Monitor ISH (2022), XXIV/2, 151–162
Drugi znanstveni članki
Other scientific article

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Hybrid Education, An Approach of STE(A)M, Hybrid Learning and Hybrid Labs[2]

Abstract: STEAM education is an approach that integrates Science, Technology, Engineering, Arts, and Mathematics to create a holistic learning experience. It prepares students for the 21st century needs, develops skills for success in any field and incorporates hands-on learning through projects, experiments, and interactive activities including problem-solving, creative thinking, collaboration, teamwork, and innovation. The HYBRID lab network project, which was an ERASMUS+ project, developed an upgraded STEAM methodology with integrated principles including the fields of humanities for educating students through experiences and practices. This paper presents the methodology, practices and benefits of Hybrid learning in order to expose these perspectives to a broader audience in the sense of educating people for the future.

Key words: education, hybrid learning, hybrid laboratory, interdisciplinarity

Hibridno izobraževanje, STE(A)M pristop, hibridno učenje in hibridni laboratoriji

Povzetek: Izobraževanje STEAM je pristop, ki združuje znanost, tehnologijo, inženirstvo, umetnost in matematiko za ustvar-

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[2] The author and memebers of the Hybrid Lab Network group would like to thank to European Union's Erasmus+ Programme for Education under KA2 grant for funding this research.

janje celostne učne izkušnje. Študente pripravlja na potrebe 21. stoletja, razvija veščine za uspeh na katerem koli področju in vključuje praktično učenje s projekti, eksperimenti in interaktivnimi dejavnostmi, vključno z reševanjem problemov, ustvarjalnim razmišljanjem, sodelovanjem, timskim delom in inovacijami. Projekt *HYBRID lab network*, ki je bil projekt ERASMUS+, je razvil nadgrajeno metodologijo STEAM z integriranimi principi, ki vključujejo področja humanistike za izobraževanje študentov skozi izkušnje in prakse. V tem prispevku predstavljamo metodologijo, prakse in prednosti hibridnega učenja, da te perspektive predstavimo širšemu občinstvu v smislu izobraževanja ljudi za prihodnost.

Ključne besede: izobraževanje, hibridno učenje, hibridni laboratorij, interdisciplinarnost

Introduction

STE(A)M (education) stands for Science, Technology, Engineering, Arts, and Mathematics. It is an educational approach that emphasizes the integration of these subjects in order to create a holistic learning experience. As a valuable approach, it prepares students for learning in the 21st century and provides them with the skills they need in order to succeed in any field. STE(A)M emphasizes hands-on learning to encourage active engagement of students with the material through projects, experiments, and other interactive activities by incorporating the arts into STEM (Bossi 2018; Radziwill et al. 2015; Marín-Marín et al. 2021; Razzouk and Shute 2012, 343). In doing so, it exposes students to problem-solving, creative thinking and, most importantly, supports collaboration and teamwork, which is of crucial importance today when solving complex problems in interdisciplinary fields. STE(A)M also puts emphasis on creativity and innovation and real-world connections. This allows students to

connect their learning in these critical areas to arts practices, elements, design principles, and standards (Radziwill et al. 2015; Marín-Marín et al. 2021; Bertrand and Namukasa 2020, 43-45).

Presently, people are adapting to fast-paced developments in technology, economic change, and new societal forms and structures. Therefore, today's students need to be educated with stimulating ingenuity, innovation, and openness, developing better social skills and a culture of co-creation. Students in STE(A)M programmes may have more experiential learning opportunities and gain a wider range of knowledge and competencies. Consequently, they are better prepared for future work environments and challenges. However, STE(A)M has rarely been applied outside the sphere of higher education and does not extend to the field of humanities, which carry an important aspect when gaining deeper insights and interpretations of the phenomena in question and in general. Hence, the HYBRID lab network is a project that integrates the benefits of STEAM into the field of humanities and new principles (using novel strategies in different contexts and audiences), through innovative methods of learning, social interaction and creativity and in doing so brings together diverse fields of science, technology, arts and humanities (Hybrid Lab Network 2023).

