



RE-EURECA-PRO

The Research and Innovation Dimension of the European University on Responsible Consumption and Production

Participants:	Montanuniversität Leoben, Mittweida University of Applied Sciences, Technische Universität Bergakademie Freiberg, University of León, University of Petrosani, Silesian University of Technology, Technical University of Crete
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1. Introduction and Context

This report on current cognitive and practical interdisciplinary collaboration models constitutes deliverable D3.1 of the RE-EURECA-PRO project. The report is one of four scientific papers (D3.1, D3.2, D3.3, D3.4), all dedicated to developing an “Interdisciplinary European Research Collaboration Strategy”. The reference points of this report are the RE-EURECA-PRO and EURECA-PRO Alliance projects. Based on these interconnected initiatives, the handling of the challenges and opportunities of interdisciplinary work in an international context will be explained. First, the project as well as the framework conditions have to be briefly outlined to understand the Alliance’s research focus and aims. To understand the research approaches to the topic of interdisciplinarity as will be outlined in this report, it is indispensable to take a look at the framework conditions of the Horizon 2020 funded project RE-EURECA-PRO in order to understand why interdisciplinary modes of collaboration are taking on an increasingly important role in the European research context.

Nine institutional partners from eight EU countries have joined forces to create a solid and unique European University in the field of Responsible Consumption and Production (RCP): EURECA-PRO. The overall objective of the *RE-EURECA-PRO*¹ project is to enhance the research and innovation dimension of the EURECA-PRO Alliance and thus to realize its transformative potential to become a leader in the field of RCP. Work will be carried out in line with the European University Alliance’s shared, integrated, long-term vision and mission for 2040, which is to holistically contribute to the highly topical issues of sustainable consumption and production and to promote the transformation of the European Higher Education Area. The Alliance’s research and educational objectives are linked to the EU’s Sustainable Development Goal 12 (responsible consumption and production) and 4 (quality education).

The need to develop and strengthen interdisciplinary research collaboration in the field of Responsible Consumption and Production (RCP) is undisputed given the complex societal,

¹ The Universities of Hasselt and Lorraine, even though they are new members of the EURECA-PRO Alliance, have not formally joined the work of RE-EURECA-PRO yet, therefore their institutions are not explicitly mentioned in the reports D3.1 and D3.2.

economic, technological and ecological challenges facing our present and future generations. A globally operating entertainment industry, global advertising strategies and emerging communication technologies have led to global consumption patterns, trends and lifestyles. People's needs and consumption behaviours are strongly aligned with the market domination of the Big Five² and global interactions influence the construction of our modern life styles. Everything is networked with everything else (increasingly on a virtual level) - locally, nationally and globally. The systemic cohesiveness of the world has become so great that global networks and structures have emerged and become established. These developments have an impact on the ways in which scientific research is conducted, developed and disseminated across diverse cultural, economic and ecological contexts. The work of RE-EURECA-PRO is dedicated to enhancing the structures, possibilities and activities of crossdisciplinary research in response to the above-mentioned global developments. In order to establish itself as a cross- and interdisciplinary research and innovation leader in qualitative environmental and social framework development, RE-EURECA-PRO is committed to developing actions and strategies which build a strong and cohesive European Research Area. Cognitive frameworks and practical modes of interdisciplinarity play a central role in this endeavor.

There is no question that when there is an awareness of global interactions and interdependencies at a time like the present, research must also rethink and redefine its concepts and parameters. The prevailing dominance of single, independent science disciplines has become untenable precisely because challenges such as climate change, responsible consumption and production, the Green Deal, technological progress, robotics, AI, etc., require interdisciplinary treatment and collaborative solution approaches. As Gräfrath et al. (1991) have argued, "[a]ll sciences must rather see themselves as an integral part of a culture of reason, whereby the provision of orientation cannot be the exclusive task of a single

² Big Tech is the name given to the five largest information technology (IT) companies in the United States, which include Facebook (Meta), Amazon, Apple, Google and Microsoft – also referred to as the Big Five. The Big Five are now among the most valuable listed companies in the world and have a market capitalization from around 1 to above 3 trillion USD. https://en.wikipedia.org/wiki/Big_Tech

discipline or a group of disciplines".³ Hence, science should provide orientation and assistance and this can best be achieved through interdisciplinary collaborations. The result is a picture of diversity: although each scientific discipline has its clearly defined research methods and practical models, the complexity of modern life and reality requires inter- and transdisciplinary approaches.

