

Co-funded by the  
Erasmus+ Programme  
of the European Union



Accelerating the transition towards Edu 4.0 in HEIs



# Partnership Manifesto – Transferability of the developed models

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**Žilina, SK, 28 April 2023**



## Executive Summary

This manifesto is the fifth intellectual output (IO) of the TEACH4EDU4 project. The overall project aim is to enable the creation of an environment that supports implementation of new learning and teaching approaches in Computer Science (CS) and related disciplines. It is designed to support Higher Education institutions (HEIs) across Europe as they incorporate innovative practices within their teaching – particularly their CS teaching.

The lead of this intellectual output was the University of Žilina (UNIZA). UNIZA was in charge of coordination of all steps leading to the development of this IO. All project partners participated in its development according to their competencies, expertise and experience. They were involved to provide valuable experience and vision in formulation of key messages this partnership has for all stakeholders - policy-makers, teachers, students, employers - about the importance and means of the transitional processes to Education 4.0 in line with the industry 4.0.

The manifesto was prepared as publishable document as a result of the following tasks:

1. Desk research - of the existing similar documents and the conclusions of other performed tasks and results of this project, also the feedback from teachers and students in this project according to the project impact analysis.
2. Summary of the research - Formulation of the key messages from the research and during multiplier events organised within the project.
3. Preparation of the document to be published.
4. Disseminate the Manifesto to the partner institutions from the outer circle - other HE institutions that partners of this project cooperate within different project and initiatives.

Applied methodology:

Both qualitative and quantitative methods were used, taking into account scientific sources and knowledge bases (i.e., for desk research) as well as inputs from real environment (i.e., input from stakeholders). The combination of both scientific and societal sources of data and information enabled the document to be both grounded in scientifically verified information and applicable in different real environments.

The document shall serve as a green paper for educational institutions transforming to Education 4.0.



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## 1. Introduction

The introduction of new technologies and digitalisation (Industry 4.0) is impacting society through changes in how people live, work, and interact with one another (Steger, 2017). Information and communication technologies (ICTs) have already been the cause of significant changes to methods of production and patterns of employment within the European Union (EU) (Eurostat, 2023). Driven by Industry 4.0 and digital technology, jobs are becoming more flexible and complex (Brynjolfsson & McAfee, 2014). As a result, people's capacities to be entrepreneurial, manage complex information, think autonomously and creatively, use resources, including digital ones, smartly, communicate effectively, and be resilient are more crucial than ever.

The Teach4Edu4 project consortium, created by seven higher education institutions (HEIs) from Croatia, Estonia, Italy, Serbia, Slovakia, Spain, and the United Kingdom, have worked together to develop the vision and solutions of how to accelerate the corresponding transition within HEIs towards Education 4.0. Together, we have prepared an essential contribution to the field of Computer Science and related disciplines.

In the Teach4Edu4 project, we recognised that without HEIs and systems that are effective in education, research, and innovation and connected to their societies, Europe could not respond to the Industry 4.0 challenges.

We have learned that cooperation between institutions from different countries is important and inevitable to reach the Education 4.0 goals. About 30 teachers, researchers, technicians, and administrative staff created the working groups for the five intellectual outputs of this project. Additionally, about 150 students participated in collaborative teaching covered by pilots of the joint creative classrooms.

**The main objective of our manifesto is to enable the transfer of the Teach4Edu4 consortium's knowledge, skills, and experience of Education 4.0 and its implementation on Computer Science and related study programmes** related to:

- a new form of teaching, learning, and assessment in Computer Science in Education 4.0;
- learning design (LD) models;
- collaborative teaching methods for joint creative classrooms (JCC);
- learning analytics (LA).

even beyond the project lifetime and enabling the transferability to other partnerships and domains.

The Teach4Edu4 manifesto has the following structure:

- Introduction to Education 4.0 approach.
- Explaining how strategic partnership can be used to improve the practices and principles of teaching and learning in Computer Science and related disciplines with regard to the Education 4.0 approach.
- Presenting the experience of the involved teachers and students in the stages of learning design and learning analytics for further availability to institutions outside the project consortium.
- Describing the inclusion of institutional processes that need to be undertaken to define joint efforts and goals in the context of institutional transition to Education 4.0.

