Review Report Form

Open Review

(x) I would not like to sign my review report

( ) I would like to sign my review report

English language and style

( ) Extensive editing of English language and style required

( ) Moderate English changes required

( ) English language and style are fine/minor spell check required

(x) I don't feel qualified to judge about the English language and style

	Yes	Can be improved	Must be improved	Not applicable
Is the content succinctly described and contextualized with respect to previous and present theoretical background and empirical research (if applicable) on the topic?	( )	( )	(x)	( )
Are the research design, questions, hypotheses and methods clearly stated?	( )	( )	(x)	( )
Are the arguments and discussion of findings coherent, balanced and compelling?	( )	(x)	( )	( )
For empirical research, are the results clearly presented?	( )	(x)	( )	( )
Is the article adequately referenced?	( )	(x)	( )	( )
Are the conclusions thoroughly supported by the results presented in the article or referenced in secondary literature?	( )	(x)	( )	( )

Comments and Suggestions for Authors

Reviewer comment:

Strengths

The article presents a unique research topic and scope related to planning and developing advanced knowledge and skills for future industrial employees in the field of artificial intelligence, the Internet of things, and edge computing.

The article presents interesting data and detailed analyzes.

The solutions to the research problem contained in the text complement the scientific literature in the scope of the present issues.

The solutions presented by the authors are interesting and broaden the scope of research related to planning and developing advanced knowledge and skills for future industrial employees in the field of artificial intelligence, the Internet of things, and edge computing.

The conclusions presented by the authors, based on the analysis of the literature are consistent with the evidence and arguments.

Authors' answer:

We would like to thank you the reviewer for your favorable opinion.

Reviewer comment:

Weaknesses

There is no precisely defined purpose of the manuscript.

Authors' answer:

We have improved the Introduction section in which we have described the purpose of the manuscript in more detail. We also have emphasized the contributions of the article, and we have pointed out what the study brings us. The revised fragment of the Introduction section is as follows:

"This paper presents the work conducted within the Planet4 project. The objective of the study is to gather and analyze the knowledge and skills on AI, IoT, and EC acquired by the students as future industrial employees deploying such technologies. The main contribution of this work is knowledge about the declared students' competences in the field of AI, IoT, and EC. Many interesting conclusions arose from the survey, such as, for example, which particular areas of AI, IoT and EC are least known by students, their need for other interdisciplinary knowledge for designing their technological developments, or even more subjective information such as what is harder for them to understand from the current curricula, or which are the most effective teaching methodologies for these areas from their point of view, etc."

Reviewer comment:

The significance of the research problem has not been presented in detail.

Authors' answer:

In the Introduction section, we have emphasized the relevance of the study more strongly. Moreover, in the Literature Review section, we have added a paragraph that describes the contribution of our article in relation to the literature. The information in these places emphasizes the significance of the research problem.

The paragraph that comes from the Introduction is as follows:

"Discussing the relevance of this study to the needs it can be said that students' answers with the presented analysis are essential to fill the gap between industry needs and knowledge provided by the academia regarding AI, IoT and EC technologies. The data collected in the research brings to academics an information which can be used in development of new educational content and/or modification of existing courses of studies."

The paragraph added to the Literature Review is as follows:

"Our work, goes beyond the SoA in many aspects. It integrates two important (up to now separated) fields of research such as students' knowledge and Industry 4.0. And as such it addresses both the skills gap between students and companies, and the learning methodologies being used. Second, the scope of the work (often limited to one country), extends to all Europe thanks to the participation of various Universities of different countries. Third, it includes Master students which are much closer to the labor market than Bachelor students, not considered in other reviews because they are less accessible and lower in amount. And fourth, it focuses on the latest Industry 4.0 technologies such as AI, IoT and EC, including their integrated use/knowledge. Finally, the outcomes of our work will be addressed through the production of new and innovative courses within the Planet 4 project in the next year."

Reviewer comment:

The research methodology has not been described in detail.

Authors' answer:

We have improved the Work Methodology section by describing the methodology more precisely. In addition, we changed the figure showing the methodology to make the view of the methodology clearer and more readable. Below we present an improved description of the methodology along with the new version of the figure.

“This section presents the research methodology, which consists of five steps (see Figure 1). In the first step, the curricula of four universities (University of Pisa, University of Ioannina, Rzeszów University of Technology, University Ramon Llull) were reviewed. The researchers were looking for the courses on which the topics related to AI, IoT and EC are discussed. The following information was collected: university, the name of the course, the name of the learning module, educational level, Intended Learning Outcomes (ILO), Teaching and Learning Activities (TLA), infrastructure indicated in curricula, software indicated in curricula as well as teaching methods and techniques used in the didactic process. The main goal of this review was to identify the topics that are covered in university courses, the tools, software, environments, and the learning methods and techniques that are being used. To sum up, the aim was to determine the competencies that students should have in the areas analyzed. The results of the curricula review are discussed in section 4.