High-level work within disciplinary boundaries is important and indeed necessary for the establishment and dissemination of knowledge expertise but it must also be interrogated for its effectiveness in today's interconnected world. The development of interdisciplinary and transdisciplinary theories and practices has been influenced by factors such as technical developments in digitalization, network management, and the transformation of mobility. Innovative technical work in these areas has greatly enhanced and facilitated the possibilities of international, intercultural, multi-level research collaborations not only within academic institutions but also with external stakeholders (business, industry, government bodies, etc.).

2. Definition of terms: inter-, multi- and transdisciplinarity

As a mode of crossdisciplinarity, interdisciplinary research is particularly valuable for the EURECA-PRO Alliance. The following definitions of *interdisciplinarity* and *interdisciplinary research (IDR)* provide helpful conceptual orientation:

- "Interdisciplinary research (IDR): Integrates information, data, techniques, tools, perspectives, concepts or theories from two or more disciplines or bodies of specialized knowledge. Can be done by teams or by individuals. Advances fundamental understanding or solves problems whose solutions are beyond the scope of a single discipline or area of research practice."⁴
- "Interdisciplinarity represents an approach to interdisciplinary collaboration that places particularly high demands on the integration of disciplinary perspectives and is thus distinguished from multidisciplinary, i.e. the coexistence of disciplines."⁵

³ Gräfrath, Bernd; Huber, Renate; Uhlemann, Brigitte (1991): *Akademie der Wissenschaften zu Berlin. Forschungsbericht*. Berlin, New York: de Gruyter, 2.

⁴ <https://beta.nsf.gov/funding/learn/research-types/learn-about-interdisciplinary-research>

⁵ Claus, Anna M. and Wiese, Bettina S. (2021): "Interdisziplinäre Kompetenzen: Modellentwicklung und diagnostische Zugänge". In: *Gruppe. Interaktion. Organisation. Zeitschrift für Angewandte Organisationspsychologie (GIO)*, Volume 52, 279–288: 280.

- “Interdisciplinary research is understood to achieve outcomes (including new approaches) that could not be achieved within the framework of a single discipline. Interdisciplinary research features significant interaction between two or more disciplines and/or moves beyond established disciplinary foundations in applying or integrating research approaches from other disciplines.”⁶

As Brandstädter (2019) argues, the emphasis of interdisciplinary work is thus on *integrating* expert knowledge that stems from different disciplines with the aim of finding “a holistic, more complex perspective on a problem or issue”.⁷ This emphasis on the integration of specialized knowledge and research practices distinguishes interdisciplinary approaches from *multidisciplinarity* which “draws on knowledge from different disciplines but stays within their boundaries. Interdisciplinarity analyzes, synthesizes and harmonizes links between disciplines into a coordinated and coherent whole”.⁸

Not all projects described as “interdisciplinary” fulfill these criteria. Therefore, a distinction between different forms of interdisciplinary collaboration and an awareness of interdisciplinary competencies is necessary. The crossdisciplinary efforts of (RE-)EURECA-PRO have much in common with *transdisciplinarity*, which follows similar goals of integration and harmonization of approaches in the context of collaboration. The added strength of transdisciplinary work is that it does not only draw on the scientific expertise of several academic disciplines but seeks to develop knowledge exchanges between science and society. Transdisciplinary research processes aim towards a discipline-transcending perspective where individual disciplinary boundaries are overcome and academic theories and methods fuse with non-academic knowledge and practices.

Importantly, inter- and transdisciplinary approaches set a common goal, which in the case of the EURECA-PRO initiative is to work towards realizing the SDG12 on Responsible Consumption and Production (RCP). However, the diversity of perspectives, expectations and work methods within all types of crossdisciplinary work can be challenging. As German

⁶ <https://www.myresearchconnect.com/interdisciplinary-research-the-silver-bullet-for-innovation/>

⁷ Brandstädter, Simone (2019): *Interdisziplinär erfolgreich – Modellierung, Validierung und Förderung interdisziplinärer Handlungskompetenz*. Dissertation. Ruprecht-Karls-Universität Heidelberg, 11. <https://archiv.ub.uni-heidelberg.de>

