



**Sulitest**.org

**ADVANCING  
SUSTAINABILITY LITERACY  
FOR THE GLOBAL GOALS**

2023 Report from the Sulitest Movement,  
a tangible implementation of the HESI &  
a contributor to the review of the 2030 Agenda



**HIGH-LEVEL POLITICAL FORUM  
ON SUSTAINABLE DEVELOPMENT**



# Table of Contents

10 years of commitment to mainstream sustainability	– 3
Sulitest, a featured initiative of HESI	– 5
The Education for Sustainable Development landscape	– 7
Our mission	– 8
Our Learning Tools	– 9
TASK™ – The Assessment of Sustainability Knowledge	– 14
Sustainability Knowledge: Trends and Data Analysis	– 32
Sulitest & the PRME Impactful Five (i5) program	– 44
List of References	– 49
Appendix A – Our governance	– 50
Appendix B – TASK™ Matrix by Sulitest	– 51
Appendix C – TASK™ Model: Technical Specification and Test Reliability	– 52
Appendix D – TASK™ OLS Regression Results	– 57



# 10 years of commitment to mainstream sustainability

Forty years after the first Earth Summit in Stockholm in 1972, the United Nations Conference on Sustainable Development (UNCSD) took place in Rio de Janeiro. Rio+20 was a key step in converging the topics of climate, poverty, and sustainable development, which had previously been treated separately. This led to the launch of the Sustainable Development Goals (SDGs) and the 2030 Agenda in 2015. But 2012 also marked a turning point in the consideration of sustainable development by higher education. In addition to UNESCO's long-standing commitment to universal access to education, for the first time, higher education was mentioned as an essential lever for paradigm change. HESI (see page 5), which represented over a third of the 700 voluntary commitments made at Rio+20, called on Higher Education Institutions (HEIs) to go beyond dedicated programs and by integrating sustainable development across all their disciplines.

Like many others at that time, we were already personally committed in our respective professions and had chosen to contribute to systemic change through higher education. We were convinced that the vast majority of economic, social, and environmental crises facing humanity were the consequences of human decisions often made within a professional framework, and many of these decisions were made by people who had the opportunity to pursue higher education.

Ten years ago, with the support of an extraordinary community, the Sulitest movement was born to advance **sustainability literacy**, which means the **knowledge, skills, and mindset** necessary for each individual to make informed decisions.

We launched an initial awareness test that was taken by several hundred thousand people, followed by other awareness tools used by universities worldwide.

Since the launch of HESI, sustainable development has become less peripheral and more integrated into the strategies of HEIs, impacting programs, courses, research, and campus management. But as these initiatives become more

structured and professionalized, it quickly became apparent that universities lacked tools and data to help them better steer, measure, and report on the pedagogical impact of their actions.

Because there is no “one-size-fits-all” way to teach such a cross-cutting subject as sustainability, it is essential to assess whether the implemented actions, both in courses and extracurricular activities, have had the intended impact. With the launch of **TASK™**, universities will now be able to ensure that future graduates, whether engineers, managers, lawyers, or doctors, share a **common knowledge base** and understanding of the sustainability challenges ahead.

As the first tool to **measure the level of sustainability knowledge** for student cohorts, TASK™ provides reliable data and indicators that can be shared with stakeholders. It will enable students—and in the future, professionals and individuals—to acquire a **certificate** attesting to their level of knowledge on major global issues. TASK™ is just a piece in the puzzle, but a crucial one that was missing in the education landscape. It provides educators and HEIs with relevant frameworks, data and metrics to support and pilot **curriculum redesign** and to **demonstrate their impact** on students’ sustainability knowledge.

We are extremely proud to present in this report the initial analyses made possible by this robust, relevant, and comparable measurement of sustainability knowledge. The data already allow us to identify enlightening trends that will contribute to the evolution of the approach to sustainability in higher education and the widespread adoption of this common language.

It is time to mainstream sustainability. Join the movement!



**Aurélien Decamps**

*Co-founder of the  
Sulitest Movement*



**Jean-Christophe Carteron**

*Co-founder of the Sulitest  
Movement*



## **Sulitest, a featured initiative of HESI**

The Higher Education Sustainability Initiative (HESI) is an open partnership among several United Nations entities(\*) and the higher education community which was launched in the lead-up to the United Nations Conference on Sustainable Development in Rio. HESI accounted for more than one-third of all voluntary commitments launched at Rio+20 and each year in the margins of the HLPF, a global HESI event is organized to showcase how the 2030 Agenda for Sustainable Development is progressing.

Through its strong association with the United Nations, HESI aims to provide higher education with an interface between higher education, science, and policy making by raising the profile of higher education's sector in supporting sustainable development, convening multi-stakeholder discussions and action, and sharing good practice.

HEIs joining HESI commit to:

1. Teach sustainable development across all disciplines of study;
2. Encourage research and dissemination of sustainable development knowledge;
3. Create green campuses and support local sustainability efforts; and
4. Engage and share information with international networks.

HEIs can register at: <https://sdgs.un.org/HESI>

**Recognized as one of the first 17 featured initiatives of the United Nations Partnerships for Sustainable Development Goals, Sulitest has, since its launch, been considered a flagship project of HESI. Today, Sulitest co-chairs HESI, together with UN DESA.**

*\*United Nations Department of Economic and Social Affairs, UNESCO, UN Environment Programme, UN Global Compact's Principles for Responsible Management Education initiative, UN University, UN-HABITAT, UNCTAD, UNITAR, UN Office for Partnerships, and UN Academic Impact.*



Division for Sustainable Development  
Department of Economic and Social Affairs (DESA)  
United Nations, New York, N.Y. 10017

Reference: DESA-2023-01446

26 June 2023

Dear Mr. Carteron,

The High-level Political Forum on Sustainable Development (HLPF) serves as the central platform within the United Nations for the review and follow-up of the 2030 Agenda for Sustainable Development and the Sustainable Development Goals (SDGs) on a global scale.

Annually, the HLPF convenes under the auspices of the Economic and Social Council, bringing together a diverse array of representatives from governments, intergovernmental organizations, United Nations entities, and stakeholders committed to supporting the implementation of sustainable development.

In accordance with SDG 4, particularly target 4.7, it is essential to ensure that all learners acquire the necessary knowledge, skills, and mindset to promote sustainable development. This encompasses education for sustainable development and sustainable lifestyles, as well as topics like human rights, gender equality, the promotion of peace and non-violence, global citizenship, and the appreciation of cultural diversity and its contribution to sustainable development. This comprehensive approach plays a vital role in expediting the overall achievement of the 2030 Agenda. Consequently, monitoring this target and the outcomes of education for sustainability is crucial for fully realizing its potential.

The Higher Education Sustainability Initiative (HESI) is an inclusive partnership initiated in the run-up to the 2012 Rio+20 Conference, bringing together multiple United Nations entities and the higher education community. Currently chaired by the United Nations Department of Economic and Social Affairs (UN DESA) and the Sulitest Association—a non-profit organization and online platform dedicated to enhancing sustainability literacy—the HESI fosters collaboration between UN entities, higher education institutions, scientific communities, and policy-making bodies.

Over the past decade, the Sulitest movement has contributed to raising awareness about the SDGs, with its tools being widely employed by universities, companies, and NGOs worldwide.

I extend an invitation to all higher education institutions to actively engage with HESI and the Sulitest platform. Furthermore, I encourage all stakeholders to deepen their understanding of the prominent challenges of our time, to enhance their training and capacity to address them effectively, and to measure the impact of their endeavours.

Sincerely,

A handwritten signature in blue ink, appearing to read 'Lotta Tähtinen'.

Lotta Tähtinen

Chief, Outreach and Partnership Branch  
Division for Sustainable Development Goals  
Department of Economic and Social Affairs



# The Education for Sustainable Development landscape

The 2030 Agenda for Sustainable Development was adopted in 2015 by 193 states to “mobilize efforts to end all forms of poverty, fight inequalities and tackle climate change while ensuring that no one is left behind.” Through 17 Sustainable Development Goals (SDGs) and 169 targets, this Agenda offers a coherent framework and roadmap to coordinate stakeholders’ initiatives and to accelerate the transition towards a sustainable future. It is a “plan of action for people, planet and prosperity,” aimed at nothing less than “transforming our world.”

By training current and future decision-makers, HEIs have a crucial mission to play in this transformation. On a day-to-day basis, HEIs like any organisation have an immediate impact on their environment and community. But as providers of education, they also – probably above all – have an impact through what they teach, the mindsets they nurture, and the behaviours they encourage.

A major **role of education** is to empower citizens so that they are able to face the complex and key challenges of the 21st century, including enabling change, making informed decisions and collectively building a sustainable future. This mission is specifically highlighted in **SDG 4 Quality Education. Goal 4.7** states that by 2030 “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.”

From this starting point, important questions quickly emerge:

- How can HEIs systematically improve sustainability literacy?
- How can HEIs monitor learning outcomes on topics addressed by the SDGs?
- How can HEIs demonstrate and measure impact?

The Sulitest movement was created to address these pressing needs.

*“Kudos to Sulitest for spurring global knowledge and competency in sustainable development. Achieving the Sustainable Development Goals and the Paris Climate Agreement requires awareness, focus, knowledge and commitment. Sulitest makes an important contribution on all of these dimensions of engagement.”*

*– Jeffrey D. Sachs, Special Advisor to the UN Secretary General on the SDGs & Director of the UN Sustainable Development Solutions Network*



## Our mission

To build a sustainable world, it is imperative to improve the knowledge, skills and mindset on sustainable development, referred to as sustainability literacy. While society needs experts who can solve specific problems in their field, **we need to mainstream sustainability knowledge**, so that **everyone** has a sufficient understanding of it, and can use it in their personal and professional lives. This is the “raison d’être” of the Sulitest movement.

Rather than being *the* solution addressing all the challenges, Sulitest strives to be *one* of the key enablers of education for sustainability. To fulfil its mission, Sulitest equips educators with tools and data which supports them in delivering, monitoring, and reporting how they are improving sustainability literacy amongst their students and/or staff.

For nearly 10 years, Sulitest has offered three online tools designed to raise awareness about sustainability, namely the *Awareness Test*, an engaging *Quiz* and the reverse pedagogy platform *Looping* (more on pages 9–13).

Moreover, in the drive to advance sustainability in HEIs, the imperative to monitor effectiveness and communicate progress is evident. Therefore, in March of 2023, Sulitest launched TASK™ – The Assessment of Sustainability Knowledge. TASK™ is an online tool which provides HEIs with **a standardised measure and a monitoring tool of the level of sustainability knowledge** of their students. A robust measurement tool that can be easily integrated into any course or program, TASK generates relevant data for adapting, monitoring, and improving the dissemination of sustainability as a common language.

With these four tools, Sulitest is accelerating the sustainability literacy movement worldwide and fulfilling its vision of participating in a planetary movement that allows everyone to understand and engage in the collective building of a sustainable future!

*“Sulitest is an innovative pedagogical tool that can be deployed in multiple ways to advance educational objectives in sustainability and global responsibility. I fully endorse this tool and encourage schools to contribute to the community working to ensure the Sulitest’s relevance for promoting action toward solving urgent global challenges and promoting transformation in sustainability education and beyond.”*

**– Eric Cornuel, Director General & CEO at EFMD**

*“The power of higher education to change the world exists both in what it is, but also more importantly in how it affects the futures of all students. Nurturing enquiring minds has always been part of that mission – but now it is more important than ever that it also encourages an aware, sustainable mindset in every student. Sulitest will support this, providing a common framework against which teaching in this vital area can be assessed.”*

**– Duncan Ross, Chief Data Officer at Times Higher Education**





## Our Learning Tools

*Since its creation, Sulitest provides organizations with locally and internationally recognized online tools to increase awareness of sustainable development.*



### Awareness Test

Launched 10 years ago, Sulitest's best-known tool is the *Awareness Test*, which improves and maps awareness about Sustainable Development topics. It consists of an international set of 30 multiple-choice questions (the "International Core Module") selected from an expert-approved database. In addition to the "International Core Module", optional country-specific, SDG-specific or even customised modules can be added. Over 40,000 people participated in an Awareness Test session between July 2022 and June 2023.

#### LOCAL MODULES

Regional or National Expert Committees (RNECs) led the development of Sulitest in their local environment by coordinating diverse stakeholders to develop local questions, translating content into their own languages and acting as ambassadors of the Sulitest movement. As of June 2022, 17 countries developed their own set of local questions.

#### SDG SPECIALISED MODULES

Sulitest has launched several projects in partnership with UN entities to create modules related to specific SDGs.

*SDG FRAMEWORK* - To support understanding of the SDG framework, Sulitest and UN DESA developed a module on the SDGs' overall conceptual framework. This module was launched in May 2017 and has been taken by over 23,000 people.

*SDG 7: AFFORDABLE AND CLEAN ENERGY, IN PARTNERSHIP WITH UN DESA* - The Division for Sustainable Development of the United Nations Department of Economic and Social Affairs (DSD/UN DESA) - the Secretariat of the HLPF - led a process to create a Sulitest SDG 7 module for use by all. This module was officially launched during the HLPF 2018 and has been taken by over 1,300 people.

*SDG 11: SUSTAINABLE CITIES AND COMMUNITY, FOCUSED ON HOLISTIC WASTE MANAGEMENT, IN PARTNERSHIP WITH UNEP* – While overlooked by many, waste management deeply affects people around the world. A specific module to address the challenges of SDG 11, focusing on holistic waste management, was developed in 2018 by Sulitest and the UN Environment – International Environmental Technology Centre (IETC) in Osaka, Japan. This module was launched during the HLPF 2018 and has been taken by over 1,100 people.

*SDG 12: SUSTAINABLE CONSUMPTION AND PRODUCTION, FOCUSED ON CIRCULAR ECONOMY, IN PARTNERSHIP WITH UNEP* – With the help of UNEP, and a group of universities and NGOs, Sulitest created a specialized module on the Circular Economy. This module helps participants and their organizations discover concepts, pathways, and opportunities to embrace the Circular Economy. This module was launched during the HLPF 2019 and has been taken by over 11,000 people.

*SDG 14: LIFE UNDER WATER, FOCUSED ON OCEANS, IN PARTNERSHIP WITH UN DESA AND WITH THE SUPPORT OF MERCATOR OCEAN INTERNATIONAL* – Sulitest, Mercator Ocean International and UNDESA, together with an expert multi-stakeholder working group, created an ocean-focused module about SDG14. The mission of this project is to raise awareness about SDG 14 so that we all become Ocean Citizens, become aware of ocean-related issues, and take action to protect this valuable ecosystem!



The *Quiz* offers an engaging and dynamic activity. Consisting of a set of 6 to 10 questions, the Quiz is the perfect tool to engage and inspire a group in only 15 minutes. The facilitator displays the Quiz on a projector screen and players use their computer, tablet, or phone to connect. All participants have one minute to answer to each question. Team scores and a learning statement (feedback) are displayed after every question. In the end, a summary displays the overall results and the winning team. The Quiz has been used in events in corporate and academic settings, in classrooms, and even in meetings with government officials. In sum, it is an outstanding engagement tool used as a fun icebreaker and to help raise awareness of sustainability.

## **SPECIALIZED MODULES**

In addition to core modules about the SDGs in general, we have developed specialized modules focusing on specific themes.

*BIODIVERSITY QUIZ* – The current rate at which species are disappearing is unprecedented – scientists refer to it as the sixth mass extinction, and the first since humans appeared on Earth. To raise awareness on the emergency regarding biodiversity collapse, Sulitest created a Quiz on biodiversity with an expert group to improve the understanding of this crucial topic.

*SDG 14 QUIZ* – The SDG 14 module described previously is also available in a Quiz format.

## **CUSTOMISATION**

Sulitest offers Premium Access for organisations that want to go further. Beyond a dedicated focal point within the Sulitest team, Premium allows institutions to create customised modules for the Quiz and Awareness Test, tailoring these tools to their particular context, needs, and objectives.



Pedagogy for the SDGs requires critical thinking and the ability to question ourselves, what we know and the way we learn, and that we ask good questions rather than trying to find a narrow-minded solution.

The *Awareness Test* and the *Quiz* are exceptional tools that raise awareness. When the Sulitest team developed these tools and their question banks, what was immediately recognized was the significant learning potential in creating robust questions and in articulating corresponding learning outcomes.

*Looping* was therefore developed to allow learners to solidify their understanding of a subject and connect their discipline to sustainability by creating questions on their own. *Looping* promotes active learning, supporting the development of agents of change who are equipped to address the pressing challenges of sustainable development.

