



SCABEE Teaching Case Studies' Impact Assessment

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of Technology



Dissemination level

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About the SCABEE project

Climate Change is one of the most crucial challenges humanity must confront in an urgent manner. Therefore, the SCABEE project aims at strengthening sustainability skills & critical thinking of engineering and business students. This helps planting sustainability in future engineers' and managers' mindsets on partner level and beyond.

The project SCABEE introduces sustainability teaching and thinking in business and engineering study degrees as a persistent leitmotif. Students will discover sustainable products and solutions through Sustainability Teaching Case Studies and develop a more sustainable behaviour in their personnel and future professional life. They will also transport their knowledge and behaviour to their companies and thereby contribute to the green transition of the European industry and help saving our planet for future generations.

SCABEE partners will produce a total of 16 Teaching Case Studies with a focus on sustainability that can be used in higher education institutions as well as vocational education training courses.

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List of abbreviations

<i>Composite</i> ≥ 4	Percentage of forms in which the respondent level mean score for the entire dimension was equal to or higher than 4
ESTA	ESTA Belfort, www.esta-groupe.fr/en
FHV	Fachhochschule Vorarlberg, Austria, www.fhv.at/en
mean	Average composite dimension score calculated from responses on a five-point Likert scale ranging from 1 to 5
MQ	Main Question
N	Number of respondents to a survey
SD	Standard deviation of the respondent level composite scores
SDG	Sustainability Development Goal (see sdgs.un.org/fr/goals)
SUT	Silesia University of Technology, www.polsl.pl/en/
SQ	Sub-question
SD-SQ	Sample standard deviation across the mean scores of the Sub-questions included in a Main Question dimension
TCS	Teaching Case Study
UCN	University College Northern Denmark, www.ucn.dk

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1 Introduction

16 SCABEE Teaching Case Studies were implemented during four rounds between December 2024 and June 2026. Each round included four cases led by ESTA, SUT, FHV and UCN. The cases addressed different environmental and industrial topics and were designed for use in engineering, business and interdisciplinary study programmes. Their diversity made it possible to examine the application of sustainability education across different institutional settings, fields of study and groups of students.

The evaluation framework was developed in Deliverable D5.1 (SCABEE Consortium, 2025) and applied through common online forms completed by students and teachers. The evaluation considered the relevance, coherence, effectiveness, efficiency, perceived impact, continuity and long-term value of the Teaching Case Studies. It also examined their contribution to environmental awareness, sustainability competences and higher cognitive skills.

This report presents a descriptive and comparative evaluation of the four implementation rounds. It combines student and teacher perspectives, identifies the main strengths of the Teaching Case Studies and highlights areas that may require further development. The results are intended to support quality assurance and the future use of sustainability-focused Teaching Case Studies within and beyond the SCABEE project.

1.1 Objective of the evaluation

The objective of the evaluation was to assess the quality and perceived educational impact of the 16 SCABEE Teaching Case Studies implemented across four rounds. In particular, the evaluation aimed to examine their relevance to students' study programmes, coherence with the teaching process, effectiveness, efficiency, contribution to sustainability competences, perceived impact and potential for continued use.

A further objective was to compare the perspectives of students and teachers and to identify results that were consistent across both groups. The analysis also sought to identify differences between implementation rounds and individual Teaching Case Studies, while taking into account variations in institutional context, case content and sample size.

The evaluation was descriptive and did not include a measurement conducted before implementation or a control group. Consequently, the findings reflect respondents' assessments and perceived effects rather than direct evidence of causal changes resulting from participation in the Teaching Case Studies.

Table 1 presents the 16 Teaching Case Studies included in the four implementation rounds, together with the project institution responsible for leading each case.

Table 1. Teaching Case Studies by implementation round and lead institution

Round	TCS	Teaching Case Study	Lead University
1	TCS01	Ananké: It's all about Energy!	ESTA
1	TCS02	Sunshine for production!	SUT
1	TCS03	AlluVance Solutions GmbH	FHV
1	TCS04	Design for Material Change	UCN
2	TCS05	ICTYOS: French Tannery SEA LEATHER	ESTA
2	TCS06	It's Just Air? Think Again.	SUT
2	TCS07	Return on CO2	FHV
2	TCS08	Taking Back the Future - Take-Back Programme	UCN
3	TCS09	Sustainable Promotion Mix	ESTA
3	TCS10	Acrylic bathtub	SUT
3	TCS11	Designing for Sustainability - From Idea to Circular Impact	FHV
3	TCS12	Growing into the future	UCN
4	TCS13	From Manual Tasks to Value-Added Roles	ESTA
4	TCS14	Efficiency and Sustainability (E&S)	SUT
4	TCS15	Mapping the Storm - Designing a Climate Resilience Dashboard for a Regional Community	FHV
4	TCS16	Modular fireplace	UCN

1.2 Methodology

The quality evaluation of the four SCABEE Teaching Case Study (TCS) implementation rounds combined two complementary perspectives: structured peer review and post-implementation evaluation conducted by teachers and project partners, and student-based evaluation. The methodological framework followed the common measurement architecture developed in Deliverable D5.1 and was applied consistently across four implementation rounds covering 16 individual Teaching Case Studies: TCS01-TCS04, TCS05-TCS08, TCS09-TCS12 and TCS13-TCS16. Quantitative responses were collected using a five-point Likert scale, where 1 represented the lowest and 5 the highest level of agreement or assessment. The descriptive analysis included response frequencies, mean scores, standard deviations, percentages of positive responses, aggregated Main Question scores and the synthetic TCS Impact Index (TCS_{impact}). No inferential statistical tests were applied, as the purpose of this chapter was to provide a descriptive and comparative assessment of the quality and perceived impact of the SCABEE Teaching Case Studies.

