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Insider Action Research On AI Needs Within The EIT Innoenergy Ecosystem

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INSIDER ACTION RESEARCH ON AI NEEDS WITHIN THE EIT INNOENERGY ECOSYSTEM

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ABSTRACT

This practice paper describes an ongoing insider action research within the EIT InnoEnergy ecosystem. Its goal is to inspire teaching staff from the seven EIT InnoEnergy double degree Master of Science programmes to integrate Artificial Intelligence (AI) tools and knowledge into their courses based on joint learning. This insider action research runs from 2023 to the end of 2024. In late 2022, a problem statement of 'AI tools for Education' was identified by EIT InnoEnergy teachers as being crucial for their future learning and teaching processes. To align the needs of teaching staff with the complexity of emerging AI tools, a decision was made to plan a hybrid insider action research method. The outcome of this research will be two-fold: one resulting in an AI toolkit covering three teaching staff needs, and two getting a better understanding of the processes involved in taking up a learning innovation at different engineering partner universities spread across Europe within the EIT InnoEnergy ecosystem. This paper shares the first phases of the insider action research and an overview of the individual AI initiatives taken by teaching staff at different partner universities that is the result of a first qualitative data analysis coming from initiatives shared by the insiders (i.e., teaching staff). Action research methodology was chosen to inspire teaching staff to take an investigative and experimental attitude to the new AI technologies while allowing all actors to support each other and grow towards an AI integration in courses and curricula.

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1 INTRODUCTION

This practice paper shares ongoing insider action research with professors and teaching staff from the European Institute of Innovation & Technology (EIT) InnoEnergy Master programmes to integrate Artificial Intelligence (AI) tools and knowledge into their Master courses. Action research's distinctive characteristics are that it addresses the twin tasks of bringing about change in organizations and in generating robust, actionable practical knowledge, undertaken in the present tense in a spirit of collaboration (Coghlan & Holian 2023, p. 174).

The recent uptake of AI propels universities as well as societies into a new era of Society 5.0, where "Society 5.0 (Super Smart Society) is a new guiding principle for innovation" (Carayannis and Morawska-Jancelewicz 2022, 3449) in a complex system. Moreover, it gives rise to organic pedagogical models that embrace "freedom within flexible boundaries, richness of possibilities, interconnectedness of all parts of the system, and collective emergence" (Laroche et al. 2007, 74).
The rise of AI also adds an additional layer of complexity to collaborative actions. To ensure the complex texture of bringing together teachers from engineering universities across Europe on a mutually identified problem, a submethod was sought that would fit EIT InnoEnergy's ecosystem's complexity. Insider action research was the best fit. To limit the focus of this paper, only AI initiatives and tools directly used in teaching were investigated and analysed.

1.1 Supporting teaching staff in times of educational complexity

The EIT InnoEnergy Master School offers 7 double degree Master of Sciences (MSc) from top European technical universities and business schools, covering different areas: renewable energy, energy in smart cities, energy technologies, sustainable energy systems, smart electrical networks and systems, nuclear energy, and energy storage. All programmes are taught in the context of innovation, research, and industrial business strategies (van Rijsingen et al. 2023). The EIT InnoEnergy's education strategy and innovation team supports teachers in all partner universities with concrete, contemporary teaching designs and approaches that embrace both innovation and entrepreneurship aspects. In this context, AI knowledge integration happens in a collaboration between teaching staff and education teams set in a multi-university setting, all actors embrace "the importance of distributive leadership in developing a culture of trust and respect" (McGraw et al. 2021, 45). EIT InnoEnergy MSc programmes have the additional complexity of integrating real-world problems in its education through industry projects and challenges posed by industry partners and providing company internships for the students. This additional complex dynamic emphasizes the importance for a "close relation between a university competing internationally and its need to build global trust in the university" (Rosyidah and Rosyidi 2020).

When analysing the opportunities and challenges of AI in this context it was decided to approach this challenge from an action research prism due its suitability to build promotional strategies aimed at building trust (Bogacz-Wojtanowska et al. 2023) 182) showed that "action research projects can be directed towards". In addition, action research is particularly pertinent to current opportunities, issues and changing demands associated with a focus on the *Future of Work*, including sustainability and the natural environment, use of artificial intelligence technologies, and flexible

employment (Delany 2022). Moreover, Coghlan et al. (2014) conclude that adding the competency (knowledge and skills) to design, facilitate and lead change by means of insider action research provides added value.

With EIT InnoEnergy particular context, one of the most attractive features of action research was its focus into the opportunity to learn with and from others, through listening and attending, acknowledging differences and assumptions when they are addressing a worthwhile issue (Coghlan and Holian 2023, p. 174). Adding the insider's perspective (the teachers and teaching staff of different academic institutions as well as the educational team), allows all stakeholders to get a voice in the final outcomes of the research. An additional benefit of the insider action research as a method was that insider action research emerged as an important way of understanding and changing organizations (Coghlan 2019; Coghlan and Holian 2007; Coghlan and Shani 2015).