Hybrid goals and characteristics

Why is it important that humanities as a field are interconnected within the interdisciplinary approach of HYBRID? These question can be referred from the HYBRID project definition and its three key objectives: a) HYBRID was designed to promote excellence in teaching and skills development in Higher Education (HE). This involves linking education with research and innovation, and fostering open, innovative and entrepreneurial process-

es, b) it was designed to promote teaching and learning partnerships with international public and private sector partners and c) and it was designed to enhance the experience of international cooperation by strengthening capacities in interdisciplinary learning/teaching. Nonetheless, interdisciplinarity, innovation, and the wider public also forces a strong social responsibility, which is a crucial part of developing new technologies. We can see the importance and consequences of the technologies developed in the last decade (social networks, CRISPR biotech, Artificial Intelligence), which brought significant changes into society. Therefore, the field of ethics must necessarily be a part of any future curriculum and education.

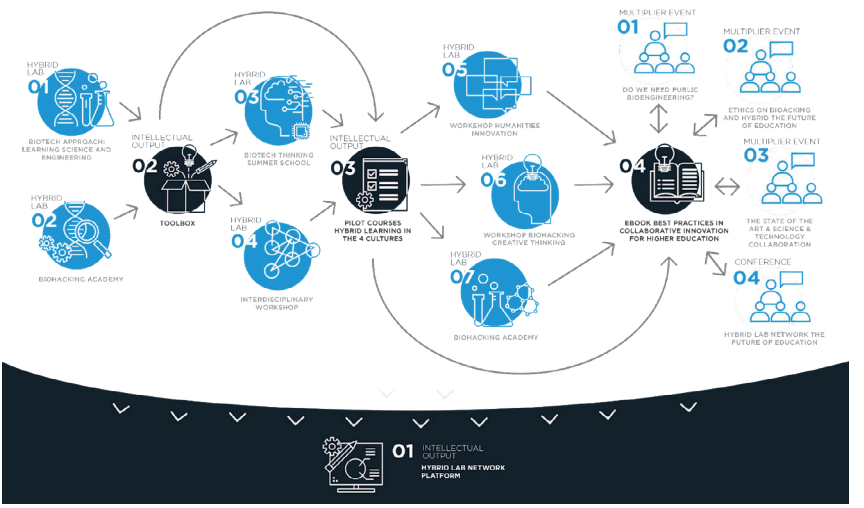
The HYBRID approach uses these dimensions of humanities along with the field of art and speculative thinking (Barendregt and Vaage 2021, 375) and integrate it with open labs and design thinking (Brown and Katz 2019; Jacobs 2018) as a main method for collaboration of different profiles. This include students, freelancers and members of the public who are involved with new learning practices beside academic teachers and staff. All of this as such puts a broad palette of advanced learning materials in the hands of the students and into their own responsibility.

As an approach, HYBRID emerged from an analytical, experimental and creative process that involved different people designing, testing and prototyping teaching/learning tools and experiences during projects through the so-called hybrid labs.

Although Hybrid education refers to a combination of online and in-person instruction (Shah et al. 2021; Szőke et al. 2022, 80-81), where some portion of the instruction is delivered online, and other portions in-person, in the context of this paper a HYBRID approach refers to the combination of traditional and non-traditional fields of study like STEAM, and Humanities that integrate principles

from different fields to promote innovation and creative practices in Higher Education institutions with an emphasis on ethics.