- Describing a way to continue the collaboration of the Teach4Edu4 consortium after the end of the project.
- Defining basic conditions and rules for further cooperation with the new partners.

## 2. What is Education 4.0?

Our partnership manifesto serves as a good practice example of a strategic approach to strengthening EU education and innovativeness when implementing the Education 4.0 approach.

Education 4.0 is an area that connects new educational practices with the needs of industry. Our consortium focused on this technique in the project intellectual output 1 (IO1) "Catalogue of new forms of teaching, learning, and assessment in Computer Science in Edu 4.0 and related teachers' skills and competences" (Ferguson et. al., 2021). The evolution of the educational system from Education 1.0 to Education 4.0 was explained in the frame of the multiplier event of the Teach4Edu4 project. Education 4.0 was mentioned as an innovation-based education (Teach4Edu4, 2023).

Education 4.0 focuses on new and innovative use of technology, as well as connections with employment and industry (Hussin, 2018; Jisc, 2019; Salmon, 2019). The number 4.0 designates a connection with the current Industry 4.0 and modern smart technologies, such as the Internet of Things (IoT).

The Teach4Edu4 project activities are aligned with the second definition of Education 4.0 (Ferguson et al., 2021): "Education 4.0 employs an approach to learning and teaching that emphasises the development of skills and competencies necessary in a modern workplace using up-to-date technology. The skills and competencies developed may relate directly to the technology or be the softer skills (such as teamwork and creativity) needed to work effectively in such an environment. The approach involves the use of technology and/or pedagogy that is innovative in the context, and therefore requires flexible and creative approaches to its implementation."

The main characteristics of Education 4.0 are (Hussin, 2018; Ferguson et. al., 2021): learning anytime, anywhere, learning personalised, choice of how to learn, project-based learning, hands-on learning, data interpretation, assessed differently, students' opinions when updating curriculum and more independent. Based on those characteristics and the literature review, three distinct innovative pedagogical practices in designing innovative courses are identified (Ferguson et. al., 2021):

- Edu 4.0 Light - mostly focussed on independent learning, learning anytime, anywhere, personalised learning and choice over how to learn with limited hands-on learning and no project-based learning.
- Project-based/hands-on learning - a strong focus on project-based and hands-on learning and relatively limited focus on a choice of how to learn, personalised learning and learning anytime, anywhere.
- Full Edu 4.0 - strongly focussed on hands-on learning, becoming more independent, personalised learning, learning anytime, anywhere and choosing how to learn with limited students' opinions when updating the curriculum.



### 3. The strategic partnership – an important pillar of Edu 4.0 practices and principles introducing

HEIs have a history of various strategic partnerships, for example, with exchange agreements, coordinated curricula, conferences, research or various consortia (Eckel & Hartley, 2008). Several existing strategic partnerships or alliances among universities (Gunn, 2020) can be used as a catalyst to find strategic partnerships for Education 4.0 practices.

We started our cooperation in the frame of the Erasmus+ KA203 project – Accelerating the transition towards Edu 4.0 in HEIs. The very first idea of our project was that the necessary change in teaching, learning, and assessment forms in Computer Science should not be realised as work, activities, and attitudes of a person, an institution, or legislation. We are all living in a global and interconnected world. Innovations such as the new form of teaching, learning, and assessment related to the vision of Education 4.0 enable action to start improving practices and principles of education able to contribute to Industry 4.0. None of these activities would be possible without a spirit of cooperation. The Teach4Edu4 consortium seeks to promote collaborative responses to common challenges and goals. The manifesto sets out a strategy for growth designed around a smart, sustainable, and inclusive education.

The goal at the beginning of the project application was to find relevant HEIs with a similar vision of successful and effective education in Computer Science and related study programmes. We are glad that in the last weeks of our project activities, we all feel that our partnership is extremely fruitful. The project activities and results were offered and used during the project and can be used after the project ends, as well, to give teachers and students more benefits and an enhanced experience of new education techniques and forms.

Our strategic partnership was used to improve practices and principles of teaching and learning by educational institutions of different qualification levels considering Education 4.0 approach. We have followed six principles on how to build the Teach4Edu4 strategic partnership. The order in which they are listed is not obligatory.