The Student TCS Impact Index was calculated as a weighted arithmetic mean of the six Main Question (MQ) dimensions:

$$TCS_{impact} = \frac{\sum_{i=1}^6 w_i MQ_i}{\sum_{i=1}^6 w_i},$$

where:

MQ_i - represents the respondent-level mean score for Main Question dimension i ;

w_i - represents the weight assigned to Main Question dimension i , defined as:

$$w_i = \begin{cases} 1, & i \in \{1,2,3,4\}, \\ 2, & i \in \{5,6\}. \end{cases}$$

For every item and aggregate, the analysis reports the number of valid responses, response frequencies, arithmetic mean, sample standard deviation and the percentage of positive responses. Aggregated student dimensions were calculated at respondent level before averaging. Each MQ dimension consisted of several Sub-questions (SQs). In Annex C, SD-SQ denotes the sample standard deviation across the mean scores of the Sub-questions included in a given MQ dimension. It therefore describes variation between the mean Sub-

question scores within the dimension rather than variation between individual respondents. The report-oriented dimensions were Relevance (SQ1.1-SQ1.3), Coherence (SQ2.1-SQ2.3), Effectiveness (SQ3.1-SQ3.4 and SQ4.1), Efficiency (SQ4.2-SQ4.3), Impact (SQ5.1-SQ5.3), Continuity (SQ6.1-SQ6.2) and Long-term effect (SQ6.3).



2 Ensuring quality of SCABEE TCS:

Quality assurance was assessed from two complementary perspectives. Teachers and project partners evaluated implementation quality, relevance, coherence, effectiveness, efficiency, sustainability competences, impact on teaching practice, continuity and transfer. Students assessed the perceived quality, usefulness and long-term effects of the learning experience. Combining these perspectives provides a more comprehensive evaluation and helps identify both consistent findings and differences related to particular TCS implementations.

2.1 Peer-review and teacher-based quality assurance

The first level of quality assurance were the peer-reviews conducted by project partners using a common template (SCABEE Consortium, 2025). The reviews covered thematic relevance, significance for students, correctness and quality of content, level of difficulty, presentation, completeness of supporting materials, sustainability competences and the intended cognitive level based on Bloom's taxonomy. The feedback was provided to the TCS authors and used as a formative quality-assurance mechanism to support the further refinement of the cases. As the peer reviews were intended primarily for developmental purposes, no aggregate analysis is presented in this report.

After each implementation, teachers completed the teacher evaluation form described in SCABEE Consortium (2025) allowing to report statistical figures about the class as well as the teacher's evaluation of the performance of the implemented TCS. A total of 38 completed forms (out of 38 implementations) have been submitted after the TCS implementations. These forms provide quantitative information about implementation quality. However, they do not represent a fully balanced evaluation as most forms were completed by the teacher/institution that led or implemented the particular TCS.

2.2 Quality evaluation by students

The overall Student TCS Impact score was 3.77/5. Teacher evaluations were also positive, with an overall TCS quality mean of 4.35 and a mean score of 4.21 for Impact on Teaching Practice. Students rated Efficiency, Coherence and long-term effects particularly well, while teachers rated teaching coherence, efficiency, sustainability competences and continuity/transfer is 4.30.

The evaluation also shows that quality varied across cases and rounds. Round 2 was the strongest student round and, together with Round 3, the strongest teacher round. TCS06 and TCS10 performed strongly from both perspectives. TCS08, "Taking Back the Future: Take Back Programme", demonstrated applicability across project partner institutions.

3 Gathering homogeneous data from students & teachers

3.1 Overall methodology

Homogeneous data collection was organised through the beforementioned peer-review template and common online forms based on the framework defined in Deliverable D5.1. Online survey forms had been created for teachers' evaluations and students' evaluations, these latter available in English, Danish, French, German, and Polish (SCABEE Consortium, 2025). Peer-reviews have been conducted by partners, whereas evaluation forms have been done immediately after each Teaching Case Study implementation. T

Access links were provided through QR codes included in the student documentation and the teacher's note (SCABEE Consortium, 2024b); an example is presented in Annex B). This approach ensured that the same core questions, response categories and TCS identifiers were used across project institutions, countries and implementation rounds.

The data processing procedure consisted of four stages: validation of complete survey records, numerical coding of the five-point scales, standardisation of institution names and TCS labels, and calculation of individual item and composite indicators. Submission identifiers were used only to verify that each record was unique. The analytical workbook provided with this report contains anonymised processed data and transparent Excel formulas for all composite measures.

3.2 Teacher evaluation form

The teacher form combined implementation metadata with 24 scored evaluation items and one Bloom's taxonomy item. Metadata captured the TCS identifier, teaching case title, institution, country, field and year of study, and the number of participating students. The scored blocks covered metadata (seven items), relevance for student awareness (three items), coherence with regard to study programme (two), effectiveness for discovering concrete solutions/actions (four), efficiency of the set-up (three) as well as questions with regard to the five competencies defined in the SCABEE Analysis Framework (SCABEE Consortium, 2024a).

Agreement items ranged from 1 (strongly disagree) to 5 (strongly agree). The sustainability-competence block used 1 (very low) to 5 (very high). Teachers also selected the highest Bloom level reached: Remember, Understand, Applying, Analyze, Evaluate or Create. The original template is referenced in SCABEE Consortium (2024a) and can be reproduced in the report annex.

Table 2 presents the aggregated results of the evaluations completed by teachers after the implementation of the Teaching Case Studies (where: *N* - the number of completed teacher evaluation forms; *Mean* - the average composite dimension score calculated from responses on a five point Likert scale ranging from 1 to 5; *SD* - the standard deviation of the respondent level composite scores; *Composite ≥ 4* - the percentage of forms in which the respondent level mean score for the entire dimension was equal to or higher than 4).

Table 2. Teacher evaluation: aggregated results

Dimension	N	Mean	SD	Composite ≥ 4
MQ1 Student awareness	38	4.32	0.98	78.90%
MQ2 Teaching coherence	38	4.36	0.96	86.80%
MQ3 Effectiveness	38	4.28	1.02	78.90%
MQ4 Efficiency	38	4.42	0.98	86.80%
MQ5 Sustainability competences	38	4.36	0.69	78.90%
Impact on Teaching Practice	38	4.21	1.05	84.20%
Continuity and transfer	38	4.30	0.98	89.50%

The overall TCS quality mean across MQ1 to MQ5 was 4.35 out of 5. Impact on Teaching Practice achieved a mean score of 4.21, while Continuity and Transfer achieved a mean score of 4.30. The highest-rated aggregate dimension was Efficiency (4.41), followed by Teaching Coherence (4.36) and Sustainability Competences (4.35). The relatively high score for Continuity and Transfer indicates a generally strong intention among

teachers to reuse, disseminate or further develop the cases. presents the Bloom's taxonomy levels selected by teachers in the evaluation forms.

