ARTICLE

COMPETENCE IN HYDROGEN SECTOR

INTERVIEW WITH DR. JAMES CARTON DUBLIN CITY UNIVERSITY

Co-funded by the European Union

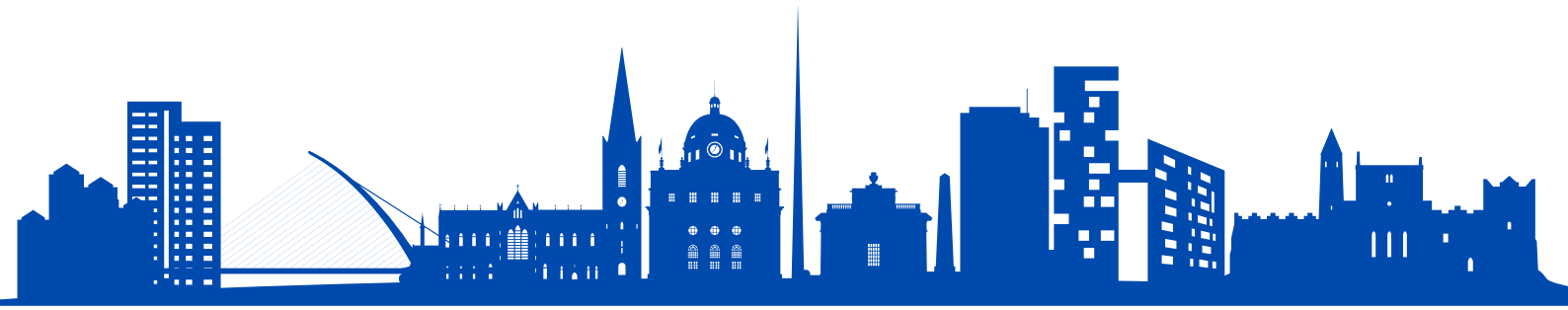
Interview with Dr James Carton Dublin City University

Hydrogen "Professionals and their skills in hydrogen"

Project: Professionals and their skills in hydrogen
Project number: 2023-1-PL01-KA220-VET-000159821

Authors:
Dr Aleksandra Marcinkowska of EDU SMART TC Limited, Ireland
Dr Aleksandra Ścibich-Kopiec of Foundation of Education, Development and Innovation "FERI", Poland

Editor: Julia Marcinkowska of EDU SMART TC Limited, Ireland



Co-funded by the European Union

Interview

As part of the 'Professionals and their skills in hydrogen' project, we interviewed Dr James Carton, Assistant Professor in Energy Sustainability & Hydrogen at Dublin City University; Funded Investigator at MaREI, the SFI Research Centre for Energy, Climate and Marine; and Chair GDSES & GCESD & MMMe. Dr Carton explained how VET/FE curricula can aid in meeting industry demands in the hydrogen sector, the importance of a cohesive approach to hydrogen training programs, as well as the necessity for a strong relationship between academia and the hydrogen sector. In addition, he discussed the role of technology, the Dublin City hydrogen department, specific professional skills, and strategies on sustainability implementation into hydrogen training. Read the full interview below.

The interview was conducted by Dr Aleksandra Marcinkowska of EDU SMART TC Limited Ireland, and Dr Aleksandra Ścibich-Kopiec of Foundation of Education, Development and Innovation "FERI" in March 2025.

Question 1 Dr Aleksandra Marcinkowska: How can VET/FE curricula be adapted to include the latest hydrogen technologies and ensure that graduates are ready to meet industry demands?

Dr James Carton: In order to meet industry demands, it is important to determine what those demands and expectations are, understand why they are set at that level, and then formulate a plan to align hydrogen training to those needs. Perhaps surveys and questionnaires could be employed to understand industry demands, coupled with research on emerging trends and recent developments in hydrogen technology; and this could enable the continuous improvement of courses and curricula. Being a fast-paced sector, it is important to acknowledge that training on hydrogen technologies must be reviewed and revalidated on a periodical basis, and care must be taken so materials and programmes don't become stagnant, outdated, or irrelevant.

Question 2 Dr Aleksandra Ścibich-Kopiec: What interdisciplinary approaches should be integrated into hydrogen training programs to foster innovation and address complex challenges in the sector?

Dr James Carton: It is always important to recognise and place hydrogen as a decarbonising vector within a much broader sector and within the broader energy transition. Hydrogen should not be taught as a standalone, isolated technology; but as part of something much bigger. The applications of hydrogen itself (in transport, energy storage, energy generation, etc.) should form the basis of a variety of interdisciplinary approaches to be considered when training the hydrogen workforce, always considering local needs and resources. Also, we believe that key aspects of certain disciplines should always be incorporated in hydrogen training, such as Risk Management (especially from a safety point of view), Project Management (as hydrogen projects will always be constrained by factors such as time, cost and scope) and Innovation (given the abovementioned complex and fast-paced nature of the sector).

Question 3 Dr Aleksandra Marcinkowska: Which specific skills gaps are currently evident in the hydrogen industry, and how can our FE programs be tailored to effectively address these deficiencies?

