DIGITAL DECATHLON

WP2-b **Evaluation of 1st competition**

- Research Paper: “Assessing the Quality of an Innovative Learning Path for BIM Education: The DIGITAL DECATHLON”
- Starting Survey Report
- Mid Term Survey Report
- Final Survey Report
- Questionaires

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Research Article

Assessing the Quality of an Innovative Learning Path for BIM Education: The DIGITAL DECATHLON

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Abstract

The Erasmus+ funded project DIGITAL DECATHLON addresses the urgent need to modernize educational practices in the construction industry, especially in the field of Building Information Modeling (BIM). This study investigates how interdisciplinary, international and game-based learning can improve the BIM skills of students from different academic backgrounds and institutions in Europe. The study investigates whether an immersive simulation game involving students from five universities in Germany, Finland, Italy and Poland can effectively develop BIM skills and promote international and intercultural collaboration. The research uses a mixed methods approach that includes observational analysis, expert evaluations and surveys to assess the effectiveness of learning methods used in the game, to exploit for the optimization of the second game experience foreseen by the project. The results show that the simulation successfully engages students and improves their practical BIM skills. Nevertheless, there are areas that need improvement. Key challenges include harmonizing disciplines, improving the understanding of project management and ensuring consistent and equal communication between teams. These findings emerge from both qualitative feedback and quantitative performance data. This makes it clear that the existing simulation game is well suited to teaching the basics of the BIM methodology, but that some improvements are still needed, which will be incorporated in a second run, again subject to evaluation for capitalization and future replication.

Keywords

Building Information Modeling, Education, Design Competition, Serious Game, Evaluation

1. Introduction

As at global level, the run towards digitization is central in the European Union, where it is considered as the precondition to sustain the parallel and urgent green transition. The EU ambitious Green Deal, the Fit for 55 Package and the Circular Economy Action Plan are just some examples of the highly value given to digital technologies and tools to support the sustainability goals, with the green and digital transition acting in synergies. The digital transformation within the construction industry necessitates that employees acquire new skill sets to meet evolving requirements. Building Information Modeling (BIM) is at the heart of this transformation, playing a pivotal role in reshaping the whole industry.

BIM has been officially introduced in EU by the Directive 2014/24/EU on Public Procurement, as a tool to improve ef-

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ficiency and transparency. Notwithstanding this common background, the BIM adoption in the EU is still jeopardized, revealing a wide range of standards and levels of implementation [1]. Given the communitarian will to create a common EU workspace, it is imperative that all EU universities innovate education to adequately prepare students for the new professional landscape, ensuring that graduates are equipped with the necessary competencies to thrive in a digitized and European construction environment.

The Erasmus+-funded DIGITAL DECATHLON (DD) project exemplifies an innovative educational approach designed to address contemporary challenges in construction education [2]. The core of the project is an interdisciplinary simulation game that introduces students in the application of the BIM methodology. It must be note that the project idea and format come from previous project experiences developed by the German partners, such as the BIM Game [3, 4]. Enlarging to a European scale, the DD involved students from the five project partners Jade University of Applied Sciences (Germany), Karelia University of Applied Sciences (Finland), University of Florence (Italy), University of Warsaw (Poland) and University of Wuppertal (Germany). Given the spirit and the nature of the Erasmus+ funding program, the project highly promotes international connections and intercultural skills, supporting the creation of a European community, starting from the young generation of students.

The simulation game is carried out twice during the project period. The first round has been completed, so that the following research questions are now to be answered:

1) How effectively does the DD promote interdisciplinary collaboration and digital skills in the field of BIM through the use of gamification and international teams?
2) What optimization strategies can be derived from the first round of the DD to make future competitions more successful?

2. The Digital Decathlon Project

The following is a brief summary of the content and procedure of the simulation game. More detailed information has already been published [5-8].

The core objective of DD is to offer students a gaming experience to learn collaborative and interdisciplinary design processes by leveraging the full potential of BIM across ten distinct disciplines / BIM use-cases (Table 1).

A total of 25 students took part in the first round of the project. It corresponded to the duration of a semester and was characterized by three main events. At the start event in Wuppertal (Germany), the participants got to know each other, were divided into international groups of five, and received an introduction to the topic of BIM, the disciplines and the task. Here, they had the opportunity to develop and present an initial concept design and the strategy to approach the various disciplines. At home, they continued their collaboration and fully developed their project. The homework was interrupted by the midterm event at which the groups presented their interim results online. The game finished with the final event at the Med Green Forum in Florence (Italy), where the groups presented their final results to a jury. The winning project was chosen, and the competition finished with an awards ceremony.

The design task of the game, to approach in a full BIM environment, was to transform a logistics center in Wuppertal (Germany) into a multifunctional cultural center.

Table 1. *Digital Decathlon disciplines and Learning Objectives.*

Discipline	Learning Objective
D01 Architecture	Develop a design idea/spatial program in a 3D model with corresponding visualization (2D)
D02 Construction	Design timber wall elements in IFC and native format
D03 MEP	Develop a proposal for a building services solution and prepare a BIM model for HVAC system
D04 Model Checking	Test the quality of models through selected software
D05 Design Coordination	Understand the multi-branch coordination process and use BIM coordination software in IFC and BCF format
D06 Construction Scheduling	Manage and represent time in a construction project digitally
D07 LCA	Understand LCA calculations, rules and databases and use LCA calculation tools
D08 Simulation	Perform different environmental simulations (energy, indoor daylight and solar radiation) with authoring software
D09 Construction Product Traceability	Carry out BIM-based building documentation using selected software

Discipline	Learning Objective
D10 Reporting	Reflect on own work, document progress, summarize complex issues, communicate appropriately

The game uses simulation, competition and mentoring as teaching methods to encourage collaborative learning between students from different disciplines. The simulation method emphasizes rapid immersion in practical tasks, moving from short theoretical lectures to hands-on BIM modeling activities that simulate real-world challenges [9]. The simulation is run as a competition, motivating students through clear assessment criteria that ensure consistent and objective evaluation [10]. The additional mentoring offered provides personal guidance and promotes a positive error culture that normalizes problem solving and prepares students for real-life scenarios [4].

3. Evaluation Methodology

Given the innovative nature of the DD digital learning format and serious game approach, a special attention has been dedicated by the project team to a systematic evaluation, with the overall objective to guarantee the quality of the learning path. The evaluation methodology has been structured to cover all the project's phases, foreseeing two cycles of evaluation parallel to the two competitions, with the objective to learn lessons from the first in order to improve the second; moreover, the overall two-cycles evaluation allows to define a final document on the lessons learned, highlighting benefits and criticalities for capitalization and future replication. This structure consented to define and have control on the quality in terms of continuous improvement, consistent results and resources maximization, adopting a scientific method of change (e.g. Deming cycle). To have a complete picture of the project and learning path, three typologies of evaluations have been developed according to the responsible actor groups, as in the following paragraphs.

3.1. Expert Evaluation

Two external experts are involved in the evaluation of the project. One of these experts, who conducts research in the field of BIM and game-based learning, is evaluating the DD project as a whole, while the other expert evaluated the learning management in particular. These results can also be used for the further development of the simulation game. The qualitative survey is carried out via non-participatory and open self-observation. The data collection procedure is predominantly unsystematic, direct and unmediated [11]. In preparation for the observations carried out during the three events, a catalog of key questions was drawn up. Observations were noted for these key questions, and these were then interpreted and evaluated. The results can be seen as supplementing or underlining the results of the surveys.

3.2. Teacher Evaluation

The evaluation of the students' work was not only based on the determination of a winning team, but also to determine how successful the students were in the various disciplines. Each discipline is divided into its subtasks (Table 2) and evaluated by the jury members (two persons from each partner university and one external jury member with practical expertise in the field of BIM) on the basis of the learning objectives, the provided learning material, the design task and the mini-EIR (Exchange Information Requirements). The scoring is based on the Rubrics evaluation [12], corresponding to 1 - limited application of concepts and methods, 2 - basic understanding with some application, 3 - solid understanding with effective application and 4 - advanced understanding with strategic and categorical application.

Table 2. Digital Decathlon disciplines and Assessment Criteria.

Discipline	Assessment Criteria
D01 Architecture	Inventiveness Appropriateness and Contextual Integration Model design and spatial representation Visual and constructive strength
D02 Construction	Appropriate selection of types of wooden elements Feasibility and compatibility Explanation Design decisions
D03 MEP	HVAC concept Water and sewerage systems Electrical / lighting and BEMS 3D model quality
D04 Model Checking	Test completeness of test report Description of the individual issues Use of new rules
D05 Design Coordi-	BEP

Discipline	Assessment Criteria
nation	BIM quality assurance and control reports
	BIM coordination reports
D06 Construction Scheduling	Construction sequence video
	Correct sequence and grouping of technological elements
D07 LCA	Realistic LCA calculation results in the report
D08 Simulation	Realistic energy performance
	Efficient positioning of solar renewable system
	Verification of indoor visual quality
	Simulation data
D09 Construction Product Traceability	Selection of objects for documentation
	Number and quality of linked objects
D10 Reporting	Frequency of posts in social media
	Contents
	Layout
	Presentation

3.3. Student Evaluation

As principal target group of the DD project, students have been asked to provide feedback about their experience in the innovative and pilot DD learning path. This has been done throughout online surveys (Google Form platform). Students' feedback was collected in the three evaluation moments, at the beginning, at the midterm and at the end of the competition. Based on the same evaluation criteria, the sequential surveys have been intended to capture the initial aspirations of students, to assess their work-in-progress experience, and to obtain a final comprehensive evaluation.

Six evaluation criteria were defined as surveys' sessions to assess the overall quality of the DD learning path: 1. BIM adoption: heart of the DD, both as object of learning and tool for the development of the design proposals; 2. Learning Quality: considering the learning in 10 DD disciplines in terms of knowledge, skills and competencies; 3. Digital Environment: evaluation of the DD digital infrastructure supporting learning and collaboration (e.g. Moodle and Common Data Environment); 4. Design Competition: quality of the design competition launched in the context of the DD, with the design task encompassing the 10 disciplines; 5. Collaboration and Support: level of collaboration between students in the implementation of the competition; support refers to the level of interaction between students and trainers; 6. Value for the Future: impact of the DD on the students' academic path and future professional life. According to the criteria, a set of questions were defined for each of the three sequential surveys, specifically formulated to capture the evolution of the project in the students' experience.