Table 3. Bloom's taxonomy levels selected in teacher evaluation forms

Bloom level	Forms	Share	Cognitive class
Remember	0	0.0%	Lower-order
Understand	2	5.3%	Lower-order
Applying	6	15.8%	Lower-order
Analyze	8	21.1%	Higher-order
Evaluate	14	36.8%	Higher-order
Create	8	21.1%	Higher-order

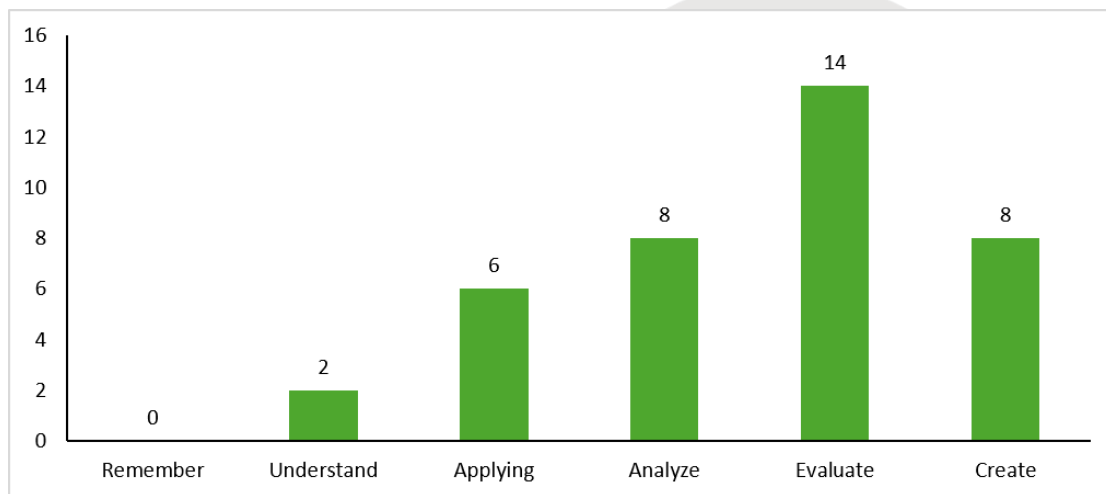


Figure 1. Bloom level selected by teachers

The highest selected cognitive level was Evaluate in 14 of 38 forms (36.8%), followed by Analyze and Create, each selected in eight forms (21.1%). Applying was selected in six forms (15.8%) and Understand in two forms (5.3%). Remember was not selected in any form. Taken together, Analyze, Evaluate and Create accounted for 30 forms, or 78.9% of the sample. Bloom categories are ordinal learning-level labels and are therefore reported as a distribution rather than averaged as if they formed an interval scale.

3.2.1 Statistical data

Table 4 presents the number of completed teacher evaluation forms and the number of students who participated in the Teaching Case Study implementations during each round.

Participating students refers to the number of students reported by teachers as having participated in a given TCS implementation. Completed student surveys refers to the number of student evaluation forms included in the analysis. The response rate was calculated as the number of completed student surveys divided by the number of participating students.

Table 4. Implementation data and student survey responses for each Teaching Case Study

Round	TCS	Lead	Teacher forms	Students reported by teachers	Completed student surveys	Response rate
1	TCS01	ESTA	2	87	71	81.6%
1	TCS02	SUT	3	34	17	50.0%
1	TCS03	FHV	1	14	8	57.1%
1	TCS04	UCN	2	28	27	96.4%
2	TCS05	ESTA	1	56	51	91.1%
2	TCS06	SUT	7	96	70	72.9%
2	TCS07	FHV	1	9	6	66.7%
2	TCS08	UCN	6	86+55*	46	32.6%
3	TCS09	ESTA	1	36	33	91.7%
3	TCS10	SUT	4	51	13	25.5%
3	TCS11	FHV	1	4	2	50.0%
3	TCS12	UCN	1	10	10	100.0%
4	TCS13	ESTA	2	46	20	43.5%
4	TCS14	SUT	3	41	41	100.0%
4	TCS15	FHV	1	4	2	50.0%
4	TCS16	UCN	2	12	5	41.7%
			38	614+55*	422+0*	

*55 Students from University of Southern Denmark reported by the teacher, none of them submitted an evaluation

3.3 Student evaluation form

Through the student evaluation forms, partners collected general information about the TCS, including its identifier and title, the student's institution and country, field of study and year of study. It also included one question on environmental awareness and 19 evaluation statements assessed using a five-point Likert scale. The statements covered relevance and awareness, coherence with the study programme, effectiveness, efficiency, impact, continuity and perceived long-term effects. Responses ranged from 1, strongly disagree, to 5, strongly agree. The original survey template is described in Deliverable D5.1 (SCABEE Consortium, 2024a) and may be included in the annex.

3.3.1 Statistical information

The student survey dataset contained 422 complete responses, with no missing values in the scored questions. Student responses were available for 16 Teaching Case Studies. For TCS cases with available information on the number of participants, 412 completed student surveys were matched with 614 + 55 consortium external students from University of Southern Denmark reported by teachers, giving an estimated response coverage of 63.1%.

Table 5. Student responses by country

Country	N	Share	Awareness	TCS Impact
Austria	24	5.70%	4.00	4.13
Denmark	70	16.60%	3.34	3.65
France	181	42.90%	3.26	3.68
Poland	147	34.80%	2.80	3.89

422

Table 6. Student responses by institution

Institution	Responses	Share*
ESTA	181	42.90%
SUT	141	33.40%
UCN	69	16.40%
FHV	24	5.70%
Other**	7	1.70%

422

* Share represents the percentage of all 422 completed student surveys submitted by students from each institution.