1.2 Emergence of AI within sustainable engineering

While classical engineering has been successful in producing efficient and reliable systems that meet prespecified constraints and prespecified standards of performance in prespecified situations (Mina et al. 2006), integrating AI in sustainable engineering courses has no established prespecified knowledge to base itself on. Due to generative AI solutions only emerging in late 2022, and changing at an immensely high pace, AI related projects need an “engineering approach capable of (1) connecting different areas of knowledge, (2) encompassing diverse aspects of sustainability, and (3) articulating conflicting realities. This approach should allow dealing with situations characterized by uncertainty, emergence, and incompleteness of knowledge and information” (Sigahi, and Laerte Idal Sznelwar 2022, 233) which fits within complexity theory. Moreover, “action research provides the opportunity to study living emergent systems due to the flexibility and adaptability of the research design” (Ollila and Yström 2020, 398).

1.3 Insider target population

The target population of this research is a cross-section of the teachers and teaching staff involved in the EIT InnoEnergy Master school programmes who want to integrate (more) AI into their courses and curricula (n = 32). An open call was launched to all the teachers and teaching staff who wanted to be involved, and it was decided to also keep the target group open, so that during the year additional teachers could join. This aligns with one of the contexts of the insider action research contribution to developing a theory of what really happens in our ecosystem when a new innovative learning tool is taken up.

2 METHODOLOGY

When the complete member base of an organization seeks to inquire into the working of their organizational system to change something in it, they can be understood as undertaking insider action research. (Coghlan & Holian 2023). The context of insider action research is the strategic and operational setting that organizational members confront in their working lives. (Coghlan & Holian 2023). This is actually the case with the emergence and need for including the new AI opportunities within engineering courses and curricula.

The context of insider action research is beneficial within an umbrella organisation consisting of multiple educational partners such as EIT InnoEnergy, since (a) they are real events that must be managed in real time, (b) they provide opportunities for both effective action and learning, and (c) they can contribute to the development of theory of what really goes on in organizations (Coghlan & Shani 2015). The latter option of understanding what really goes on in our teacher organisation allows us to work on a long-term strategy to implement educational change more easily for future learning innovations.
Late 2022, a voluntary group of teachers and teaching staff replied to a call from EIT InnoEnergy's education team on what the teachers found to be their main learning and teaching problem. The teachers and teaching staff identified the problem area as: the understanding, evaluation, and uptake of AI tools by us - teaching staff - to optimize courses and curricula for EIT InnoEnergy Master programmes, in short AI needs in education. This would become the central topic of collaborative research.

As an additional challenge for this research, some of the teachers started experimenting with AI tools and services already. This meant, the group needed to share and discuss relevant data (e.g., first initiatives, research including AI…) of existing AI initiatives within the EIT InnoEnergy university ecosystem, to plan a collaborative action for stimulating AI knowledge and integration in education, as well as in the entrepreneurship journeys. Luckily, action research is a cyclical process, enabling immediate and ongoing optimisation and joint learning. It also allows the researchers to be actors, triggering additional practices and providing an active collaboration with practitioners (Ollila and Yström 2020). With the problem identified, a research initiative was started in January 2023 and running up until December 2024.

2.1 Action Research within sustainable engineering

The collaborative experience derived from an action research process is "designed to inspire an investigative, experimental attitude towards one's own professional practice beyond the organisation of data and the writing process" (Feldman et al. 2018). Thus, a space to share and build on all the teaching staff's experiences regarding AI was created in the form of insider action research. Ensuring a dialogue between all the actors of the target population throughout the research. This motivated EIT InnoEnergy teaching staff to reflect on integrating AI meaningfully in their courses based on the experience. Wood and Butt (2014) emphasised that "all voices are heard and engaged with as new patterns of being emerge". This is why all interested teaching staff was and is invited to instigate or participate in the new AI projects that we research as "action research can offer a positive medium through which to develop emergentist curricula, learning, and assessment approaches" (Wood and Butt 2014, 25).

Insider action research enables to follow the living, emergent system of integrating AI, while providing a research design agile enough to respond to events within our EIT InnoEnergy teaching staff network to create opportunities for joint learning. Thus, the actions, outcomes, and development paths were not planned. Instead, we followed the design as described by Ollila and Yström (2020), stating that actions

“emerged as we followed the matters of genuine concern in the collaborative setting” (p. 402).