4. Results and Analysis

4.1. Results of the Expert Evaluation

The observations have produced many findings that can be condensed into the following points resulting recommendations in the area of learning management.

Providing students with a more comprehensive map to contextualize and interconnect the disciplines could enhance their understanding and foster more independent exploration. This would reduce disorientation among participants and enable them to navigate the simulation with greater confidence.

Ensuring a balanced focus across all disciplines can improve the overall learning experience. While the strong emphasis on D01 demonstrates student engagement, encouraging a more even distribution of attention will provide a more holistic educational experience.

Integrating additional training on the principles of project management could greatly benefit the students. By equipping them with these essential skills, we can enhance their efficiency and effectiveness within the simulation, thereby enriching their overall learning experience.

Introducing further control mechanisms, such as mandatory joint appointments with mentors, can facilitate smoother cooperation within teams. This proactive approach can help identify and address challenges early on, promoting a more collaborative and supportive team environment.

To ensure consistent and equitable communication, adhering to the agreed communication tool, and adding a chat function can be highly beneficial. This will standardize the information dissemination process, ensuring all students receive the same guidance and support, regardless of their group or nationality.

The learning materials and software solutions provided effectively supported students, with the identified gap in D05 suggesting the integration of a CDE solution to improve the efficiency and quality of collaboration and promote students' digital competences.

4.2. Results of the Teacher Evaluation

The results of the students in the individual disciplines are rather heterogeneous. Certain disciplines such as D03, D04 and D07 seem to be more difficult for students than others such as D02, D08 and D10 (Figure 1). This means that, on average and considering the standard deviation, students' learning successes mostly remain at level 2, which corresponds to a basic understanding. A basic understanding of the

application of the BIM method can be regarded as a successful result in the context of the research project, as it represents a first playful and practical introduction to the topic for the students. However, the disciplines D03, D05 and D07 need to be considered in more detail here to ensure a basic understanding among the participants in future game runs.

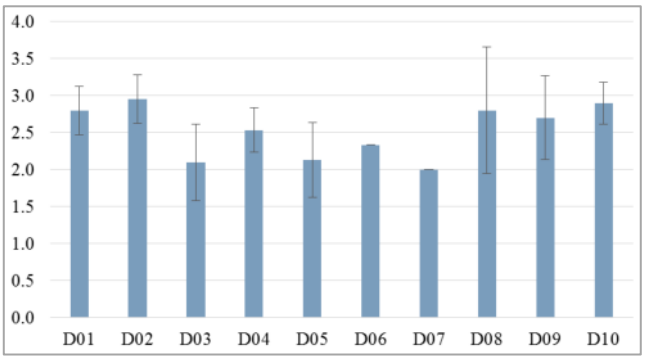

Figure 1. *Evaluation of participants' performance: Disciplines.*

When examining the performance of the teams, the ratings exhibit a high degree of similarity. The range between the lowest and highest ratings is merely 0.16 points (Figure 2). Additionally, the standard deviation for all teams' hovers around 0.5, further underscoring the consistency in performance across teams. These observations suggest that the teams were relatively equally proficient across all disciplines.

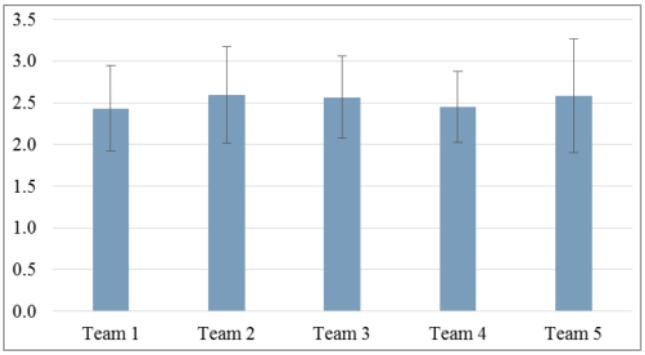

Figure 2. *Evaluation of participants' performance: Teams.*

4.3. Results of the Student Evaluation

The majority of students involved in the DD participated in the evaluation surveys (starting survey: 19/25 answers received; midterm survey: 16/25; final survey: 18/25).

The initial survey revealed a very high interest of students on BIM, together with a common positive consideration (Figure 3); at the same time, it revealed variety in the pre-existing knowledge of students, mainly referring to low levels. More than half of the surveyed students (63%) reported to not having received any specific training on BIM; students who instead participated in previous BIM learning paths referred to very different typologies of attended courses. In the midterm, it was possible to assess the efficacy of the BIM introductory course (prepared by the University of Wuppertal), while in the final survey the majority of students (more than 70%) considered improved their BIM skills.

Figure 3. *Words cloud visualization of students' answers on BIM consideration.*

Answers received from students in the initial survey revealed that the proposed novel learning format highly stimulated a positive attitude and feeling, with students recognizing the opportunities in improving international collaboration and exchange, BIM skills, interdisciplinary understanding, language proficiency and confidence, matching the ambitions of the trainers. When inquiring about their competences and interest levels in the 10 proposed disciplines, the responses varied significantly; therefore, students were given the freedom to choose the two disciplines they wished to focus on within their team. In the midterm and final surveys, students were asked to provide feedback about the prepared learning material, suggestions for improvement and their perception on the effective workload. Students appreciated the "click tutorial" format of the learning material (consisting in step-by-step guidelines, considered as "satisfactory"), but also asked for more interactive formats, such as video tutorials and more traditional frontal lectures. At the end of the competition, they considered the workload too much intensive, referring to the D01 Architecture, D03 MEP and to the energy simulation in D08, but in general they declare a good level of satisfaction with the developed work in most disciplines (Figure 4).

Regarding the digital environment, students referred to a low experience in this kind of learning (mainly adopted during the Covid period), expressing the need for clearer guidance. They suggested different ways to improve the digital environment (Moodle), such as a Q&A page with the most asked questions and chat-boxes with tutors. It must be noted that the main critical points were referred to the BIM operative/working digital environment, and not to the learning one.

Students encountered difficulties in handling the numerous software and plug-ins required to manage and exploit the BIM model, in terms of interoperability and workflows, asking for the creation of a comprehensive list/picture of programs/platforms and their specific intended uses.

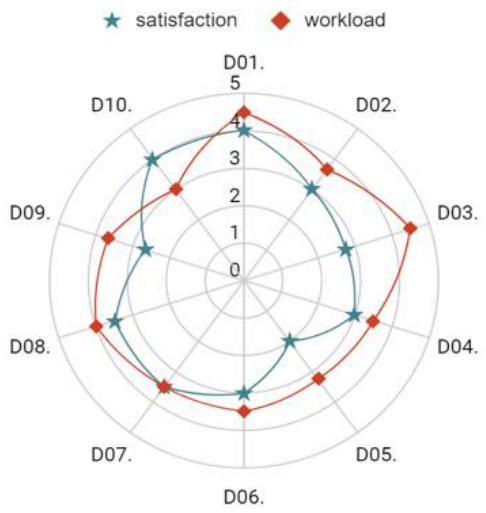

Figure 4. *Students' evaluation of the DD disciplines, in terms of satisfaction and workload.*

Some critical points emerged in the design competition: whereas students were highly excited in taking part in international and interdisciplinary working teams, considered as an "opportunity to more advanced stuff in comparison to basic university courses", the design task has been considered as time consuming and difficult to conduct "not in presence". In particular, students recognized the problem of dependency within the disciplines, expressing concern with tasks that rely on others' completion (e.g. slow development of D01 Architecture).

Similarly, some issues emerged in the section collaboration and support about the interpersonal experience. While considering stimulating teamwork as preparation for professional life, students noticed the different commitment among team members and varying levels of experience and BIM competencies, which led to demotivation and sometimes pressure. Moreover, given the difficulties in conducting a smooth and integrated design process, students suggested to foresee one tutor for each group (avoiding the adopted system of "on request" revisions) with whom there is regular consultation.

All the students agreed on the value of the participation to the DD for the future, as innovative and valuable experience to highlight in their curricula and in their future professional life.

5. Discussion

In the light of the applied evaluation methodology and results, comprehensive of the contribution of external experts, DD trainers and students, it is possible to delineate some focal points, presenting at the same time positive and negative aspects:

1) Intercultural dimension: Working in international teams gives students an unique opportunity to improve soft skills, English proficiency, intercultural inclusion, and a common European spirit, matching the objectives of the Erasmus + projects;
2) Interdisciplinarity: The involvement of students from different disciplines promotes a comprehensive understanding of BIM and simulates real project environments. At the same time, the lack of experience in interdisciplinary teamwork resulted in a timid development of a truly integrated project, and in the over attention and engagement solely in architectural aspects;
3) Cooperation and management: even if the experience of interdisciplinary and international team working has a greater potential for the preparation of future professionals, it requires basic project management skills, comprehensive of mechanisms of control and support;
4) Practical application: The rapid involvement of students in practical BIM modeling activities after short theoretical introductions promotes effective learning. Conversely, the immersion in the practical work resulted in the lack of comprehensive orientation, with students having difficulties in linking the disciplines and understanding the overall context of the project;
5) Gamification through competition: The simulation of a design competition motivates students and ensures consistent assessment based on predefined criteria. Yet, some students do not catch the game approach, experiencing performance anxiety and receiving pressure from the more motivated teammates.

Based on these findings, some practical suggestions have been derived to improve the second foreseen competition:

1) New concept for BIM pre-course: A mandatory pre-course or a more intensive introduction to the individual disciplines could ensure that all students start the project with the necessary basics;
2) More comprehensive introduction and orientation: Develop a guide to help students in understanding integrated projects and the link between the different disciplines;
3) Ensure balance between disciplines: Encourage a more even distribution of attention across all disciplines to create a balanced learning environment, with distributed responsibilities and engagement, such as a fair distribution of the workload;

4) Strengthening project management skills: Integrate additional training on project management principles to improve efficiency and coordination within teams;
5) Early intervention in team dynamics: Introduction of regular joint meetings with mentors to promote collaboration and recognize team problems at an early stage. discussion.

6. Conclusions

The DD project has shown that interdisciplinary, international and game-based learning can improve basic BIM skills.