⁸ Choi, Bernard CK; Pak, Anita WP (2006): “Multidisciplinarity, interdisciplinarity and transdisciplinarity in health research, services, education and policy: 1. Definitions, objectives, and evidence of effectiveness”. In: *Clin Invest Med* 29(6), 351-64. <https://pubmed.ncbi.nlm.nih.gov/17330451/>

psychologist Simone Brandstädter (2019) accurately explains, such diversity can be a double-edged sword. On the one hand, cognitive diversity leads to better decisions being made, more creative solutions being developed, and more innovative products being developed; on the other hand, such heterogeneity in a research team can also create obstacles, conflicts and challenges which have to be overcome so that effective crossdisciplinary work can be carried out.

3. Research cooperation within EURECA-PRO

Within EURECA-PRO important structural frameworks and impulses for joint research about responsible consumption and production are already articulated in the Organisational Scientific Framework Charter (SFC) for interuniversity research collaboration and in the work of the Research Task Force (RTF). The RTF has identified five topical Lighthouse Research Missions which focus on 1) responsible material flows, 2) environment and water, 3) sustainable materials and 4) production, clean energy, process automation and industry (see EURECA-PRO WP3, D3.1 E-Book). The thematic foci of the lighthouse missions reflect the distinct research expertise and scientific traditions of the partner universities which strive for alignment and integration of research collaboration. The work of WP3 within RE-EURECA-PRO (specifically deliverables D3.1-4) needs to be carried out and evaluated in the context of the SFC, which is the scientific manifesto of this European University initiative whose aim is to create a New Open European Research Area.

The SFC articulates the collaborative mechanisms and support structures for research within and across the lighthouse missions by defining the communication flows, roles and responsibilities of each partner. The designated Research Task Force creates, implements and organizes joint research inside EURECA-PRO through the use of digital tools and dialogue platforms (e.g. the digital Societal Dialogue Platform, which serves as an information, communication and activity interface between EURECA-PRO and civic society) and by hosting regular Open Science events. The aims of the multi-level, transdisciplinary research activities and organizational tasks of the RTF is to integrate the disciplinary expertise and skill-sets of the partner universities (which cover a diverse range of technological, ecological, policy,

economic and societal aspects). This integration of expert knowledge and best practices is needed in order to tackle the challenges presented by the ecological, economic, technological and cultural transformations of our global society.

Work package 3 of RE-EURECA-PRO contributes to the research efforts as identified by the SFC in important ways. Firstly, it addresses the challenges, barriers and (often unarticulated) uncertainties of interdisciplinary cooperation; secondly, it examines existing cognitive and practical models of collaboration and seeks to identify interdisciplinary competencies; and thirdly, the overall aim is to transfer effective collaboration mindsets and frameworks to concrete SDG12 solutions.

4. Interdisciplinary collaboration

4.1. General conditions

According to Hollaender (2003), there are several factors that influence interdisciplinary cooperations. They consist of the following: group constellation, group size and identity; individual behavior; the willingness to cooperate (motivation); organizational structures; spatial distance between participants; and leadership (competent management). One might add to this list social factors, cultural differences, knowledge diversity, and communication competencies.

De Bruin and Fischhoff (2019) have identified the following conditions for interdisciplinary collaboration: shared project goals, shared methodology, shared effort and communication, and shared benefits (project outcomes relevant for all).

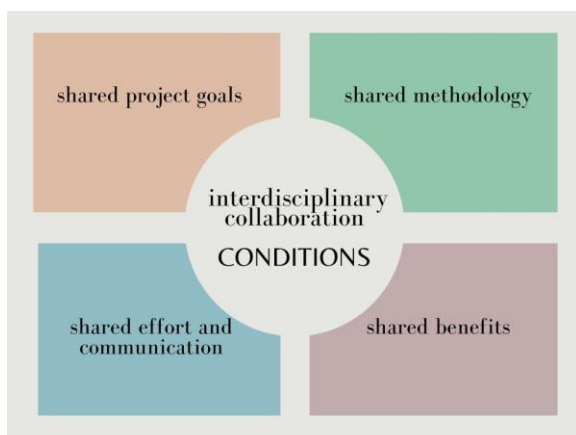


Fig. 1: Wändi Bruin de Bruin & Baruch Fischhoff (2019)

The below-mentioned models of collaboration bear these conditions in mind and have been designed to maximize their realization and impact.