Dr James Carton: Skills gaps of all types are evident in the hydrogen workforce. In a 2021 survey carried out by the Erasmus+ HySkills project (which DCU was a part of), two-thirds of companies surveyed across different European countries affirmed that is it hard to find skilled professionals, with nearly 80% highlighting the need to train workers internally for hydrogen-related activities. Besides the evident technical skills, human and conceptual skills also present a considerable gap, being virtually not fostered in many VET/FE programmes. Human Skills, including the ability to work in groups and build cooperative efforts, are vital in such a complex sector that requires partnerships and constant collaboration. Likewise, Conceptual Skills, including the ability to see the environment as a whole and visualise relationships between sectors and areas, need to be fostered in such a broad and varied sector – as previously discussed. Ultimately, the continuous update and improvement of courses and curricula should aim to fill gaps in all types of skills – technical, human, and conceptual – always remembering that VET/FE is also part of the educational system and thus should generate graduates with a broad skillset and equipped with important transversal skills.

Question 4 Dr Aleksandra Ścibich-Kopiec: In what ways can stronger partnerships between academia and industry enhance practical, hands-on learning experiences for future hydrogen professionals?

Dr James Carton: As mentioned in Question 1, the interaction between academia and industry can establish a valuable loop of continuous feedback and improvement, aiming to align the skills and knowledge of learners with industry needs. Furthermore, such partnerships could enable more authentic experiences for learners in companies that have the infrastructure in place to facilitate hands-on training on-site (which many educational/training institutes may not have). By providing opportunities for practical experience and internships, a mutually beneficial bond between industry and VET/FE can be established, further strengthening the alignment of skills that would ensure that industry demands are met.

Question 5 Dr Aleksandra Marcinkowska: How can Dublin City University's hydrogen department play a pivotal role in shaping national VET policies that support the growth of the hydrogen economy?

Dr James Carton: Dublin City University conducts research on a variety of topics related to the hydrogen sector and the broader sustainability sector, including on the education and training in those areas. Current research on the role of VET/FE as an enabler of the hydrogen sector is exploring innovative pedagogies, transversal/transferrable skills, as well as vital elements of adult education, as important elements of Further Education on sustainability. The findings will hopefully provide the Irish FE sector with results and insights that will allow them to reshape policies, strategies and programmes. Additionally, DCU has consolidated itself as the epicentre of Ireland's hydrogen research, being part of many collaborative projects, and featuring a hydrogen lab.

Question 6 Dr Aleksandra Ścibich-Kopiec: What strategies can be implemented to ensure that sustainability and environmental considerations are central to the training of hydrogen specialists?

Dr James Carton: As mentioned in Question 2, hydrogen training requires an interdisciplinary approach, taking into consideration its applications and uses in different environments, and always incorporating the concept of hydrogen being immersed in the much bigger sustainability sector. Therefore, key aspects of sustainability and environmental responsibility should be integral to any hydrogen training course. For example, from a basic level, learners should be made aware of the different sources of hydrogen, the different modes of hydrogen production, and the emissions associated with each method. Learners should develop an understanding of the hydrogen supply chain and associated impacts, as well as of the various applications of hydrogen as a decarbonising agent and energy vector. Overall, a broader understanding of the sustainability sector should be facilitated – highlighting hydrogen's strengths and limitations within electricity, transport, and heating & cooling. This also aligns with the idea of a broad skillset (transversal skills) described in Question 3, where students not only develop a narrow set of technical skills, but also a broad skillset that can be transferred to any job in the sustainability sector and beyond.

Question 7 Dr Aleksandra Marcinkowska: How might emerging digital tools and simulation technologies be incorporated into our training programs to better prepare students for real-world applications in the hydrogen sector?

Dr James Carton: Digital tools can provide a more immersive experience for learners, although consideration is needed regarding cost and technical support for each application. In the abovementioned Erasmus+ HySkills project, suggestions were made in terms of interactive videos, Augmented Reality (AR), and Virtual Reality (VR), although none of the ideas materialised into real-life resources. In training programmes where the budget and scope can be adapted to include these technologies, they can be useful when training learners for specific tasks – especially from a safety point of view, when the simulation provides a safe digital environment. Another tool that deserves consideration is the use of Artificial Intelligence (AI) – its applications in training programmes, and in the hydrogen sector as a whole, have great potential. As an emerging technology, however, more investigation is needed in terms of the opportunities (and risks) that AI presents for education and training.

Question 8 Dr Aleksandra Ścibich-Kopiec: What key performance indicators should we use to evaluate the long-term impact of VET/FE initiatives on the development of a skilled, agile workforce in the hydrogen industry

Dr James Carton: Skills acquisition, retention, and alignment – It would be interesting to measure the skills that learners acquired during their training programme (via continuous assessment or a final examination, for example), measure the retention of those skills after a certain period of time (via surveys, questionnaires, etc.), as well as the alignment of those skills with industry needs (by also interacting with industry and comparing skills required vs skills available). Employment metrics – While employment rate is the most obvious performance indicator, others can also be explored, such as job retention (after a certain number of years), career advancement, and employee/employer satisfaction. All of these would require a follow-up with former learners and employers, which is not always easy. Impacts on the industry itself – more "macro" indicators can be used to measure the impacts on the broader industry and economy. The growth of the hydrogen industry, its contribution to the local GDP, economic impacts, jobs created, amongst others, could be used to evaluate medium- and long-term impacts of effective FE initiatives.

Thank you for the interview Dr Carton.

The work of Dr James Carton and Dublin City University covers technology such as VR and AI, as well as pedagogies and transversal/transferrable skills in adult education. The extensive research carried out at the University has allowed for its progression as the central hub for hydrogen research in Ireland, aiming to provide the Irish FE sector with strategic insights.

Disclaimer

Project: Professionals and their skills in hydrogen
Project number: 2023-1-PL01-KA220-VET-000159821

Co-Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.