark green): 66%, 74%, 73%
- **I have been affected by the effects of climate change.** (green): 51%, 50%, 51%
- **Climate change is too complex to be easily addressed.** (dark blue): 48%, 41%, 42%
- **The current rate of climate change is mostly attributed to human activities.** (light blue): 80%, 85%, 85%
- **The topic of climate change is as important as social and economic issues.** (magenta): 55%, 68%, 60%
- **Climate change presents a threat to both present and future generations.** (orange): 89%, 89%, 88%
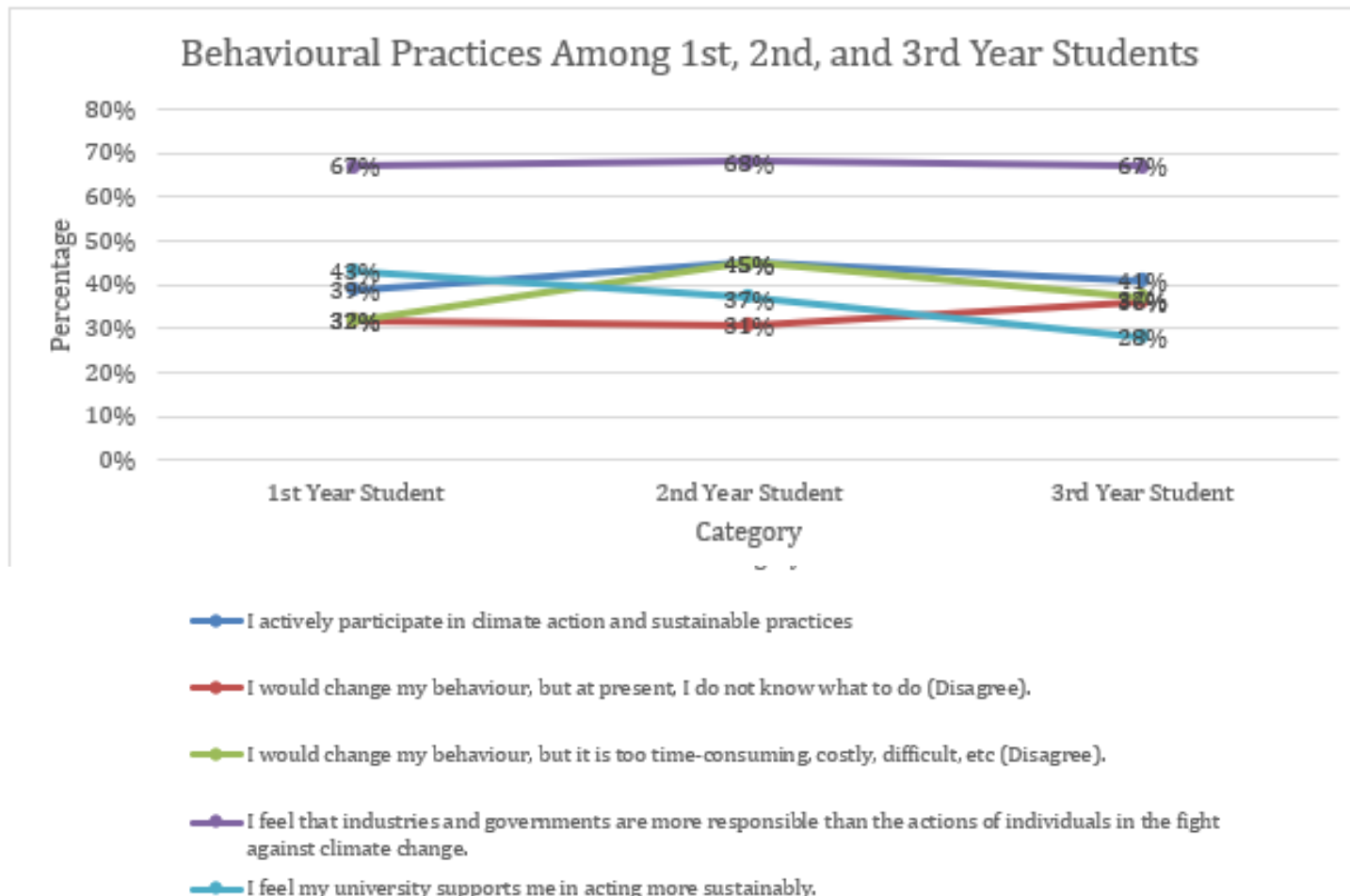
The numbers indicate that all categories largely believed: 'the current rate of climate change is largely attributed to human activities' and 'the topic of climate change is as important as social and economic issues.'