Firstly, we identified our goals - attractiveness, effectiveness, and flexibility increase of Computer Science and related study programmes. We found that all project consortium members share similar values - openness to change and improve their internal educational processes. Secondly, we established clear expectations. Our main goal was to explore Education 4.0 approach and pilot joint teaching activities (defined as the joint creative classrooms later). By establishing clear expectations, we prevented issues that could hinder the partnership's integrity. In the frame of the third way, we were looking for partners with different knowledge, skills, and experience in fields of higher education, pedagogy, and Computer Science, including cooperation with industry partners, and change management. It was very important for us to understand that our collaboration must be strategic - it should be well thought out, and there should be a reason behind doing it. There should be a potential metric-oriented output or outcome. There were a few important online meetings when creating the project consortium that included important discussions of our project aims, goals, and outputs. Three very important principles were used before and during the project application. The fourth principle is the signing of the project agreement. It followed after the project application approval. The project agreement entails the scope of our partnership. It acts as a document that helps the project partners understand their responsibilities. The project consortium recognised another principle of successful strategic partnership in the project preparation phase. It is mentioned

as the fifth. It is related to the involvement of the partners with the "brand" - well-recognised academic institutions. Five of the seven project partners' ranking was above 1000 based on QS World University Ranking 2020 and Times Higher Education World University Ranking 2020. The last but not the least principle we have followed in our consortium is "building relationships". Networking is an essential condition of a successful strategic partnership. We have built our success on relationships. We have been developing networking time constantly - in the form of our personal, online, and hybrid project meetings.

## 4. Lessons learned from the TEACH4EDU project

### 4.1. Experience of the teachers and students – piloting of the joint creative classes

The Teach4Edu4 project has included HEIs joining in the partnership to enable its teachers and students a unique exercise in acquiring new skills and teaching methods in line with the developments in Industry 4.0. The Teach4Edu4 consortium decided to pilot the new forms and methods of teaching, learning, and assessment in Computer Science based on Education 4.0 ideas in the joint creative classes (JCCs) frame.

Virtual classrooms "in which the lecturers and students are participating from different places at the same time and the lecturers can store lecture material to be watched or aired in the future" (Beier et al., 2012) are important in computer science. Workers very often work in virtual teams, and students should be taught these skills during their education. The Teach4Edu4 consortium defined JCCs as "the computer science courses developed in collaboration of two or more project partners by using LD models usually with a total workload of 2-3 ECTS" (Muccini et al., 2022). The JCC approach supports various innovative joint teaching and creative learning practices that presuppose an active role for the learner and new roles for the teacher, mainly as a learning process facilitator. The JCC approach supports the development of teachers' skills and students' soft skills and competencies related to Education 4.0.

The project partner institutions selected several courses from their curricula to enable the cooperation of their teachers and students (e.g. Software architecture, Modelling and computer simulation, Internet/IoT security, Machine learning, Data analytics/data mining). In addition, they created international teams in which at least two project partners participated.

There were two important phases in preparing the JCC content, covered by two project intellectual outputs (Balaban et al., 2021; Muccini et al., 2022):

- research on new forms and methods of teaching, learning, and assessment in scientific journals, to prepare the catalogue of them, and
- developing the learning design for all JCCs.

We would like to emphasise the second phase - developing the learning design. The starting point was the Open University Learning Design Initiative (OULDI, 2020). It defined seven basic learning design activities - assimilative, finding and handling information, communication, productive, experiential, interactive/adaptive, and assessment (Balaban et al., 2021). The OULDI is described as "a methodology for enabling teachers to make more informed decisions in how they go about designing learning activities and interventions, which is pedagogically informed and makes effective use of appropriate resources and technologies" (Conole, 2012). It is focused on 'what students do' as part of their learning, rather than on 'what teachers do' or on what will be taught. We recommend reading the project intellectual output 2 (IO2) "Learning design models" (Balaban et al., 2021) for



more information about learning design. In the course design practices identified in IO1 (Ferguson et. al., 2021), three clusters (templates) were used for preparing learning designs of the pilot JCCs (EDU 4.0 light, project-based/hands-on learning and full EDU 4.0).