Valuing the contributions of DD actors (trainers and students), combined with an external perspective, the proposed evaluation methodology enables control over the innovative learning path and facilitates its progressive improvement, adaptation and optimization over time, both within the project and beyond, for future replication, consolidation and capitalization. The optimization process begins with the development of the second competition, which will also be subject to the same evaluation procedure. Findings from the evaluation of the first competition significantly influence the preparation and organization of the second one, which will involve twice the number of participating students (50). For example, given the main objective of preparing the young generation of students for the digital professional future, there is a shift towards emphasizing BIM methodology and technology in the competition, rather than the design process. This adjustment aims to balance the workload and avoid overemphasis on architecture, thereby preserving the interdisciplinary contribution.

The ongoing effort is to improve the prototypical serious game learning format to such an extent that it can be used to prepare future student to the digital and collaborative requirements of the construction industry, essential to support the green transition of future sustainable buildings and cities.

Abbreviations

BIM	Building Information Modeling
DD	DIGITAL DECATHLON

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This contribution is the result of the collective results achieved by the Digital Decathlon team, composed by: Grunwald Gregor, Zeisberg Loreen, Alves Sharina, Hollermann Sebastian, Christian Heins (Jade University of Applied Sciences); Laakkonen Ossi, Matveinen Mikko (Karelia Ammattikorkeakoulu), Czmoch Ireneusz, Piotr Bartkiewicz, Dudzińska Emilia (Politechnika Warszawska); Meins-Becker Anica, Kelm Agnes (Bergische Universität Wuppertal); Calcagno Gisella, Bertelli Matteo, Trombadore Antonella, Pierucci Giacomo (Università degli Studi di Firenze).

Author Contributions

Gisella Calcagno: Methodology, Investigation, Formal Analysis, Data curation, Writing – original draft, Writing – review & editing

Sharina Alves: Methodology, Investigation, Formal Analysis, Data curation, Writing – original draft, Writing – review & editing

Gregor Grunwald: Project administration, Resources, Supervision, Validation

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Conflicts of Interest

The authors declare no conflicts of interest.

References

[1] Mitera-Kiełbasa, E., Zima, K. BIM Policy Trends in Europe: Insights from a Multi-Stage Analysis. Applied Sciences. 2024, 14(11). https://doi.org/10.3390/app14114363

[2] Digital Decathlon Website. Available from: https://digitaldecathlon.projekt.jade-hs.de/index.html (accessed 30 June 2024).

[3] Grunwald, G., Heins, C. BIM Game: A Testing Ground for Specifying, Modelling, Evaluating, and Visualising Information in IFC Formats. In Proceedings of the 5th International Conference on Civil Engineering and Architecture, Singapore, 2022; pp. 677–688. https://doi.org/10.1007/978-981-99-4049-3_52

[4] Heins, C., Grunwald, G., Helmus, M. Gamification and BIM: The Didactic Guidance of Decentralised Interactions of a Real-Life BIM Business Game for Higher Education. In Proceedings of the 38th ISARC, Dubai, UAE, 2021; pp. 932-939. https://doi.org/10.22260/ISARC2021/0126

[5] Grunwald, G., Alves, S., Bertelli, M., Calcagno, G., Czmoch, I., Dudzinska, E., Heins, C., Hollermann, S., Kelm, A., Kokkonen, J., Laakkonen, O., Matveinen, M., Meins-Becker, A., Piotr, B., Trombadore, A., Zeisberg, L. Building BIM Competence: Learning in the DIGITAL DECATHLON. In Sayigh, A., Trombadore, A., Calcagno, G., Eds., GETTING TO ZERO. Beyond Energy Transition Towards Carbon-Neutral Mediterranean Cities. Selected Papers from the World Renewable Energy Congress Med Green Forum 2024. Chennai, India: Springer Nature; 2024 (in publication).

[6] Calcagno, G., Bertelli, M., Grunwald, G. The Digital Decathlon: A Journey in Building Information Modelling Education. In Proceedings of the International Conference of Contemporary Affairs in Architecture and Urbanism – ICCAUA, Alanya, Turkey, 2024 (in publication).

[7] Grunwald, G., Hollermann, S., Kawasaki, J. BUILD DIGITAL. BUILD BETTER. The "Digital Decathlon" a European Erasmus+ Project. In Proceedings of 2023 JSEE Annual Conference, Hiroshima, Japan, 2023; pp. 2–5. https://doi.org/10.20549/jseeen.2023.0_2

[8] Zeisberg, L. BIM Practice and Experience: Digital DECATHLON. In Luhmann, T., Sieberth, T., Eds., Photogrammetrie Lasers canning-Optische 3D-Messtechnik – Beiträge der 21. Oldenburger 3D-Tage, Berlin/Offenbach, Germany: Wichmann Verlag; 2024.

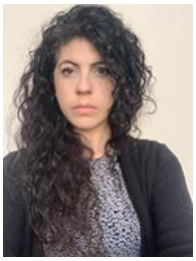
[9] Özener, O. Ö. Context-based learning for BIM: simulative role-playing games for strategic business implementations. In Smart and Sustainable Built Environment, 2024, 13(4), pp. 908-933. https://doi.org/10.1108/SASBE-08-2022-0184

[10] Aibinu, A. A., Evelyn, T. A. L., Rojas-Quintero, J. S., Hosseini, M. R., Dey, C., Taban, R., Ahmad, T. Using gamification and competitions to enhance BIM learning experience. In BIM Teaching and Learning Handbook, New York, NY: Routledge, 2022, pp. 305-324. https://doi.org/10.1201/9780367855192-24

[11] Byrman, A. Social Research Methods. 4th ed. Oxford, UK: Oxford University Press; 2004.

[12] Preskill, H., Russ-Eft, D. Building Evaluation Capacity: Activities for Teaching and Training. 2nd ed. Los Angeles, CA: Sage; 2016.

Biography



Gisella Calcagno is an architect, MSc and PhD, with expertise in green and socially responsive architecture. She graduated from the University of Florence (Unifi), where she also completed a postgraduate interuniversity master's degree in bioecological architecture and innovative technologies for the environment. Her PhD research focused on the impact of the architectural and urban space on the vulnerable population of asylum seekers. Since 2020, she has been working at beXLab (building environmental eXperience, Unifi) on the application of Digital Twins to support awareness in sustainable building/urban renovation projects, and as project manager for several EU projects. Expert in environmental design, she is lecturer in bioclimatic and green architecture at Unifi and in the international Master SUArch (Sustainable Architecture, with International University of Rabat, Morocco). Contract professor in traditional/innovative textile fibers for the Textile and Fashion Design program (Unifi).

Sharina Alves is a research associate at the Jade University of Applied Sciences at the Institute for Database-Oriented Engineering. She completed her M.Eng. in Management and Engineering in Construction in 2019 and subsequently worked in the field of technical building management and computer aided facility management. She is currently a PhD student researching Building Information Modeling in Facility Management and game-based learning. She is a lecturer for infrastructural facility management and information management and is involved in various research projects on BIM, serious gaming and digitization of small and medium-sized enterprises in construction.

Gregor Grunwald, Prof. Dr.-Ing. is an architect. He received his diploma in architecture from the Technical University of Aachen. He completed his doctorate at the Technical University of Berlin in 2007. After ten years of professional experience in the construction industry, gained in the planning and construction management of major international projects, he was appointed Professor of Building, Planning and Construction Management at the Jade University of Applied Sciences in Oldenburg in 2018. Here he teaches architecture students in the bachelor's and master's degree programmes in the fields of building design, construction management and digital planning.

Research Field

Gisella Calcagno: Sustainable architecture, green buildings, environmental design, energy efficiency, building renovation, ethic design, digital twin, comfort and wellbeing, social awareness, people engagement

Sharina Alves: Facility management, building information modeling, game-based learning, computer aided facility management, artificial intelligence in civil engineering, lean construction

Gregor Grunwald: Building Information Modeling, Setup and Training of Artificial Intelligence, Artificial Intelligence in Architecture, Robotic Process Automation, Digital Twins, Augmented Reality in Design Processes, Parametric Design, Membrane Structures, Pre-fabricated, modular building units, Didactic in Architecture

DD: STARTING SURVEYS REPORT

(I competition: 10.10.2023 – 15.02.2024)

WP 2_ Quality of the Learning Path

UFI

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CONTENTS

INTRODUCTION

As described in the “Evaluation Process” document, the assessment of the Digital Decathlon (DD) as a “quality learning path”, objective of WP2 (led by UFI), has been conducted through a defined approach, methodology and structure. The evaluation process targets the two main protagonists/participants of the DD project: students and trainers.

This report contains the results of the two surveys (for students and for trainers) provided before the launch of the first DD design competition, at the beginning of October 2023.

As the first of three, these starting surveys have been intended and constructed to explore and collect the aspirations of DD participants in relation to the incoming experience.

Both the surveys are grounded in the same evaluation criteria (recalled to follow), but declined in specific questions tailoring the specific target and its role in the DD.

It has to be noted that these firsts of the three surveys foreseen to evaluate the whole DD competition (a second round of three surveys will assess the second competition), have a broader scope, resulting in an open structure and in a qualitative nature, intended to capture as much as possible participants suggestions to improve the learning path and the same evaluation process.

In this perspective, the other two surveys, evaluating the DD competition in the mid-term and at the end, will be progresssively

more focused and oriented towards closed questions, allowing a more quantitative evaluation.

Evaluation surveys have been provided exploiting the Google Form platform.

The elaboration of results, object of this report, is oriented to derive recommendations and suggestions to improve ongoing the DD learning path, along the first competition, and above all to improve the foreseen second one.

Six main criteria have been considered to assess the Digital Decathlon as a quality learning path:

A. LEARNING QUALITY
B. DIGITAL ENVIRONMENT
C. BIM ADOPTION
D. DESIGN COMPETITION
E. COLLABORATION AND SUPPORT
F. VALUE FOR THE FUTURE

1. STARTING SURVEY FOR STUDENTS (SS1)

The Starting Survey for Students has been sent to all the students involved in the DD

competition, for a total of 25 students (5 from each of the 5 universities involved in the project).

Nineteen answers have been received.

The report is organised in sections following the evaluation criteria, containing the list of the provided questions and the results analysed and discussed.

A. LEANING QUALITY

Quality of the DD as a learning path., considering the 10 DD disciplines and assessed in relation to the specific knowledge to acquire, the skills to improve and the competencies to develop.