** Other refers to respondents working in industry.



4 Impact on students and teachers (data analysis)

4.1 Addressing business & engineering students

The study sample consisted predominantly of students enrolled in engineering programmes and interdisciplinary programmes combining engineering and business. This composition reflects the educational objectives of the SCABEE Teaching Case Studies, which aim to integrate environmental sustainability with technical decision making, economic considerations and the practical implementation of solutions. The participation of students from both fields also supported a broader assessment of the Teaching Case Studies by combining technical and managerial perspectives. Students from all reported years of study were represented in the survey, although second- and third-year students formed the largest groups. This distribution indicates that the evaluation covered participants with different levels of academic experience, while the results primarily reflect the perspectives of students at an intermediate stage of their studies. The study sample consisted of **422 students who completed the student evaluation survey (N= 422)**. It predominantly included students enrolled in engineering programmes and interdisciplinary programmes combining engineering and business.

Table 7. Field of current studies

Field	N	Share
Engineering & Business studies	239	56.60%
Engineering studies	165	39.10%
Business studies	10	2.40%
Other / unspecified	8	1.90%
	422	

Table 8. Year of study

Study year	N	Share
Year 1	32	7.60%
Year 2	165	39.10%
Year 3	152	36.00%
Year 4	14	3.30%
Year 5	47	11.10%
More than 5 years	12	2.80%
	422	

Engineering & Business students accounted for 56.6% of the sample and Engineering students for 39.1%. Pure Business students represented 2.4%. Second- and third-year students together accounted for 317 responses (75.1%), providing substantial evidence from the central phase of undergraduate study.

4.2 Awareness raising of students

The analysis included 422 completed student surveys (N = 422). Mean values are presented together with the standard deviation (SD), which indicates the degree of variation in responses around the mean. A lower standard deviation indicates greater consistency among respondents, while a higher value indicates greater variation in their assessments.

The following tables present descriptive statistics for the student survey results. The same definitions of the statistical measures apply to all tables in this section:

- 🔊 *N* - the number of completed surveys included in the analysis;
- 🔊 *Mean* - the average score calculated from responses on a five-point Likert scale;
- 🔊 *SD* - the standard deviation and indicates the variation in responses around the mean. A lower standard deviation indicates greater consistency among responses, while a higher value indicates greater variation.

Table 9. Personal environmental awareness rating by country

Country	N	Mean	SD	Interested / very interested
Austria	24	4.00	0.72	75.00%
Denmark	70	3.34	1.18	48.60%
France	181	3.26	0.97	41.40%
Poland	147	2.80	1.08	25.9%

Table 10. Overall student evaluation dimensions

Dimension	N	Mean	SD	Composite ≥ 4
Relevance	422	3.70	0.78	49.10%
Coherence	422	3.91	0.67	60.20%
Effectiveness	422	3.85	0.65	51.90%
Efficiency	422	3.93	0.80	68.20%
Impact	422	3.57	0.79	40.50%
Continuity	422	3.82	0.78	61.10%
Long-term effect	422	3.91	0.87	73.70%

Table 11. Awareness, long-term effect and TCS Impact by round

Round	N	Awareness	TCS Impact	Long-term effect
1	123	3.31	3.68	3.79
2	173	3.12	3.91	4.10
3	58	3.21	3.83	3.86
4	68	2.94	3.55	3.66

Across all 422 student responses, Efficiency received the highest mean score ($M = 3.93$), while Coherence and Long-term effect both achieved a mean score of 3.91. These were the highest-rated areas of the student evaluation. The overall synthetic Student TCS Impact Index was 3.77 ($SD = 0.61$). Round 2 achieved the highest average Student TCS Impact Index ($M = 3.91$), followed by Round 3 ($M = 3.83$), Round 1 ($M = 3.68$), and Round 4 ($M = 3.55$).

The statement "I think the effects of Teaching Case Studies remain in the long term" received a mean score of 3.91, with 73.7% of students selecting "Agree" or "Strongly agree". This result provides the clearest student-survey indication that the effects of the Teaching Case Studies were perceived as extending beyond the immediate classroom activity. However, because the survey measured students' expectations rather than outcomes observed over time, the result should not be interpreted as evidence that long-term effects actually occurred. Skills and mindset evolution of teachers

Teacher responses indicated a strong perceived effect on both student learning and teaching practice. The five Part B dimensions all exceeded 4.2/5 overall. The teacher-impact and continuity blocks also remained above 4.2, suggesting that most respondents saw value not only in the implemented TCS but also in reusing sustainability-oriented cases, sharing them with colleagues and developing further teaching content.

Table 12. Teacher results by implementation round

Round	Forms	Participants	Overall TCS quality mean	Impact on teaching practice	Forms indicating Analyze, Evaluate or Create (%)
1	8	163	4.45	4.33	62.50%
2	15	302	4.64	4.58	86.70%
3	7	101	4.67	4.57	85.70%
4	8	103	3.42	3.08	75.00%

Overall TCS quality mean represents the aggregated result for MQ1 to MQ5, covering student awareness, teaching coherence, effectiveness, efficiency and sustainability competences. Impact on teaching practice represents the mean score for three items concerning the attractiveness of teaching, motivation to develop additional environmental content and the teacher's interest in environmental issues.

The distribution of Bloom's taxonomy levels provides additional evidence of the development of advanced cognitive skills. More than three quarters of the teacher evaluation forms identified Analyze, Evaluate or Create as the highest cognitive level achieved by students. Evaluate was the most frequently selected category. These results suggest that the Teaching Case Studies generally required students to move beyond remembering and understanding information. Students were expected to analyse problems, compare possible approaches, assess available solutions, justify their decisions and, in some cases, develop their own solutions.

4.3 Overall outcomes

Table 13 brings together the principal student and teacher indicators for each TCS. The results should be interpreted with the sample size visible: TCS07 (six student responses) and TCS16 (five) are particularly sensitive to individual ratings.