Looping not only supports the development of knowledge but also of skills. It prompts participants to identify key elements and synthesize information, valuable skills for any professional. Secondly, in the

peer-evaluation phase of *Looping*, candidates give and receive feedback, developing these key leadership abilities.

While it is an extremely flexible tool, the general purpose of a *Looping* session is to create the set of questions which stakeholders know how to answer in order to make informed decisions.

*"Mobilising collective intelligence of the next generation towards the SDG is key for our common future. The Sulitest is a first step towards the acknowledgement of their contributions and the ones of their school and university."*

**– François Taddei, President at Learning Planet Institute (LPI)**

*"Sulitest movement allows learners and examiners to assess the sustainability knowledge index of the candidates. This helps players in ESD to identify areas where they need to create more awareness. Sulitest has enabled Regional Centre of Expertise on Education for Sustainable development (RCE) Greater Nairobi hosted by Kenyatta University, create SDG awareness among students and staff in the institution. Students undertake Sulitest to map their sustainability knowledge. They also engage in sustainability activities to put to action the knowledge they have on Sustainable Development Goals. Equipping students with sustainability knowledge will help them train others on sustainable development."*

**– Nancy Ireri, Administrator at Kenyatta University**

*"For many years now, I've used Sulitest in my class on the Business Case for Sustainability as a pre- and post-test indication of students' development of a sustainability mindset. In addition to appreciating their growth of knowledge through the course, this tool provides them with immediate feedback for learning, as well as benchmarking their performance to other students in our country and around the world. It is an invaluable tool for developing a sustainability mindset, and capacity for understanding global trends."*

**– David DuBois, Adjunct Faculty, Management & Information Systems at Ambassador Crawford College of Business and Entrepreneurship, Kent State University**

*"The SuLiTest is a great adventure. Using such a tool for use within universities is valuable. A wide range of topics are covered, not only environment and ecology but also social and organizational aspects which are often poorly studied but so important to act the change. The multiplicity of the fields evoked in the SuLiTest allows a deep reflection among students and opens their mind. The most involved of them were very proud to be valued through the first TASK™ session."*

**– Emilie Gadoin, Maître de Conférences at Polytech Nantes - Nantes Université**

*"University of Worcester has been using SuLiTest since 2016 as a way of mapping student knowledge and awareness in individual modules and for supporting training for course reps initially. We extended this to all students enrolling in 2020 to help us understand the breadth of engagement and knowledge of sustainability within the broader student population. We have found it to be a powerful and valuable tool and would recommend it to any institution looking to monitor engagement, impact, and outcomes for their students."*

**– Katy Boom, Director of Sustainability at University of Worcester**

*"We do use the Sustainability Literacy Test in a learning mode at emlyon for several years now. CSR and Sustainability are mandatory elements of curricula in all programs at emlyon and implemented across all management disciplines. Besides a mandatory core course about CSR, almost every single course questions the social and environmental impact of businesses and managerial decisions in our programs. The SuLiTest is an important element of an online learning package that is meant to be used for individual preparation of students before the first session about CSR and Sustainability in the classroom. This year, almost 2.300 participants, from BBA to Master and MBA programs have taken it at the beginning of their studies to assess their initial knowledge about Sustainability and the SDGs. The SuLiTest is highly appreciated, and our experience shows that the test has a real added-value as a pedagogical tool, even for people with a professional background, such as the participants of our Executive MBA."*

**– Hans-Jörg Schlierer, Coordinator for CSR and Sustainability at emlyon business school**

*"Sulitest encourages people to increase her/his literacy on sustainability, hence supporting an impact in the society aimed to achieve sustainable development. It is an easy and friendly way to make people aware of her/his literacy on sustainability in a challenging way. Moreover, it allows firms as well as other organisations to assess sustainability literacy of their current and/or potential employess, both considering their knowledge and the mindset in term of sustainability. It also gives a certificate of sustainability literacy (where required). Every year BBS uses the core module of the survey Sulitest to map students' knowledge both at the beginning and at the end of all their teaching programme, in order to get an idea to what extent students literacy has grown (or not) also thanks to Bologna Business School's master they attend."*

**– Benedetta Siboni, Associate Professor of Business Administration and Accounting Studies at Alma Mater Studiorum Università di Bologna**



# TASK™ – The Assessment of Sustainability Knowledge

The “raison d’être” of Sulitest is to **mainstream Sustainability**. Having developed a set of engagement tools that are widely used, Sulitest has nurtured a movement to raise awareness, to support educators in bringing sustainability in the classroom and starting the discussion, and to map the awareness of cohorts with preliminary trends and indicators.

For years, we have dreamed of being able to go further and develop a **robust, reliable, and comparable assessment tool for the level of sustainability knowledge**. A valid measurement of sustainability knowledge could be employed for assessing the effectiveness of educational interventions on knowledge development; understanding levels of sustainability knowledge across an organization or school for internal learning and policy development; and external reporting for accreditations, rankings, and other stakeholders.

Now in 2023, Sulitest is proud to release TASK™ – The Assessment of Sustainability Knowledge – with the ambition of **transforming education** by (re)setting the **standard of sustainability knowledge** which, henceforth, must constitute the very foundation of human decision-making and agency. The TASK™ tool provides a robust, research-based, and online assessment process leading to an internationally recognized certificate demonstrating a level of sustainability knowledge. TASK™ is accessible via an easy-to-use platform that provides relevant and comparable metrics for monitoring and steering education for sustainability across any educational program.

By design, TASK™ was built to align with existing pedagogical approaches to education for sustainability, sustainable development, and ecological transition such as Education for Sustainable Development Goals: Learning Objectives (UNESCO, 2017)<sup>1</sup>, the GreenComp – European Sustainability Competence Framework, (European Union, 2022)<sup>2</sup>, the Jean Jouzel<sup>3</sup> report: “Sensibiliser et former aux enjeux de la transition écologique dans l’Enseignement supérieur”(French Ministry of Higher Education, 2022)<sup>4</sup>, and the Four-Dimensional Competencies/Sub-competencies Framework focused on knowledge, skills, character, and meta-learning (Center for Curriculum Redesign, 2019)<sup>5</sup>.

---

1 <https://unesdoc.unesco.org/ark:/48223/pf0000247444>

2 <https://publications.jrc.ec.europa.eu/repository/handle/JRC128040>

3 Jean Jouzel is the former vice-chair of the Scientific Working Group of the Intergovernmental Panel on Climate Change (IPCC) and co-laureate of the Nobel prize with the IPCC.

4 <https://www.enseignementsup-recherche.gouv.fr/fr/sensibiliser-et-former-aux-enjeux-de-la-transition-ecologique-dans-l-enseignement-superieur-83888>

5 Fadel, Bialik & Trilling, 2015, *Four-Dimensional Education: The Competencies Learners Need to Succeed*, Center for Curriculum Redesign (CCR). <https://curriculumredesign.org/frame-work/>

While TASK™ is but one tool in Sulitest’s education for sustainability toolbox—focused on core cognitive knowledge—it fills an important gap in the landscape of sustainability assessment by measuring one’s level of knowledge revealed through multiple item-responses situated within a **holistic, integrated, systemic, and interdisciplinary structure**.

While curriculum and pedagogical transformation takes multiple forms across diverse contexts, **TASK™** is the **“game changer”** that makes **sustainability a common language for all**, regardless of the degree, specialization, profession, or business sector. It constitutes a base of common knowledge upon which engineers, managers, biologists, and public authorities—for example—can communicate and use a common language as they work together to build a sustainable tomorrow. Of course, knowledge is not enough; sustainability literacy also requires a discrete mix of attitudes and mindsets, competency-based skills, and behaviors that enable action. However, several studies (including those cited above) provide compelling evidence that the sharing of a common base of knowledge is crucial to enabling transformative action and triggering systemic change.

*“I support the idea of seeking to identify key principles and insights around sustainability, track initial awareness and progress in business education and beyond to raise quality and ultimately action to tackle global warming. Sulitest is an important initiative to explore ways to meet these goals.”*

– **Andrew Jack, Global Education Editor at Financial Times**

*“The Assessment of Sustainability Knowledge (TASK™) is an exciting initiative for measuring sustainability knowledge across the globe. At AASHE, we believe that sustainability should be incorporated throughout the curriculum so that all graduating students, no matter what career path they chose, are equipped with the knowledge and solutions they need to address sustainability challenges.*

*TASK™, through its evaluation of students and their knowledge, will help realize this goal throughout the world.”*

– **Meghan Fay Zahniser, Executive Director at AASHE**

*“As we face the climate catastrophe, the role of higher education in solving one the greatest challenges ever facing humanity has never been greater. Sulitest provides an important lens on how well we are educating students to respond to this emergency - equipping institutions with vital insight to ensure they can adapt their pedagogical approaches and raise literacy around sustainability. This will drive the transformation of sustainability education for years to come.”*

– **Leigh Kamolins, Director of Analytics & Evaluation at QS Quacquarelli Symonds**

*“Having a tool that allows higher education and business to easily assess sustainability knowledge for students and employees is critically important to meeting impact goals. The Sulitest tools will help your organization assess the knowledge, skills, and attitudes to further drive your sustainability initiatives.”*

– **Nicholas Igneri, SVP & Chief Global Product Officer at AACSB**

## Engaging relevant contributors and stakeholders

The development of TASK™ took place over 1 year. Coordinated by the Sulitest team, it mobilized as many stakeholders as possible to ensure that this new tool is robust, reliable, and relevant.

In addition to the internal Sulitest team, three different groups were involved in the development of TASK™:

- A **“TASK™ Force”**<sup>6</sup> composed of experts, practitioners and researchers who worked on the foundations of the tools, the characteristics of the assessment and the specifications of the platform. A team of external writers (experts and researchers in the field of sustainability) completed the TASK™ Force for creating the assessment content: the questions/answers and their alignment with the TASK™ domain of knowledge (see below).
- The Sulitest Impact **R&D Committee**<sup>6</sup> supported this effort by ensuring the consistency of decisions made by the operational TASK™ Force.
- The **Fellows**<sup>6</sup>: Defining our model of sustainability knowledge with the TASK™ Force required engaging with the relevant scientific literature and existing approaches and frameworks for sustainability. Sulitest also mobilized an assembly of relevant stakeholders (almost 70 people from academics to corporates, from accreditations and rankings to students’ organizations, from institutions to civil society and NGOs), the “Fellows”, to provide feedback and ensure the coherence and consistency of this work. This process required making choices to position our tools and actions in the fields of sustainability and sustainability education, which allowed us to build our own model of sustainability knowledge reflecting our vision of sustainability.

*“By successfully mobilizing a global network of experts, academics and institutions to co-create the tool and its content, Sulitest is setting a new benchmark for collaborative innovations serving people, planet and then prosperity.”*

*– John North, Managing Director at GRLI*

## Defining a model of sustainability knowledge

Defining and documenting our approach to sustainability knowledge required a considerable amount of work, given that sustainability is a contested concept that is not yet anchored to a well-defined and consensual body of knowledge. It encompasses diverse and sometimes conflicting notions and approaches.

The Sulitest team and the TASK™ Force therefore mobilized a wide body of recent and relevant science-based literature and existing approaches, methodologies,<sup>6</sup> and frameworks for sustainability. Then the assembly of Fellows were consulted and asked to provide feedback, allowing Sulitest to sharpen the approach in an iterative process. This year-long process also implied that Sulitest make conscious and intentional choices that necessarily situated Sulitest concepts, tools, and actions at specific locations within an existing field of sustainability and education for sustainability. As such, **we combine major frameworks to build our own model of sustainability knowledge, one that projects our vision of sustainability.**

<sup>6</sup> [bit.ly/task-contributors](https://bit.ly/task-contributors)



We consider this model of sustainability knowledge as a bold vision for our world and shared future. It builds upon the embeddedness of Earth systems, upon a solid foundation of human welfare, and upon multiple levers of action and opportunity that make sustainability possible, although, alas, still uncertain. It requires that humans know and understand the multiple frameworks, domains, and subjects that constitute sustainability, as well as their systemic interlinkages of causality and impact. This model is a call for **radical systemic** change in what we need to know and understand in order to empower ourselves for the building of the sustainable future we want and need.

*“Understanding ecological issues in all their complexity and systemic dimension must become the norm. Initiatives such as Sulitest and TASK™ help to ensure that the subject is taken seriously, through systematic assessment of learners, which is essential if any approach to teaching about transition issues is to be credible!”*

*– Clémence Vorreux, Higher Education Coordinator at The Shift Project*

## MAIN SOURCES OF CONCEPTUAL INSPIRATION

- I. The **UN 2030 Agenda for Sustainable Development**<sup>7</sup>, which provides a common roadmap embracing the systemic nature of sustainability with 17 Sustainable Development Goals (SDGs) and 169 related targets. Holistic and integrated by design, the 17 SDGs reveal a systemic approach to sustainability via their multiple interlinkages, synergies, co-benefits, trickle-down effects, feedback loops, but also potential conflicts, trade-offs, and zero-sum gains.

Specifically, the Global Sustainable Development Report (GSDR) and its 2019 edition<sup>8</sup> identifies **four levers of action** that support deep transformation for the global goals, which we have adapted and integrated into our model: Governance; Economy and Finance; Science and Technology; and Individual and Collective Action.

- II. The **Planetary Boundaries Framework** by the Stockholm Resilience Center<sup>9</sup>, which identifies nine planetary boundaries that regulate the stability and resilience of the Earth system and provide a safe operating space for humanity to thrive<sup>10</sup>. Acknowledging that there is a scientific debate occurring currently around the concept of planetary boundaries, and that the quantifications of these boundaries are continuously evolving and in the process of being documented, this approach provides nevertheless a solid framework to articulate the different domains of Earth Systems and their systemic interactions. Climate change and biosphere integrity are the core domains of Earth systems, and they are continuously interacting with all other regulating planetary boundaries.

<sup>7</sup> <https://sdgs.un.org/goals>

<sup>8</sup> Messerli, P., Murniningtyas, E., Eloundou-Enyegue, P., Foli, E. G., Furman, E., Glassman, A., ... & van Ypersele, J. P. (2019). *Global Sustainable Development Report 2019: The Future is Now – Science for Achieving Sustainable Development*. <https://sdgs.un.org/gsdrgsd2019>

<sup>9</sup> <https://www.stockholmresilience.org/research/planetary-boundaries.html>

<sup>10</sup> Rockström, J., Steffen, W., Noone, K., Persson, Å., Chapin III, F. S., Lambin, E., ... & Foley, J. (2009). “Planetary boundaries: exploring the safe operating space for humanity.” *Ecology and Society*, 14(2). See also, Steffen, et al, “Planetary Boundaries: Guiding Human Development on a Changing Planet.” *Science*, 347(6223), 15 Jan. 2015.

This framework inspires an embedded conceptualization of sustainability, where the SDGs can be viewed as a “wedding cake”<sup>11</sup> where the Economy is embedded in Society, which is itself embedded in the Biosphere.

III. The Kate Raworth Model<sup>12</sup> of “**Doughnut Economics**” provides a third framework the Sulitest TASK™ Force used to delineate sustainability knowledge. This model of sustainability holds that humanity might thrive beyond the 21st century by requiring that meeting human needs (the social foundation) remains subject to the ability of the living planet to provide for such needs (the ecological ceiling).