2.2 Gathering first data: mapping existing AI initiatives

First insights emerged through the continuous dialogue between EIT InnoEnergy teachers and the educational team during educational meetings. As mentioned, the problem statement emerged during a Teacher Conference late 2022. From there, an online dialogue was set up between all interested teaching staff. That dialogue comprised of sharing existing initiatives, as well as emerging challenges, and wish lists regarding necessary AI tools. Aligned to this dialogue between interested teaching staff, the EIT InnoEnergy Teaching Staff newsletter was used to disseminate the existing AI initiatives, as well as the emerging questions that arose. This was done to keep an open, welcoming mindset, allowing other teachers to join the ongoing insider action research.

This understanding enabled the educational team to act flexibly while concretizing the action research cycles of: identifying a problem area, gathering relevant data (e.g., existing AI initiatives – see list below, emerging problems), interpreting data (e.g., teachers identified wishful AI lists, that data was analysed to find patterns), acting on evidence (e.g., re-entering any conclusions to the dialogues), and evaluating outcomes (e.g. if a need for special AI tools were listed, was that in alignment with the needs of more than one teacher). This flexibility includes the continuing “spiral of action research cycles that emerge from the interventions, reflection, and learning after each cycle” (Ollila and Yström 2020, 398), within the overall research design agreed upon with the InnoEnergy teachers to support them with AI tool awareness and integration.

One of the first dialogues on AI tools that happened after the indicated problem, was on identifying the major strands for investigation. A question was launched to all the volunteering teaching staff (n = 32), asking them to share which type of AI support they were interested in. That resulted in three main AI categories:

1. AI tools to support administration (e.g., reporting, proposal writing),
2. AI tools enabling research activities, and
3. AI tools that could be embedded in pedagogical approaches for teaching and learning within engineering for sustainable energy.

During spring 2023, all the existing AI initiatives across the technical partner universiteis of EIT InnoEnergy were mapped. These initiatives were then analysed by all insiders, and reflected upon in group to see whether any of these initiatives would be useful for other members of the teaching staff. The initiatives shared were:

- Learning Analytics projects focused on analysing learner data from courses from the MSc school to inform and improve learning design using AI.
- EIT InnoEnergy teachers’ experiments with AI and ethics within their Master courses (ethics, as well as energy and sustainability).
- Initiatives to integrate more digital skills in the curriculum in the form of Data Science and AI courses where students work on real energy problems analysing big data sets and developing e.g., predictive models

(https://www.linkedin.com/pulse/importance-active-learning-data-science-education-empowering/).

- EIT InnoEnergy research on the impact of using AI-generated synthetic video in an online learning platform on both learners' content acquisition and learning experience. A mixed-method approach randomly assigning adult learners (n=83) into one of two micro-learning conditions, collecting pre- and post-learning assessments, and surveying participants on their learning experience. The results show no significant differences in how learners perceived the traditional and synthetic videos (Leiker et al. 2023).
- Projects using AI technology based on Natural language Processing (NLP) to extract AI and sustainable energy skills from job offers, CVs and energy job market reports and be able to map skills to courses available on the market [4].
- And several teachers' exploration of AI tools for several teacher activities (resulting in the 3 identified AI strands to investigate).

From the perspective of the teachers of the individual MSc programmes, we learned that the emerging generative AI presented many new opportunities and insecurities to EIT InnoEnergy's multi-university teaching staff.

3 EMERGING TOPICS AFTER FIRST FULL CYCLE FINDINGS

After following a first cycle of action research: identifying a problem area, gathering the first relevant data coming from the insiders, interpreting that data, acting on evidence, the group had an evaluation after this first cycle. From the discussions three major topics emerged which would be re-entered into the group to set off the next cycle of action research: generative AI and AI tools within our entrepreneurial journey and courses, and emerging AI questions coming from initiatives.

3.1 Generative AI, strategy towards ChatGPT

To create a consensus on how to look like a group to ChatGPT and consequent strategies to take it up or limit its use, an activity needs to be planned where the impact, opportunities, and challenges of ChatGPT4 can be analysed by the group. Ever since the launch of ChatGPT to the wide public late 2022 and the proliferation of other generative AI tools, there has been an explosion of reactions in the education world. Different attitudes could be observed amongst educational institutions that can be categorized, as Philippa Hardman (2023) put it in a TEDx talk, as either dystopian or utopian, with a team "Avoid", trying to keep the technology out of the classroom, team "Ban" convinced that students should be forbidden to use the technology and that plagiarism detection needs to be put in place, and finally team "Embrace" emphasizing the opportunity it brings for the enhancement of educational practice.
Following the words of Saçan, "distrust towards chatGPT is a bad quick fix" (Saçan 2023, 2), and it is our believe that schools and educational institutions should encourage its' exploration so teachers can evaluate and compare uses and potential benefits.