Table 13. Mixed student and teacher outcomes by TCS

Round	TCS	Teaching Case Study	Student N	Student Impact	Teacher forms	Impact on Teaching Practice
1	TCS01	Ananké: It's all about Energy!	71	3.61	2	4.00
1	TCS02	Sunshine for production!	17	3.55	3	4.67
1	TCS03	AlluVance Solutions GmbH	8	3.83	1	4.67
1	TCS04	Design for Material Change	27	3.93	2	4.00
2	TCS05	ICTYOS: French Tannery SEA LEATHER	51	3.61	1	4.67
2	TCS06	It's Just Air? Think Again.	70	4.19	7	4.90
2	TCS07	Return on CO2	6	4.24	1	4.67
2	TCS08	Taking Back the Future - Take-Back Programme	46	3.78	6	4.17
3	TCS09	Sustainable Promotion Mix	33	3.83	1	3.67
3	TCS10	Acrylic bathtub	13	4.10	4	4.83
3	TCS11	Designing for Sustainability	2	4.53	1	4.33
3	TCS12	Growing into the future	10	3.35	1	4.67
4	TCS13	From Manual Tasks to Value-Added Roles	20	3.65	2	4.67
4	TCS14	Efficiency and Sustainability (E&S)	41	3.45	3	1.00
4	TCS15	Mapping the storm	2	4.04	1	4.33
4	TCS16	Modular fireplace	5	3.70	2	4.00

The numerically highest Student TCS Impact score was recorded for TCS11 at 4.53. TCS07 achieved the next-highest score at 4.2. Among the cases evaluated by at least ten students, the highest scores were recorded for TCS06 at 4.19 and TCS10 at 4.10.

According to the teacher evaluations, the highest scores for Impact on Teaching Practice were recorded for TCS06 at 4.90 and TCS10 at 4.83. TCS02, TCS03, TCS05, TCS07, TCS12 and TCS13 also achieved high mean scores of 4.67. However, these results were based on between one and three teacher evaluation forms per case and are therefore not equally robust.

TCS08 provides the strongest evidence of applicability across different institutions. It achieved a Student TCS Impact score of 3.78 based on 46 student responses and an Impact on Teaching Practice score of 4.17 based on six teacher evaluation forms. Three forms concerned implementations at the institution responsible for leading the case, while two concerned implementations at another project partner institution and one concerned an implementation at an external institution. This broader implementation base strengthens the evidence that the case can be transferred to different institutional and educational contexts.

The main Teaching Case Study requiring further attention is TCS14. Its Student TCS Impact score was 3.45, which was below the overall student mean of 3.77 but remained above the neutral midpoint of the scale. In

contrast, the mean score for Impact on Teaching Practice was 1.00. The three teacher evaluations produced a highly polarised pattern: the development of sustainability competences received a mean score of 4.00, whereas most other dimensions received considerably lower ratings.



5 Conclusion

The combined survey evidence indicates that the four SCABEE implementation rounds achieved generally positive aggregate results in terms of quality and impact. The overall Student TCS Impact score was 3.77 out of 5. The teacher evaluations yielded an overall TCS quality mean of 4.35, while Impact on Teaching Practice achieved a mean score of 4.21 and Continuity and Transfer achieved a mean score of 4.28. Students gave particularly positive evaluations of Efficiency, Coherence and anticipated long-term effects. In the teacher evaluations, Teaching Coherence, Efficiency and Sustainability Competences achieved mean scores above 4.3, while Continuity and Transfer was rated slightly below this level at 4.30.

The results also show descriptive differences between individual Teaching Case Studies and implementation rounds. Round 2 achieved the highest average Student TCS Impact score at 3.91, followed by Round 3 at 3.83, Round 1 at 3.68 and Round 4 at 3.55. Round 2 also achieved the highest mean score for Impact on Teaching Practice at 4.58, closely followed by Round 3 at 4.57. TCS06 and TCS10 performed strongly in both the student and teacher evaluations. TCS08, “Taking Back the Future – Take-Back Programme”, demonstrated particularly strong evidence of applicability across institutional contexts, as it was implemented at the lead institution, another SCABEE partner institution and an external institution.

Some implementation evidence is now available for TCS11 and TCS15, but the sample sizes are too small to support robust conclusions. TCS11 achieved a Student TCS Impact score of 4.53 based on two student responses and an Impact on Teaching Practice score of 4.33 based on one teacher form. TCS15 achieved corresponding scores of 4.04 and 4.33, also based on two student responses and one teacher form. These values may be reported descriptively, but they should not be compared directly with results based on substantially larger samples.

TCS14 requires further examination because its results differed substantially from the general pattern. Its Student TCS Impact score was 3.45, which remained above the neutral midpoint but was below the overall student mean of 3.77. Its mean score for Impact on Teaching Practice was only 1.00, while its overall TCS quality mean was 1.98. At the same time, teachers rated Sustainability Competences at 4.00. This pattern suggests that the sustainability topic and related learning objectives were perceived as valuable, whereas the main concerns may have related to the organisation of the teaching process, the clarity of the instructions, the coherence of the materials, the expected workload or the potential transfer of the case to other educational settings. However, the result was based on only three teacher forms, and no qualitative comments were collected. TCS14 should therefore be examined in consultation with the teachers who implemented it before any revisions are introduced.

The results presented in this report are descriptive. Differences between countries, institutions, Teaching Case Studies and implementation rounds may reflect variations in case content, institutional context, student profiles, timing and sample size. They should not be interpreted as evidence of causal relationships or statistically significant differences. In addition, the survey forms did not contain qualitative comment fields. Consequently, the available data cannot fully explain the reasons behind every score or provide direct quotations from teachers and students.