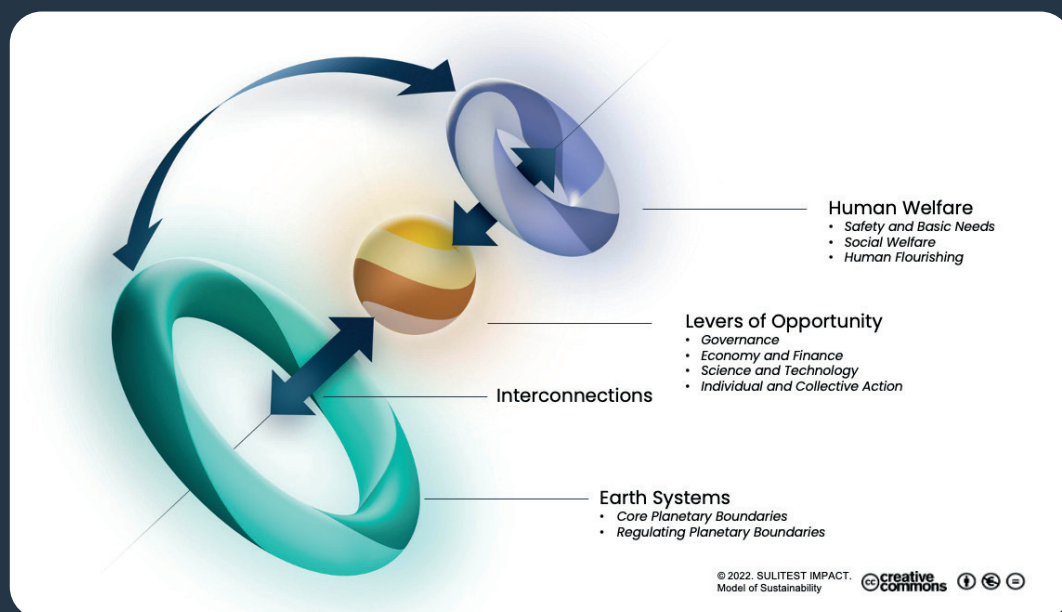
## STRUCTURING AND OPERATIONALIZING OUR MODEL IN A FOUNDATIONAL MATRIX

Combining these sources of inspiration with the existing literature in the fields of sustainability and education for sustainability, the TASK™ Force structured the **model of sustainability knowledge** into a **foundational matrix**. This matrix seeks to articulate the inspirational frameworks previously mentioned within a coherent model, enriched with our own vision of sustainability knowledge.

This model of knowledge is not specific to a discipline or a sector but follows the thematic, integrated, embedded, and systemic nature of sustainability literacy.

***The model states that all individuals should know and understand Earth systems, the social foundations of human welfare, the levers of action and opportunity that inform and influence our ability to build a sustainable future, and the systemic interlinkages existing between and across them.***

This Model is operationalized via a foundational Matrix of Sustainability Knowledge organized into three Frameworks:



<sup>11</sup> <https://www.stockholmresilience.org/research/research-news/2016-06-14-the-sdgs-wedding-cake.html>

<sup>12</sup> Raworth, K. (2017). *Doughnut Economics: Seven Ways to Think Like a 21st-Century Economist*. Chelsea Green Publishing.

As also designed by the Sulitest TASK™ Force, and as indicated in the matrix, there are four discrete types of sustainability knowledge assessed by TASK™:

- **Descriptive:** what are we talking about? How does this work?
- **Contextualized:** Where are we now? How are things changing?
- **Causal:** Why is this happening? Who is doing what and why?
- **Integrated:** What are the related effects? How is this affecting the larger system?

In conclusion, the resulting Sulitest matrix consists of 3 higher-order Frameworks (e.g., Earth Systems); 9 second-order Domains (e.g., Core Planetary Boundaries); 28 third-order Subjects (e.g., Climate Change); and 96 test Items at the most granular level (e.g., Definition of climate change). This **foundational matrix** expresses our systemic vision of sustainability knowledge. It can be found in **Appendix B**.

#### WHERE DOES TASK™ SITS IN THE EDUCATION LANDSCAPE?

Few words from Aurélien DECAMPS, Co-Founder of the Sulitest movement

*"TASK™ is designed to set a new standard of sustainability knowledge that anyone should have, the common language that enables the building of a sustainable tomorrow.*

*The education landscape is currently moving toward a necessary transformation. It takes multiple forms in various contexts, and we see a profusion of pedagogical resources and initiatives emerging to rethink curricula. This is a super good news!*

*In this movement, TASK™ is adopting an original position: we provide a robust measure based on a structured model of sustainability knowledge and a foundational matrix. To navigate through this model, our standardized assessment comes with a mapping of the key ideas covered by each subject of the matrix, articulated in core learning objectives and key sources and references. Their primary purpose is to inform the ongoing process of reviewing and revising course learning objectives and corresponding curricular content.*

*Of course, there is not one best way to transform education toward sustainability. Each educator has the freedom and expertise to build their own pedagogy that best matches the learning objectives of their educational context. TASK™ is allowing educators to map their current courses, to pilot the transformation of their curricula with relevant frameworks and data, and to assess their impact on sustainability knowledge.*

*TASK™ is just a piece in the puzzle, but a crucial one that was missing in the education landscape. It does not mean to replace the trainings or learning tools and material, but to provide relevant frameworks, data and metrics that enable the academic community to fulfill their mission for the global goals. A vibrant community of Change Leaders is currently experimenting various ways of embedding TASK™ into the curriculum, learning from their peers and building new paths for truly mainstreaming sustainability knowledge."*

## Developing and piloting TASK™

The TASK™ Force and the team of writers contributed to the development of questions based on their areas of expertise. Questions were formulated in a multiple-choice format, with one correct response and three incorrect responses. They were organized using the structure of the matrix (see above) and tagged for bibliographic reference, author, and additional miscellaneous information (e.g., connection to SDGs, relation to other dimensions in the matrix, etc.).

The **first step of establishing face validity** was organized by an editorial team coordinated by Sulitest using the following criteria : format of the questions (including number of words), relevance of the questions (what learning outcome is assessed by this question), relevant metadata (matrix subject, SDGs...), correct answer and distractors (plausibility, similarity in terms of length and wording...), language / phrasing, source, and expiration date allowing for a continuous updating of content.

Once the first step was completed, a **pilot study** was conducted in November 2022. Thanks to the support of many students' networks and academic networks, the pilot study was a success with a sample of 1382 respondents who completed the pilot-version of TASK™.



A first batch of 288 questions were tested (in English and French) and two types of analysis were conducted: a first analysis harvesting qualitative feedback from the respondents about the relevance of TASK™, the content, and the user experience accessing the online platform and taking the assessment; a second quantitative analysis for test reliability based on Item Response Theory.

**Qualitative data** was collected via a feedback form (optional at the end of completing the TASK™ pilot) and through three group sessions conducted at different universities. In general, participants of the TASK™ pilot study found it very useful to have a (quantitative) assessment score for their level of sustainability knowledge. 28% of respondents found it “critical”, while 55% of respondents found it “very useful”. 56% of respondents found TASK™ “slightly enjoyable” and 24% of respondents found it “very enjoyable”. 60% of the respondents expressed that TASK™ represents “well” sustainability knowledge and 25% “very well”. In addition, there was a general perception that the TASK™ was a difficult test. Most respondents found TASK™ to be either “very difficult” (34% of respondents) or “slightly difficult” (62% of respondents). To address this feedback, an important effort to revise almost half of the questions was carried out in December 2022 and January 2023, and a second sample of 684

respondents tested the revised content in February 2023 prior to the launch of TASK™.

The **quantitative analysis** used psychometrics techniques from Item Response Theory (IRT) to confirm the **validity and reliability of the assessment**. This analysis is continuously updated with the latest data from TASK™. The next section presents the psychometric foundations of the TASK™ model and the updated analysis of test reliability with an sample of 4346 completions of the assessment between its launch in March 2023 and June 2023.

*“The Sulitest serves as a useful tool to advance the knowledge and skills required for a more just and sustainable future. Future graduates will have deeper understanding and appreciation for how sustainability relates to all disciplines and careers thanks to the work of the Sulitest community. We’ve been really delighted to support the latest pilot of the Sulitest and see it as a complementary tool to our whole institution change programmes like Responsible Futures and campaigns like Teach the Future. It’s exciting to see the Sulitest develop and align with our mission to see all students learning and leading for sustainability.”*

**– Quinn Runkle, Director of Education at Students Organising for Sustainability UK**

*“As a student activist and member of Pour un Réveil Écologique, I’ve seen a striking gap between students’ sustainability aspirations and the response from higher education institutions. TASK is not only a personal assessment tool but also a potential game-changer in sustainability education. It can be used as a real anti-greenwashing test, offering a tangible measure of the efficacy of sustainability teaching, and thereby revealing alignment, or misalignment, between an institution’s words and deeds. By providing clear data on student knowledge at different points in their academic journey, TASK can help inform and shape sustainability strategies within these institutions. I see TASK as an indispensable tool in our lobbying efforts to push for more robust integration of sustainability in education.”*

**– Grégoire Landoyer, member of Pour un Réveil Écologique**

*“TASK™ by Sulitest are pioneering embedding Education for Sustainable Development (ESD) into usable course content that can go into curricula in such a way that can launch an international movement of sustainability worldwide. The SDG Students Program from the Sustainable Development Solutions Network – Youth’s (SDSN Youth) 69 Hubs from across the world, partnered to trial TASK™ in its initial stage. Sulitest regularly engaged with young people through SDSN Youth, viewing students as stakeholders for ESD in higher education. They also offered our students the first opportunity to earn a TASK™ certificate, which is a fantastic opportunity for developing the sustainable development knowledge for young people in our program. We have been thrilled to work with Sulitest, and celebrate their championing the importance of ESD in higher education for a better world.”*

**– Ellen Dixon, Project Lead at the SDG Students Program at SDSN Youth**

*“Supporting Sulitest has demonstrated to us how valuable a tool it is to mainstream sustainability literacy and ensures that a growing number of graduates have sufficient understanding of sustainability education and how to integrate into their daily lives. We see this as the start of an accelerating movement to bring sustainability education critically into all disciplines and look forward to collaborating further to enhance Sulitest’s vision of making sustainability education accessible, understandable, and practical and supporting the creation of sustainability minded future leaders.”*

**– Amy Brereton, Chief Operating Officer at Enactus UK**



## 25 universities commit to mainstreaming sustainability knowledge

Only three months after the launch of TASK™, we are excited to announce that 25 prestigious HEIs have joined the Change Leader Program. This program aims to make sustainability a common language for all graduates, with the ambitious objective of certifying at least 75% of their graduates within the next three years. By integrating sustainability into their curricula, these institutions are taking a significant step towards equipping future leaders with the necessary knowledge and skills to address the pressing challenges facing our planet.



### THE POWER OF CHANGE LEADERS

HEIs hold a critical role in fostering sustainability and tackling the global challenges we face. The Change Leader Program recognizes the urgency of incorporating sustainability into every curriculum, ensuring that graduates from diverse fields are equipped with the tools to implement sustainable solutions.

### STANDARDIZED MEASUREMENT AND MONITORING

Thanks to TASK™, these HEIs will have a standardized measurement and monitoring tool, which enables them to assess the level of knowledge about sustainability among their students. While recognizing that sustainability knowledge is just one element in the transition to a

desirable future, such knowledge plays a fundamental role in building a sustainable world. By monitoring their students' understanding of major sustainability issues and their interconnections, these institutions can now identify areas of improvement and adapt their teaching methods accordingly.

For example, offering TASK™ to their students at the beginning of a course can help educators to gain a better insight into their level of understanding of basic concepts. This way, they can adjust their pedagogical approach and deliver more appropriate teaching.

Moreover, TASK™ also allows institutions to measure the impact of their educational offerings. Offering TASK™ as an entry- and exit-testing in a program provides rich insights to assess the impact of pedagogy on graduates' sustainability knowledge.

Lastly, the detailed and aggregated results provide tangible evidence to demonstrate the impact of sustainability education strategy to accreditors, rankings and various stakeholders.

## **EMPOWERING FUTURE LEADERS**

The integration of sustainability into higher education curricula empowers students to become change agents and leaders in their respective fields. By equipping graduates with a deep understanding of sustainability challenges, strategies, and solutions, these institutions are nurturing a new generation of professionals who will drive the transition towards a sustainable world. The Change Leader Program ensures that sustainability is not confined to a single discipline but becomes an integral part of every student's educational journey!

## **FORMING A COMMUNITY OF PRACTICE**

Transforming education, rethinking curricula and mainstreaming sustainability knowledge is a tremendous challenge, highlighting the crucial role of higher education in the global agenda. It can take multiple forms in various context, and we need collective intelligence, to learn from our peers to provide relevant paths for answering to this challenge. By forming a vibrant community of practice, the Change Leaders are building these new paths to embed sustainability into the educational journey and to demonstrate the impact on their students' sustainability knowledge.

*“KEDGE Business School supports the development of Sulitest from the early stages. Following our ambition to include sustainability in all curricula, taking the Sulitest has been a graduation requirement for 100% of our students since 2016. When the Sulitest initiative has scaled up in 2022, KEDGE has been one of the main contributors to the fundraising that led to Sulitest Impact. Today, Sulitest Impact, incubated at KEDGE, launches TASK™, built on contributions from several researchers – including KEDGE’s center of excellence. In line with its KEDGE Impakt strategy, KEDGE is now committed to certifying TASK™ at least 75% of its graduates.”*

**– Alexandre de Navailles, General Manager at KEDGE Business School**

*“TBS Education became a company with a mission (statut de société à mission) in 2022. Among our statutory objectives, we are committed to training responsible players by integrating the challenges of transition into our teaching. Sulitest is an integral part of our system, enabling us first to raise awareness among our students, then to measure the impact of our teaching by validating their level with TASK™. We have joined the Change Leader program, and we intend to share our commitment as widely as possible with our partners, particularly our international academic partners.”*

**– Florent Deisting, Director of Societal Transition at TBS Education**

*“In 2023, students, staff and alumni of ENTPE, a French civil engineering school, performed TASK™. It enabled them to have a comprehensive vision of the whole SDG’s and to assess their knowledge on sustainability beyond their central technical expertise as engineering students.”*

**– Lionel Bessard, CSR Chief Officer at ENTPE**

*“Since January 2023, our engineering school has been a member of the Change Leaders community. Our goal is to use Sulitest as a learning tool for Sustainable Development Goals. All our students, about 250 people per promotion, will pass the TASK™ certifying test every year, and they will see their own progress in Sustainability Literacy. We are proud to support our students in the ecological and social transition to come.”*

**– Roseline Descout-Rénier, Teacher at Ecole Nationale Supérieure de l’Electronique et de ses Applications**

*“At a time when CSR is playing a growing role not only in corporate decision-making but also in our daily lives as citizens, students at ECE and ESCE International Business School are experimenting with the first online certification of their sustainability knowledge thanks to TASK™, a certification designed by Sulitest that should eventually be accessible to all OMNES Education Group students.”*

**– Pascal Vidal, Dean Academic Programs at OMNES**

*“At Institut Mines-Telecom Business School, the most socially inclusive French business school and the most advanced regarding the contribution to the SDG, we strongly believe that our main responsibility is to train future managers and entrepreneurs that will lead the transition towards a sustainable and desirable future. To do so, we have been supporting Sulitest from the outset. All our students have to pass it. We think that we now need to move one step further, with the certification of the acquired competencies. We are very proud to be one of the first Change Leaders supporting TASK™ by Sulitest.”*

**– Denis Guibard, Dean at Institut Mines-Telecom Business School**



*"Since 2014, GEM has actively engaged in the development and implementation of Sustainability Literacy Test tools to enhance sustainability awareness among students, staff, and faculty. The customizable tools, such as Sulitest, Suliquiz, and Looping, have been widely deployed across various programs and have been instrumental in promoting strategic initiatives like GEM's Zero Waste ambition and its Société à Mission status. The newly introduced TASK™ certificate allows for measuring and benchmarking core sustainability knowledge, including understanding planetary limits and emerging economic models like the Donut. Grenoble Ecole de Management has been working to equip our students with the knowledge and skills necessary to provide responses pressing global sustainability issues and create a common language to address them professionals and citizens and the Sulitest community is an important part of this transformation. "*

**– Jaclyn Rosebrook, Head of Sustainability at Grenoble Ecole de Management**

*"Building on the long-standing relationship between IESEG School of Management and Sulitest, we have decided to become TASK™ Change-Leaders to promote TASK™ among our eco-system. After a voluntary session for all our IESEG students and alumni in June 2023, TASK™ will become mandatory for all Master students of the Programme Grande Ecole in October 2023 as part of the "Change Management for Sustainability Strategies" course. For IESEG students, this is a great chance to be among the first to certify their sustainability knowledge. For faculty, integrating this externally-verified tool into the curriculum demonstrates alignment with international competence frameworks, and promotes a harmonized approach across schools."*

**– Myriam Degrave, Environmental and Social Impact Manager at IESEG School of Management**

*"Humanity is facing increasing pressure to tackle climate change and social disturbances. We must be aware that we cannot solve these issues with the same mindset, tools and theories that created them. For higher education, it means we cannot conduct our research and education mission the same way – we must innovate in both our content and learning experience. To do so, we have to see students' academic results as an output, and the impact of our teaching on their behaviour and understanding of sustainability issues as an outcome. Understanding and measuring this outcome requires innovative tools, such as TASK™ by Sulitest. Every institution is unique, and combining our diversity through a common platform is one of the greatest strengths of TASK™ by Sulitest.*