[4] https://aiskills.innoenergy.com/

3.2 Exploring the options of AI within entrepreneurship journey and collaborations with startups and companies

The development of AI tutors and mentors is an area of increasing relevancy for education in general and for entrepreneurship education specifically. Very current examples are Khanmigo[5], a learning tutor embedded in the Khan academy and Yoodli[6], an app giving live feedback on presentation/sales pitch skills. In addition, companies launch AI tools in which ChatGPT 4 makes all business decisions for them (Santos 2023). While adopting such AI tools, teachers must ensure that students understand the impact of decisions based on AI, especially for entrepreneurs who influence society through various economic innovations. Action research incorporating joint learning across teaching staff towards future entrepreneurs is a necessity.

The engineering MSc programmes of EIT InnoEnergy also have an entrepreneurial side to them. Which meant that some of the insiders (business teaching staff) were emphasizing the growing effect of AI in business and entrepreneurship, and the need to explore these applications. AI is revolutionizing the way entrepreneurs are working and the way entrepreneurship can be potentially taught. McKinsey (2022) pointed out that generative AI and ChatGPT-like applications are taking assistive technology to a new level, reducing application development time, and bringing powerful capabilities to nontechnical users. We are already seeing examples of early-stage development of applications in areas such as marketing and sales, operations, IT/engineering, risk and legal or R&D. Specifically in the world of entrepreneurship, we now see public and private investor efforts to use StartupRadar's[7] data and OpenAI[8] to create embeddings, numerical representations of a startup, that allows for quick identification of similar startups (Lorey 2023), tracking of startup performance or tracing of most promising entrepreneurs.

3.3 Emerging AI questions

The ongoing conversations with the insiders, resulted in emerging AI questions containing practical AI use cases for energy engineering education, focusing on opportunities and value increase, while keeping an eye on risks and educational quality:

- Can generative AI tools automate course production such as video creation, content translation and assessment generation reduce the workload for teachers aiming to convert their courses to flipped classroom designs?
- How can students be allowed to use tools like ChatGPT or ChartGPT, for generating code and data visualizations in a way that supports the development of their coding skills?
- How can teachers encourage students to try out tools like ChatGPT to support them as a personal coach in their learning process and assist them in their writing assignments?
- How can teachers use chatbots to support their work such as the creation of lesson plans and generation of good coaching dialogues?

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[5] https://www.techlearning.com/news/what-is-khanmigo-the-gpt-4-learning-tool-explained-by-sal-khan
[6] https://app.yoodli.ai/
[7] https://startupradar.co/
[8] https://openai.com/

- Can AI help to trigger ideas and brainstorming, or even create mock-ups for an innovative digital product (see for example 1 AI tool that designs in 1 minute!).
- How can AI tools support Innovation & Entrepreneurship education, i.e. the more creative processes - traditionally identified as humans' advantage over computers - of ideation, synthesis, customer need validation, product building, and slide creation or pitch structuring for student presentations? How can the tools then be used to **augment** human intelligence and **not replace** human intelligence (De Cremer and Kasparov 2021)?

4 SHARING PRELIMINARY RESULTS AND NEXT ACTIONS

To address the emerging issue of Generative AI, AI in the entrepreneurial journey as well as in education in general, the educational team of EIT InnoEnergy planned an in-person workshop in the autumn of 2023, dedicated to:

- Understanding of the risks and opportunities of generative AI
- Launching an AI toolbox for all teachers
- Adding a focus on AI for its use in entrepreneurial education

Which will lead to the next cycle of the action research aligning it with the spiraling aspect of it described by Ollila and Yström (2020).

5 PRELIMINARY CONCLUSIONS AND ACKNOWLEDGMENTS

Although the action research is ongoing, some first conclusions were captured. A more in-depth understanding of generative AI is necessary, a closer look at entrepreneurial use of AI is requested and needed, and from exploring and sharing AI experiences more AI questions emerged to be addressed. These first cycle findings already highlight the empowering effect of working as a group of insider action research. Not only do the individual contributors grow their understanding of AI, but the group is taken to the next level of understanding by mutual inspiration. Next to redefining foundational knowledge within the teacher group, the skills and attitudes needed to perform key engineering tasks, as well as new skills must be integrated into university programmes.

5.1 Next steps

On 14 September 2023, the next in-person gathering takes place to follow up on this insider action research project. During this workshop, the full AI landscape (including ChatGPT) will be introduced by an AI expert to increase our mutual understanding and discussed by all present to align with the insider action research method. In addition, an AI toolkit will be presented and tested by actors of this insider action research. This toolkit will consist of AI tools useable for administrative purposes, for research support, as well as for teaching and learning (both engineering and business). Based on the outcomes of the workshop, the toolkit will be adjusted and finally disseminated to all EIT InnoEnergy teachers.

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