4.2. Models

Models or frameworks create a conceptual vision of reality and enable us to depict complex processes and data. Models are often developed with qualitative approaches and they can provide a guide for research practice. This idea is crucial because it creates an awareness for critical thinking - models reflect reality and try to capture as many features as possible. Nevertheless, when working with models, it has to be pointed out that they (also in an interdisciplinary context) can only provide an orientation and guideline because interdisciplinary work always has to be practical, goal-oriented and team specific in order to be effective and transformational. The models of inter- and transdisciplinary collaboration that have been included in this report provide an insight into current research in this area and they are by no means exhaustive. As work on WP3 of RE-EURECA-PRO progresses, additional crossdisciplinary approaches will be considered and evaluated for their effectiveness and usefulness for the Alliance's research aims. The overall goal is to tailor the most effective models to the vision and work of EURECA-PRO and therefore it is important to focus on cognitive models of interdisciplinarity that are transferable, flexible, and adaptable to the needs of our consortium.

4.2.1. "Mental-Models" approach

Mental-models research is commonly used to determine public understanding of an issue (e.g. participants' perceptions about the dangers or benefits of a new technology) and it aims to improve effective communications between experts and lay persons. This model was originally designed in the context of transdisciplinary collaborations between a natural

(climate) scientist and a social (behavioral) scientist who worked on a project about public perceptions of low-carbon electricity-generation technologies.⁹

Within a research team, this model is highly relevant for team productivity and growth, as it is dynamic and process-oriented. The four steps involved in this model are as follows (Fig. 2):

1) a crossdisciplinary expert panel makes informed decisions about what people need to know about a certain topic (*expert decision panel*)

2) surveys and interviews are conducted to find out what people already know and believe (*lay person panel*)

3) communication content is designed (compares expert knowledge and lay opinion; addresses misconceptions; makes technical information understandable)

4) the effectiveness of communication is tested (evaluation of recipients' understanding and subsequent behaviour)

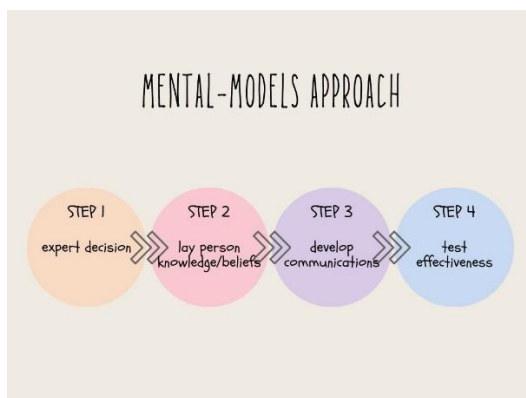


Fig. 2: Wändi Bruine de Bruin & Ann Bostrom (2013)

At the heart of this model is ongoing *communication development*, which is kick-started by surveys and interviews with members of the intended audience (public). The aim of this initial communication phase is to gauge the audience's understanding, perceptions, beliefs, worries and general attitude to the given issue (e.g. perceptions about low-carbon technology).

Initial findings in the above-mentioned study showed that there were negative affective responses to new technologies, including increased perceptions of risks and decreased perceptions of benefits.¹⁰ In the process of developing communications about green

⁹ Wändi Bruine de Bruin and M. Granger Morgan (2019): "Reflections on an interdisciplinary collaboration to inform public understanding of climate change, mitigation, and impacts". In: *Proc Natl Acad Sci U S A* 116 (16), 7676-7683.

¹⁰ See *ibid.*, 7678.

technology, it was observed that it was important to repeatedly *emphasize the shared research goal and benefits of the project* (to further public understanding of climate change and its impacts) and to *disseminate complex technical information in understandable words*. This approach is for obvious reasons highly relevant for the transdisciplinary research efforts (science communication) of our consortium as the aim is to communicate with diverse audiences about pressing environmental issues.