1. What do you think you will be able to do after the completion of the DD?
2. In which of the 10 disciplines of the DD do you think you have more competencies? (1 - a little bit / 5 - a lot)
3. How much are you interested in the following 10 DD disciplines? (1 - a little bit / 5 - a lot)

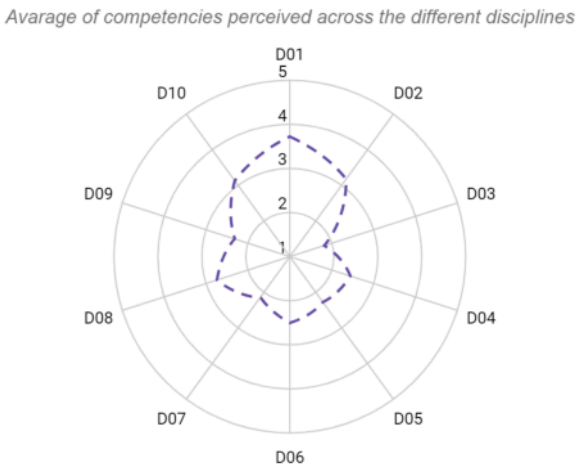
Students reveal an ambitious thinking about the abilities to develop thanks to the DD learning path[1].
Across answers, several recurrent improvement areas emerge:

- International Collaboration: desire to work more fluently and confidently in international settings;
- BIM Skills: aspiration to improve proficiency in Building Information Modeling (BIM) and related digital tools;

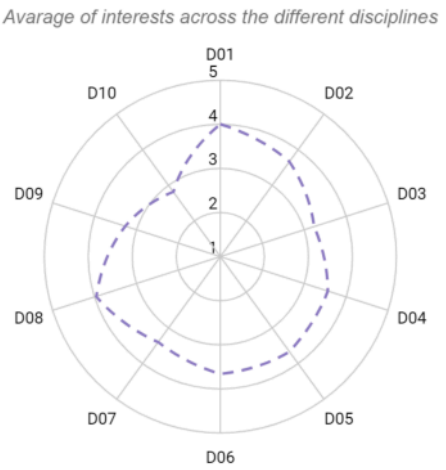
[1] All the students answers are reported at the end of this paragraph (*).

- **Interdisciplinarity:** better comprehension of how different disciplines collaborate and connect within a design project;
- **Language Proficiency**: importance of improving English language skills to communicate effectively in international design teams;
- **Confidence:** enhance overall skills, confidence in the context of international collaboration and digital project management.
- **Cultural Exchange:** value of comparing with individuals from different backgrounds and exchanging ideas to find the best solutions.

Overall, the survey responses highlight a strong emphasis on improving international collaboration and exchange, BIM skills, interdisciplinary understanding, language proficiency, and confidence in professional abilities.
Competency levels perceived by students vary significantly across the various disciplines.



The disciplines reporting a notable prevalence of high competencies are D.01 Architecture, D.02 Construction and D.10 Reporting.
Conversely, the discipline that predominantly demonstrated lower competency levels is D.03 MEP, followed by D.07 Construction Scheduling and D.05 BIM Design Coordination and Communication.
Other disciplines are characterised by a more distributed range of competencies.
The revealed variability characterised a nuanced landscape of competences across disciplines, each presenting specific strengths and opportunities for improvement.
The examination of interest levels across the various disciplines reveals a more equilibrated situation.



Disciplines D.01 Architecture and D.08 Simulation notably exhibit a prevalent inclination towards high levels of interest among participants. In contrast, D.10 manifests a more moderate interest level.

In comparison with the more variable perceived competencies, the levels of interest in the 10 DD disciplines resulted more equilibrated, revealing an average engagement for all the disciplines.

(*)

1. Work more fluently internationally
2. same as before
3. Have a more open view of BIM modelling and working systems around Europe.
4. Simulations including for example photovoltaics, energy
5. Be better in BIM and work better together with others.
6. Being able to implement a Design I made into a bim software. A better understanding of the different disciplines and how they are connected.
7. Better digital skills
8. I think I will have a better understanding of the various professions that work on a project, better communication and understanding of the integration between the various fields related to the construction of a structure.
9. Better digital skills and working with other people together
10. Communicate much easier with international colleagues, have more confidence with coordination
11. In DD I learned how to work in team, I gained new skills using BIM and I understood the importance of different visions about the project
12. I think I would understand BIM better. I would like to know how to work in an international team.

13. I will improve my overall skills and my english
14. I will be able to design a construction project digitally in all construction phases. For this I will learn some programs and methods
15. I think i will have more skills in the design field especially through BIM
16. Compare myself with people with a different background than mine, and who speak another language.
17. I think I will be more confident in talking English and better understand architectures and civil engineers point of view
18. To know how to communicate with all project partners in a BIM/digital way of communication
19. Work in international teams, holding discussions in English about the various disciplines. Work in interdisciplinary groups, exchange ideas about the context of the respective tasks and find solutions. Process a project more efficiently with the help of BIM.

B. DIGITAL ENVIRONMENT

1. What do you think about digital learning environments? List advantages and disadvantages.
2. How much do you think the digital environment is good in your university learning path?

The perspectives on the advantages and disadvantages of digital learning environments emerged from students' answers[2] have been summarised in the following points:

Advantages:

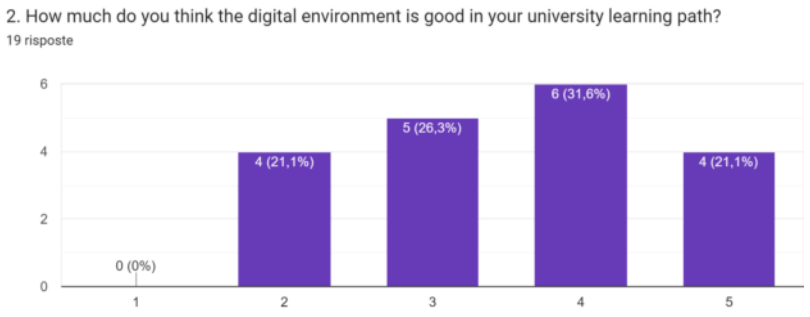
- Accessibility
- Flexibility
- Collaboration
- Multiple resources
- Efficiency

Disadvantages:

- Lack of face-to-face interaction
- Communication challenges
- Technical issues
- Technology dependency
- Difficulty in developing common ideas

Students recognise that while digital learning environments offer numerous benefits, they also present challenges, mainly related to the difficulties in interpersonal communication.
As in the following graph, the adoption of digital learning environments in the university learning path is generally considered as positive.

[2] All the students answers are reported at the end of this paragraph (*).



(*)

1. Advantages are: easy to use and to have kind of mobility
2. Digital learning environments could sometimes be too complicated, so as much as simple as possible is the best path
3. I think it would be have tutorials in a video format and not just text. I think it would be good to have a link to online meeting for each of the disciplines. I think it would be good to have a chat function under each principle to chat with the teachers
4. + flexibility , + nice for group, - small , - far away
5. Digital learning environments are a great way to bring people from different countries together and give them the chance to learn something remotely at any time they want. It can be difficult to implement those environments in existing structures, but that's a problem that can be solved
6. The advantages are learning the different ways of working and consulting people who have more knowledge in specific tasks. The disadvantage would be probably that is more time consuming
7. I think that this is important for our days, there is an advantage to know the tools that technology gives as for knowing our final product in the most efficient way
8. Flexibility, you can do it from home. Disadvantage: you don't interact with people the same way if it wouldn't digital
9. Advantages: it is great that those environments are available from everywhere. Also we can open files everytime we want. Disadvantages: I think that learning from classes „in real life" is more effective
10. The advantage is that various software has a lot of compatibility between them this can make easier the communication between the various discipline - The disadvantage is that the learning of the software is a little bit difficult
11. I think It is very important. It gives the chance to work with anybody in the world. I think that is the future of designing buildings
12. advantages: more comprehensible for evaluation, more practical, future-oriented - disadvantages: not so social, misunderstandings happen more often, dependent on technology
13. Advantages of digital learning environments are that it allows learners to access instructional materials anytime, anywhere. They also offer a wide range of resources, such as interactive multimedia content and online collaboration tools, and allow for more diverse learning methods. - Disadvantages include potentially increased screen time during the day, the possible lack of face-to-face interaction, and that any technical or connectivity problems can disrupt the learning process
14. I think digital learning environments are appropriate for today's world, but I also think that face-to-face interaction should not be totally neglected

15. regarding the advantages, I think that working digitally is very fast, it is possible to work in different places with different people, but on the other hand it does not allow real interaction between people making communication difficult
16. I think it can help us to review the various tutorials if we need it. the disadvantage is that in-person lessons have a greater value for communication and for the fact that people can ask and express their doubts
17. Advantages: I can study whenever I want, I can choose time when I have good conditions to study, I can spend more time on thing I don't understand and skip them which I already know - Disadvantages: I can't ask questions in real time, need to look at screen for another few hours
18. To be able to learn any time is a big advantage. Not to be in a direct contact to persons is a disadvantage
19. It is positive that we can work together on a project from our countries across borders. It is possible to discuss questions together, exchange files and share comments in models. The disadvantage is that it is difficult to develop common ideas and gather inspiration without personal contact. It's also difficult to find a time when everyone can attend a meeting together so that answers to questions don't just come with a delay. This takes up a lot of time when solving problems and developing common models only digital

C. BIM ADOPTION

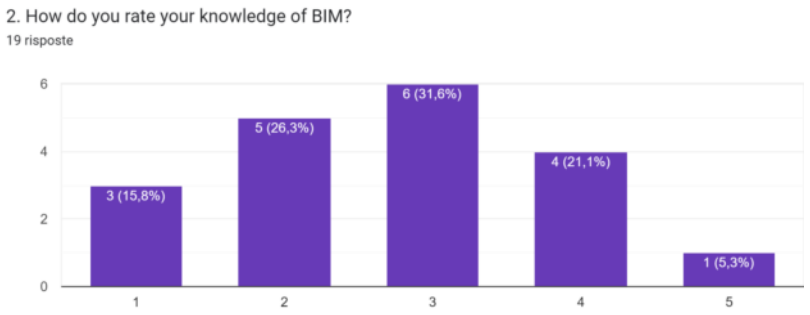
1. Please provide 3 keywords to describe your opinion about BIM.
2. How do you rate your knowledge of BIM?
3. Did you receive specific BIM training on BIM?
4. If yes, please list and briefly describe the type of courses you attended, specifying the ones supplied by your university.

The opinions of students about BIM, collected in keywords[3], reveal a very positive consideration (as in the words cloud visualisation below). The only "negative" keyword reported was *confusing*.

https://tagcrowd.com/

According to students' opinions, the knowledge of BIM varies across the low to the high level, presenting a concentration of answers in the medium-low level.