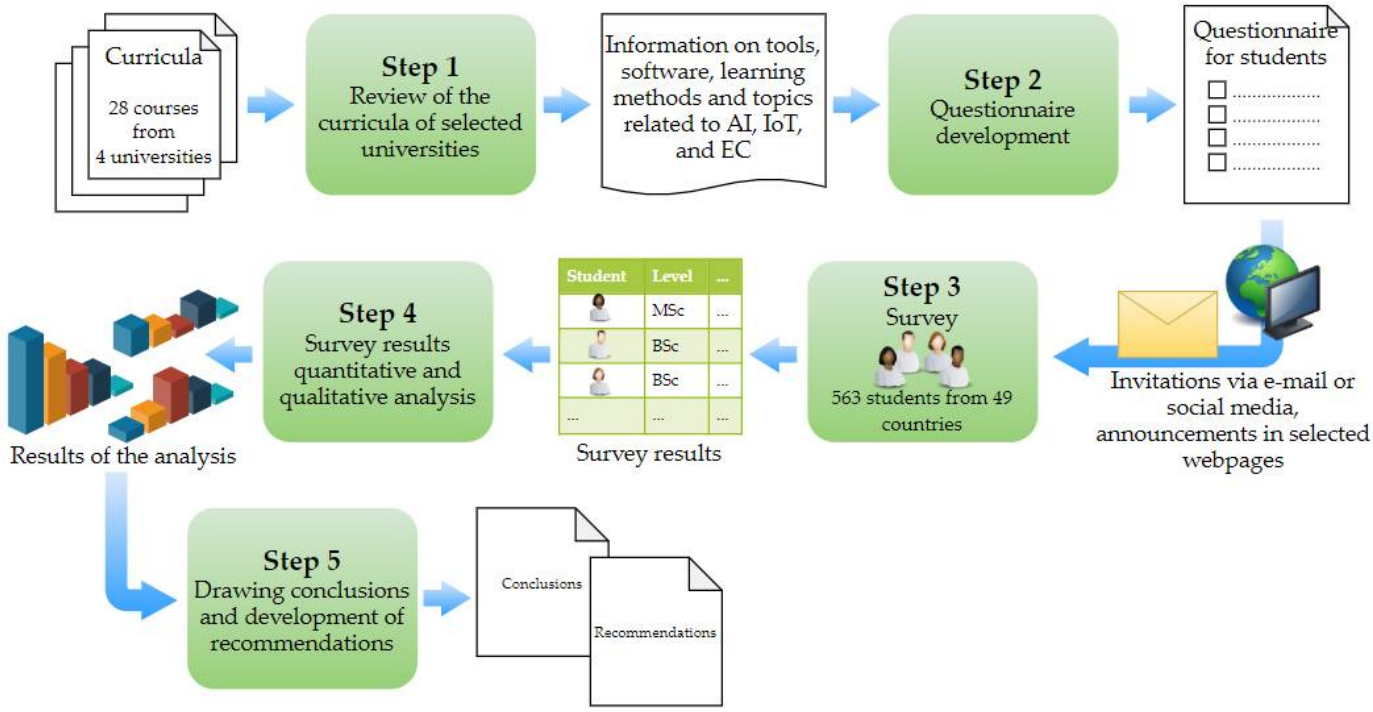


Figure 1. Work methodology.

The knowledge and competences described in the curricula were the basis for the development of the questionnaire, which is the second step of the methodology. Information on the identified topics, applications, software, tools and methods of education was used to define the survey questions. The survey questions were divided into three parts related to the three topics under consideration: AI, IoT, and EC. The survey questions concerned, inter alia, students’ knowledge about the areas and topics of AI, IoT and EC that appeared in the curricula, familiarity with appropriate tools and software, knowledge of practical applications and the suitability of teaching techniques used in universities.

The initial version of the survey was tested by a group of several dozen students. Each of them filled in the questionnaire and made some comments. Based on the results of the initial questionnaire and the comments from the students who answered the survey questions, the final version of the questionnaire was established. Detailed information on creating questionnaires is provided in section 5.

The final version of the questionnaire was used to conduct the main survey (third step). Information about the survey was published on selected websites (including websites of universities and the Planet4 project). The questionnaire was also sent directly to several hundred students from dozens of countries, by contacting them via e-mail or social media messages. Five hundred and sixty-three students from forty-nine countries responded positively to the invitation to participate in the survey. More information about the survey participants is provided in section 6.

After the survey was completed, the answers to all survey questions were quantitatively and qualitatively analyzed (fourth step). The quantitative analysis included a summary of the number of answers in each level of the Likert scale for every close-ended question. It allowed to determine, inter alia, which AI, IoT and EC topics are better known to students. In addition, the AI knowledge index was calculated to investigate the relationship between students' participation in projects and their knowledge in the field of AI. In turn, the qualitative analysis of students' answers took into account open-ended questions in which students could indicate what, in their opinion, is the most difficult in learning AI/IoT/EC, what are the shortcomings in the education process and what could support them in learning AI/IoT/EC. The answers to all survey questions are summarized in section 7.

The fifth step of the work methodology is based on the results of the analysis of students' surveys. The results of the analysis led to the formulation of conclusions about students' knowledge and skills they gain during their studies. The results also contributed to the proposal of some recommendations on the didactic process and changes in the content of university courses. This information is provided in section 8."

Reviewer comment:

There are no references to the directions of further research.

Authors' answer:

We have improved the Conclusions section, in which we have described the directions of further research. Below, we present a paragraph from the Conclusions that discusses further research.

"As future research regards, as academic representatives, we intend to promote the integration of other scientific fields (e.g., social sciences, business science) in the teaching of AI, IoT, and EC to serve–the so crucial in the new era–interdisciplinarity, where the citizen is provided with all the required skills and knowledge to be flexible and adaptable to diverse and rapidly changing working environments. It would be of great interest to experiment and examine the degree of acceptance and penetration of such an expedition and the subsequent benefits that may occur. This research could proceed one step further, incorporating and examining the level of students' competence in other state-of-the-art technologies being components of the I4.0 model, and therefore obtain the ability to gain a deeper insight into them Last but not least, based on the experience we gained, we can refine the survey and use it as the prototype for relevant surveys."

Reviewer comment:

Authors should:

The purpose of the article should be specified.

Define the essence and importance of the described problem.

The methodology should be completed in detail of the conducted empirical research.

Lines for further research should be identified.

Authors' answer:

All of the comments that are mentioned in the "Authors should" section have been incorporated into the article as discussed above.

We would like to thank you very much once again for all the comments that allowed us to improve our article.

Authors