In order to enable teachers to plan their JCCs in accordance with the requirements of the Teach4Edu4 project, and taking into account the defined JCC templates, the T4ELD tool was developed (<https://bdp-ld.foi.hr>). This tool was used in the preparation phase of all piloted JCCs. Detailed information related to the JCC approach and JCCs piloting can be found in the intellectual output IO3 "Collaborative Teaching Methods for Joint Creative Classrooms" (Muccini, 2022) and the "Institutional processes..." section of the Manifesto.

HEIs are in the frame of Education 4.0, moving towards a more personalised way of learning. By utilising data and tracking students' performance, HEIs can be able to identify struggling students and provide optimised learning strategies to suit their needs using learning analytics.

The benefits of learning analytics for HEIs, staff, and students are multiple, such as improving student retention, supporting informed decision-making, increasing cost-effectiveness, understanding students' learning behaviours, and providing personalised assistance for students and timely feedback.

In order to connect learning design and learning analytics, the intellectual output 4 (IO4) Guidebook on Learning Analytics and Dashboards, explaining how to use learning analytics data to create evidence-based learning design decisions, was developed (Virkus, Mandre & Uverskaja, 2023). The aim of this guidebook is to support teachers and educators in making evidence-based learning design decisions and to support them in evaluating the effects of these decisions.

We realised desk research focused on learning analytics in the frame of IO4. From different methodologies mentioned in the IO4 project output, we have used descriptive learning analytics after each JCC end. Students completed pre-survey and post-survey, and we have used new knowledge related to learning analytics to prepare questionnaires for teachers to evaluate our piloted JCCs as well.

Three main points were identified in terms of how participating teachers reflected on their lived experiences of their JCC: learning design, JCC experience, and future intentions.

In terms of learning design, in general, most of the teachers' overall experiences and perspectives of the T4ELD tool were positive. In terms of "Design process and reflection" teachers reflect on the type of activities considering having a correct balance among them, not including too many "acquisition" type learning activities: "Sharing the design among institutions" was proven to be a good experience where teachers from different institutions were positive. In terms of the T4ELD "Tool feedback and improvement", feedback is good in terms of easiness, although feedback should be included once the course has been run. While visualisation of the learning activities was useful, it could be easier to share with students and embedded in the learning management system (LMS), e.g. Moodle. About the three common learning designs (mentioned as three distinct clusters on the previous page), about a third of teachers indicated that their learning activities mostly resembled the full EDU4 model, while a quarter of teachers indicated that their design resembled the project-based approach. The rest could be categorised as Education 4.0 light.

In terms of the JCC experience, both positive and negative aspects were thematically analysed. Some of the "positive aspects" of the JCC experience, including the use of different languages in international processes, are "Collaboration between institutions and students" and "Motivation of

students". While "negative aspects" include the bureaucracy and a lot of time invested. Also, the collaboration did not work well in all JCCs because their participants (teachers and students) were busy or had communication problems. And the roles of teachers were not always clear.

Finally, regarding future use, it includes using the content in "regular" classes, particularly for master's or PhD students, with motivated students.

More than 100 students took part in the survey of their experience related to the JCCs' participation. Exactly 108 participants completed the survey. The students generally agreed that they received "innovative" Education 4.0 elements in their learning design. In order of students' preference, 96% received learning and teaching that emphasised skills and competencies in a modern workplace, 95% indicated that they could learn where and when they chose, 95% could study how they would like to study, 92% worked on projects with other students, 93% learned how to interpret and reason with data, 91% gained hands-on, authentic experiences and real-world skills, 93% worked with the assessments to were innovative, 90% were able to develop their soft skills, 90% of students wanted to develop their skills to work effectively in a modern workplace, 84% have become more independent in how they study, 80% indicated that the JCC was personalised to their learning, while 70% indicated that their voice was used to contribute to the design and implementation of the JCC. It is noteworthy to report that on most elements of Education 4.0, the JCCs delivered or exceeded students' expectations. In particular, it is recommended that students feel that the JCCs provided skills and competencies of the modern Computer Science workplace and that there was flexibility in terms of how they could study and work together. At the same time, probably because of the relatively new innovation, fewer students felt part of the (co-)creation and implementation of the JCCs, which given the context in which teachers from different institutions had to collaborate on relatively short notice together, is not entirely surprising.