4.2.2. Model of interdisciplinary competencies

One way of identifying interdisciplinary competencies is to focus on relevant personal and social competencies, as has been suggested by the study on interdisciplinarity prepared by the *Projekt Nexus*.¹¹ The project's working definition of interdisciplinarity is very useful: interdisciplinarity is understood as "a form of scientific cooperation in relation to content and methods to be jointly developed, which is designed to provide the most appropriate problem-solving potential for jointly determined objectives through the cooperation of suitable scientists from different professional backgrounds".¹²

The study acknowledges the importance of subject-specific and methodological competencies, but also draws attention to social and personal abilities which are instrumental for effective transdisciplinary collaborations. Key elements of social and personal competencies are 1) teamwork skills, 2) the ability to apply interdisciplinary knowledge to different situations, and 3) an aptitude for self-reflection. Specifically, examples of **personal competencies** are: self-competence (reflective awareness of one's own resources, biography, thoughts and actions) and change of perspective (ability to take on divergent standpoints). **Social competencies** (often referred to as "soft skills") are developed in relation to our interactions with other people in diverse environments and include communication skills (the ability to express oneself in clear and understandable language and interpret messages

¹¹ Sebastian Lerch (2019): *Interdisziplinäre Kompetenzbildung - Fächerübergreifendes Denken und Handeln in der Lehre fördern, begleiten und feststellen*, NEXUS IMPULSE FÜR DIE PRAXIS (Ausgabe 18), www.hrk-nexus.de

¹² "als eine Form wissenschaftlicher Kooperation in Bezug auf gemeinsam zu erarbeitende Inhalte und Methoden, welche darauf ausgerichtet ist, durch Zusammenwirken geeigneter Wissenschaftler/innen unterschiedlicher fachlicher Herkunft das jeweils angemessenste Problemlösungspotential für gemeinsam bestimmte Zielstellungen bereitzustellen" (ibid., 3).

adequately; active listening; debating and argumentation skills) and teamwork (empathy, cooperation, the ability to deal with conflict).

Claus and Wiese (2021)¹³ have also developed a model of interdisciplinarity, which identifies four competencies that are required for successful collaboration: 1) initiative for exchange, 2) targeted communication, 3) knowledge integration, and 4) reflection on one's own discipline (Fig. 3).