Annex A Bibliography

SCABEE Consortium (2024a) **SCABEE Analysis of Sustainability in Teaching in Partner's Study Programmes. Initial Analysis Research Framework. Deliverable A2.1.** Aalborg (Denmark), <https://scabee-project.eu/download/570/?tmstv=1787759422>

SCABEE Consortium (2024b) **Short links and QR-Codes. Information.** Unpublished

SCABEE Consortium (2025) **SCABEE Teaching Case Study Impact Assessment Schemes. Deliverable A 5.1.** Gliwice (Poland), <https://scabee-project.eu/download/708/?tmstv=1787033729>



Annex B Examples of QR-Codes and Links to evaluation forms

Access-Information to student evaluation (SCABEE, 2024b)

1.6 It's Just Air? Think Again.

TCS-Number	TCS06
Leading partner	SUT02
TCS Name	It's Just Air? Think Again.
TCS Slogan	
URL	https://form.jotform.com/243114513267046/prefill/673376ed343165a23fa9758b417e
Short Link	https://rebrand.ly/sf1dd0
QR-Code	
QR file	TCS06_Student_Survey.png TCS06_Student_Survey_bw.png TCS06_Student_Survey.svg

Access to Teacher evaluation (SCABEE, 2024b)

2.6 It's Just Air? Think Again

TCS-Number	TCS06
Leading partner	SUT02
TCS Name	It's Just Air? Think Again.
TCS Slogan	
URL	https://form.jotform.com/243500936138354/prefill/675ff078643062c149d4475dc9a5
Short Link	https://rebrand.ly/7ca6d0
QR-Code	
QR file	TCS06_Teacher_Survey.png TCS06_Teacher_Survey_bw.png TCS06_Teacher_Survey.svg

Annex C Detailed analyses

Table 14. Student outcomes by individual TCS

Round	TCS	Teaching Case Study	Lead	N	Awareness	Relevance	Coherence	Effectiveness	Efficiency	Continuity	Long-term	TCS Impact
1	TCS01	Ananké: It's all about Energy!	ESTA	71	3.23	3.45	3.81	3.67	3.45	3.62	3.80	3.61
1	TCS02	Sunshine for production!	SUT	17	2.82	3.63	3.39	3.72	3.74	3.44	3.41	3.55
1	TCS03	AlluVance Solutions GmbH	FHV	8	3.75	4.04	3.83	3.93	4.25	3.81	4.13	3.83
1	TCS04	Design for Material Change	UCN	27	3.70	3.96	4.20	3.97	3.93	3.91	3.89	3.93
2	TCS05	ICTYOS: French Tannery SEA LEATHER	ESTA	51	3.12	3.24	3.56	3.77	3.99	3.84	3.98	3.61
2	TCS06	It's Just Air? Think Again.	SUT	70	2.89	4.21	4.38	4.33	4.59	4.09	4.31	4.19
2	TCS07	Return on CO2	FHV	6	3.67	4.11	4.06	4.13	4.33	4.42	4.33	4.24
2	TCS08	Taking Back the Future - Take-Back Programme	UCN	46	3.39	3.82	4.04	3.86	3.82	3.80	3.87	3.78
3	TCS09	Sustainable Promotion Mix	ESTA	33	3.39	3.69	3.94	3.82	3.73	3.92	3.94	3.83
3	TCS10	Acrylic bathtub	SUT	13	3.08	4.08	4.10	4.06	4.12	4.12	4.15	4.10
3	TCS11	Designing for Sustainability	FHV	2	5.00	4.17	4.00	4.30	4.50	4.75	4.50	4.53
3	TCS12	Growing into the future	UCN	10	2.40	3.60	3.70	3.16	3.40	3.60	3.10	3.35
4	TCS13	From Manual Tasks to Value-Added Roles	ESTA	20	3.40	3.33	3.75	3.66	4.10	3.88	3.95	3.65
4	TCS14	Efficiency and Sustainability (E&S)	SUT	41	2.54	3.46	3.59	3.53	3.77	3.50	3.51	3.45
4	TCS15	Mapping the storm	FHV	2	5.00	3.83	4.17	4.00	4.00	4.00	4.00	4.04
4	TCS16	Modular fireplace	UCN	5	3.60	3.73	3.80	3.68	4.00	3.80	3.60	3.70

Annex C.1 Impact Assessment of TCS Implementation Round 1

A total of 123 Students participated in the TCS developed in round 1 over the project duration (some TCS have been used with several classes). Evaluations have been conducted on a Five-Point Likert Scale.

Individual environmental awareness profile

Distribution of participants' responses to the question: "How do you rate your personal awareness of environmental issues?"

Table 15. TCS Overview (Round 1): Environmental awareness of participating students (absolute figures and percentages)

Institution	Not at all	Slightly	Fairly	Interested	Very interested	N
ESTA01	1	15	30	17	8	71
SUT01	2	5	5	4	1	17
FHV01	0	0	3	4	1	8
UCN01	0	5	5	10	7	27
Institution	Not at all %	Slightly %	Fairly %	Interested %	Very interested %	N
ESTA01	1.4%	21.1%	42.3%	23.9%	11.3%	71
SUT01	11.8%	29.4%	29.4%	23.5%	5.9%	17
FHV01	0.0%	0.0%	37.5%	50.0%	12.5%	8
UCN01	0.0%	18.5%	18.5%	37.0%	25.9%	27

TCS Overview

Table 16. TCS Overview (Round 1): Number of student evaluations and overall TCS Impact

Institution	Teaching Case Study	N	TCS Impact
ESTA01	Ananké: It's all about Energy!	71	3.61
SUT01	Sunshine for production!	17	3.55
FHV01	AlluVance Solutions GmbH	8	3.83
UCN01	Design for Material Change	27	3.93

Table 17. TCS evaluations (Round 1): Means and standard deviation per main question

Evaluations by TCS and main question

MQ	ESTA01		SUT01		FHV01		UCN01	
	mean	SD-SQ	mean	SD-SQ	mean	SD-SQ	mean	SD-SQ
MQ1 - Relevance	3.45	0.16	3.63	0.03	4.04	0.19	3.96	0.04
MQ2 - Coherence	3.81	0.17	3.39	0.22	3.83	0.31	4.20	0.15
MQ3 - Effectiveness	3.63	0.19	3.72	0.09	3.84	0.43	4.04	0.24
MQ4 - Efficiency	3.58	0.22	3.73	0.21	4.25	0.25	3.85	0.13
MQ5 - Impact	3.51	0.10	3.55	0.09	3.42	0.38	3.79	0.30
MQ6 – Sustainability (Continuousness)	3.68	0.11	3.43	0.21	3.92	0.26	3.90	0.02
Overall impact	3.61		3.55		3.83		3.93	
N	71		17		8		27	