## 4.2. Institutional processes in the context of institutional transition to Education 4.0

It is necessary to define joint efforts and goals in the context of the institutional transition to Education 4.0 to develop and continue the Teach4Edu4 project ideas. We have used our experience of strategic partnership for 30 months. We have discovered that the most relevant part of our cooperation and joint efforts in the Teach4Edu4 project and the best transferable activity in the context of the transition of project partner institutions to Education 4.0 was the piloting of the JCCs. Read the intellectual output "Collaborative Teaching Methods for Joint Creative Classrooms" (IO3) of the Teach4Edu4 project for more information.

The institutional processes to organise and manage the JCC can be described in different levels of management - consortium, partner institution, and JCC.

### *Institutional processes - consortium level*

1. Invitation for the project partners to propose the JCC topics
2. Merge of proposals for the JCC topics
3. Agreement on the JCC topics and establishing of the JCCs
  - a. including topics details - language, start, end, ECTS, syllabi
  - b. teachers - partners involved (names)
  - c. students - partners involved (number)
  - d. JCC facilitator (coordinator)
  - e. etc.



4. JCC accreditation - e.g. implementation to curricula of at least one project partner (or creation of BIP that will cover the JCC)
5. JCC catalogue - information for all partners
6. JCC realisation
7. Evaluation of JCC reports
8. Learning analytics based on all JCC reports
9. JCC certificates for students and teachers

*Institutional processes - teachers as "course owners"*

1. Invitation for teachers - including an explanation of the JCC concept (JCC collaboration dimensions, JCC attributes - e.g. teaching type) and collaborative teaching methods (workshop organised by a partner in the local language - alternatively, it can be organised for all partners as an online workshop in English)
2. Creating the course list - what can be offered by a specific partner to create JCCs with other partners
3. Receiving a list of JCCs defined on the consortium level
4. The final list of JCCs for a specific time period (academic year, semester)
5. Student recruitment
6. JCC realisation - teaching, assessment
7. Information about finished JCC - report
8. JCC recognition - for students and teachers

*Institutional processes - JCC level*

1. Teachers agree on the JCC topic and content
2. Timetable for the JCC
3. Learning design
4. Document for JCC catalogue
5. Student recruitment
6. JCC realisation - teaching, learning, assessment
7. Report after JCC finishes

The institutional processes described in this section were verified by preparing eight JCCs (Teach4Edu4, 2022). We recommend organising future project activities (mentioned in the following section - BIPs, "full" courses) in accordance with these institutional processes. Of course, some deviations may be necessary in connection with the development of educational processes at the Teach4Edu4 consortium partners and also in the activities of the Erasmus+ programme.

## 5. Sustainability of project results

### 5.1. The Teach4Edu4 consortium after the end of the project

The Teach4Edu4 project duration was set up to 30 months. The consortium partners have decided they would like to continue their cooperation after the project ends. We are glad we were able to fulfil our goals described in the project application. However, we have detected a few topics to be discussed and solved in the near future to improve and make our cooperation more effective.

The project activities were organised in the direction to support and develop the JCCs approach. We believe this approach is the backbone of our cooperation for the future. To be successful in organising and offering the JCCs we need to solve the recognition of teachers' work and embedded courses (JCCs) in the curriculums of the consortium partners.

The teachers' work in the frame of the JCCs has the same nature as preparing and teaching of courses at their home institution. The teachers' participation in piloting JCCs was covered by the Teach4Edu4 activities. It is necessary to cover work recognised as an indivisible part of the teachers' job content, e.g. in the frame of internationalisation activities or teaching of foreign students, virtual mobility, or any similar category defined by teacher effort evaluation implemented at their home institution. It is hard to expect that teachers will be motivated to cooperate in the JCCs without the relevant recognition at their home institution.

We would like to continue preparing joint courses - JCCs. To include them in the legal framework of HEIs activities, they have to be accepted as regular subjects (courses). Currently, there are two ways (dimensions) how to cover the JCCs in the standard education processes:

- JCCs organised as BIPs with 3 ECTS, covered by Erasmus+ KA131 projects and bilateral agreements among the consortium members.
- Subjects (courses) with a duration of a regular semester, for example as a part of the joint degree programmes - with 5-7 ECTS, while JCCs are components of curricula.