The percentage of students who reported being affected by climate change or saw climate change as being too complex to be easily addressed remained relatively the same from year 1 to year 3.

A noteworthy observation is that the agreement with the assertions 'climate change is a significant concern to me' and 'the topic of climate change is as important as social and economic issues' increased from the first to the second year.

It is, therefore, hard to conclusively state if increasing educational level leads to pro-sustainability attitudes

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4. Results: Relationship between Sustainable Education and Pro-Sustainable Behaviour

Behavioural Practices Among 1st, 2nd, and 3rd Year Students

Legend:
- I actively participate in climate action and sustainable practices
- I would change my behaviour, but at present, I do not know what to do (Disagree).
- I would change my behaviour, but it is too time-consuming, costly, difficult, etc (Disagree).
- I feel that industries and governments are more responsible than the actions of individuals in the fight against climate change.
- I feel my university supports me in acting more sustainably.

Students from all categories (Year 1: 68%; Year 2: 67% and Year 3: 68%) largely recognised the role of industries and governments in the fight against climate change. However, all groups barely recognised the role of individual action, with low numbers reporting behaving sustainably or taking part in climate action. The most active group was Year 2, with 45%.

The majority of students did not identify limiting factors such as knowledge, cost, time, or ease of implementation (from Year 1 to Year 3) to explain their lack of personal involvement.

A key observation was the negative correlation between educational level and the belief that universities support sustainable behavioural practices.

5. Discussion: Participants' Demographics

The survey results were predominantly influenced by the views of students, as they constituted over 80% of the participants. Staff members (lecturers and administration) were, therefore, markedly underrepresented. This disparity may be due to the perception that the survey's objectives were primarily focused on students' needs.

As the willingness of leaders, policymakers, decision-makers, and other administrative staff within the university community is often missing, it has slowed and resulted in failed attempts at the sustainable transition of educational institutions (Avila et al., 2017).

The underrepresentation of staff highlights the need to actively engage and motivate these university members if a community in which sustainability is not just a word but a way of being.

Recommendation 1

Explore innovative training activities, e.g. serious games, and promote lifelong learning opportunities to motivate and regularly train the university's staff members so as to increase interest and involvement in sustainability initiatives.

5. Discussion: Sustainable Education and Awareness

The quality of the teaching activities for the partner universities was evaluated by assessing the staff's experience with sustainability-related teaching projects and knowledge of sustainability competency frameworks, the adequacy of student's skills, the level of academic training, and familiarity with key sustainability themes.

67% (48 participants) of staff across the four universities reported having experience working on sustainability-related projects or teaching sustainability concepts. These results may be biased, as individuals with a stronger interest in sustainability were likely more inclined to participate. Environmental training (20%) and science/technology (43%) were the most prevalent specialisations among staff. This distribution aligns with the survey's broader dissemination within the engineering departments.

Despite the staff's background, over 60% reported not knowing about sustainability competences frameworks. These frameworks are recognised as providing common ground and guidance for learners and educators, advancing a consensual definition of sustainability competences, and responding to the growing need for people to improve and develop the knowledge, skills, and attitudes to live, work, and act sustainably (European Commission, 2024).