[3] All the students answers are reported at the end of this paragraph (*).



More than half of the surveyed students (63%) reported not having received any specific training on BIM. Students who instead participated in BIM learning paths referred to specific and very different typologies of attended courses[4].

(*)

1. Exact, knowledge, clarity
2. useful, necessary, future
3. Innovative, cost-saving, effectivity
4. Standardization, communication, efficiency
5. Future, together, process
6. Collaborative, efficient, sustainable
7. Confusing, new and future oriented
8. Effective, clear, intuitive
9. Future, new and confusing
10. Useful, informative, expanded
11. Useful, interesting and complete
12. Modern, useful, easier
13. Building Information Modeling
14. forward-looking, important, process-simplifying
15. multidisciplinary meticulous interoperable
16. accurate complex useful
17. Make designing easier :)
18. Effective/ provident/ straightforward
19. Sustainable, digitalization, efficient

(**)

1. I had an additional online course about document types and naming regarding BIM
2. I know how to use revit and Archicad and looking forward to attend the online seminar from Wuppertal on Bim
3. BIM and CAD

[4] All the students answers are reported at the end of this paragraph (**).

4. Basic Revit course at university and additional Allplan short course
5. WPK Bachelor: VR mit unreal Digitales Engineering Entwerfen 4.0 BIM Anwendungsfälle Entwicklung digitaler Bauteile Digitale Planungsmethoden WPK Master: modellbasierte Lebenszyklusanalyse (LCA) von Gebäuden Digitale Architekturdarstellung
6. I took an external course at the university at the Archibit company in Rome. I am not aware of any efficient internal university courses
7. Revit MEP- at the begging on my studies Ventpack, DALUX- previous job
8. MuM Revit course (Revit Master)
9. Last semester I took the "BIM" sub-module of the "Construction Management" module. In this we analysed a high-rise project currently under construction for selected aspects of sustainability, developed concepts to improve sustainability and then implemented them using BIM as an example.

D. DESIGN COMPETITION

1. Have you ever been involved in a design competition?
2. If yes, please list what you like and what you dislike about your experience in design competitions.
3. Do you think that participating in design competitions can improve your learning path?

The majority of students targeted by the survey (84%) declared having never been involved in a design competition. The only three students who experienced design competitions reported positive aspects of the *"opportunity to more advanced stuff in comparison to basic university courses"*, and as negative, that they are time-consuming and difficult to conduct not in presence (characteristic of the DD).
Almost all the students (90%) agreed that the participation in design competitions is beneficial for the learning path.

E. COLLABORATION AND SUPPORT

1. Did you ever participate in an interdisciplinary design team?
2. Did you ever take part in an international team?
3. Please provide some keywords to explain your expectations about the participation in an interdisciplinary and international team.

The majority of students (75%) reported not having experience in interdisciplinary design teams. A larger majority (80%) refers to not having participated in any international team yet. Combining these two experiences, it can be sustained that the DD is a novelty for almost all the students.
A series of keywords[5] describing the personal expectations for the DD highlights the positive perspectives of students in participating in design competitions, such as:

- Deeper knowledge and understanding
- Skills development
- Cultural exchange
- Personal growth and confidence
- English proficiency
- Collaboration
- Teamwork
- Fun

(*)

1. Fun, new, exciting
2. Nothing
3. Challenge, language barricade, opportunity, inspiration, possibility
4. Flexibility, openness, collaboration
5. More and different opinions
6. Getting to know other people and seeing what their way of working is like.
7. Knowledge in construction, digital programs and visualisation
8. Interesting, educational, productivity
9. New knowledge, improving skills in digitalization, improving skills in communication
10. Communication skills, getting confidence in coordination, practice language, meet people from other culture
11. Collaboration, teamwork and communication

[5] All the students answers are reported at the end of this paragraph (*).

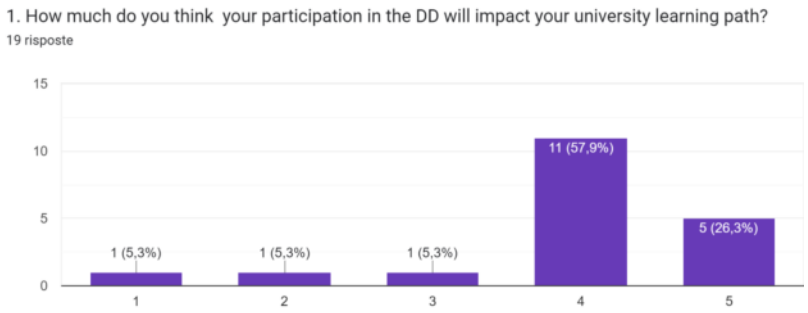
12. Practising English, learning about other countries laws and standards in creating buildings, training teamwork, understanding the trends and creative process in different Universities
13. I expect insights into what such competitions are like from the perspective of the participants and how they could be improved
14. gain other points of view, understand other ways of doing things and what is important to the others
15. synergy debate resourcefulness
16. discovery learning curiosity
17. Improve me English and communication skills, try to understand how architects and civil engineers are looking at concept of building and also how do they look at MEP installations
18. To learn how to communicate end accomplish the objectives as a part of such a group
19. Making agreements, changing perspectives, using different knowledge to find solutions

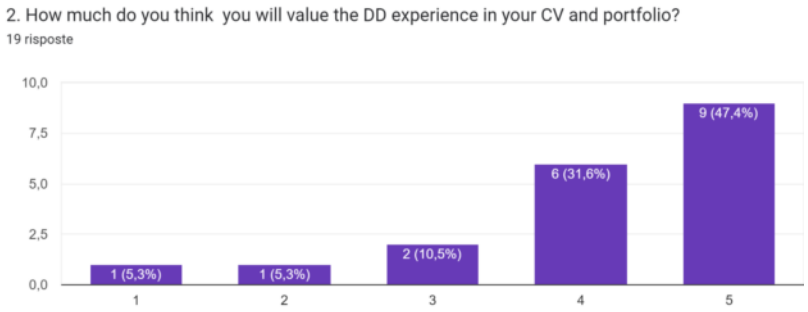
F. VALUE FOR THE FUTURE

1. How much do you think your participation in the DD will impact your university learning path?

2. How much do you think you will value the DD experience in your CV and portfolio?

The majority of students consider the DD impactful in their university learning path, as well as they believe to value the DD experience in their CVs.





DD: MID TERM SURVEYS REPORT

(I competition: 10.10.2023 – 15.02.2024)

WP 2_ Quality of the Learning Path

UFI

Co-funded by the European Union

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CONTENTS

INTRODUCTION

As described in the “Evaluation Process” document, the assessment of the Digital Decathlon (DD) as a “quality learning path”, objective of WP2 (led by UFI), has been conducted through a defined approach, methodology and structure. The evaluation process targets the two main protagonists/participants of the DD project: students and trainers.

This report contains the results of the two surveys (for students and for trainers) provided in the middle of the first DD design competition, at the end of November 2023. As the second of three, the middle-term surveys have been intended and constructed to understand the ongoing experience of the DD, initiated two months before and lasting in the middle of February 2024.

As the starting, both the surveys for students and for trainers are grounded in the same evaluation criteria (recalled to follow), but declined in specific questions tailoring the different targets and their role in the DD.

Taking into account the considerations that emerged from the starting surveys, the middle-term ones have been focalised for trainers, reducing open answers and the time of compilation; instead, the survey for students has been structured to valorise their voices, collecting answers on their DD experience.

Evaluation surveys have been provided exploiting the Google Form platform.

The elaboration of results, object of this report, is oriented to derive recommendations and suggestions to improve ongoing the DD learning path, along the first competition, and above all to improve the foreseen second one.

Six main criteria have been considered to assess the Digital Decathlon as a quality learning path:

A. LEARNING QUALITY

B. DIGITAL ENVIRONMENT

C. BIM ADOPTION

D. DESIGN COMPETITION

E. COLLABORATION AND SUPPORT

F. VALUE FOR THE FUTURE

1. MIDDLE TERM SURVEY FOR STUDENTS (SS2)

The Middle-term Survey for Students has been sent to all the students involved in the DD competition, for a total of 25 students (5 from each of the 5 universities involved in the project). Sixteen answers have been received.

The report is organised in sections following the evaluation criteria, as the survey's questions, reported with results analysed and discussed.

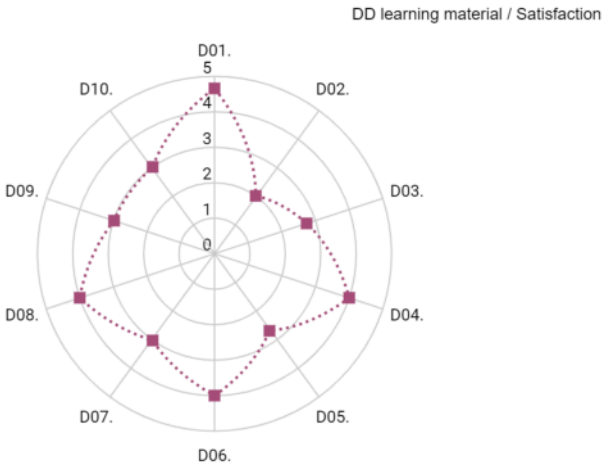
A. LEANING QUALITY

Quality of the DD as a learning path., considering the 10 DD disciplines and assessed in relation to the specific knowledge to acquire, the skills to improve and the competencies to develop.

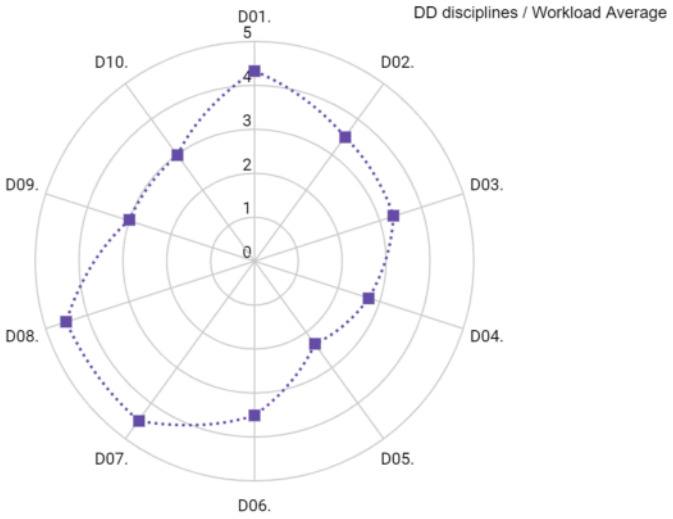
1. Can you please select the first discipline you selected?
2. Have you begun working on it already?
3. If yes, how much are you satisfied with the provided material?
4. Can you please indicate, if you found, critical points in the tutorial provided?
5. What do you think about the workload?
6. Do you have some suggestions to improve the learning material?