**– Jean-Michel Champagne, Lecturer and Sustainability Officer at HEC Montréal**

*"TASK™ is an invaluable tool for assessing the quality and relevance of our teaching in terms of training in the challenges and solutions of ecological and societal transition. By integrating TASK™ into the curriculum, at the end of a series of courses on sustainable development issues, and before the end of their bachelor's degree, we can measure the real impact of our program and ensure that our future graduates have the knowledge and skills they need to meet the challenges of major transitions, and make the right choices in terms of orientation, internships and career paths. We value its key features of automation, repeatability, robustness, consistency and frequent updates. This guarantees a constant and reliable assessment of the sustainability knowledge of our stakeholders – students, staff, alumni. To be part of the TEST, or not to be, TASK™ is more than the question, it's the solution!"*

**– Johanne Géa, CSR Project Manager at JUNIA**

*"We support the Sulitest movement because we are convinced of the need for a tool to assess students' knowledge of ecological and social transition issues. The sulitest tools are based on a strong scientific foundation and cover a wide range of subjects (environmental, social and human organization). Our idea is to be able to use TASK™ to compare our students' scores at the start and end of their studies, to see how they have progressed thanks to the program they attended."*

**– Maud Chassande, Head of Ecological Transformation at ESSEC Business School**

*"I support the Sulitest movement because it embodies values that are close to my heart. The Sulitest tools offer a unique opportunity to promote sustainability and social responsibility in higher education. They enable us to measure and evaluate our understanding of these issues, as well as our ability to respond to them effectively. I use Sulitest tools with my students to assess their knowledge and skills, identify gaps and take concrete steps to improve their contribution to a more sustainable future. Thanks to Sulitest, I can play an active role in building a better world."*

**– Sebastien Bourdin, Full Professor at EM Normandie Business School**

*"In its first year, the TASK™ was taken by over 100 UniLaSalle students, enabling them to assess their knowledge of ecological and societal transformation. In fact, some students took the test on a voluntary basis, so as to be able to promote it to future employers as part of their search for a CSR internship."*

**– Caroline Le Moulec, Responsable de la transformation écologique et sociétale at UniLaSalle**

*"The ESME engineering school with Sulitest is the guarantee of being able to challenge our knowledge on environmental and social stakes on a global scale. Our students will progress and evolve professionally and personally by validating a level of certification with the TASK™ tools to have a common language and culture of the CSR in a fast changing world. Thanks to this tool, we can develop our learning methods and use strong references in sustainability."*

**– Véronique Bonnet, General Manager at ESME**

*"As a university teacher, I want my students to develop their knowledge and skills. Sulitest's TASK™ creates the opportunity to assess and demonstrate one's understanding of sustainability, an essential competency that should belong to any diploma – hence, that cannot be made visible in all diplomas. TASK™ feels this gap and I'm enthusiastic to be a part of its deployment."*

**– Laurent Audouin, Associated Professor at Université Paris-Saclay**

*"The deployment of TASK at ENPC is part of the school's approach to integrating ecological issues, with the aim of training tomorrow's engineers, capable of thinking about systemic issues and adjusting their decisions accordingly. By enabling students to test their knowledge in the field of sustainability, TASK contributes to this movement."*

**– Léa Falco, Sustainability Training Project Manager at ENPC**

## **Case Study - Integrating TASK™ at EM Normandie**

### **WHO IS COORDINATING THE USE OF TASK™ EM NORMANDIE?**

The use of TASK™ is being coordinated by the Chief Strategy Officer of Societal and Environmental Impact. On an operational level, it is overseen by Sébastien Bourdin, a professor of economic geography, who handles the coordination and organization of TASK™ in conjunction with the program management. His role involves planning and coordinating the application of TASK™, ensuring issues are identified and improvements are implemented.

### **HOW WAS IT IMPLEMENTED?**

The implementation of TASK™ was a collaborative effort with the Program Management team. We reached out to academic directors and study directors to find a slot in the students' schedules. The organization of exam sessions was arranged based on these time slots. Most of these slots were fixed, but some were spread over a week to allow students the freedom to take it when they preferred. An email was sent to each student with the instructions.

### **WHAT HAVE YOU LEARNED FROM IT?**

The implementation of TASK™ - Sulitest was a rich learning experience. It helped us identify disparities in results between different cohorts of students and also pinpoint areas of improvement to enhance their level and better prepare them for future challenges. This kind of data-driven approach to learning and improvement is increasingly recognized as crucial in educational settings.

### **ANY BEST PRACTICES YOU RECOMMEND?**

It is important not to underestimate the time required to set up sessions and coordinate with study directors and academic directors in advance.

### **YOUR FUTURE PLANS WITH TASK™**

Our future plans involve further deployment of the exam, providing precise tracking, sensitizing study directors more in advance, preparing engaging speeches that highlight the benefits and interests for the students in taking the test, and working on a list of references to allow students to prepare for the exam.

## A robust measure of knowledge based on psychometrics

To assess this specific model of sustainability knowledge and to provide a robust measure of ability, TASK™ is based on a psychometric model developed by Sulitest's Data Scientist Alexander Brewer, collaborating with Dr Talia Stough (Assistant Professor at Open Universiteit and member of the TASK™ Force) and a group of researchers.

### POSITIONING – WHY PSYCHOMETRICS?

Imagine you're an educator, and your primary goal is to foster learning and development in your students. To achieve this, you need to understand your students' strengths and weaknesses, their learning progress, and the effectiveness of your teaching methods. Now, that's a lot to figure out just by observation or casual classroom assessments, isn't it?

This is where psychometrics comes into play. At its core, psychometrics is the field that deals with the measurement of knowledge, abilities, attitudes, and personality traits. Its application in education is called educational assessment.

First, let's consider standardized tests like the SAT, TOEFL, or GMAT. It's through psychometric principles that we can trust these tests to give us a reasonable measure of a student's academic abilities. These exams are carefully designed, tested, and revised to ensure they accurately and fairly evaluate students' knowledge and skills.

In addition to large standardized tests, psychometrics can also be applied to classroom quizzes, exams, and other types of assessments. It helps ensure that the questions we ask truly measure what they're intended to. For instance, if a math test question inadvertently requires extensive reading comprehension, it may not accurately reflect a student's math skills. Psychometric analysis can detect and help correct such issues.

Moreover, psychometric data can provide insights about learning progress over time. Teachers can use this to identify students who are excelling or falling behind and then adapt their teaching strategies accordingly.

Psychometrics also plays a crucial role in evaluating educational interventions. Let's say a new teaching method or curriculum is introduced. Psychometric assessments can help determine whether this new method is more effective than the previous one.

*"Sustainability is growing in importance for candidates interested in graduate business education. GMAC's research shows that 4 out of 10 prospective students – including 5 out of 10 women – expect sustainability or corporate social responsibility to be a part of their graduate management education curriculum. After graduation, business school candidates tell us they want to use their education to make a positive impact on the planet and its people. Sulitest will help empower business students to deliver on their goals of translating sustainability and social good from the classroom to the real world."*

**– Joy Jones, CEO at Graduate Management Admission Council**

Finally, these assessments help uphold standards of fairness and equality. For example, they can help ensure that assessments are unbiased and don't disadvantage any particular group of students.

So even though the statistical back-end of psychometrics may seem complex or daunting, its value is evident. It allows us to measure, track, and facilitate learning in a systematic, reliable, and fair way, ultimately helping to enhance educational outcomes.

## BACKGROUND

The initial investigations of TASK™ during the pilot study prior to its launch were primarily focused on assessing test reliability and conducting a qualitative analysis of respondent traits. In the ongoing pursuit of data-driven insights, these analyses are continuously updated with the latest data. In the case of the present report: 4346 completions of the assessment between March and June 2023.

Given the potential of psychometrics in fostering learning and development, a key area of our focus now lies in investigating the relationship between respondent's abilities in the sphere of Sustainability Literacy. To this end, we examine TASK™'s descriptive statistics, the underlying model, and delve into the intricacies of the relationships between respondent abilities and the content of the assessment.

## TASK™ MODEL

A central limitation of Classical Test Theory (CTT) is that it operates under the assumption of test scores being linear and the same across all test takers. This disregards individual differences in ability levels, item characteristics, and the dynamic interplay between these factors. CTT's reliability statistics, consequently, are sample-dependent and lack generalizability across different groups or conditions. This becomes particularly limiting when analyzing complex constructs, like sustainability knowledge, where individual response behaviors can greatly vary, and different knowledge areas are subjects to systemic interactions.

To provide a robust psychometric measure of ability, **TASK™ is building on Modern Test Theory (MTT), or Item Response Theory (IRT)**. Sulitest attempts to innovate in the field of psychometrics through the development of a **reformulated IRT model** which includes hierarchal parameterizations of items allowing to integrate the structure of the matrix of sustainability knowledge and multidimensional assumptions of ability into a geometric representation of ability. The inclusion of hierarchal item parameters, multidimensional assumptions, and geometric representation of ability aims to provide a system of measurement that can be used to inform curriculum structures with quantitative science. The use of data science techniques, such as machine learning, to analyze large amounts of assessment data and the specification of the model support the robustness of TASK™ as a measure of ability and allow for continuous improvement of the validity and reliability of test scores.

The **technical specification of the TASK™ model as well as the test reliability analysis** are detailed in **Appendix C**.

The detailed granularity of this model is particularly paramount given the systemic nature of sustainability. This multifaceted concept, embracing an extensive range of subjects from environmental science to social justice, necessitates a multidisciplinary understanding. By leveraging the intricate parameterization in our model, we can accurately identify areas where respondents demonstrate proficiency or reveal gaps in knowledge.

This insight not only enhances our understanding of an individual's sustainability knowledge but also provides valuable information for educational programming. With this level of detail, we can guide the refinement of education and training programs to ensure they address identified gaps and further strengthen areas of proficiency. In essence, the integration of item family parameters offers a novel and comprehensive method to assess, enhance, and tailor sustainability education.

## UNDERSTANDING THE SCORE

In IRT, ability is typically estimated on a latent trait continuum, which is an unobservable, hypothetical construct that represents the test-taker's level of proficiency or mastery of the test content. To provide a more natural interpretation of TASK™ scores, ability is estimated on a geometric latent trait continuum and measures a respondent's ability to assess sustainability knowledge, as defined by the model and content matrix put forth.

As previously described, TASK™ score is calculated by a machine learning IRT algorithm which models a respondent's abilities, dependent on the parameters of items and item groupings. TASK™ score is presented out of 100 which corresponds to the geometric transformation of the continuum contained within the applied model.

Sulitest's approach to the TASK™ matrix refutes the idea that sustainability knowledge can be precisely measured as a unidimensional construct or trait. Instead, **the capacity to assess sustainability knowledge is treated as a multi-faceted product of multiple abilities**. In essence, this reflects the premise that an individual is not merely the sum of their parts but embodies a more intricate underlying structure.

While the overarching structure of MTT and IRT models might seem complex to fully grasp, it's vital for respondents to comprehend how they can influence their TASK™ score.

### **A respondent affects their TASK™ score by:**

- Their engagement with items: **the number of items answered** by a respondent plays a crucial role. An unanswered question leads to a decrease in the precision of modelling the respondent's ability related to that item. Therefore, TASK™ incentivizes respondents to answer all questions.
- The **accuracy of responses**: correct answers serve as evidence that the

respondent's ability level surpasses the combined level of difficulty of the answered question.

- The **parameters of the answered items**, including difficulty: correctly answering more difficult questions yields higher points for that item. Although Sulitest's assessment forms are calibrated to comprise questions with equivalent average difficulty, variations between item difficulties do exist.

It's important to bear in mind that even with a functional geometric scale in place, the score merely approximates the underlying latent trait score. Moreover, the scale score is susceptible to influences from statistical assumptions and factors such as test-taking strategies, guessing, and measurement error.

Having examined the **reliability of the TASK™ test through the lens of Item Response Theory** in **Appendix C**, we can confidently state that our instrument is well-calibrated to provide accurate and meaningful insights into respondents' abilities. However, the proof of a test's value ultimately lies in the richness and applicability of the data it generates. Therefore, we now turn our attention to analyzing the respondents' abilities globally, and specifically in terms of the SDGs and Matrix Subjects. This transition allows us to move from the technical aspects of our assessment to the practical implications of the scores it produces, thereby painting a fuller picture of sustainability knowledge within our sample.



# Sustainability Knowledge: Trends and Data Analysis

## Trends at a glance

- 4346 completions between March and June 2023
- Average score of 50.95 and Median score of 51 (with a balanced distribution)
- 11.1% of all respondents with high scores of 70 or above
- Balanced distribution between Earth Systems, Human Welfare and Levers of Action, but disparities within these 3 frameworks.
- Higher level of abilities for:
  - Earth Systems : Climate Change, Ocean Acidification, Novel Entities
  - Human Welfare : Nutrition, Health, Housing and Human Settlements, Basic Income and Decent Work, Gender Equality and Education and Culture
  - Levers of Action : Infrastructure, Planning, and Natural Resource Management, Macroeconomic & Microeconomic Considerations, Sustainability Science, Transformative Change and Cognitive Capacity for Sustainable Development
- SDGs 1 (No Poverty), 17 (Partnerships for the Goals), 13 (Climate Action), 3 (Good Health and Well-being), and 14 (Life Below Water) present on average the highest ability scores (from 52.23 to 60.26).
- SDG 8 (Decent Work and Economic Growth) and SDG 9 (Industry, Innovation, and Infrastructure) have the lowest average scores (respectively 41.43 and 39.28)
- Modeling interactions between subjects using ability correlations indicates a clear difference between knowledge about Earth System and Human Welfare on one hand, and knowledge about Levers of Action on the other hand. Currently, knowing how to act seems to be a more specific knowledge.
- The SDGs presenting the highest level of interactions with others are SDGs 3 (Good Health and Well-being), 4 (Quality Education), 6 (Clean Water and Sanitation), 12 (Responsible Consumption and Production), and 13 (Climate Action).
- On the contrary, SDGs 8 (Decent Work and Economic Growth) and 9 (Industry, Innovation, and Infrastructure) exhibit lower correlations with others in the current knowledge of our sample.
- Finally, the variable significantly affecting the ability score of sustainability knowledge are:
  - Education attainment and education for sustainable development with a positive impact
  - Respondents who classified their sustainability knowledge as basic and moderate experienced a higher score than who classified their knowledge as experts.



## TASK™ DESCRIPTIVE STATISTICS

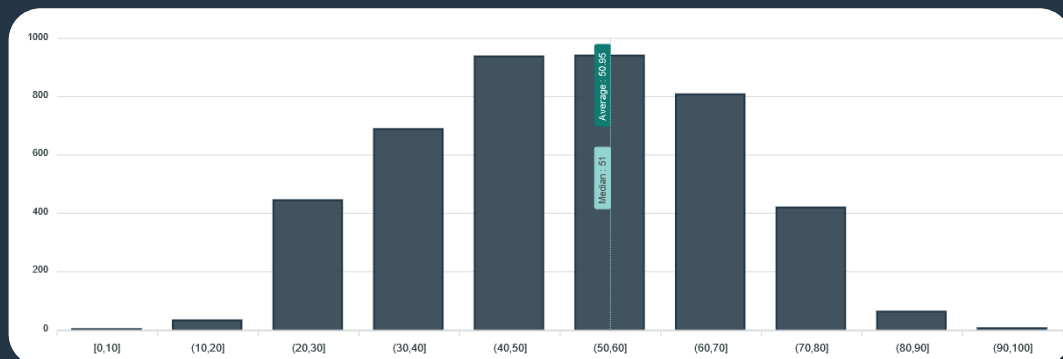
In our analysis of TASK™, we found a rich dataset based on **4346 completions** of the assessment between **March and June 2023**. The **average score** among all respondents was **50.95**, and a **median score** of **51**, indicating that at least half of the respondents achieved this score or higher.

The **standard deviation**, a measure of the spread or dispersion of scores, was calculated to be **17.46**. This signifies a considerable spread in scores, with many individuals scoring significantly above or below the mean.

Upon further analysis, we identified a small group of individuals with a high level of sustainability knowledge. Six respondents achieved scores between 90–100, 63 respondents scored between 80–90, and 420 respondents scored between 70–80.