Recommendation 2

Establish and promote the use of Sustainability Competence Frameworks to assess the quality of sustainability teaching and to identify best practices and gaps in sustainability offerings

# 5. Discussion: Sustainable Education and Awareness

Approximately 32% of the staff believed that students had sufficient skills to meet the sustainability requirements of the job market. The best assessment of students' skill sets was that of the IPL staff, with 52% believing their students had adequate sustainability skills. Although the response may indicate that the staff was uncomfortable with the question, it confirms a general lack of confidence in students' sustainability competences.

The inadequacy in training was again reflected by participants when they were asked to rate their level of academic training, with 51% confirming that either they were extensively or adequately trained. Participants from Metropolia University (59%) expressed the highest satisfaction with their level of academic training.

In analysing the awareness of sustainability concepts, 40% of participants indicated they were either extremely familiar or familiar with these concepts, with staff reporting higher familiarity than students. The most familiar concept was the greenhouse gas effect, which over 80% of participants reported being extremely familiar or familiar with. The least familiar concept was the three core elements of sustainability/sustainable development. The campus most familiar with the aforementioned concept was IPL (54%), closely followed by the UPHF campus with 52%.

A further analysis of the awareness level of participants was done by assessing their knowledge of mechanisms involved in climate change. Although participants demonstrated a satisfactory level of knowledge relating to the causes and consequences of climate change, the results also indicated that there is a need for further knowledge building as 80% of participants attributed water pollution as a contributing factor to climate change, and 30% agreed to or were unsure as whether climate change led to decreasing sea levels.

Recommendation 3
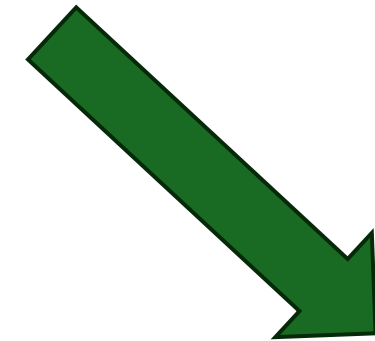
Execute a comprehensive curriculum analysis to explore best-case practices within the EFEU Consortia and associated institutions of higher learning

5. Discussion: Sustainable Attitudes and Behavioural Practices

Several notable observations were made while exploring participants' attitudes and behaviour. Most participants expressed concern over the climate change issue, with 76% of participants viewing climate change as a significant concern and 89% of participants seeing climate change as a threat to both present and future generations. Per group, the topic of climate change was seen as most significant to the Portuguese participants (87%), although the group reported being less affected by climate change (43%).

These results indicate that although groups may perceive themselves as being unaffected by climate change, they recognise the relevance of the climate crisis and are concerned about its current and protracted threats.

The results also confirmed that participants attached value to environmental issues, as 86% expressed that climate change is as important as social and economic issues. Over 50% of participants believed climate change was too complex to address.

The findings revealed a mixed perspective: Participants are hopeful about combating climate change, yet they lack a complete understanding of the complexities involved in addressing the crisis.

Participants (86%) recognised that the current rate of climate change is attributed to human activities. Nevertheless, only 47% reported participating in climate action or sustainability practices. The most active groups were staff (66%) and Portuguese participants (54%). Participants also recognised the role of governments and industries, with 66% viewing these parties as crucial in the fight against climate change.

These views demonstrate that participants recognised the role of human activities in the climate change phenomenon and the relevance of governmental agencies and the industrial sector in implementing mitigating measures. The results also indicate the lack of personal commitment to the climate change fight.

Recommendation 4

Implement surveys and further research to determine factors that limit sustainable behaviour and if and how these factors can be addressed.

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5. Discussion: Sustainable Attitudes and Behavioural Practices

Though participants demonstrated pro-environmental or sustainable attitudes, these attitudes do not translate into sustainable behavioural practices. This observation aligns with findings by Carrington et al. (2014) and Juvan and Dolnicar (2014), who stated that positive environmental attitudes and intentions are, unfortunately, not always and entirely reflected in people's behaviour.