The current consortium will continue in research and application of learning analytics. The importance and impact of LA could be summarised by these statements (Virkus, Mandre & Uverskaja, 2023):

- LA initiatives can help students acquire self-directed learning behaviours and attributes, and provide feedback to students about their learning activities, progress, and performance in order to support the development of self-regulation skills.
- LA promises to provide insights helpful for enhancing teaching practice, learning decisions, and educational management.
- To successfully introduce LA initiatives, providers need policies aligned with organisational strategic goals and objectives, the necessary infrastructure, skilled staff, and appropriate organisational culture.
- The most commonly used LA tools are dashboards, which visually represent indicators of student progress and academic performance.

Besides these, our consortium will follow different calls to prepare new projects:

- Erasmus+ KA2 projects
- Horizon Europe projects - Cluster 4: Digital, Industry and Space
- DIGITAL Europe programme (especially Advanced Digital Skills related to the Digital Education Action Plan). (European Commission, n.d.)

The Teach4Edu4 consortium priority for the upcoming three years is to organise BIPs and at the same time continuously cooperate on developing joint degree programmes.

## 5.2. New partners in our initiative and how to join the Teach4Edu4 consortium

Higher education institutions with Computer Science and related study programmes throughout the world are facing many similar challenges in teaching. Members of the Teach4Edu4 consortium are committed to shaping the future of Education 4.0 approach within Computer Science and related study programmes.

As a member of the Teach4Edu4 consortium, new members can take full advantage of being part of the new community. The existing and new members can expect the positive influence of the Teach4Edu4 consortium because

- They will be part of a community of teachers and researchers, which would include other higher education institutions that, due to various shared resources within the community, will have the opportunity to achieve the goal: improvement of existing knowledge and practices used for the preparation of teaching and educational materials, accreditation of study programs, an offer of study activities.
- It is bringing forward the institutions' interests, gains visibility, and influence on Education 4.0 approach topics at the international level.
- They can learn directly from the experience of other consortium partners, and exchange insights and best practices with academic, technology, and IT industry leaders.
- It will be easier for them to implement Education 4.0 at their own institution.
- They will have access to the intellectual outputs and the background of their development. It will provide them with invaluable arguments in discussions with university management, government authorities, or funding bodies.
- It will give them access to a database of interesting BIPs organised by the Teach4Edu4 consortium.
- They will be able to shape strategic priorities of Computer Science and related study programmes education in Europe.
- They will be invited to prepare together research papers related to Education 4.0 and its implementation in Computer Science and related study programmes and exchange the project ideas with similar organisations of different educational levels and different activities, but with a link in the ICT field.

Based on our cooperation in the frame of the Teach4Edu4 project and our memberships in other academic consortiums and academic platforms we are proposing the following definition of the basic conditions and rules for further cooperation on the higher education transition towards Edu 4.0 for the new members of our consortium:

- Computer Science or related study programme at bachelor or master study level.
- Pedagogy-focused study programme with experience of teaching Computer Science teachers for secondary education.
- Previous cooperation with at least one founding member of the Teach4Edu4 consortium.
- Dedication to the continual advancement of education with the goal to improve all aspects of life.

The Teach4Edu4 consortium is open to welcoming new members. We are convinced that Education 4.0 approach can help to change and improve the education of Computer Science and related study programmes. We are sure it is promising for both teachers and students. Education 4.0 is characterised by its own concepts and methods.

## 6. Summary/Conclusion

Education of the future ICT specialists is a very important role of HEIs. In 2021, slightly less than two-thirds of all ICT specialists in the EU had completed a tertiary level of educational attainment.

Across the whole of the EU, ICT specialists accounted for 4.5% of the total workforce in 2021 (Eurostat 2023).

The Teach4Edu4 consortium will continue project activities and prepare new activities to support EU goals in the education of future ICT specialists.

The main objective of the Teach4Edu4 project was to respond to the horizontal priority of the Erasmus+ KA2 programme: Supporting educators, youth workers, educational leaders and support staff, since the project activities were designed to enable the creation of the environment for implementation of new learning and teaching approaches in Computer Science and related disciplines. With the unique concept of Joint Creative Classrooms (JCCs), this project offered virtual and blended mobility and a significant increase of knowledge in the field of Computer Science education.