Figure 1. HYBRID LAB



Reprinted from *HYBRID project (Hybrid Lab Network. 2023). The HYBRID project initially involved two distinct phases, Problem Definition / Understanding and Ideation (HYBRID LAB 01 and HYBRID LAB 02). The first phase consisted of generating and exploring ideas for viable training actions, and of prototyping proposals for tools that would work with the training modules. Subsequent Testing and Implementation phases involved running the suggested training actions, using the framework that was set out in the formative proposals (HYBRID LAB 03 and HYBRID LAB 04). This gave rise to four new and differentiated formative proposals. The new proposals, when woven back into HYBRID's guiding principles, were more complex than the initial proposals. The four formative proposals – or courses – were once again put through Ideation (HYBRID LAB 05, 06 and 07) and where then tested, either in total or in part.*

Hybrid lab session: An example

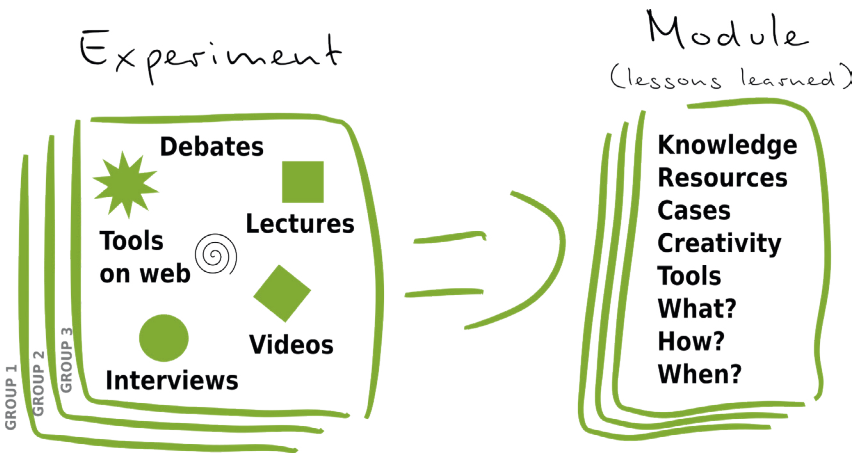
HYBRID LAB learning offers a wide range of flexibility and dynamics. It is characterized trough the developed methodology of designing a workshop, which uses integrative educational spaces for addressing the project's formulated problems. It is aimed at higher education participants from multi-disciplinary backgrounds and was developed by the project that emerged from the experiences, observations, tools and approaches through the HYBRID LABS (see Figure 1 respectivetly).

The HYBRID LAB workshop consists of the following steps that need to addressed by its design: definition of a theme, challenge and some clear key objectives, definition of the observers (coaches who will guide the workshop activities), mix of different profiles of people (teachers, students, researchers, artists, freelancers and volunteers), creation of a shared space in which all these disciplines can feel safe in letting go of their assumptions so that they can explore new and emerging fields and create and test prototype models and, last but not least, the use of different HYBRID learning methodologies, tools and practices (see Figure 2 and Figure 3 respectively); speculative thinking and design thinking are always crucial (Brown and Katz 2019; Jacobs 2018; Tomljenović 2020).

Furthermore, the design of the workshop needs to set out an interpersonal space in which participants from different disciplines can connect on a more personal level; for example, participants develop social skills and connections to the team through icebreakers and games at the beginning, which is beneficial to them when exploring the challenge with clear themes and objectives later in the process. This also means that different people and disciplines with a focal point need to be included in the workshop. This way, one discipline can lead the workshop out of its comfort zone, creat-

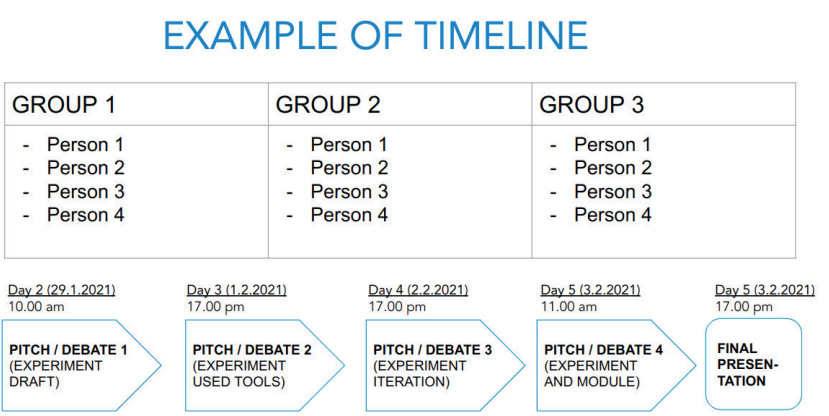
ing a space in which other disciplines can be explored and played safely within this less familiar field.