The section of the questionnaire has been organised to investigate, for each discipline, the ongoing students' experience in the DD as a learning path, also in terms of suggestions for improvement. Regarding satisfaction with the provided learning material, the

students answered as follows according to the 10 DD disciplines:



Relating to the workload, these are the received answers for disciplines:



The following contains the answers received from students, organised according the 10 DD disciplines (rows) and the following topics (columns):

- starting working (Y/N)
- critical points

- suggestions to improve the learning material

Discipline	Start?	Criticalities	Suggestions
D01. ARCHITECTURE	Y		It's good enough
	Y		
	Y		
D02. CONSTRUCTION	Y		
	Y	I don't know what are critical points	Definitely there should more information on how to design structures with wood
D03. MEP	N		
	Y	For someone with no backgound in this MEP field I wouldn't be able to rely just on the Moodle material to complete the task. One think that would impove the Moodle is to add some level of interactivity with the teacher, eg. chat box for individual questions to the teachers and a separate discussion box visible to all about general issues and questions. This Moodle change I would recommend for every task.	I would like more instructions on how to do the model part. I have never done a model from a MEP perspective. Do I use an IFC from the architectural model or a copy of the Revit for example.
	Y		English subtitles everywhere please:)
	N		
D04. MODEL CHECKING	Y	Lizenzes	Providing testing guidelines in English. Early deadline for the architectural model so that the other disciplines can start working sooner. Fixed contact person for the BEP, who is responsible for the group filling it out together and the person uploading it.
	Y		
	Y		
	Y	The testing guidelines are provided in German, which means that Solibri's error report is also issued in German, sometimes over 100 pages long. This means a lot of translation work.	Providing testing guidelines in English. Early deadline for the architectural model so that the other disciplines can start working sooner. Fixed contact person for the BEP, who is responsible for the group filling it out together and the person uploading it.

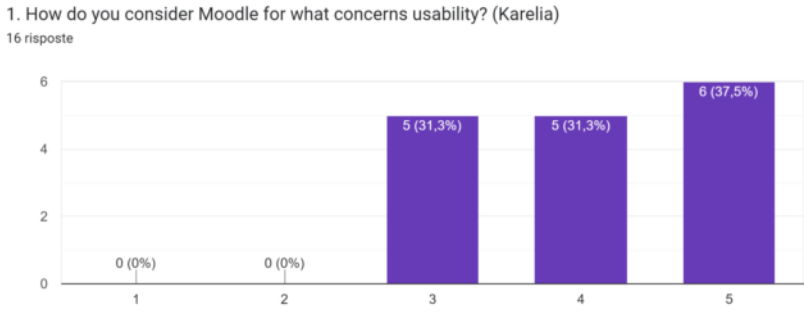
D05. BIM DESIGN COORDINATION AND COMMUNICATIO N	Y	Why don't we use Autodesk 360 or Trimbleconnect? D4 model checking with rules is fine, but for BIM work progress, collision checking with separate sub-models is more important. The Solibri program is a bold choice D5 Communication with programs such as Solibri or Enscape or Bim Collab that use BCFs does not work if: A. Not everyone gets a licence (Enscape) B. the programs work on different engines (Solibri BCF is not Enscape BCF) Ideally, D4 and D5 would need to be worked in one program (not 2) and supervised by one university since they work so closely together	1 Tutorial for 1 Programm for D4 and D5 BimCollab or Autodesk 360. pls no Solibri is not working well with some CAD Programms
	N		
	Y		
	N		
D06. CONSTRUCTION SCHEDULING	Y		
	N		
	Y	i think it would have been better to have video tutorials and not screen shots but they are satisfactory	also focus on the schedules and costs part
D07. LIFE CYCLE ASSESSMENT	N		
	N		
	N		
D08. SIMULATION	N	I am still awaiting for my teammate to add the glazing on the model so I can commence on my task.	I think it would be good if there were some video tutorial links. One think that would improve the Moodle is to add some level of interactivity with the teacher, eg. chat box for individual questions to the teachers and a separate discussion box visible to all about general issues and questions. This Moodle change I would recommend for every task.
	Y		
D09. BUILDING PRODUCT	N		
	N		

TRACEABILITY	Y	There was only information about the Dalux program, but no precise information about which aspects are important in the product data sheets and tips for researching them.	Precise information about which aspects are important in the product data sheets and tips for researching them are provided.
D10. REPORTING	Y		
	Y		

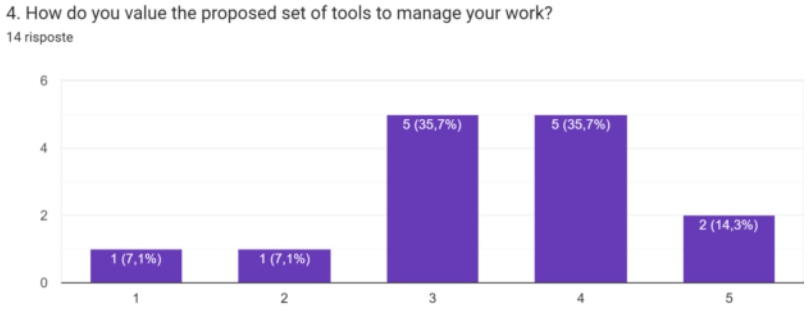
B. DIGITAL ENVIRONMENT

1. How do you consider Moodle for what concerns usability? (Karelia)
2. Did you like the system of booking revision online?
3. Which platform did you use for teamwork?
4. How do you value the proposed set of tools to manage your work?
5. Do you have any comments about the previous answer?

According to students, the usability of the main DD digital platform is considered as medium- good (see the bar chart below).



The majority of students appreciated the online revision booking system on Moodle (60%).
For online team working, the majority of students adopted Zoom platform (10/16), followed by Whatsapp (5/16), also the use of different platforms is signalled.
Evaluating the suite of tools provided for managing work tasks, the average of the perceived value is good (3,5/5), with some criticalities reported.



Six students provided valuable insights[1] by commenting on the previous answers. One student emphasised the importance of **clarity and clear guidance on the digital environment**, by suggesting the provision of a **list detailing the programs** provided and their intended uses. Similarly another student, expressing **confusion with multiple platforms**, suggested the provision of a **comprehensive list or depiction of all platforms**, generally considered as abundant.

Additionally, some questioned the necessity of using multiple platforms when **certain tools fulfil similar functions**, and expressed concerns regarding data management across different platforms, noting the risk of **data loss and inefficiency**.

Another student expressed frustration regarding the pace of group work despite the availability of digital tools. One suggested assigning **a teacher/mentor to each team for regular progress checks**.

Overall, the students' responses underscored the importance of **clarity, efficiency, and simplification** in the DD digital environment.

Working on **coherence, not redundancy and on clear guidance** of the digital environment could enhance the learning experience for students, improving usability and overall productivity.

(*) answ. 5

1. The should be a list at the beginning what programs were provided / what they should be used for
2. I think that despite all the digital tools the group work feels slow. I think it would be useful if every team had one teacher as a "mentor" to check on us weekly or so if only by whatsapp on the progress. I am still waiting for model changes in order to commence on my tasks.
3. It is confusing at the beginning to get to know all the platforms. A given list or depiction of all platforms would help. Also I think if we already use Dalux for D04 and D05 and as CDE - we don't have to use Chmura.
4. There are far too many platforms and software available. There is a need for clarity and straightforwardness, Students are not yet experienced and professional
5. A lot of data is generated and exchanged across different platforms. This can result in loss of data. It would be better if there was a unified CDE. It would help to set up a proper CDE. At Chmura we started creating a folder structure, but after uploading the first files we realised that we should change something in the folder structure. Unfortunately we cannot move files, which would be very helpful. It would also be nice to have a chance to delete things at the beginning, as we weren't familiar with how to use it before and not everyone was aware that you can't delete files if you accidentally upload them.
6. Maybe 1 cloud, 1 Moodle or 1 separate website would be better, then 5 clouds with 5 Moodles. Now the information that each school releases is different because uploads are made on all platforms with different relevance. On a separate website for

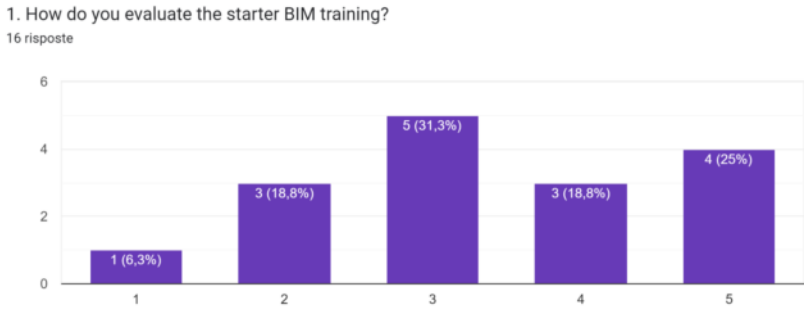
[1] All the students answers are reported at the end of this paragraph (*).

everyone, the information released would not be different and would be visible to everyone.

C. BIM ADOPTION

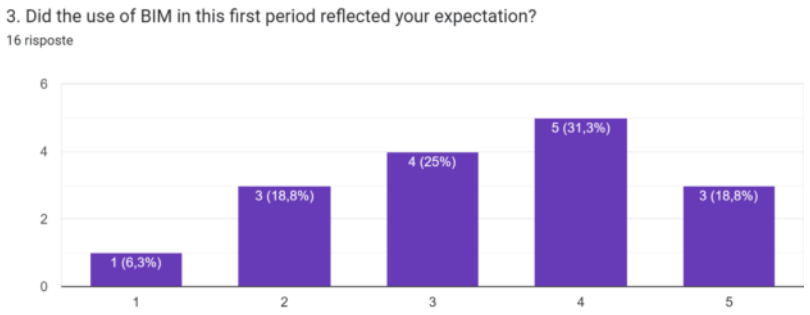
1. How do you evaluate the starter BIM training?
2. Motivated the previous answer about what you like and dislike.
3. Did the use of BIM in this first period reflect your expectation?