Many participants did not attribute knowledge, cost, time, or difficulty in implementing sustainable practices as limiting factors in behaving sustainably. However, they acknowledged (61%) that their universities were not doing enough to promote sustainable behaviour. The Portuguese respondents (51%) reported the best performance, which was closely followed by Metropolia (47%).

These findings highlight the relevance of suggestions by Dabija et al. (2017), who recommended that understanding the causes and impacts of key factors, including their linkages (environmental, education, social, etc.) in building sustainable behaviour, should be a focal area in curricula of universities. It will be necessary to measure how selected sustainability topics or learning activities implemented or intended for implementation impact students' understanding, attitude and behaviour.

Recommendation 4

Implement innovative modes of teaching, employ and enhance incentives, policies, awareness campaigns, etc that motivate behavioural shifts

5. Discussion: The Impact of Education on Awareness, Attitudes and Behavioural Practices

The hypothesis that advanced education enhances awareness, attitude and behaviour was tested by assessing the views of 1st, 2nd and 3rd year students. The findings demonstrated no direct correlation between increasing educational training and awareness levels or attitudes. All categories demonstrated minimal involvement in sustainable behavioural practices. The results show insufficient alignment with the notion posed by researchers such as Hsu (2004), Roth (1992), Sia et al. (1986), and Michaels et al. (2020), who proposed that increased environmental awareness, pro-environmental attitude and sustainable behaviour of individuals are reflected in the increase in environmental knowledge. It is essential to note that the survey sample was small and the analysis was limited to only bachelor students.

The focus group also revealed that although satisfaction in sustainability training increased from year one to year three (41%, 51%, and 60%), students did not feel that their universities supported them in acting sustainably. 43% of first-year students, 37% of second-year students, and 28% of third-year students expressed satisfaction with their universities' performance.

Recommendation 5

Present findings from assessments, analyses, surveys, etc. to established focus groups or review committees, with a diverse mix of stakeholders including students, to facilitate open discussions on current teaching practices and the curricula, and to identify opportunities for refining sustainability offerings at appropriate intervals and stages of the university experience.