This document was prepared based on the experience of HEIs within Computer Science and related study programmes, but its application isn't limited to tertiary education. We are sure our experience can be further transferred to different educational levels. We believe it can be inspiring for a broad range of disciplines. It shall not be limited to computer science.

Amongst others, our manifesto is the reflection of practitioners who were active associated partners of the Teach4Edu4 consortium. They have contributed to the discussion about the vision and purpose of Education 4.0 and their role in it. Based on our cooperation with the associated project partners, we are able to indicate the changes which are necessary if we want education to contribute to Industry 4.0.

The founding members of the Teach4Edu4 consortium believe that through the manifesto, the sustainability of the Teach4Edu4 project idea is further enabled. Our goal is to build on the Teach4Edu4 project results and continue, in terms of the exchange of knowledge, future upgrade of joint educational activities (especially JCCs), and development of new ways of teaching within Computer Science and related disciplines by similar organisations.

Experience of participation in different international teams, created for different purposes and with different motivations, has helped us to see our project goals, issues, and solutions from different and sometimes unexpected perspectives and points of view. It would not be possible to reach all our results in this kind of synergic effect without our cooperation. Teaching staff and students of the consortium members were empowered to use foreign languages in teaching and learning, as well as everyday communication with international partners. This could be mentioned as an additional important impact on the partner institutions.

The Teach4Edu4 consortium is open to receiving and accepting the manifesto by other institutions. Contact us to join the Teach4Edu4 community of teachers and researchers. Be part of the community willing to innovate their education programmes and to raise internationalisation level.

Also, with the emergence of Industry 5.0, with key concepts of human-centricity, sustainability and resilience (Breque, De Nul, & Petridis, 2021), the concept of Education 5.0 also surfaced. Education 5.0 focuses on improved learning with personalisation but also strives for innovation and industrialisation (Bigirimana, 2021; Leelavathi et al., 2022). This gives new importance to JCCs because they can enable exactly the education of future workers in the scope of Education 5.0 that Industry 5.0 needs. The Teach4Edu4 consortium would like to continue in this direction and adapt cooperation.