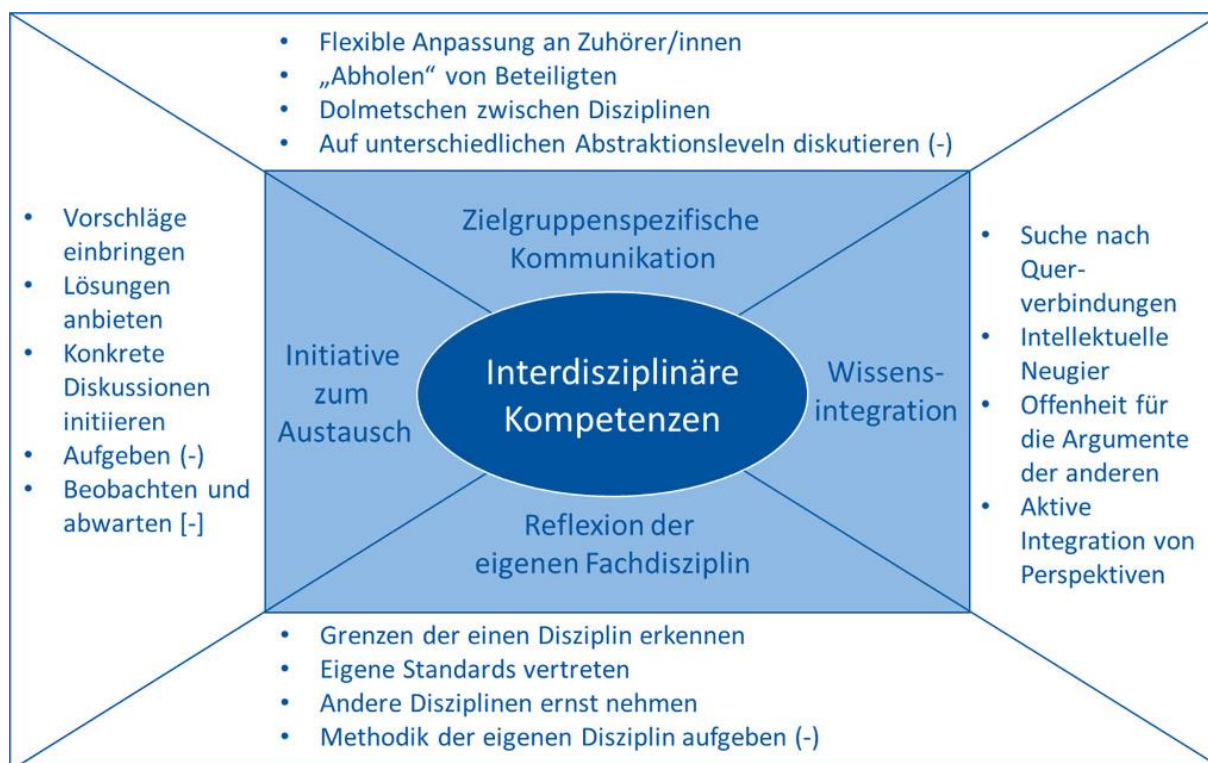


Fig. 3: Model of interdisciplinary competencies with instrumental behaviours (Claus & Wiese)

Each dimension of competence is associated with instrumental behaviour patterns, explained as follows:

Initiative for exchange involves the proactive ability to initiate discussions, make proposals and offer suggestions for solutions. **Targeted communication** refers to a flexible,

¹³ Anna M. Claus and Bettina S. Wiese, "Interdisziplinäre Kompetenzen: Modellentwicklung und diagnostische Zugänge" ("Interdisciplinary competencies: model development and assessment approaches") in: *Gruppe. Interaktion. Organisation. Zeitschrift für Angewandte Organisationspsychologie (GIO)*, Volume 52 (2021), 279–288.

understandable communication style that adapts to the needs of the target audience, can translate between disciplines, and draws attention to potential misunderstandings. Core behaviours of the **knowledge integration** competence involve cognitive skills such as the ability to establish cross-references between disciplines, openness towards different arguments, intellectual curiosity, and the active integration of diverse perspectives. **Reflection on one's own discipline** means a critical awareness of the limitations and potential of one's disciplinary expertise and background, as well as a readiness to defend one's own disciplinary quality standards and take seriously the results from other disciplines.

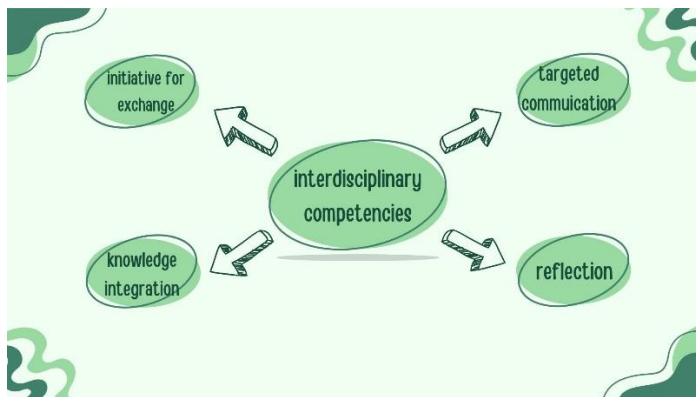


Fig. 4: Model of interdisciplinary competencies (English translation) (Claus & Wiese)

4.2.3. Social-cognitive framework

Another way of presenting interdisciplinary competencies is to divide them into cognitive (personal, individual) and social competencies, bearing in mind a degree of overlap between both dimensions. Such a framework has, for example, been developed with regards to multidisciplinary team innovation in a project that examined the impact of knowledge diversity on team outcomes (Paletz and Schunn 2010).¹⁴ The research has shown that a set of cognitive as well as social variables have an impact on the construction, recognition and evaluation of knowledge diversity within collaboration. Amongst the **social variables** of an effective integration of knowledge diversity are team structures and formal roles,

¹⁴ Susannah B. F. Paletz and Christian D. Schunn, "A Social-Cognitive Framework of Multidisciplinary Team Innovation" in: *Topics in Cognitive Science* 2 (2010), 73–95.

communication norms, sufficient participation and information sharing. **Personal cognitive variables** include information search, analogy, and evaluation.