5. Discussion
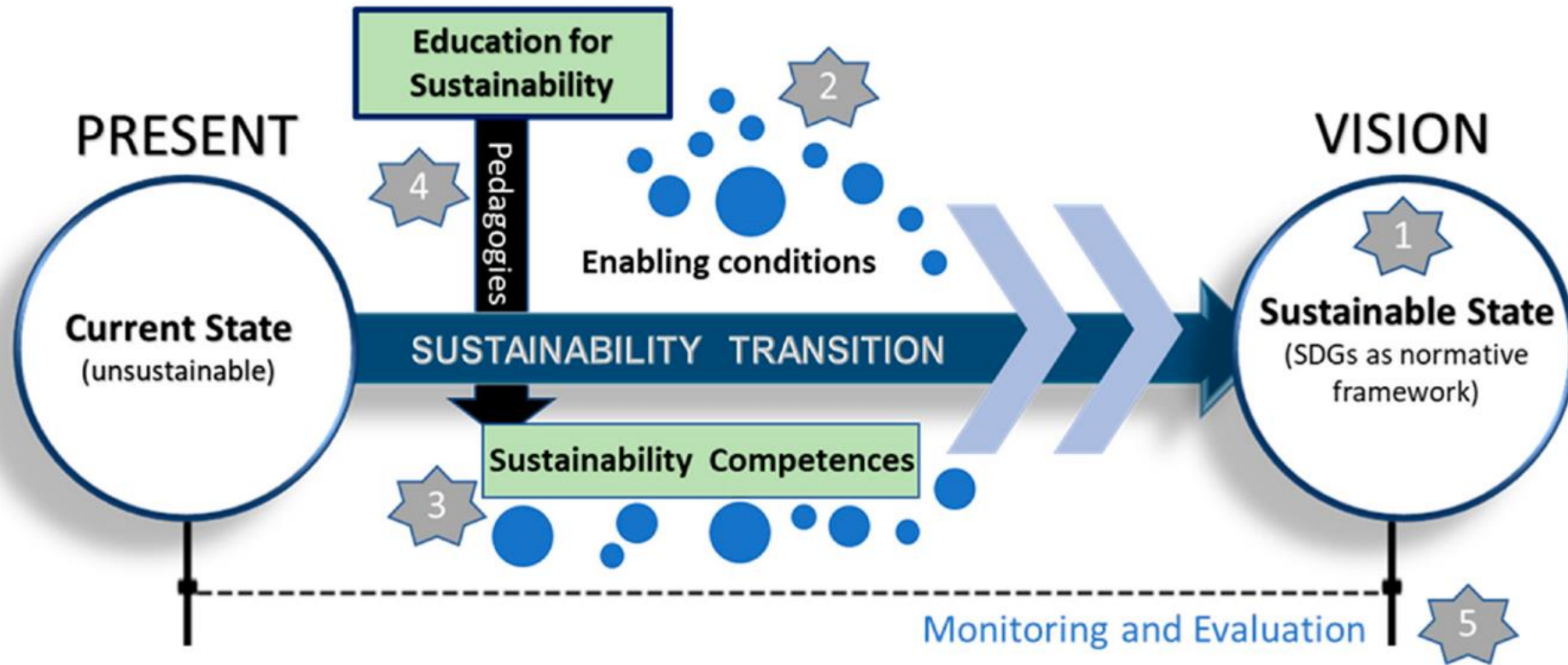
Kioupi and Voulvoulis, 2019

Suggested Education Framework for Sustainable Transformation

6. Conclusion

Institutions of higher learning are invaluable players in the transformative shift needed to engender sustained thinking, attitudes, and actions that support sustainability. Therefore, universities must fully integrate sustainability aspects into their mission, vision, objectives, and philosophy. Moreover, consideration has to be given to formal committees, roles and responsibilities, assessment frameworks, policy, teaching, and, in particular, curriculum development that supports effective knowledge transfer (Malik et al., 2019).

This study revealed noteworthy conclusions and key considerations in the future development of the engineering programs of the included case studies. Firstly, staff (lecturers and administration) was underrepresented. Staff is essential in the sustainable education discourse. Both administration and lecturers must work collaboratively to create a culture of sustainability within educational institutions. This holistic approach ensures that sustainability is embedded in every aspect of education, from policy to practice.

Secondly, though the partner universities provide ample training opportunities, these have to be uniquely tailored and crafted to meet the sustainability demands of the job market and support the necessary attitudinal and behavioural shifts. An overarching goal is that relevant knowledge is transferred to the university community so that members are conscious, conscientious and proactive agents of the sustainability movement within their personal and professional realms. A more immediate and specific goal is to ensure staff and students are more knowledgeable about basic and pertinent concepts such as climate change. Additionally, universities should continuously employ and enhance incentives, policies, awareness campaigns, etc, that increase awareness and motivate sustainable behaviour.

6. Conclusion

Thirdly, universities must ensure that the quality of sustainable learning and teaching activities is measured regularly. As assessments (e.g., competence framework, curriculum analysis, sustainability certificates, and sustainability awareness surveys) provide an overview of baseline conditions, it is strongly suggested that partner universities incorporate them to track their performance. These are valuable instruments as they identify strengths, weaknesses, and opportunities for advancement. The results of these assessments must be shared with the universities' stakeholders, in particular students, to ensure their views and recommendations are integrated into key decision-making processes.

It is fair to conclude that partner universities, like many other educational institutions, facilitate knowledge transfer, capacity building, and raising awareness of critical sustainability issues. However, these universities need to make the necessary re-adjustments to more closely align with the global standards for education for sustainable development and evolving demands within the field of engineering. As engineers are tasked with tackling the increasingly complex societal challenges of the 21st century, higher education institutions must rethink their approach to preparing them for the future. The results of the EFEU will prove crucial for guiding the next steps for the four partner universities.

**Thank You!
Danke! Merci!
Obrigado! Kiitos!**