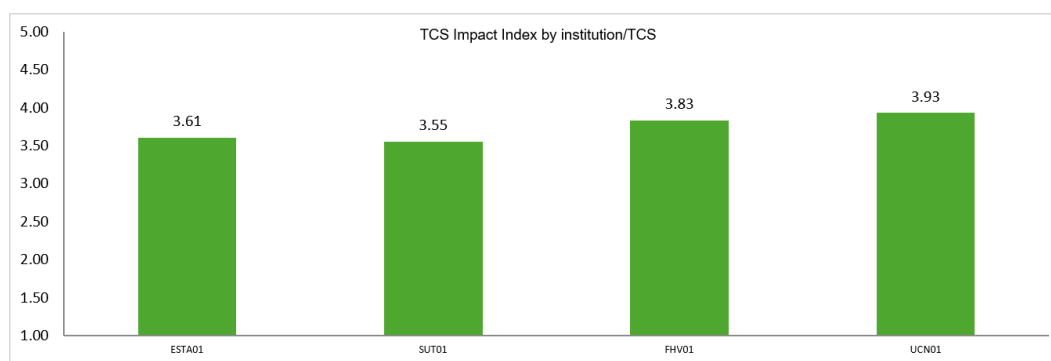


Figure 2. Overall TCS impacts (Round 1)

Annex C.2 Impact Assessment of TCS Implementation Round 2

A total of 164 Students participated in the TCS developed in round 2 over the project duration (some TCS have been used with several classes). Evaluations have been conducted on a Five-Point Likert Scale.

Individual environmental awareness profile

Distribution of participants' responses to the question: "How do you rate your personal awareness of environmental issues?"

Table 18. TCS Overview (Round 2): Environmental awareness of participating students (absolute figures and percentages)

Institution	Not at all	Slightly	Fairly	Interested	Very interested	N
ESTA02	0	17	9	14	3	43
SUT02	4	26	20	14	6	70
FHV02	0	0	2	4	0	6
UCN02	3	5	14	16	7	45

Institution	Not at all %	Slightly %	Fairly %	Interested %	Very interested %	N
ESTA02	0.0%	39.5%	20.9%	32.6%	7.0%	43
SUT02	5.7%	37.1%	28.6%	20.0%	8.6%	70
FHV02	0.0%	0.0%	33.3%	66.7%	0.0%	6
UCN02	6.7%	11.1%	31.1%	35.6%	15.6%	45

Table 19. TCS Overview (Round 2): Number of student evaluations and overall TCS Impact

University	Teaching Case Study	N	TCS Impact
ESTA02	ICTYOS: French Tannery SEA LEATHER	43	3.60
SUT02	It's Just Air? Think Again.	70	4.19
FHV02	Return on CO2	6	4.24
UCN02	Taking Back the Future - Take-Back Programme	45	3.78

Table 20. TCS evaluations (Round 2): Means and standard deviation per main question

MQ	ESTA02		SUT02		FHV02		UCN02	
	mean	SD-SQ	mean	SD-SQ	mean	SD-SQ	mean	SD-SQ
MQ1 - Relevance	3.24	0.12	4.21	0.01	4.11	0.10	3.82	0.07
MQ2 - Coherence	3.56	0.50	4.38	0.10	4.06	0.35	4.04	0.10
MQ3 - Effectiveness	3.68	0.18	4.29	0.05	4.08	0.22	3.88	0.12
MQ4 - Efficiency	4.05	0.11	4.56	0.05	4.33	0.17	3.80	0.04
MQ5 - Impact	3.29	0.13	3.87	0.29	4.28	0.19	3.51	0.32
MQ6 – Sustainability (Continuousness)	3.89	0.17	4.17	0.14	4.39	0.10	3.83	0.11
Overall impact	3.61		4.19		4.24		3.78	

N	51	70	6	46
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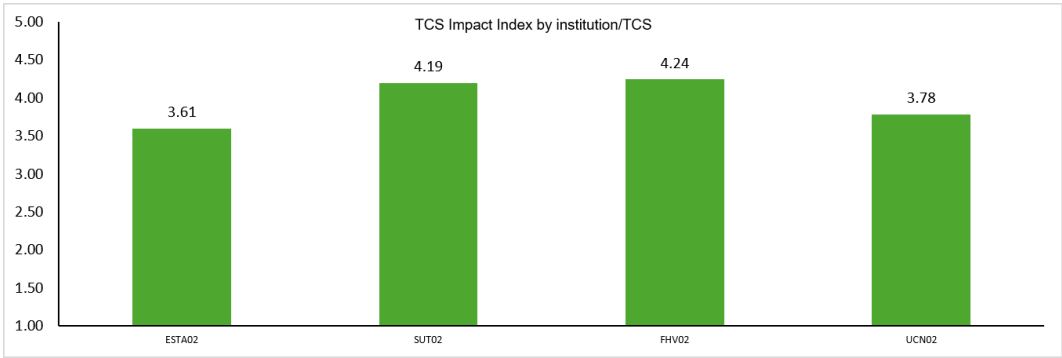


Figure 3. Overall TCS impacts (Round 2)



Annex C.3 Impact Assessment of TCS Implementation Round 3

A total of 58 Students participated in the TCS developed in round 3 over the project duration (some TCS have been used with several classes). Evaluations have been conducted on a Five-Point Likert Scale.

Individual environmental awareness profile

Distribution of participants' responses to the question: "How do you rate your personal awareness of environmental issues?"

Table 21. TCS Overview (Round 3): Environmental awareness of participating students (absolute figures and percentages)

Institution	Not at all	Slightly	Fairly	Interested	Very interested	N
ESTA03	1	5	11	12	4	33
SUT03	1	2	6	3	1	13
FHV03	0	0	0	0	2	2
UCN03	1	5	3	1	0	10

Institution	Not at all %	Slightly %	Fairly %	Interested %	Very interested %	N
ESTA03	3.0%	15.2%	33.3%	36.4%	12.1%	33
SUT03	7.7%	15.4%	46.2%	23.1%	7.7%	13
FHV03	0.0%	0.0%	0.0%	0.0%	100.0%	2
UCN03	10.0%	50.0%	30.0%	10.0%	0.0%	10

Table 22. TCS Overview (Round 3): Number of student evaluations and overall TCS Impact

Institution	Teaching Case Study	N	TCS Impact
ESTA03	Sustainable Promotion Mix	33	3.83
SUT03	Acrylic bathtub	13	4.10
FHV03	Designing for Sustainability	2	4.53
UCN03	Growing into the future	10	3.35