Responses regarding the introductory BIM training offered as educational material exhibit some divergences, see the bar chart below, with the average score of 3,5 in the range between *Superfluous and boring* (1) and *Useful and interesting* (5).



The students' feedback on the BIM training introductory course highlights a range of experiences and perspectives[2].
Various students appreciate the course's well-structured format, judging it as informative and engaging. Others express concerns about the workload exceeding expectations and the limited time available for completion.
Language barriers, particularly with German content, pose difficulties and hindered progress for some students, affecting their ability to fully engage with the material (use of subtitles).
Students considered as positive the shared understanding of BIM terminologies, while recognizing the disparities in prior experience with e-learning and BIM. The discrepancies in BIM levels among the team members is considered as a criticality deriving from an unclear communication regarding whether the course is intended as a beginner's course.
Not all students are satisfied about the use of BIM in the first period of the competition, but the average score of 3,5/5 testify the positive matching of BIM expectations.

[2] All the students answers are reported at the end of this paragraph (*).



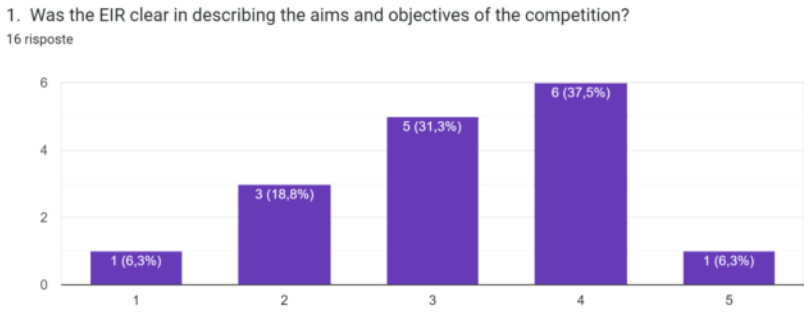
(*) answ. 2

1. The structure of the BIM training is good.
2. I think it gives a general but technical vision
3. I like that it is well structured and that learning is fun and interesting.
4. There was more work than I anticipated.
5. It would be better if we had more time to complete it
6. Hard to do because the language is in German and messy allround, and I haven't had time to really focus on it because of the end of semester and lots of school work.
7. I don’t know why but I can’t do anything more despite level 1
8. Liked the different kinds of tasks
9. The content was organised complicated and leading to confusion
10. I don’t have anything to say about that because i work since 2 years with that and it’s nur new for me
11. I haven’t finished it because i had problems with translated subtitles
12. I don't understand a word of German and parts of the pages were in German
13. The group's uniform understanding of BIM helps to work on the project together. This means everyone knows what is meant by the BIM terms and you don't talk past each other or have to explain these basics to others from scratch. Unfortunately, not everyone has done e-learning, which makes collaboration more difficult and time-consuming.
14. Is this a competition or a beginner's course? This should be clarified in the conceptual approach. If it is supposed to be a competition, do not allow students into the course who have not yet come into contact with BIM. a small Bimable IFC model resulting from a provided floor plan and a section should be published as an "application" for certification before choosing the course. If only one person in a group can model 3D and has an idea of BIM and the others don't, then one person won't learn anything and the others would be overwhelmed. Is this a competition or a beginner's course? This should be clarified in the conceptual approach. If it's an introductory course for complete beginners, give this course a different name and communicate it more clearly so the case that one person in the group doesn't get bored and four are overwhelmed doesn't happen

D. DESIGN COMPETITION

1. Was the EIR clear in describing the aims and objectives of the competition?
2. In your opinion, how stimulating is the Design task?
3. Please list what you like and what you dislike about the Design task.

The Mini-EIR is considered quite clear in describing the aims and objectives of the competition, with an average score of 3 over 5 and a distribution as in the following bar chart.



The DD Design task is considered as stimulating (average score of 4/5).
Students highlighted some positive and negative aspects of the DD Design task[3], also providing very useful insights.
Students liked:

- multidisciplinarity;
- the relatively easy geometry of the building (weird that it does not exist);
- the freedom to create their own room program;
- the approach behind the design task, particularly BIM.

Instead, they disliked:

- Dependency on disciplines. Students express frustration with tasks that rely on others' completion, suggesting strict deadlines to ensure that everyone has sufficient time to contribute;
- limited time to fully engage with the project;
- lack of clear guidance;

[3] All the students answers are reported at the end of this paragraph (*).

- restriction in using wood structures;

(*) answ. 3

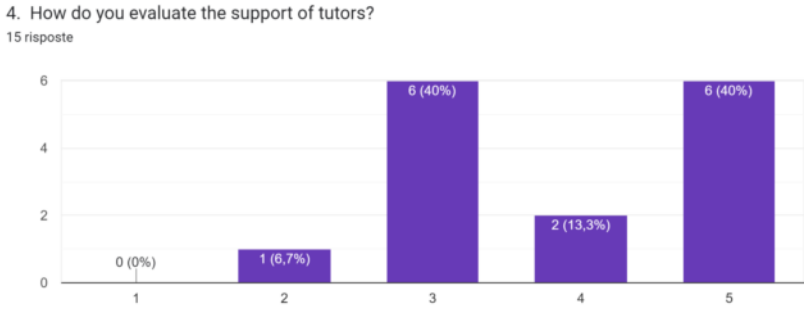
1. It's a bit weird to assume a building that is not existing. But I like that we have relatively easy geometry, so it's easier to not focus so much on architecture but on the team work and functionality. I think I should be mentioned more often, that architecture is not 90% of the project, it's 10%. The freedom you have (in terms of creating your own room program, etc) makes the design task interesting.
2. of the design part i like the philosophy behind it, the reasoning that led to an idea and it visualisation through BIM
3. I am not sure
4. I think some of the tasks are relying on other people's tasks. There should be different hand in times, eg. architectural models should be submitted earlier, so that everyone gets enough time for their part.
5. In particular, however, you have a lot of focal points to deal with, but in a positive way
6. Hard to say because havent had the time to really dive into the project.
7. Liked the idea really much, but there could be a given date on which the first 3D has to be uploaded.
8. I would have preferred to be able to use any contact we want, not only timber!
9. I do not have an opinion.
10. I think with Design can i better convince other people and I can show exactly what i mean
11. I like that i can try working with wood as structural material
12. We should have had a clearer framework of what to do
13. Interesting project, it's nice that it's not a new building, but rather the revitalization of an old industrial hall. It would be even better and more sustainable if it were a real hall and the groups' ideas could also help with a real redesign so that the groups' work doesn't come to nothing.
14. I like: Building with existing buildings. I do not like: Location (there's a boulder hall 200m away, I wanted to design one .... damn it)

E. COLLABORATION AND SUPPORT

1. How do you judge the collaboration within your team?
2. According to your opinion, was the distribution of the different disciplines equilibrated for each member of the team?
3. Please list what is going good and what is bad in your team working experience until now.
4. How do you evaluate the support of tutors?

Students evaluate the collaboration within design teams as positive (average score of 4/5, bar chart to follow).

Regarding the distribution of the different disciplines, half believe it is fair and half not.
The support provided by trainers has been valued as positive, with an average score of 4/5, and the following distribution. .



(*)

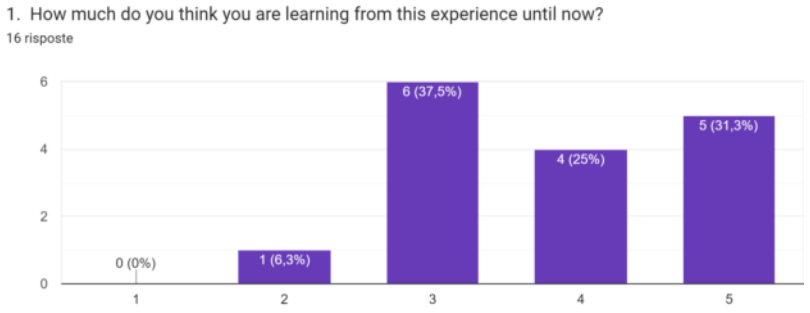
1. It's hard to keep in contact with every Team member, when they ignore messages or don't attend meetings. Because of the distance it's quite a challenge. Working with the ones that regularly come to meetings works perfectly fine. It's nice to figure out how to improve a team and how we can benefit from each other.
2. One positive thing is that we are calm among ourselves and that we threw ourselves into the game trying to do our best while having fun. The negative part is that any remote dialogue does not have the same intensity and collaboration compared to talking to people in person.
3. It is very difficult to communicate completely digitally without any possibility of seeing each other in real life. In addition, most students are not flexible enough to meet for a zoom conference at the same time as their studies and work, which has made most of the work unnecessarily long.
4. People are busy and have other priorities than this course. Whatsapp messages are not being read in days.
5. Everyone gathered ideas. We had to find compromises in some places. But it all worked really well so that everyone was happy.

6. Pros: regular meetings normally once a week, everyone is paying attention. Cons: Hard to find real time for group meetings, a little bit messy.
7. The best is support for everyone, if anybody has a question rest is trying to help him.
8. I can’t find anything bad :)
9. The different knowledge of BIM is noticeable, because not everyone did the course in the given time.
10. Sometimes I get this feeling that some issues aren't taken seriously !
11. Seems that all of the other students who are specialising in architecture are well invested in this project.
12. I didn’t have any bad experience but for example architecture is very very harder than other tasks and I think it would be better if for next time 2 students have this task and they work together because i had to have concept and after that floor plan and 3D Model and support system and facade and all of that was my job and other students said just their Opinion and that was difficult for me because I had to work every day
13. 2 members of our team don’t work at all
14. There is some language barrier, but the main challenge is the different level of understanding of construction among students and the differences in practice between countries
15. Some people in the group didn't get in touch for several weeks. Since the architectural design also depended on them, it was not possible to work on the model together after an initial good collaboration and exchange. After several requests to provide the other group members with a first version of the model, we only received it a few days before the interim presentation. This made these days very stressful. Due to the different communication between the trainers, our group was told that only the architectural model was important for now, which is why the other disciplines and the BEP were not processed further for the intermediate exam. There must be a more uniform agreement on the requirements among the trainers in order to create the same conditions for all groups and to be able to work well as a group.
16. 2 Persons 100% - 2 Persons 0% - me ?