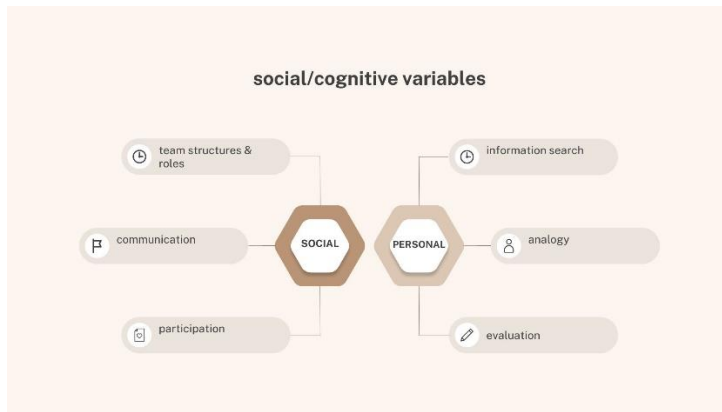


Fig. 5: Social/cognitive variables of team innovation (Paletz and Schunn 2010)

Both social and personal (cognitive) variables are shaped by divergent as well as convergent thinking processes which have an effect on team outcome. Paletz's and Schunn's research emphasizes the necessary interplay of divergent and convergent processes for the successful realization of research goals which draw on knowledge diversity. *Divergent thinking* is usually part of the beginning of project work when team members brainstorm possibilities, generate multiple ideas, explore possibilities and show creativity in their approaches. Broad participation of team members and effective information sharing are part of this initial phase in the collaboration process. Divergent thinking can also be triggered by certain disagreement and dissent within the group, which can be productive for the generation and discussion of novel ideas. Later on, in the *convergent phase* of collaboration, the diverse ideas and knowledge input need to be evaluated and brought together, decisions need to be taken and project tasks assigned. These convergent processes are crucial for the success of a collaboration, its outcomes and transdisciplinary impact. Convergence is heavily influenced by the overriding vision of a team and their attitude to progress, as well as team members' shared mental models, norms and expectations.

4.2.4. Model of interdisciplinary communication

Interdisciplinarity is necessary so that we may recognize and overcome the significant challenges facing society by considering technological, ecological and social aspects as interconnected problems. At this point, it must be pointed out that experts are qualified to work in an interdisciplinary manner due to their expertise acquired through years of training (e.g., university studies, additional qualifications, etc.). However, a challenge already becomes apparent: They encounter peer actors who are experts in a different field. To make matters worse, experts from other scientific disciplines now find themselves in an ordinary world. All premises (e.g., common knowledge background, common technical language) that apply within one's field must be discussed in interdisciplinary collaboration. It is important that interdisciplinary teams agree on the project's goals, set criteria for success, and develop joint methodologies. Nevertheless, the other disciplines remain "strangers" to some extent. Thus, one must be able to agree on commonalities and shared points of view and that is why language (effective communication) plays a vital role.

To make interdisciplinary collaboration successful it is therefore crucial that communication across disciplinary boundaries is facilitated and enhanced. Shared communication skills and structures are needed to unite different methodological approaches and ways of thinking within diverse research teams. In her interdisciplinary communication model, Suditsch (2017) identifies **concept (terminology)**, **speaker role** and **interaction** as the three relevant levels for interdisciplinary communication. The concepts and language used within a specialized scientific community (LSP – languages for special purposes) may be difficult to understand and translate into common language (CL) used in other contexts of audiences (laypersons). Therefore, speakers must draw attention to the context-specific nature of their specialist language (terminology) and find ways of translating and explaining it. Speaker roles change from expert to layperson (one expert can be a layperson in another field and vice versa) and the consequences for interaction (communication) are determined by varying meaning associations of terms in different speaker contexts.

5. Outlook

Interdisciplinary work is about satisfaction, community, knowledge, cohesion, flexibility and exchange. RE-EURECA-PRO aims to question and critique some of the value frameworks prevalent in European teams and build a foundation of trust together to enable interdisciplinary collaboration and create the best possible joint outputs from diverse creative minds. RE-EURECA-PRO aims to provide researchers with the necessary interdisciplinary and transnational work tools to carry out successful collaborations in the context of increasingly interconnected environments. For this reason, a survey was conducted in the (RE-)EURECA-PRO consortium to determine current interdisciplinary approaches and to draw attention to the difficulties, concerns, expectations and wishes of the people involved in the project. The results of this questionnaire are presented in the report D3.2, which also includes an appraisal of existing interdisciplinary mindsets of collaboration in the partner institutions in the form of a SWOT analysis.

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