Figure 2. Experiment design through the workshop



Participiants based on goal and theme get the materials and lectures during the workshop and so explore new and emerging fields and to create and test prototype models.

Figure 3. Example of timeline



Workshop is designed form different group of people using different profiles. Their activities are involved through presentation during the workshop on defined schedule.

Challenges, dissusion and conclusion

The implementation of HYBRID learning requires a prepared workshop with clear themes and goal objectives as well as experienced mentors and various profiles of participants all grouped differently when addressing problems (teachers, academic staff, freelancer, wider public etc.). It also uses design thinking (Brown and Katz 2019; Jacobs 2018), art thinking (Jacobs 2018; Tomljenović 2020) and speculative thinking (Barendregt and Vaage 2021, 376) which are a crucial part of the workshop where participants integrate the field of humanities during the learning of new technologies in interdisciplinary / transdisciplinary domain of complex real world problems. Such an approach, however, can face some challenges, which need to be addressed and overcome when implementing HYBRID learning versus the classical educational approach.

Transdisciplinarity

There is still a place for development in the philosophy and methodology of transdisciplinary education in general (Renn 2021; Laasch et al. 2020, 735-736; Kushnir 2021, 47-48), as we seek to create possibilities for educational exposure to other disciplines. At the final project conference of the Hybrid Lab project, Alexandre Quintanilha, an experienced scholar, framed transdisciplinarity as a subject of experience: "you cannot teach inter/transdisciplinarity – you can only experience it." Transdisciplinarity is therefore not a field, but a possibility and an approach within education.

Academic and non academic space

A HYBRID space that affords the technical facilities to support multidisciplinary approaches for different types of experimentation needs to be as open as Laboratories are (science class design). Ateliers/studios (arts class design) are not set up for the precise execution of scientific protocols. Therefore, space in HYBRID needs to offer flexibility and freedom while at the same time it needs to avoid chaotic situations.

Prior curricular orientation

HYBRID workshop sessions require the experimental freedom that can beget chaotic course management. Because of this, it's crucial to provide curricular orientation before work begins, thus allowing time and space for test runs on any full experimental response.

Oversimplification and concepts

Hybrid education approach involves certain basic scientific concepts that can be implicit but not obvious to interdisciplinary audiences, so it's important to address oversimplification in communication. The exercise should involve elements of disruption from the earliest stages of the teaching/learning process to provoke disruptive exploration and it should be framed by rules that are fully understood and have gained participant consensus. It's important for participants to develop a mutual understanding of new concepts, build a shared language for new ideas and gain trust in the new collective vocabulary.

Overcoming disciplinary dominance

The existence of dominant disciplines is a main obstacle to HYBRID exploratory teaching/learning processes. In HYBRID, science and technology often self-proclaim as superior to humanities

and arts. Therefore, dystopian futures were more prevalent when science subdued the arts and humanities, whereas utopian futures were more likely when the latter disciplines were more influential. HYBRID activities that involve bringing different approaches to solve a problem often lead to difficulties as the different approaches are incompatible.

Although HYBRID learning faces these challenges that came to light during the project, this way of learning present a necessary approach when learning new technologies and new disciplines in the complex world of today, where training in classical education in these fields is not sufficient anymore to provide a good reference set of skills. As was quoted in this paper you cannot teach inter/transdisciplinarity in a classical way, you can only experience it. Therefore, HYBRID learning is a tool that enables such as experiences what present a novel part when addressing modern education.

Bibliography

Barendregt, Laura and Nora S. Vaage. 2021. Speculative Design as Thought Experiment. *She Ji: The Journal of Design, Economics, and Innovation* 7(3): 374–402. Access: https://doi.org/10.1016/j.sheji.2021.06.001 (12 February 2022).