In total, approximately **11.1% of all respondents** demonstrated high sustainability knowledge **with scores of 70 or above**. These high-performing individuals reflect the potential of TASK™ in fostering and identifying a deep understanding of sustainability. This differentiation in understanding emphasizes the efficacy of the TASK™ assessment in the educational landscape of sustainability knowledge.

The findings of this descriptive analysis will be further examined and integrated into the IRT model in subsequent analyses, as the sample of respondents will grow over time.



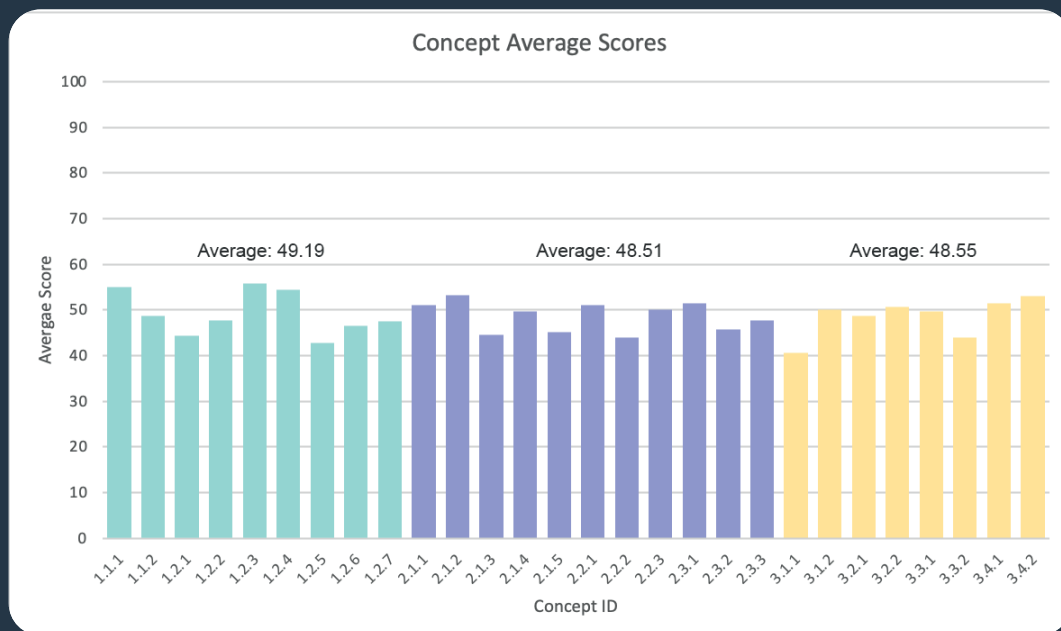
## AVERAGE SCORES – SUBJECTS & SDGS

As we delve further into understanding the results from our TASK™ assessment, a critical part of our investigation centers on analyzing the average scores of respondents' abilities. This analysis is organized around two significant dimensions: the Matrix Subjects, which is the content mapping defined by Sulitest, and the globally recognized Sustainable Development Goals (SDGs).

The Matrix Subjects provide a fine-grained view of specific knowledge areas and competencies that Sulitest has identified as integral to sustainability literacy. By examining the respondents' scores according to these Matrix Subjects, we can gain a detailed understanding of their strengths and areas of potential improvement across a wide range of sustainability-related topics.

Simultaneously, aligning our investigation with the SDGs allows us to examine respondents' abilities in the context of the global sustainability agenda. This alignment presents a unique opportunity to understand how well-equipped respondents are to contribute to these universally agreed-upon goals. Analyzing scores in terms of SDGs can help us gauge whether our respondents are prepared to tackle real-world challenges and contribute to the efforts towards sustainable development.

In the upcoming sections, we will present a detailed analysis of the respondents' average scores based on both the Matrix Subjects and the SDGs. Through this two-fold examination, we aim to offer a comprehensive perspective on the respondents' sustainability knowledge and abilities, thereby guiding our efforts to improve sustainability education and literacy.



The bar chart reveals interesting insights about the average scores of respondent's abilities linked to each subject of the matrix.

**If the three frameworks structuring the matrix seem relatively balanced in terms overall ability, significant differences in abilities appear within each framework.** These differences stay within a reasonable range (between 40 and less than 60), no subject present an average ability really lower nor really higher than the others. However significant disparities are observed, offering valuable insights to educators in building strategies to address these disparities in their curriculum and to enhance sustainability education and action.

Within **Earth Systems**, Climate Change (1.1.1), Ocean Acidification (1.2.3) and Novel Entities (1.2.4) are the three subjects presenting the highest average scores, respectively 55.10, 55.73 and 54.46. These scores indicate a stronger understanding or ability related to these subjects among the respondents compared to other subjects within Earth Systems.

Biosphere integrity (1.1.2) with 48.65, Land System Change (1.2.2) with 47.61, Atmospheric Aerosols Loading (1.2.6) with 46.55 and Stratospheric Ozone Depletion (1.2.7) with 47.44 are characterized by slightly lower ability scores, demonstrating a more moderate level of knowledge on these subjects.

Finally, Freshwater Use (1.2.1) and Biogeochemical Flows (1.2.5) presents the lowest ability scores within Earth Systems, respectively 44.30 and 42.82.

Looking at the subjects of the second framework **Human Welfare**, two main groups of ability score are distinguished.

On one hand, Nutrition (2.1.1), Health (2.1.2), Housing and Human Settlements (2.1.4), Basic Income and Decent Work (2.2.1), Gender Equality (2.2.3) and Education and Culture (2.3.1) have the highest average scores within the subjects of Human Welfare, ranging from 49.76 to 53.28.

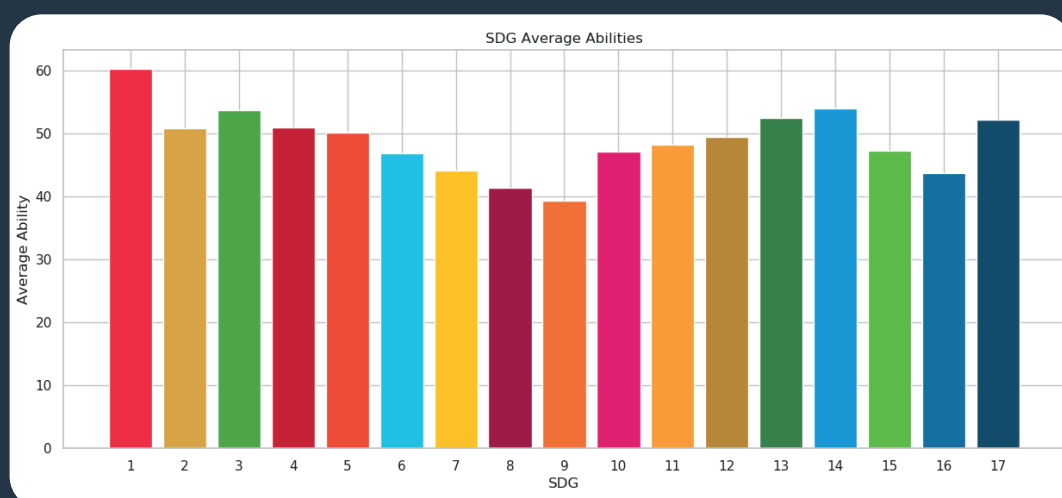
On the other hand, Access to Water and Sanitation (2.1.3), Access to Energy (2.1.5), Social Equity (2.2.2), Peace, Justice and Political Voice (2.3.2) and Gender Equality (2.3.3) present lower ability scores ranging from 43.87 to 47.66.

Finally, the trends in ability within the third framework of the matrix also reveal two main groups. This framework is assessing knowledge about the **Levers of Opportunity that make sustainability possible**.

Within these levers, Infrastructure, Planning, and Natural Resource Management (3.1.2), Macroeconomic Considerations and Finance (3.2.1), Microeconomic Considerations, Business, and Industry (3.2.2), Sustainability Science (3.3.1), Transformative Change (3.4.1) and Cognitive Capacity for Sustainable Development (3.4.2) present higher ability scores ranging from 48.75 to 53.13.

On the contrary, Laws, Policies, and Institutions (3.1.1) and Technology and Innovation (3.3.2) are characterized by lower ability scores from 40.66 to 44.02.

These preliminary results must be taken with caution as they rely on the sample of 4346 TASK™ takers who have completed the assessment during its first academic semester between march and June 2023. However, this sample is already significant, and it will grow as TASK™ is more and more used, providing insightful trends mapping sustainability knowledge to inform curriculum redesign and education for sustainability.



The bar chart reveals interesting insights about the average scores of respondent's abilities linked to each of the **Sustainable Development Goals (SDGs)**.

Starting from the lower end of the spectrum, **SDG 9** (Industry, Innovation, and Infrastructure) and **SDG 8** (Decent Work and Economic Growth) have the lowest average scores of approximately 39.28 and 41.43 respectively. This suggests that respondents on average may find concepts or competencies related to these goals more challenging to comprehend or apply, or it may reflect a lack of knowledge or emphasis on these areas in their educational or professional experiences.

As we progress upwards, **SDGs 16** (Peace, Justice and Strong Institutions), **7** (Affordable and Clean Energy), **6** (Clean Water and Sanitation), and **10** (Reduced Inequalities) exhibit marginally higher average scores ranging from about 43.67 to 47.14. Meanwhile, **SDGs 15** (Life on Land), **11** (Sustainable Cities and Communities), **12** (Responsible Consumption and Production), **5** (Gender Equality), **2** (Zero Hunger), and **4** (Quality Education) fall into a middle range with average scores spanning from approximately 47.23 to 50.93.

Next, **SDGs 17** (Partnerships for the Goals), **13** (Climate Action), **3** (Good Health and Well-being), and **14** (Life Below Water) register even higher average scores in the range of about 52.23 to 54.04. These scores may indicate a stronger understanding or ability related to these goals among the respondents, potentially due to greater exposure, interest, or emphasis on these areas in their training or environment.

Finally, **SDG 1** (No Poverty) stands out with the highest average score of approximately 60.26. This suggests that respondents demonstrate a particularly strong understanding or ability related to this goal, which could reflect the fundamental and cross-cutting nature of poverty reduction in sustainability efforts.

Even if the disparities between SDGs are limited within a reasonable range (between 40 and 60), disparities do exist. Of course, these trends will become more and more precise as the sample of TASK™ takers will grow. In summary, these findings underscore the varied levels of understanding and abilities related to different SDGs among respondents, offering valuable insights to educators, policymakers, and other stakeholders in tailoring strategies to address these disparities and enhance sustainability education and action.

## ABILITY CORRELATIONS – SUBJECTS & SDGS

Correlation matrices and their visualization through heatmaps represent powerful tools in our analysis of the **relationships between ability levels across different ability subjects.**

Correlation matrices offer a quantitative measure of the relationships between multiple variables at a time. Each entry in the correlation matrix represents the correlation coefficient between two variables, giving an indication of the strength of their relationship. In our context, each variable represents an ability subject, and the correlation coefficient is a measure of how closely related the ability levels are between two subjects.

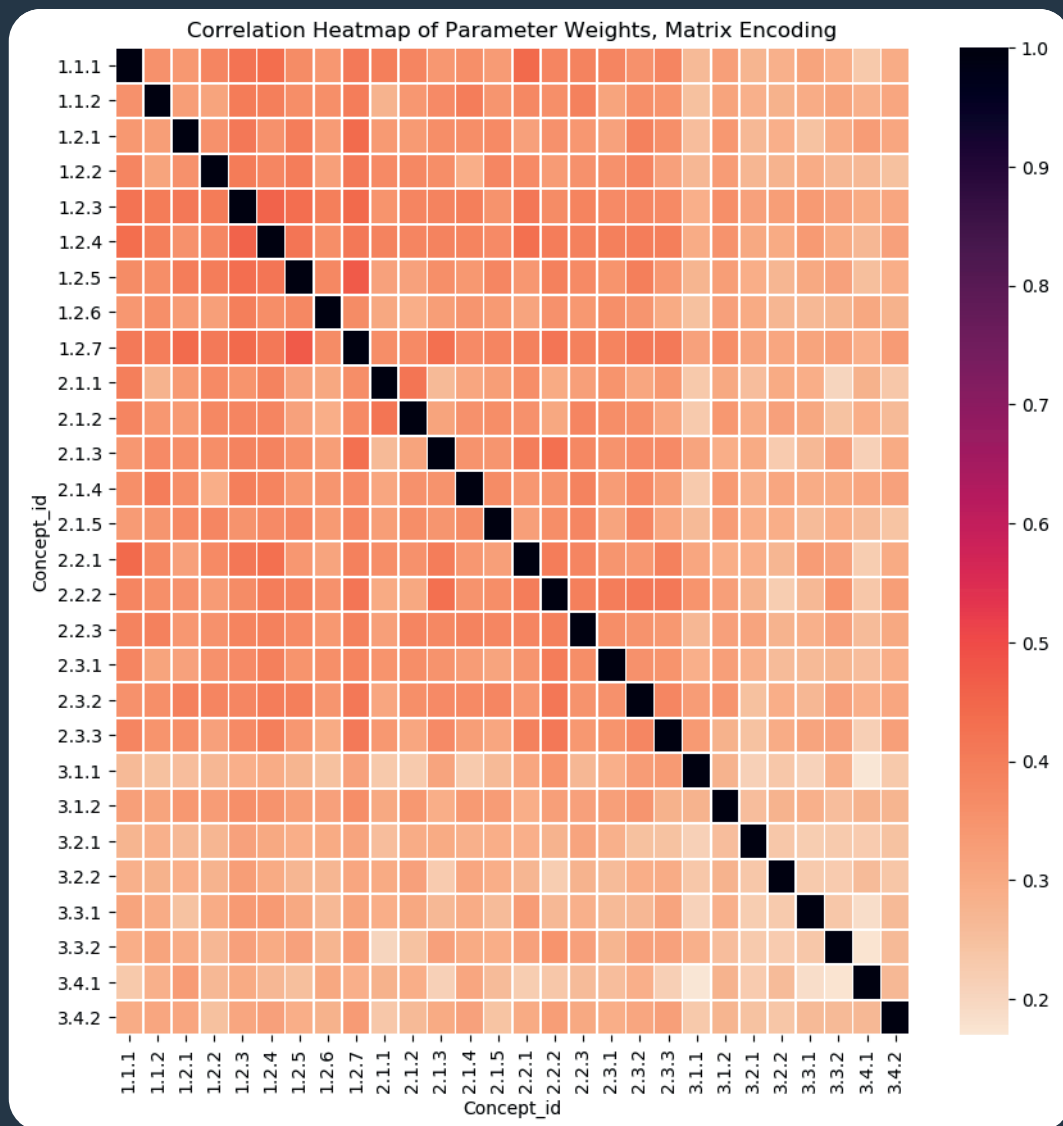
When we calculate correlation matrices of ability level per ability subject, we essentially compare every ability subject with every other ability subject. This

allows us to identify which ones are closely related (i.e., have high correlation) and which are not (i.e., have low correlation). It represents an **innovative way of mapping interactions between sustainability subjects**, based on the actual knowledge of TASK™ takers, as measured by the model.

Plotting these correlation matrices as heatmaps provides an intuitive, visual representation of the relationships between ability subjects. In a heatmap, each cell's color represents the strength of the correlation between two variables – in our case, two ability subjects. This visual approach simplifies the process of interpreting the correlation matrix and helps us quickly identify patterns in the relationships between ability subjects. For example, darker or lighter colors might indicate stronger relationships, while mid-range colors indicate weaker relationships.

Why do we do this? Essentially, understanding the relationships between ability subjects can provide understanding of sustainability knowledge, and invaluable insights for education strategies. For instance, if two ability subjects are highly correlated, it might suggest that teaching strategies or resources could be shared or combined between them. Conversely, if two ability subjects are not closely related, it may indicate that different teaching approaches are needed.

The first heatmap was developed based on the correlation matrix calculated for the 28 TASK™ matrix subjects. Each of these subjects reflects a different area of sustainability knowledge, and the heatmap provides a visual representation of the relationships between these various areas.