Table 23. TCS evaluations (Round 3): Means and standard deviation per main question

MQ	ESTA03		SUT03		FHV03		UCN03	
	mean	SD-SQ	mean	SD-SQ	mean	SD-SQ	mean	SD-SQ
MQ1 - Relevance	3.69	0.07	4.08	0.08	4.17	0.76	3.60	0.26
MQ2 - Coherence	3.94	0.16	4.10	0.09	4.00	0.00	3.70	0.20
MQ3 - Effectiveness	3.73	0.11	4.04	0.13	4.25	0.29	3.15	0.37
MQ4 - Efficiency	3.88	0.26	4.13	0.04	4.50	0.00	3.33	0.23
MQ5 - Impact	3.78	0.17	4.10	0.24	5.00	0.00	3.07	0.31
MQ6 – Sustainability (Continuousness)	3.93	0.14	4.13	0.12	4.67	0.29	3.43	0.58
Overall impact	3.83		4.10		4.53		3.35	
N	33		13		2		10	

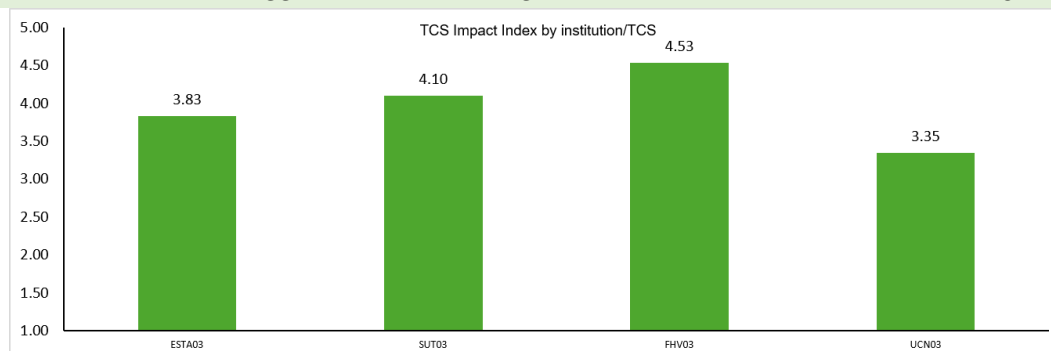


Figure 4. Overall TCS impacts (Round 3)



Annex C.4 Impact Assessment of TCS Implementation Round 4

A total of 68 Students participated in the TCS developed in round 4 over the project duration (some TCS have been used with several classes). Evaluations have been conducted on a Five-Point Likert Scale.

Individual environmental awareness profile

Distribution of participants' responses to the question: "How do you rate your personal awareness of environmental issues?"

Table 24. TCS Overview (Round 4): Environmental awareness of participating students (absolute figures and percentages)

Institution	Not at all	Slightly	Fairly	Interested	Very interested	N
ESTA04	0	4	6	8	2	20
SUT04	6	18	9	5	3	41
FHV04	0	0	0	0	2	2
UCN04	0	1	1	2	1	5

Institution	Not at all %	Slightly %	Fairly %	Interested %	Very interested %	N
ESTA04	0.0%	20.0%	30.0%	40.0%	10.0%	20
SUT04	14.6%	43.9%	22.0%	12.2%	7.3%	41
FHV04	0.0%	0.0%	0.0%	0.0%	100.0%	2
UCN04	0.0%	20.0%	20.0%	40.0%	20.0%	5

Table 25. TCS Overview (Round 4): Number of student evaluations and overall TCS Impact

Institution	Teaching Case Study	N	TCS Impact
ESTA04	From Manual Tasks to Value-Added Roles	20	3.65
SUT04	Efficiency and Sustainability (E&S)	41	3.45
FHV04	Mapping the storm	2	4.04
UCN04	Modular fireplace	5	3.70

Table 26. TCS evaluations (Round 4): Means and standard deviation per main question

MQ	ESTA04		SUT04		FHV04		UCN04	
	mean	SD-SQ	mean	SD-SQ	mean	SD-SQ	mean	SD-SQ
MQ1 - Relevance	3.33	0.03	3.46	0.10	3.83	0.29	3.73	0.23
MQ2 - Coherence	3.75	0.30	3.59	0.13	4.17	0.29	3.80	0.20
MQ3 - Effectiveness	3.54	0.18	3.54	0.08	4.00	0.00	3.70	0.12
MQ4 - Efficiency	4.12	0.06	3.68	0.15	4.00	0.50	3.87	0.23
MQ5 - Impact	3.33	0.08	3.17	0.04	4.17	0.29	3.53	0.31
MQ6 – Sustainability (Continuousness)	3.90	0.28	3.50	0.11	4.00	0.00	3.73	0.42
Overall impact	3.65		3.45		4.04		3.70	
N	20		41		2		5	

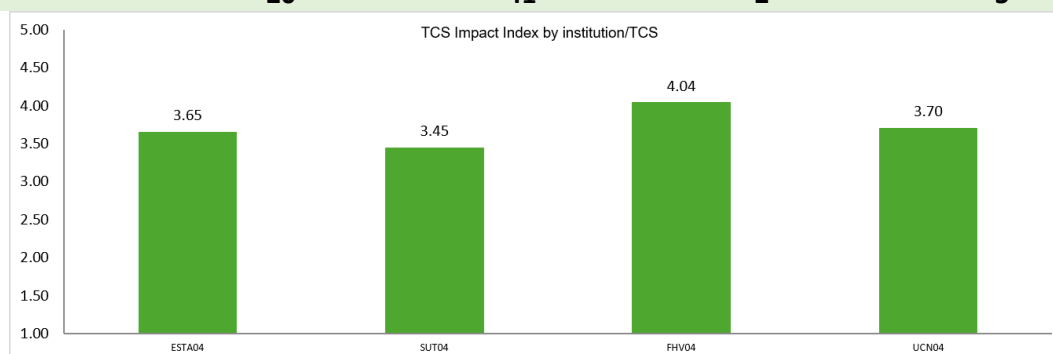


Figure 5. Overall TCS impacts (Round 4)