Bertrand, Marja G. and Immaculate K. Namukasa. 2020. STEAM education: student learning and transferable skills. *Journal of Research in Innovative Teaching & Learning* 13(1): 43–56. Access: https://doi.org/10.1108/JRIT-01-2020-0003 (12 February 2022).

Bossi, Donald E. 2018. *STEM*: At the Crossroads of Traditional and Online Learning. *The Journal* (6 December). Access: https://thejournal.com/Articles/2018/06/12/STEM-At-the-Crossroads-of-Traditional-and-Online-Learning.aspx (12 February 2022).

Brown, Tim and Barry Katz. 2019. *Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation*. New York: Harper Business.

Hybrid Lab Network. 2023. Access: https://hybrid.i3s.up.pt (12 February 2022).

Jacobs, Jessica. 2018. Intersections in Design Thinking and Art Thinking: Towards Interdisciplinary Innovation. *Creativity. Theories — Research — Applications* 5(1): 4–25. Access: https://doi.org/10.1515/ctra-2018-0001 (12 February 2022).

Kushnir, Oksana. 2021. Role and importance of communication in transdisciplinary research management. *EUREKA: Social and Humanities* (1): 47–54. Access: https://doi.org/10.21303/2504-5571.2021.001626 (12 February 2022).

Laasch, Oliver, Dirk Moosmayer, Elena Antonacopoulou and Stefan Schaltegger. 2020. Constellations of Transdisciplinary Practices: A Map and Research Agenda for the Responsible Management Learning Field. *Journal of Business Ethics* 162: 735–757. Access: https://doi.org/10.1007/s10551-020-04440-5 (12 February 2022).

Let's STEAM. 2021. Access: https://www.lets-steam.eu/ (12 February 2022).

Marín-Marín, José-Antonio, Antonio-José Moreno-Guerrero, Pablo Dúo-Terrón and Jesús López-Belmonte. 2021. STEAM in education: a bibliometric analysis of performance and co-words in Web of Science. *International Journal of STEM Education* 8: 1-21. Access: https://doi.org/10.1186/s40594-021-00296-x (12 February 2022).

Radziwill, Nicole M., Morgan C. Benton and Cassidy Moellers. 2015. From STEM to STEAM: Reframing What it Means to Learn. *STEAM* 2(1): 1–7. Access: https://doi.org/10.5642/steam.20150201.3 (12 February 2022).

Razzouk, Rim and Valerie Shute. What Is Design Thinking and Why Is It Important? *Review of Educational Research* 82(3): 330–348. Access: https://doi.org/10.3102/0034654312457429 (12 February 2022).

Renn, Ortwin. 2021. Transdisciplinarity: Synthesis towards a modular approach. *Futures* 130: 102744. Access: https://doi.org/10.1016/j.futures.2021.102744 (12 February 2022).

Shah, Umang, Pavan Inguva, Benjamin Tan, Henrico Yuwono, Vijesh J. Bhute, James Campbell, Andrew Macey and Clemens Brechtelsbauer. 2021. CREATE Labs – Student centric hybrid teaching laboratories. *Education for Chemical Engineers* 37: 22–28. Access: https://doi.org/10.1016/j.ece.2021.07.004 (12 February 2022).

Szőke, Máté, Andrew Katz, Aurélien Borgoltz and William Devenport. 2022. Development of Hybrid Laboratory Sessions During the COVID-19 Pandemic. *Advances in Engineering Education* 10(2): 80–100. Access: https://doi.org/10.18260/3-1-1153-36029 (12 February 2022).

Tomljenović, Zlata. 2020. The Cognitive Aspect of Interactive Learning and Teaching in Visual Arts Education. *Revija za elementarno izobraževanje* 13(2): 131–152. Access: https://doi.org/10.18690/rei.13.2.131-152.2020 (12 February 2022).