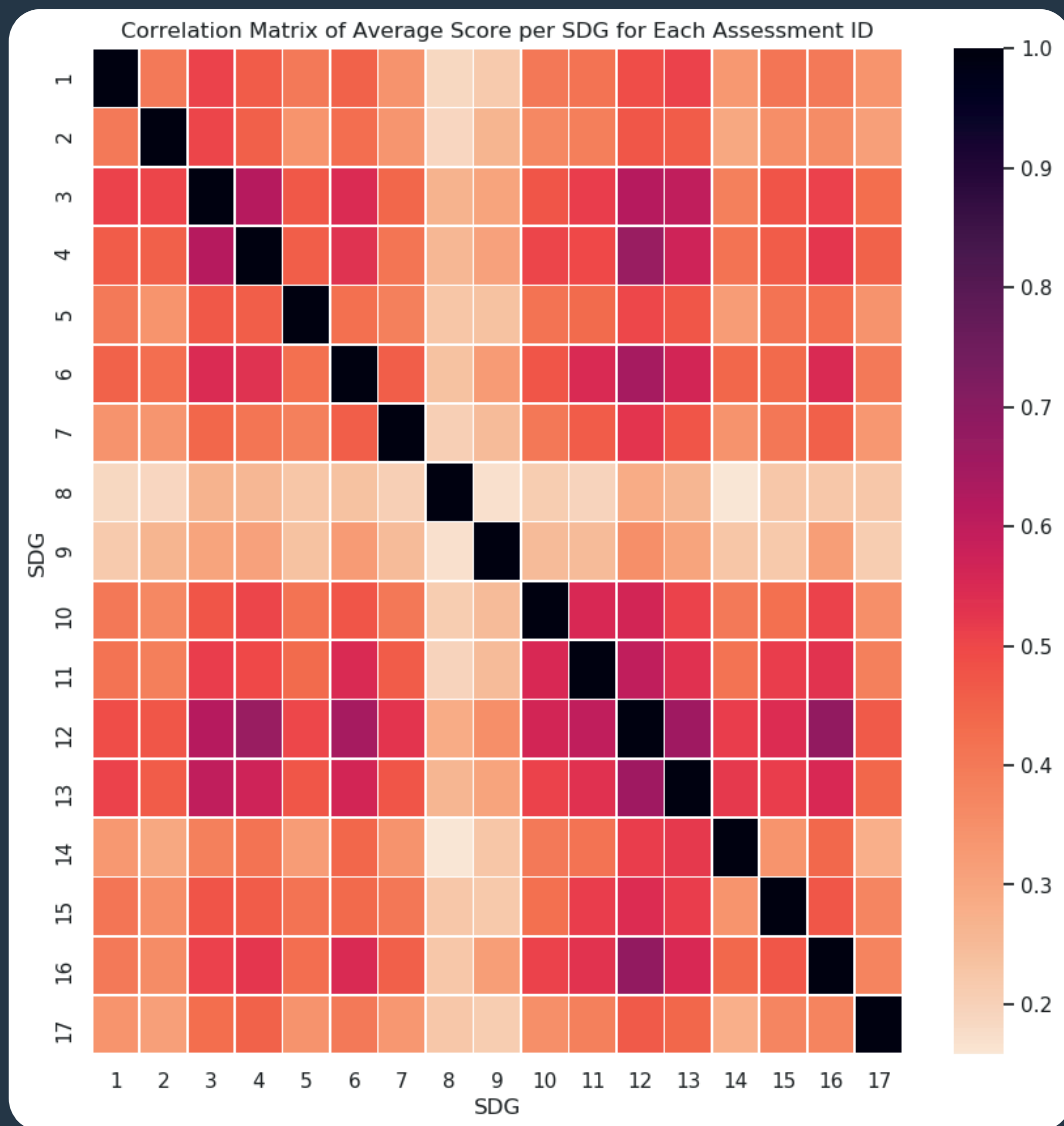
The first result that is visually highlighted by the heatmap is the clear difference between the first two frameworks of the matrix (Earth Systems and Human Welfare) and the third framework (Levers of Opportunity). It is consistent with our model of sustainability knowledge because we know that they are different in nature. Earth Systems and Human Welfare represents planetary boundaries that we don't want to overshoot to ensure a safe operating space for humanity and social foundations to ensure that no one is left falling short on life's essentials and everyone has the ability to live a flourishing life (the two rings in our model, shown on the figure on page 18). Whereas, the Levers of opportunity represent the ways we can act on sustainability through the four levers that are: Governance, Economy, Science and Technology, Individual and Collective Action (the sphere in our model, shown on the figure on page 18). This result indicates that, in the context of the current TASK™ takers' knowledge, understanding how to trigger levers of opportunity to act on sustainability is a more specific knowledge than understanding the environmental ceiling and the social foundations of sustainability. **Knowing how to act thus represents a different area of ability.** This result is fundamental to inform education for sustainability and pedagogical practices, to connect the fundamental principles of sustainability with the levers of action.

The heatmap also shows the **systemic nature of the subjects in Earth Systems and Human Welfare**. All subjects are correlated within each framework (nine planetary boundaries within Earth Systems and eleven social foundations within

Human welfare) and between the two frameworks (nine planetary boundaries correlated with the eleven social foundations). This result confirms the systemic interactions between these subjects and between the environmental and social pillars of sustainability, with an innovative way to map it based on the current knowledge of TASK™ takers.

Subsequently, we mapped the content of TASK™ to the Sustainable Development Goals (SDGs). The SDGs represent globally recognized objectives aimed at addressing a range of pressing environmental, social, and economic challenges. By aligning TASK™ content with these goals, we can better understand how sustainability knowledge, as measured by TASK™, contributes to broader sustainable development objectives.

With this alignment in place, we recalculated the correlation matrix, this time for all SDGs, and generated a second heatmap. This heatmap reveals the correlations between the ability levels of respondents across the different SDGs. As with the first heatmap, this visual representation offers an at-a-glance overview of the relationships between the various SDGs within our context, demonstrating where strong relationships exist and where they are weaker.



Within the context of our heatmap visualization, we can first identify the **goals presenting the highest level of interactions with others**, which can be considered as an indicator of their systemic nature. These highly correlated

SDGs are **SDGs 3** (Good Health and Well-being), **4** (Quality Education), **6** (Clean Water and Sanitation), **12** (Responsible Consumption and Production), and **13** (Climate Action).

Specifically, we notice that SDG 3 (Good Health and Well-being) demonstrates strong relationships with SDGs 4 (Quality Education), 6 (Clean Water and Sanitation), 12 (Responsible Consumption and Production), and 13 (Climate Action). This suggests a deep-seated understanding and engagement among respondents with the linkages between good health, education, clean water, responsible consumption and production, and climate action.

Furthermore, we discern notable correlations between SDGs 4 and 12, 6 and 4, and between SDGs 6 and 11 (Sustainable Cities and Communities), 12, 13, and 16 (Peace, Justice and Strong Institutions). This could imply that understanding and promoting quality education (SDG 4), clean water and sanitation (SDG 6), sustainable cities and communities (SDG 11), responsible consumption and production (SDG 12), climate action (SDG 13), and peace, justice and strong institutions (SDG 16) are intimately interconnected.

Moreover, the connections between SDGs 10 (Reduced Inequalities) and 11, 12 and between SDGs 11 and 13 reveal a network of interdependent SDGs. This may suggest, for instance, that sustainable cities and communities (SDG 11) are inherently tied with climate action (SDG 13) and reducing inequalities (SDG 10).

On the other hand, it's noteworthy that **SDG 8** (Decent Work and Economic Growth) and **9** (Industry, Innovation, and Infrastructure) **exhibit lower correlations with all other SDGs**. This may indicate that these areas require distinct abilities that are not as closely linked to those required for understanding and acting upon other SDGs. It is also interesting to note that these SDGs are usually attached to economics within the global agenda, together with SDG 12 (Responsible Consumption and Production) which is presenting a much higher level of correlation. This could mean that within current sustainability knowledge, the relationship between economics and the global goals is more attached to responsible consumption and production rather than decent Work and economic growth or industry, innovation, and infrastructure.

In essence, these correlations reflect the integrated and interconnected nature of the SDGs themselves, affirming that the abilities related to different SDGs are not isolated but rather mutually reinforcing. This presents an added layer of intricacy to our assessment, underscoring the need for items capable of accurately gauging these interrelated abilities and the systemic interactions between the SDGs.

## RESPONDENT METACHARACTERISTICS AND SCORE

As we further delve into the intricate relationship between respondents' metacharacteristics and their test scores, we employ the technique of linear regression analysis. This approach aids in identifying potential linear relationships between these **metacharacteristics** – including **factors such as age, gender, and education level** – and the obtained test scores.



However, it's important to note a critical aspect of this analysis: the sample size significantly decreases from 4346 to 1295 respondents. This reduction is due to the fact that not all respondents chose to answer the survey questions embedded within TASK™. Since the completion of these questions was voluntary, some respondents opted not to provide responses. As a result, for the regression analysis involving these metacharacteristics, we only include respondents who completed the relevant sections of the survey.

While this reduction in sample size is considerable, the remaining sample still provides valuable insights. Nevertheless, it's essential to interpret the findings from this analysis with an understanding of this limitation.

In the context of our analysis, categorical survey questions such as **years of education** (with categories including 'none', 'bachelors started', 'bachelors completed', 'masters or more completed'), **amount of sustainability training received** (categorized as '0', '1', '2', '3 or more'), and **self-reported sustainability knowledge** (categorized as 'none', 'basic', 'moderate', 'expert') are transformed into dummy variables.

This allows for each category to be treated independently in the regression model, enabling us to investigate the impact of each category on the dependent variable (in this case, the test scores) while holding other variables constant.

To ensure an accurate and valid regression analysis, and avoid multicollinearity, one category from each of the categorical variables is typically excluded from the regression model. These are referred to as the "reference categories": 'none' for years of education and self-reported sustainability knowledge, and '0' for the amount of sustainability training received.

Subsequently, the coefficients of the dummy variables represent the change in the mean response relative to this reference category. For example, the coefficient for 'bachelors started' represents the mean difference in test scores between individuals who started a bachelor's degree and those with no formal education, while keeping other variables constant.

This approach allows us to comprehensively explore the relationship between the respondent's metacharacteristics and their test scores, providing valuable insights that can help us better understand the determinants of performance on our test.

## REGRESSION RESULTS

Through our linear regression model, we discovered significant connections between respondent attributes and their performance on the TASK™ assessment (see **Result Table** in **Appendix D**). The variables contributing to this relationship encompassed the level of education achieved, the extent of sustainability training undergone, and the self-rated sustainability knowledge.

The first important result is that **education matters!** Our analysis shows a positive trend linking the progress in higher education to better performance on TASK™. The progression from partial higher education to the completion of

a bachelor's degree, and even further to the attainment of a master's degree or higher, corresponded to successive increases in TASK™ scores. This pattern hints at a positive correlation between increased educational attainment and higher TASK™ scores.

**Education for Sustainable Development also significantly matters!** We identify a favorable relationship between the number of sustainability courses completed and the TASK™ scores. Respondents who completed three or more sustainability courses experienced a noticeable average score increase, evidenced by a mean increment of 4.78 points.

In addition, self-perceived sustainability knowledge proved to have a significant impact on TASK™ scores. This resonates with the principle of 'self-efficacy' prevalent in psychometrics, suggesting that individuals who believe in their competence in a particular domain can perform better in that area. Supporting this notion, **respondents who classified their sustainability knowledge as basic and moderate** experienced an average score increase of 5.24 and 9.92 points, respectively.

This result is particularly interesting as it seems counter-intuitive. Bearing in mind the fact that the present analysis is exploratory and will need to be confirmed by further research as the sample of TASK takers will grow, we propose two possible interpretations:

- Firstly, experts are usually experts in one specific field or domain (i.e. Climate change or Poverty or Governance). As they are mastering this particular domain of sustainability, they rightfully perceive themselves as experts. When it comes to a systemic perspective of sustainability, as we the one we convey with TASK™ where the purpose is to build a common understanding of the holistic view of sustainability and the multiple interlinkages between subjects, respondents will necessary have to go out of their expert zone.
- Secondly, the current knowledge and understanding of sustainability is changing fast. Individuals who have recently "discover" the topic of sustainability are learning a lot and might quickly feel they become "expert" on the topic, without yet grasping the deepness of this systemic domain of knowledge and the fact that they might be at the beginning of a learning curve.

However, it's crucial to recognize the limitations of our model as well. The R-squared value was found to be 0.155, adjusting to 0.149, indicating that our model explains about 15% of the variance in TASK™ scores. Although this relationship is statistically significant, approximately 85% of the variance remains unaccounted for by this model.

## CONCLUSION

In the quest to advance the global sustainability agenda, our comprehensive study of the **TASK™** assessment provides valuable insights into the **complex structure of sustainability knowledge and education**. We delve deeply into the intersection of respondents' performance, abilities, and their alignment with the SDGs , all through the lens of a sophisticated IRT model.

This analysis unpacks the **TASK™ score**, calculated using an **innovative machine learning-empowered IRT algorithm**, which allows for a nuanced understanding of respondents' abilities, dependent on individual item parameters and their groupings. This IRT model creates a meaningful context, acknowledging the complex structure of underlying abilities that collectively shape an individual's sustainability knowledge.

Through regression analysis, we found significant associations between TASK™ scores and factors such as the respondent's **level of education**, the **number of sustainability courses undertaken**, and **self-perceived sustainability knowledge**. Notably, while these factors are statistically significant, they accounted for only about 15% of the variance in TASK™ scores, underscoring the multifaceted nature of test performance and sustainability knowledge.

Analyzing the relationship between the scores and the SDGs, we discovered **strong relationships between the abilities related to various SDGs**. This interconnectedness reflects the holistic and integrated nature of the SDGs themselves and emphasizes the need for a comprehensive approach in sustainability education.

However, as we assessed the average scores of respondents' abilities in terms of Matrix Subjects and SDGs, we discovered that performance was not uniformly high across all areas. This variability highlights the areas where respondents might require additional support and guidance and underlines the importance of targeted education strategies in enhancing sustainability literacy.

In essence, this study underscores the complexity of measuring sustainability literacy and the critical roles of education, training, and self-perception in shaping it. As we propel forward in our collective pursuit of the global sustainability agenda, it becomes paramount to continuously refine our measurement techniques, harness the power of data-driven insights, and enhance our education strategies. The ultimate goal is to foster a comprehensive understanding of sustainability and empower individuals worldwide to contribute meaningfully to the attainment of the Sustainable Development Goals.



## Sulitest & the PRME Impactful Five (i5) program

The **Principles for Responsible Management Education (PRME)** is a United Nations-supported initiative founded in 2007. As a platform to raise the profile of sustainability in schools around the world, PRME equips today's business students with the understanding and ability to deliver change tomorrow.

PRME recognizes the need for business schools to provide educational experiences and classroom content which matches the creativity and urgency needed to train the leaders and managers of tomorrow. In order to achieve this mission, PRME has been awarded a grant from the LEGO Foundation to be delivered over a 3-year period. This grant will be used to further enhance PRME's work in equipping today's business students with the understanding and ability to deliver change tomorrow.

**The PRME Impactful Five (i5) program** is motivated by two-time sensitive opportunities: the ability for business schools to adjust to the current global challenges including social, economic, and ecological issues by shaping a new style of responsible manager who has the skills to lead more holistically, and the need to increase the relevance of business school education in the newly emerging landscape of micro-credentials and digital learning, open access academic content and lifelong reskilling.

**Through a partnership with Project Zero at the Harvard Graduate School of Education**, PRME analyzed research from The LEGO Foundation childhood and youth development research-spheres to create a pedagogy for the higher education business school context. These findings were translated into a Playbook for educators from the PRME community to utilize as a set of tools in their classroom and to better engage with the i5 characteristics of system for i5.

*"The Principles for Responsible Management Education (PRME) is a United Nations-supported initiative founded in 2007 through the UN Global Compact. As a platform to raise the profile of sustainability in schools around the world, PRME equips today's business students with the understanding and ability to deliver change tomorrow."*

*In the past years, Sulitest has allowed hundreds of business schools and universities to raise the awareness of their students on sustainability. With TASK™ – The Assessment of Sustainability Knowledge – Sulitest is now enabling business schools to assess and demonstrate the impact of their pedagogy on students' knowledge of sustainability. PRME is happy to contribute to this impactful initiative and to recommend Sulitest as a best practice for integrating the SDGs into business education.*

*Sulitest is also developing a tailored assessment system for the PRME Impactful Five (i5) program that aims to foster responsible leadership by making learning meaningful, joyful, actively engaging, socially interactive, and iterative. This program is a perfect occasion to reinforce our impactful collaboration with Sulitest."*

**– Meredith Storey, Senior Manager at Principles for Responsible Management Education (PRME)**

**Sulitest's partnership with PRME for i5 program** was also designed in the conception phase of the project and is for its whole duration 2022-2024.