## References

- Balaban, I., Divjak, B., Zlatovic, M., Sobodić, A., Grabar, D., Vondra, P., Muccini, H., Jeremic, V., Llorens, A., Virkus, S., Rienties, B. & Marton, P. (2021). *Learning Design Models* (IO2). <https://teach4edu4-project.eu/sites/default/files/2022-04/IO2%20Learning%20Design%20Models%20-%20v1.0%20final.pdf>
- Beier, S. Bickel, M., Brockmann, P., & Choinzon. M. (2012). It takes a global village to teach global software engineering: A mongolian-german team-teaching project. *In 2012 International Conference on E-Learning and E-Technologies in Education (ICEEE)*, 152–157. <https://doi.org/10.1109/ICeLeTE.2012.6333395> .
- Bigirimana, S. (2021). Embedding Intellectual Property in University Education: Strides towards Education 5.0. *Academia Letters*, 2.
- Breque, M., De Nul, L, & Petridis A. (2021). *Industry 5.0 – Towards a sustainable, human-centric and resilient European industry* (Policy Brief). European Commission. <https://data.europa.eu/doi/10.2777/308407>
- Brynjolfsson, E., & McAfee, A. (2014). *The second machine age: Work, progress, and prosperity in a time of brilliant technologies*. W W Norton & Co.
- Conole, G. (2012). *Designing for Learning in an Open World*. Springer.
- Eckel, P. D., & Hartley, M. (2008). Developing academic strategic alliances: Reconciling multiple institutional cultures, policies, and practices. *The Journal of Higher Education*, 79(6), 613-637.
- European Commission. (n.d.) *Digital Education Action Plan (2021-2027)*. Retrieved March 30, 2023, from <https://education.ec.europa.eu/focus-topics/digital-education/action-plan>
- Eurostat. (2022a, October 10). *Employed ICT specialists - total*. Retrieved April 8, 2023, from [https://ec.europa.eu/eurostat/databrowser/view/isoc\\_sks\\_itspt/default/table?lang=en](https://ec.europa.eu/eurostat/databrowser/view/isoc_sks_itspt/default/table?lang=en)
- Eurostat. (2022b, October 10). *Employed ICT specialists by educational attainment level*. Retrieved April 8, 2023, from [https://ec.europa.eu/eurostat/databrowser/view/isoc\\_sks\\_itspe/default/table?lang=en](https://ec.europa.eu/eurostat/databrowser/view/isoc_sks_itspe/default/table?lang=en)
- Eurostat. (2023, April 5). *ICT specialists in employment*. Retrieved April 8, 2023, from [https://ec.europa.eu/eurostat/statistics-explained/index.php?title=ICT\\_specialists\\_in\\_employment](https://ec.europa.eu/eurostat/statistics-explained/index.php?title=ICT_specialists_in_employment)
- Ferguson, R., Herodotou, C., Iniesto, F., Rienties, B., Sargent, J., Muccini, H., Isidori, M. V., Jeremic, V., Llorens, A., Alier, M., Virkus, S., Hajdin, G., Zlatovic, M., Gonda, D., Kvet, M., Marton, P., Moravcik, M., Papán, J., & Uramova, J. (2021). *Catalogue of new forms of teaching, learning and assessment in Computer Science in Edu 4.0 and related teachers' skills and competences* (IO1). [https://teach4edu4-project.eu/sites/default/files/2022-01/IO1\\_Teach4EDU\\_catalogue%20of%20teaching\\_final.pdf](https://teach4edu4-project.eu/sites/default/files/2022-01/IO1_Teach4EDU_catalogue%20of%20teaching_final.pdf)
- Gunn, A. (2020). The European universities initiative: a study of alliance formation in higher education. In A. Curaj, L. Deca & R. Pricopie. (Eds.) *European higher education area: challenges for a new decade* (pp. 13-30). Springer International Publishing.
- Hussin, A. A. (2018). Education 4.0 made simple: Ideas for teaching. *International Journal of Education and Literacy Studies*, 6(3), 92-98.



Jisc. (2019). *Education 4.0 – transforming the future of education (through advanced technology)*. Retrieved March 25, 2023, from <https://www.youtube.com/watch?v=aVWHp8FsV1w>

Leelavathi, R., Bijin, P., Babu, N. A., & Mukthar, K. J. (2022). Industry 5.0: A Panacea in the Phase of Covid-19 Pandemic Concerning Health, Education, and Banking Sector. In *Explore Business, Technology Opportunities and Challenges After the Covid-19 Pandemic* (pp. 3-12). Cham: Springer International Publishing.

Muccini, H., Isidori, M. V., Forlizzi, L., Melideo, G., Balaban, I., Rienties, B., Marković, A, Zornić, N., Llorens, A., Virkus, S., Rienties, B., & Marton, P. (2022). *Collaborative Teaching Methods for Joint Creative Classrooms* (Teach4Edu4 IO3).

Open University. (2020). *Open University Learning Design Initiative*. Retrieved March 31, 2023, from <http://www.open.ac.uk/blogs/archiveOULDI/>

Salmon, G. (2019). May the Fourth Be with you: Creating Education 4.0. *Journal of Learning for Development*, 6(2), 95-115.

Steger, M. B. (2017). *Globalisation: A Very Short Introduction* (4th ed.). Oxford University Press.

Teach4Edu4. (2022, July 5). *Joint Creative Classrooms Catalogue*. [https://teach4edu4-project.eu/sites/default/files/2022-11/TEACH4EDU4\\_JCC\\_Booklet\\_2022\\_11\\_08.pdf](https://teach4edu4-project.eu/sites/default/files/2022-11/TEACH4EDU4_JCC_Booklet_2022_11_08.pdf)

Teach4Edu4. (2023, March 10). *Multiplier event Ready4Edu4 in Croatia and final conference held*. <https://teach4edu4-project.eu/en/news/multiplier-event-ready4edu4-croatia-held>

Virkus, S., Mandre, S., & Uverskaja, E. (2023). *Guidebook on Learning Analytics and Dashboards* (Teach4Edu4 IO4).