A specific team has been gathered to answer the following mission:

1. Build, test and improve **a tailored assessment system** for i5
2. Harvest the assessment's results

Within this scope, the assessment will focus in a first phase on **i5's impact on educators' pedagogy and learners' skills**, and in a second phase on **i5's impact on the broader system**.

It is also part of our mission to participate in **i5's project coordination**, under the lead of the PRME team, on all subjects that will be put on the agenda (roll-out, IT, events, etc).

## **What is special for Sulitest in this program? How have we approached our mission?**

- We are not using our classic tools, but the expertise developed to create those tools, and the network of contacts who can help us bring the expertise needed for such a wide project.
- We are taking an iterative approach to suit as closely as possible the project's needs and its evolution. We started with an Assessment Task Force of 12 individuals with specific and diverse expertise to explore how to have the best impact on the project and to frame our mission of assessing i5's impact on educators' pedagogy and students' skills. This helped us identify new questions and possible solutions, as well as strengthen our contribution to the project and its purpose. We are very grateful for this incredible team who worked with us with talent and dedication for a big half of 2022.
- Learning from the project development and from this first phase, we concluded that we could answer our assessment mission with 3 synergic approaches that we call Tracks:

### **TRACK 1**

- We design longitudinal surveys, interviews and tools for a wide audience.
- The 4 longitudinal surveys will help us monitor the project, by gathering sociodemographic information about the participants and track their progress by integrating i5 into their pedagogy and class.

- The tools have a triple goal:
  - a formative assessment for the participants to track their progress;
  - a way to assess the impact on their students;
  - a means to gather data about the way educators are implementing (i5) in their courses.
- We also conduct focus group: these interviews are conducted with a small group to make sense of their experience with (i5).

## TRACK 2

- We conduct a longitudinal qualitative study on a smaller group, beginning next semester (2023) during a year, with a pre/post aspect, before and after having been exposed to an (i5) training. During the summer, we will select participants who will give some classes in 2023–2024. We're going to focus on 1 course they teach and observe at least 2 sessions of this course, one without any i5 pedagogy, one with i5 pedagogy in the preparation and delivering of the course. In the meantime, we organize a journaling tool to keep track of their journey and process.
- We aim to assess impactful pedagogical change and student experience in a group of educators who are exposed to an (i5) training. Our research questions for this study are:
  - How is i5 integrated in pedagogical practices? Does it change the way educators are conceiving their pedagogy? Does it change the way they are doing class? Does it change the relationship with the students? Is i5 helping to develop teaching skills? Does it give educators more critical thinking? Does it change their teaching posture?
  - How is i5 received by the students? Are they experiencing a change in pedagogy? Does i5 help them develop particular skills?
- Our research use "grounded theory" as a method of gathering data and then systematically develop the theory derived directly from the data, rather than develop a theory and then systematically seek out evidence to verify it. This implies constant comparison and backs and forths between theory and the field. In this way, we aim to produce rich descriptions and understandings of i5 implementation in Business Schools context.

## TRACK 3

- We examine existing research on related subjects or projects.
- Eventually we design specific tools used within PRME network to complete answers we can't get from tracks 1 and 2.

## Preliminary results

Around 200 participants answered to our surveys, coming from all over the world, with an over-representation of UK, India, Australia, South Africa and the United States of America. 64,6% of the respondents are female, 33,3% male, 2.1% prefer not to say. The average age is 44 years old and the average number of years of teaching is 13. The majority comes from a Business background and they mostly taught Management, Business, Business Administration, Finance and International Business.

From open-text questions, we highlighted that participants think that i5 project is setting ambitious pedagogical goals to Business Schools. Here is a representative collection of some testimonials:

- “The i5 project highlights the importance of pedagogy in delivering transformative education, in the (unsupportive) context of business schools that do not reward pedagogical innovation.”
- “It has inspired me to try new things and be brave in terms of developing, implementing, and sharing ideas.”
- “It reinforces the need to be more learner-centered and to do that well likely means having to cut back on the amount of content delivered in a given class.”

Some already shared noticing impact on students:

- “Students have already been commenting positively during the sessions how much they enjoy this module and its structure. It is also obvious during the weekly sessions. Formal feedback reports follow later in the year.”
- “Some students expressed that they are learning and questioning issues they have never thought about. They are realizing how important Ethics and Sustainability is, which they never did.”
- “I think it made them think about how they would like to conduct themselves in a professional setting and consider whether high paying job is enough for their happiness and well being.”

*“Founded in 1967, Project Zero at the Harvard Graduate School of Education is interested in understanding and developing human potentials, including play, learning and ethics. Extending our research in playful learning to higher educational settings with UN PRME presents a unique opportunity to change pedagogical practices in business schools worldwide.”*

*Our collaboration with Sulitest has been an inspiring journey in advancing sustainability education. Together, we aimed to explore, research, develop and test a pedagogy rooted in play that could foster responsible leadership and sustainable thinking in business students. Sulitest’s commitment to strategic visioning, quality assessment, and sustainable development has been indispensable. Together alongside the PRME Secretariat and a global assembly of business school educators, we iterated on a new framework and developed the i5 Playbook – a workbook for business school educators detailing the new i5 pedagogy. We see our joint contributions within the i5 project as catalysts for reshaping business education worldwide.”*

**– Amber Kamilah, Senior Research Manager, Project Zero at the Harvard Graduate School of Education & Daniel Wilson, Principal Investigator, Project Zero at the Harvard Graduate School of Education**

- “This is reflected in their feedback of my unit, in interviews they were part of for their internship and in taking on leadership roles within their internship in Sustainability focused firms.”

One important aspect of the i5 project is that it brings together educators who sometimes experiment pedagogical changes isolated. They enjoy that i5 give them the opportunity for sharing experiences with their peers and build a community of practice and peer learning.

They're particularly interested in Sulitest's assessment mission because they are seeking tools to help them assess the impact of their pedagogical change towards i5 framework on students and learning outcomes.

Some participants aim to integrate 'small moves' into an existing course, instead of aiming to change everything and then never doing it.

## **What is next?**

The i5 program has a strong action research component. It evolves and our assessment helps and adapt to this evolution.

All along the first half of the project, we gave the results of our assessments to i5's coordination team so that it could sense and respond to better steer the programme.

This second half of the project will be focused on (1) continue developing the assessment tools and strategies to answer i5's initial questions, and (2) supporting with regular information to all people involved in the project.





## List of References

- Baker, F. B., & Kim, S. H. (Eds.). (2004). Item response theory: Parameter estimation techniques. CRC press.
- Bianchi, G., Pisiotis, U., & Cabrera Giraldez, M. (2022). GreenComp The European sustainability competence framework (No. JRC128040). Joint Research Centre (Seville site). <https://publications.jrc.ec.europa.eu/repository/handle/JRC128040>
- Fadel, Bialik & Trilling, 2015, Four-Dimensional Education: The Competencies Learners Need to Succeed, Center for Curriculum Redesign (CCR). <https://curriculumredesign.org/framework/>
- Gelman, A., Carlin, J., Stern, H., Dunson, D., Vehtari, A., Rubin, D., (2021). Bayesian Data Analysis. CRC press
- Jouzel, J., Abadie, L. (2022). Sensibiliser et former aux enjeux de la transition écologique dans l'Enseignement supérieur. Rapport remis au ministère de l'Enseignement supérieur et de la Recherche. <https://www.enseignement-sup-recherche.gouv.fr/fr/sensibiliser-et-former-aux-enjeux-de-la-transition-ecologique-dans-l-enseignement-superieur-83888>
- Messerli, P., Murniningtyas, E., Eloundou-Enyegue, P., Foli, E. G., Furman, E., Glassman, A., ... & van Ypersele, J. P. (2019). Global sustainable development report 2019: the future is now—science for achieving sustainable development. <https://sdgs.un.org/gsdrgsd2019>
- Nunnally, J. C. (1978). Psychometric theory (2nd ed.). New York: McGraw-Hill.
- Raworth, K. (2017). Doughnut economics: seven ways to think like a 21st-century economist. Chelsea Green Publishing.
- Rockström, J., Steffen, W., Noone, K., Persson, Å., Chapin III, F. S., Lambin, E., ... & Foley, J. (2009). Planetary boundaries: exploring the safe operating space for humanity. *Ecology and society*, 14(2).
- Steffen, W., Richardson, K., Rockström, J., Cornell, S. E., Fetzer, I., Bennett, E. M., ... & Sörlin, S. (2015). Planetary boundaries: Guiding human development on a changing planet. *science*, 347(6223), 1259855.
- United Nations Educational, Scientific and Cultural Organization (UNESCO). (2017). Education for sustainable development goals: Learning objectives. <https://unesdoc.unesco.org/ark:/48223/pf0000247444>
- United Nations. Department of Economic and Social Affairs. (2022). The Sustainable Development Goals: Report 2022. UN.



## Appendix A – Our governance

The Sulitest movement was born out of the dynamics of the Rio+20 Earth Summit. With the mission of “raising awareness and assessing sustainability literacy”, the Sulitest association, created in 2014, intends to play a key role in achieving objective 4.7 of the Sustainable Development Goals (SDGs) Agenda, which aims to “ensure that all learners acquire the knowledge and skills necessary to promote sustainable development”.

Tangible implementation of the Higher Education Sustainability Initiative (HESI), the Sulitest movement was recognized in 2016 as one of the remarkable initiatives in the United Nations partnership for the Sustainable Development Goals. Today, the association holds three United Nations accreditations, co-chairs HESI alongside UN DESA, and has a very strong international recognition.

In order to scale up its impact, the association and its two co-founders decided to create in 2021 a social business. Under the French law, Sulitest Impact is a *Entreprise de l'Économie Sociale & Solidaire (SAS de type ESUS)*, a framework that guarantees not only purpose but also commitments and responsibilities of the company as a social business. In January 2022, a fundraising initiative saw the participation of six private and public HEIs, along with business angels, who invested capital into the venture.

We are committed to making Sulitest a movement and a community serving the “common good”. Today the Sulitest movement is therefore supported by two legal structures, the association and the social business, in order to combine relevance, independence and efficiency. The association, shareholder of the social business, is the guarantor of meaning. It has a role of advocacy supporting the mainstreaming of sustainability literacy. It will eventually play a role in capacity building, supporting sustainability education and research. The social enterprise is responsible for the design, editing, development and management of all tools, as well as the deployment of the business. Finally, it develops research and development on the impact of the use of Sulitest tools on individuals and organizations.



# Appendix B – TASK™ Matrix by Sulitest

TASK™ Matrix by Sulitest Sustainability Knowledge			x.1.1. Knowledge and Understanding		x.2. Interlinkages	
Framework	Domain	Subject	x.1.1. Definitions and Key Concepts		x.2.1 Major Causes	
			Descriptive Knowledge What are we talking about? How does this work?	Contextualized Knowledge Where are we now? How are things changing?	Causal Knowledge Why is this happening? Who is doing what and why?	Systemic Impacts What are the related effects? How is this affecting the larger system?
1. Earth Systems The Environmental Ceiling	1.1 Core Planetary Boundaries	1.1.1 Climate Change	1.1.1.1	1.1.1.2	1.1.1.1	1.1.1.2
		1.1.2 Biosphere Integrity	1.1.2.1	1.1.2.2	1.1.2.1	1.1.2.2
	1.2 Freshwater Use	1.2.1 Freshwater Use	1.2.1.1	1.2.1.2	1.2.1.1	1.2.1.2
		1.2.2 Land-System Change	1.2.2.1	1.2.2.2	1.2.2.1	1.2.2.2
	1.2.3 Ocean Acidification	1.2.3.1	1.2.3.1	1.2.3.1	1.2.3.1	1.2.3.2
		1.2.4 Novel Entities	1.2.4.1	1.2.4.2	1.2.4.1	1.2.4.2
	1.2.5 Biogeochemical Flows	1.2.5.1	1.2.5.1	1.2.5.1	1.2.5.1	1.2.5.2
		1.2.6 Atmospheric Aerosols Loading	1.2.6.1	1.2.6.2	1.2.6.1	1.2.6.2
	1.2.7 Stratospheric Ozone Depletion	1.2.7.1	1.2.7.2	1.2.7.1	1.2.7.2	1.2.7.2
	2. Human Welfare The Social Foundation	2.1 Safety and Basic Needs	2.1.1 Nutrition	2.1.1.1	2.1.1.2	2.1.1.1
2.1.2 Health			2.1.2.1	2.1.2.2	2.1.2.1	2.1.2.2
2.1.3 Access to Water and Sanitation		2.1.3.1	2.1.3.1	2.1.3.1	2.1.3.1	2.1.3.2
		2.1.4 Housing and Human Settlements	2.1.4.1	2.1.4.2	2.1.4.1	2.1.4.2
2.1.5 Access to Energy		2.1.5.1	2.1.5.1	2.1.5.1	2.1.5.1	2.1.5.2
		2.2.1 Basic Income	2.2.1.1	2.2.1.2	2.2.1.1	2.2.1.2
2.2 Social Welfare		2.2.2 Social Equity	2.2.2.1	2.2.2.2	2.2.2.1	2.2.2.2
		2.2.3 Gender Equality	2.2.3.1	2.2.3.2	2.2.3.1	2.2.3.2
2.3 Human Flourishing		2.3.1 Education and Culture	2.3.1.1	2.3.1.2	2.3.1.1	2.3.1.2
		2.3.2 Peace, Justice, and Political Voice	2.3.2.1	2.3.2.2	2.3.2.1	2.3.2.2
3. Levers of Opportunity That Make Sustainability Possible	3.1 Governance	3.1.1 Laws, Policies, and Institutions	3.1.1.1	3.1.1.2	3.1.1.1	3.1.1.2
		3.1.2 Infrastructure, Planning, and Natural Resource Management	3.1.2.1	3.1.2.2	3.1.2.1	3.1.2.2
	3.2 Economy and Finance	3.2.1 Macroeconomic Considerations and Finance	3.2.1.1	3.2.1.2	3.2.1.1	3.2.1.2
		3.2.2 Microeconomic Considerations, Business, and Industry	3.2.2.1	3.2.2.2	3.2.2.1	3.2.2.2
	3.3 Science and Technology	3.3.1 Sustainability Science	3.3.1.1	3.3.1.2	3.3.1.1	3.3.1.2
		3.3.2 Technology and Innovation	3.3.2.1	3.3.2.2	3.3.2.1	3.3.2.2
	3.4 Individual and Collective Action	3.4.1 Transformative Change	3.4.1.1	3.4.1.2	3.4.1.1	3.4.1.2
		3.4.2 Cognitive Capacity for Sustainable Development	3.4.2.1	3.4.2.2	3.4.2.1	3.4.2.2

© 2023 Sulitest TM-VI-Er. 2023/03/01

© 2022 Sulitest impact. This work is licensed under a CC BY-NC-ND 4.0 license (<https://creativecommons.org/licenses/by-nc-nd/4.0/legalcode>)



## **Appendix C – TASK™ Model: Technical Specification and Test Reliability**

The Multidimensional Bayesian Two-Parameter Logistic (2PL) Item Response Theory (IRT) model represents an evolution from the conventional 2PL IRT model. This advanced model is designed to accommodate multiple latent traits or abilities, a progression from the earlier version that only considered a single trait. The basis of this model is the Bayesian statistical framework, which allows for the integration of pre-existing data with new observations.

Bayesian sampling is achieved via Markov Chain Monte Carlo (MCMC) methods, integrating prior distributions for both item parameters and traits. The inclusion of prior distributions is crucial as it allows for the integration of external data into the model and acts as a regularization tool for estimates, especially beneficial in complex multidimensional models.

In the evaluation of the model sampling performance, we refer to “Bayesian Data Analysis” (Gelman et al., 2013) for the principles behind our diagnostic tools – the Rhat statistic and the ESS (Effective Sample Size) bulk. As per Gelman et al. (2013), the Rhat statistic, also known as the potential scale reduction factor, should ideally be near 1. A Rhat value significantly deviating from 1 could be indicative of potential non-convergence, suggesting a necessity for additional iterations.

Furthermore, Gelman et al. (2013) highlight the role of the ESS, particularly the bulk ESS, as an indicator of the MCMC process’s efficiency. A larger ESS is associated with a more efficient sampling procedure, leading to more accurate and trustworthy estimates. The acceptable threshold can vary based on the specific context of the analysis.

Throughout the production deployment of TASK™, both the Rhat and ESS have consistently stayed within the acceptable ranges as proposed by Gelman et al. (2013). This consistency implies satisfactory chain convergence, thereby endorsing the reliability of our model performance.

The model operates as a two-stage procedure, presenting a significant advantage over synchronous modeling techniques by enabling asynchronous estimation of item parameters and individual abilities. This asynchronous operation brings marked benefits in terms of operational efficiency and scalability.

The initial phase of the model focuses primarily on the estimation of item parameters, specifically discrimination (a) and difficulty (b). A large and diverse calibration sample is used during this stage to train the model and compute these parameters for each item. The model’s learning process, which involves the refining of its estimates, is carried out over extended periods, leveraging high volumes of data for optimum results.

The first phase or the “learning” phase of the TASK™ model can be visually interpreted below:

<input type="checkbox"/>		SN.NORD* PRODUCTS	Carte A. Decamps	09 juin 2023	Manquant	- 238,61 EUR
<input type="checkbox"/>		a.NordProductsnl	Carte A. Decamps	09 juin 2023	Manquant	- 238,61 EUR
<input type="checkbox"/>		SN.NORD* PRODUCTS	Carte A. Decamps	09 juin 2023	Manquant	- 238,61 EUR
<input type="checkbox"/>		a.NordProductsnl	Carte A. Decamps	09 juin 2023	Manquant	- 238,61 EUR
<input type="checkbox"/>		SN.NORD* PRODUCTS	Carte A. Decamps	09 juin 2023	Manquant	- 238,61 EUR
<input type="checkbox"/>		SN.NORD* PRODUCTS	Carte A. Decamps	09 juin 2023	Manquant	- 238,61 EUR

At the onset, our model operates at the item or question-level, employing a collection of hyper priors that orchestrate the distribution of item parameters. These hyper priors play a pivotal role in re-calibrating the distribution of item parameters, thereby offering the model more flexibility to navigate the probability space.

The hyper priors include  $\sigma_{a_j}$ ,  $\sigma_{b_j}$ , and  $\mu_{b_j}$ . Here,  $\sigma_{a_j}$  denotes the standard deviation of the item discrimination parameter ‘a’, while  $\sigma_{b_j}$  represents the standard deviation of the item difficulty parameter ‘b’. The mean of the item difficulty parameter ‘b’ is symbolized by  $\mu_{b_j}$ .

Following these hyper priors, we proceed to the item priors  $a_j$  and  $b_j$ . The former refers to the item discrimination parameter, signifying how effectively an item differentiates between individuals possessing varied ability levels. On the other hand,  $b_j$  represents the item difficulty parameter, indicating the challenge posed by an item to individuals.

Transitioning to the matrix subject-level, the model employs another series of hyper priors that shape the distribution of matrix subject parameters. These comprise  $\sigma_{a_m}$ ,  $\sigma_{b_m}$ , and  $\mu_{b_m}$ . Here,  $\sigma_{a_m}$  stands for the standard deviation of the matrix subject discrimination parameter ‘a’, whereas  $\sigma_{b_m}$  designates the standard deviation of the matrix subject difficulty parameter ‘b’. The mean of the matrix subject difficulty parameter ‘b’ is represented by  $\mu_{b_m}$ .

These hyper priors pave the way for the matrix subject priors  $a_m$  and  $b_m$ . The former signifies the matrix subject discrimination parameter, reflecting how well a matrix subject differentiates between individuals of varying ability levels. Conversely,  $b_m$  corresponds to the matrix subject difficulty parameter, expressing the level of difficulty a matrix subject presents to individuals.

These parameters converge into a Bernoulli distribution to form a probability function. This function determines the probability of a respondent correctly answering an item, considering their ability level and the item and matrix subject parameters, thereby encapsulating the probabilistic aspect of responses.

In the second stage of the model, we shift our focus to estimating the abilities or traits (denoted by  $\theta$ ) of new individuals engaging with the test. This two-stage procedure bolsters operational efficiency by leveraging pre-determined

item parameters to estimate new test-takers' abilities, eliminating the need for perpetual re-estimation of item parameters.



<input type="checkbox"/>	←	SN.NORD* PRODUCTS	Carte A. Decamps	18 juil. 2023	Manquant	+ 238,61 EUR
<input type="checkbox"/>	←	a.NordProductsnl	Carte A. Decamps	12 juil. 2023	Manquant	+ 238,61 EUR
<input type="checkbox"/>	←	SN.NORD* PRODUCTS	Carte A. Decamps	11 juil. 2023	Manquant	+ 238,61 EUR
<input type="checkbox"/>	←	SN.NORD* PRODUCTS	Carte A. Decamps	11 juil. 2023	Manquant	+ 238,61 EUR

Within this stage, we revisit  $\sigma_{b_j}$  and  $\mu_{b_j}$ , which now function as hyper priors for the ability distributions of each new respondent. For each dimension of the item or matrix that the respondent encounters during the test, these hyperpriors offer preliminary estimates of variability ( $\sigma_{b_j}$ ) and central tendency ( $\mu_{b_j}$ ) for the respondents' abilities.

Subsequently, the model employs the  $j_A$  and  $j_B$  parameters, embodying the realized discrimination and difficulty for each test-taker in every response event. Preserved from the initial model sampling, these parameters provide valuable insights. The  $j_A$  parameter conveys how efficiently a specific item differentiates between respondents with varied levels of the latent trait during each response event. Concurrently, the  $j_B$  parameter reflects the level of the latent trait at which the item yields maximum information in that response event's context.

Incorporating item and matrix subject-level discrimination and difficulty parameters into our model allows for a sophisticated comprehension of how individuals, possessing varied ability levels, interact with distinct sustainability questions and topics. This approach not only generates a comprehensive picture of each respondent's sustainability knowledge but also facilitates the consistent enhancement and precision of our assessment tool.

## TASK™ RELIABILITY

In assessing the reliability of a test under the lens of Item Response Theory, we focus our analysis on the Fisher Information statistic. This measure is derived from the variance of individual items or the entire set of items in the assessment. It provides an illustration of the association between the quantity of information, that is, the precision, and an examinee's ability across the entire ability spectrum (Baker, 2004).

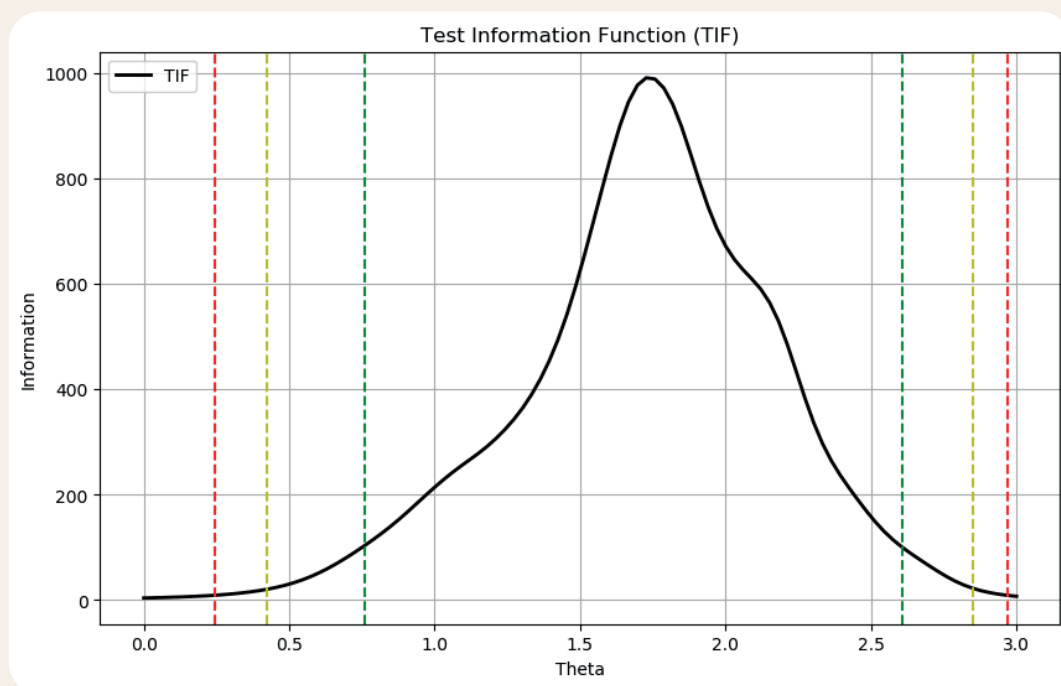
A significant advantage of utilizing the Fisher Information function is its capacity to denote the degree of precision in estimating the examinee's ability at every point on the proficiency scale. In other words, it serves as a metric that showcases how accurately the assessment can gauge an individual's capability level, regardless of whether the individual is at the low end, high end, or anywhere in between on the ability continuum. This characteristic is integral

to ensuring the reliability and validity of the assessment, thereby promoting a more robust and comprehensive understanding of an individual's capabilities.

When discussing the reliability of psychological and educational measurements, it's important to establish a common frame of reference for interpreting reliability coefficients. Historically, these coefficients are represented by a value between 0 and 1, with higher values indicating higher reliability.

The most accepted thresholds for reliability coefficients are often traced back to Nunnally's (1978) seminal work on psychometric theory. He proposed that, in the early stages of research, a reliability coefficient of 0.70 might suffice. However, for applied settings, a coefficient of 0.80 is more desirable, and in the context of high-stakes testing, a value of 0.90 or higher is typically considered the standard (Nunnally, 1978).

Integrating this into the context of the Test Information Function (TIF), a graphical representation within the IRT framework, provides an intuitive way to visually interpret reliability across different levels of the latent trait. In a TIF graph, the x-axis signifies varying levels of the latent trait, while the y-axis symbolizes the amount of test information - a direct reflection of measurement precision - at each trait level.



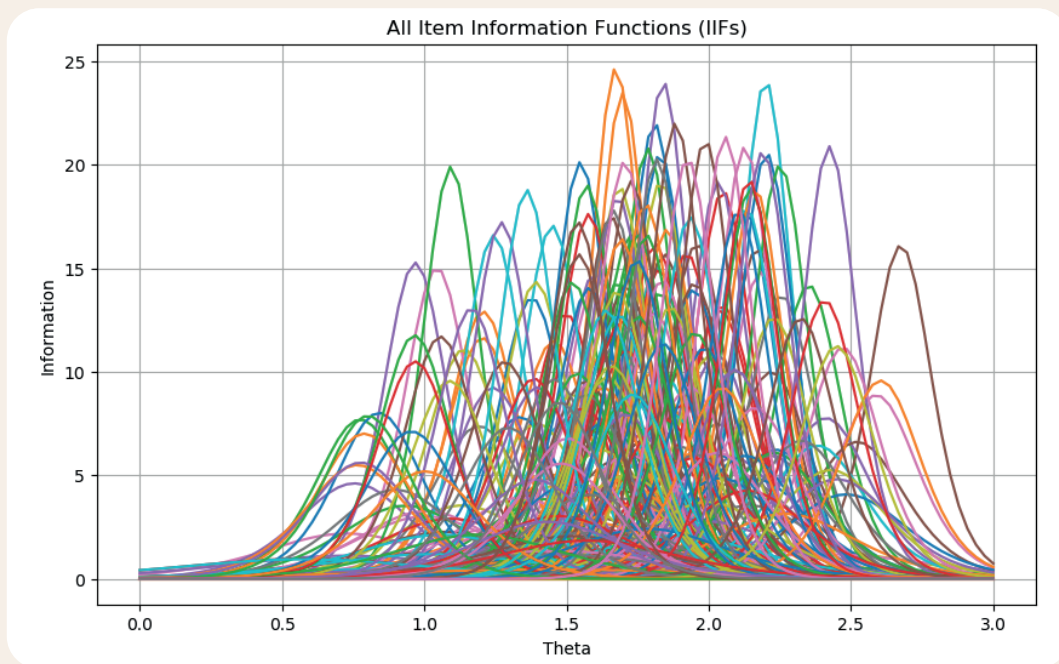
As we build upon the previous discussion on interpreting the TIF within the context of IRT, let's focus on the observed TIF graph for our specific test.

The majority of the TIF curve for our test is situated either above or within the lines that represent reliability coefficients of  $>.99$ ,  $>.95$ , and  $>.90$ . This positioning indicates that for most levels of ability, our test achieves a high level of reliability, adhering closely to the commonly accepted thresholds proposed by Nunnally (1978). This observation suggests that our test provides highly precise and reliable estimates for the majority of the latent trait spectrum, which is a positive indication of the test's overall quality.

However, there is a specific region of low ability space where the TIF curve

falls slightly beneath the  $>.95$  reliability line, showing a relatively flat area on the graph. This flat area signifies a part of the trait spectrum where the test provides less information and, therefore, less measurement precision. In other words, for individuals with trait levels within this region, our test's reliability is slightly less than  $.95$ , which, while still acceptable based on Nunnally's (1978) guidelines, might warrant further investigation.

Item Information Functions (IIFs) offer another layer of granularity in our understanding of test reliability. The IIFs represent the amount of information, or measurement precision, that each item contributes at various levels of the latent trait.



In our particular case, visualizing these IIFs on a graph reveals a distributed nature across most of the latent trait spectrum. This distribution indicates that our test items collectively cover a broad range of ability levels, thereby providing us with information across most of this spectrum.

However, it is noteworthy that these item information functions are highly concentrated around a high-middle level of ability. This concentration signifies that our test items are particularly informative, and hence most reliable, for individuals within this high-middle range of the latent trait.

Building on the prior statement, the concentration of item information functions around a high-middle level of ability within our test indicates a deliberate emphasis on literacy over basic understanding or expertise. This test structure's main advantage lies in its applicability to a broader segment of the general population.

Fundamentally, literacy is seen as a critical competence that strikes a balance between basic understanding and expertise. In the context of a general population, a significant portion of individuals may surpass the level of basic understanding but not reach the level of true expertise. As such, concentrating items at a high-middle level of ability means the test is more likely to differentiate among these individuals, thus providing a more nuanced and detailed assessment of their literacy.





# Appendix D – TASK™ OLS Regression Results

```

=====
Dep. Variable:          Average Score   R-squared: 0.155
Model:                  OLS            Adj. R-squared: 0.149
Method:                 Least Squares  F-statistic: 23.61
Date:                   Thu, 06 Jul 2023 Prob (F-statistic): 3.70e-41
Time:                   15:57:53      Log-Likelihood: -5254.5
No. Observations:      1295         AIC: 1.053e+04
Df Residuals:          1284         BIC: 1.059e+04
Df Model:               10
Covariance Type: nonrobust
=====
coef      std err      t      P>|t|      [0.025      0.975]
-----
const***
31.4670    1.859    16.931    0.000    27.821    35.113

Some higher education completed***
6.8677    1.964    3.497    0.000    3.015    10.720

Bachelors completed***
8.8635    1.795    4.938    0.000    5.342    12.385

Masters or more completed***
11.7091    1.792    6.533    0.000    8.193    15.225

1 sustainability training completed
-0.3826    1.104    -0.347    0.729    -2.549    1.783

2 sustainability trainings completed
-0.2121    1.212    -0.175    0.861    -2.590    2.165

3 or more sustainability trainings completed***
4.7790    1.068    4.475    0.000    2.684    6.874

Self rated basic sustainability knowledge***
5.2378    1.026    5.103    0.000    3.224    7.251


Self rated moderate sustainability knowledge***
9.9236    1.006    9.866    0.000    7.950    11.897

Self rated expert sustainability knowledge
-0.7992    1.731    -0.462    0.644    -4.194    2.596

Age
0.0013    0.004    0.323    0.747    -0.007    0.009

=====
Omnibus:                18.171   Durbin-Watson:          1.175
Prob(Omnibus):           0.000   Jarque-Bera (JB):       13.501
Skew:                    0.147   Prob(JB):                0.00117
Kurtosis:                 2.595   Cond. No.                 879.
=====

```



**For more information,  
email us at [contact@sulitest.org](mailto:contact@sulitest.org)**

By Alexander Brewer, Aurélien Decamps, Estela Castelli Florino Pilz,  
Jean-Christophe Carteron, Pauline Proboeuf and Scott Blair

July 2023

The Sulitest Association holds Observer status to the UN Environment Assembly (Accreditation 430/218) Special consultative status with the UN Economic and Social Council since 2019 NGO in official partnership with UNESCO (consultative status) since 2022

The Social Business Sulitest Impact is an “entreprise de l’Économie Sociale & Solidaire” under the French law (“SAS de type ESUS”)