F. VALUE FOR THE FUTURE

1. How much do you think you are learning from this experience until now?

Students think that they are learning a lot from the DD experience, with an average score of 3.8/5 and a distribution as in the following bar chart.



DD: STUDENT FINAL SURVEY REPORT

(I competition: 10.10.2023 – 15.02.2024)

WP 2_ Quality of the Learning Path

UFI

Co-funded by the European Union

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CONTENTS

INTRODUCTION

As described in the “Evaluation Process” document, the assessment of the Digital Decathlon (DD) as a “quality learning path”, objective of WP2 (led by UFI), has been conducted through a defined approach, methodology and structure. The evaluation process targets the two main protagonists/participants of the DD project: students and trainers.
This report contains the results of the final survey provided to students at the end of the first DD design competition, in the middle of February 2024.
As the third of three, the final surveys have been intended and constructed to understand from the end the experience of the DD, initiated four months before.
As the starting and the mid-term, surveys are grounded in the same evaluation criteria (recalled to follow), but declined in specific questions tailoring the different targets and their role in the DD.
Taking into account the considerations that emerged from the starting and mid-term surveys, the final ones have been focalised, reducing open answers and the time of compilation; instead, the survey for students has been structured to valorise their voices, collecting open answers about their experience.
Evaluation surveys have been provided exploiting the Google Form platform.
The elaboration of results, object of this report, is oriented to derive recommendations and suggestions to improve ongoing the DD learning path, along the first competition, and above all to improve the foreseen second one.
Six main criteria have been considered to assess the Digital Decathlon as a quality learning path:

A. LEARNING QUALITY
B. DIGITAL ENVIRONMENT
C. BIM ADOPTION
D. DESIGN COMPETITION
E. COLLABORATION AND SUPPORT
F. VALUE FOR THE FUTURE

1. FINAL SURVEY FOR STUDENTS (SS3)

The final Survey for Students has been sent to all the students involved in the DD competition, for a total of 25 students (5 from each of the 5 universities involved in the project). Eighteen answers have been received.

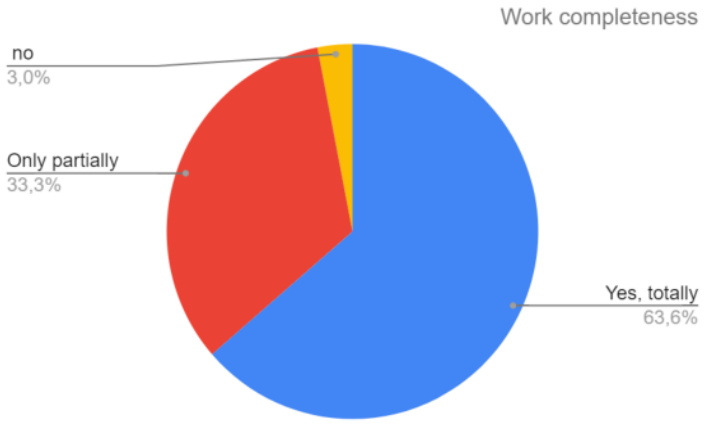
The report is organised in sections following the evaluation criteria, as the survey's questions, reported with results analysed and discussed.

A. LEANING QUALITY

Quality of the DD as a learning path., considering the 10 DD disciplines and assessed in relation to the specific knowledge to acquire, the skills to improve and the competencies to develop.

1. Can you please select the first discipline you worked on?
2. Did you finished the work requested?
3. On the basis of your previous answer, can you motivate the it? (please refer to practical examples, critical points of workflow, …)
4. How much are you satisfied with your work?
5. How do you judge the total workload?
6. Do you have some suggestions to improve the learning material?

The section of the questionnaire has been organised to investigate, for each discipline, the students' experience of the DD as a learning path, also in terms of suggestions for improvement.
Considering the received design task and learning materials, the majority of students reported to finished their work under their specific disciplines (each student worked on two disciplines):



According to students answers, the difficulties in completing the requested work depended from the following points:

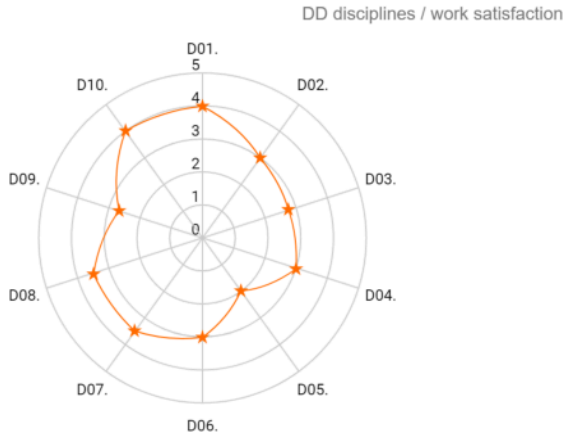
1. Interest and Learning: Some students expressed enjoyment and found the project interesting and relevant to their future careers.
2. Long Task and Overwhelm: Many felt the task was lengthy and overwhelming, particularly due to the complexity of the programs and the amount of work relative to the credit points.
3. Platform and Resource Issues: A common criticism was the difficulty in accessing materials and information spread across multiple platforms. Students suggested consolidating everything on one website.
4. Delays and Dependencies: Several students mentioned delays caused by issues with the architectural model, which affected their ability to complete the work on time.
5. Preference for In-Person Meetings: Some students felt that more could be accomplished with initial in-person meetings rather than relying heavily on online communication.
6. Challenges with Tutorials and Software: The click tutorials were often unclear, and some found the software difficult to use, especially those with less experience.
7. Motivation and Time Management: The workload was considered too high for the credit points received, leading to difficulties in managing time effectively, especially alongside other university projects.

8. Model Changes: Frequent changes to the architectural model led to significant delays and rework, causing frustration among the students.

Answers from students: (question 3)

1. I like this discipline
2. This was a quite long task
3. I worked on the dicipline 4 and 9 and I was totally good withe the learning material I have become. The only point I would criticise is, das it was unnecessary hard to check all the different platforms for working Material, Information and Upload. It would be great if all of these points would be covered on one website oder something.
4. We can't finalized because of one model we didn't became
5. It was more "paperwork" for me I don't like, but also I think more stuff should be done on first live meeting
6. The click tutorial was less clear and the level of this discipline It goes beyond the level of the project, especially with the choice of the manufacturer, but I also found it difficult to make the materials coincide with the construction choices
7. I was overwhelmed with the Programm and I had to do the first discipline also , so I was too much and I did not manage my time that good. It was also too much requested for too less credit points so I had also to work on my other projects at the Uni wich have more cp.
8. Yes I think it item I like for my future
9. We had a lot of problems with the architectural model, and a big delay with the architectural model
10. I worked on the dicipline 4 and 9 and I was totally good withe the learning material I have become. The only point I would criticise is, das it was unnecessary hard to check all the different platforms for working Material, Information and Upload. It would be great if all of these points would be covered on one website oder something.
11. Yes, it was a interesting project to work on it and to finalized it
12. I was overwhelmed because of all the new Programms and it was to much work for so less credit Points
13. I think online meetings with tutors for example for 3 weeks should motivate me more
14. The main problem was to receive the model late, as it was changed often, and built in incorrectly
15. I only did not do the rendering because the program for it was not easy to use for me. I'm also in the 5. Semester so I did not bring that much experience with me.

Regarding satisfaction with the provided learning material, the students answered as follows according to the 10 DD disciplines:



Relating to the workload, these are the received answers for disciplines:

For each discipline, the following suggestions for improvement have been provided:

Disciplines	**Suggestions**
D01. ARCHITECTURE	Few people in the group to cope with the discipline: too much work
D02. CONSTRUCTION	-
D03. MEP	Organise more online meeting with trainers

D04. MODEL CHECKING	too much platform and software to use (e.g. Solibrì)
D05. BIM DESIGN COORDINATION AND COMMUNICATION	more video material
D06. CONSTRUCTION SCHEDULING	-
D07. LIFE CYCLE ASSESSMENT	-
D08. SIMULATION	video tutorial dependency on the architectural model
D09. BUILDING PRODUCT TRACEABILITY	better definition of the task
D10. REPORTING	pro version of software for full access to the functionalities (Canva)

Answers from students: (question 6)

1. I think for architecture it would be better if 2 student work on it and they can learn from each other and it's not very difficult to finish the work they can share the task
2. More Information and correct step to step tutorials
3. Video tutorial and not pdf
4. Yes. There should be more information on how to do the 3D model
5. I worked on the dicipline 4 and 9 and I was totally good withe the learning material I have become. The only point I would criticise is, das it was unnecessary hard to check all the different platforms for working Material, Information and Upload. It would be great if all of these points would be covered on one website oder something.
6. Maybe to look if it's works with windows and Mac. Because I have some difficult to use the Programm on my Mac
7. Online meetings with tutors one of the time
8. No the learning material was good and complety
9. You could do like more people in a group so the amount of work is equally shared.
10. Maybe some examples for next Time because first i didn't know what you want from me I hope I did it right
11. The pro version of Canva, because it was hard to get music for the reels
12. Video tutorial
13. I think it was not very clear that the energy model should be a conceptual model in order to develop the design. I thought that the energy model should be conducted on the end of the process. It took a long time then to wait for the architecture model to be complete in order to proceed with my task.

14. I worked on the dicipline 4 and 9 and I was totally good withe the learning material I have become. The only point I would criticise is, das it was unnecessary hard to check all the different platforms for working Material, Information and Upload. It would be great if all of these points would be covered on one website oder something.
15. More video materials
16. For the tutorials it would be better to define the purpose of the task which was unclear especially the papers to be produced
17. I would like to have some pdf with some material informations so I don't have to search them on the internet.

B. DIGITAL ENVIRONMENT

1. Considering the criticalities of the DD digital environment, do you have any other suggestions for improvement?

Several suggestions have been provided by students to improve the DD digital environment. One key recommendation is to increase the number of online meetings with trainers in order to enhance motivation and engagement. Obligatory weekly meetings with tutors are proposed to ensure that all the students in the teams are working efficiently and systematically, providing regular check and support. Respondents emphasised the need for more guidance on the different softwares and platforms to use, such as on how to approach the workflow and make the digital experience smoother.
The reduction of platforms is a recurrent theme; many students felt that the current setup with multiple platforms was confusing and suggested reducing it to a single platform for uploading and downloading material.
Furthermore, several respondents suggested the inclusion of videos explaining the working materials, as well as a Q&A page featuring the most common questions and answers to reduce confusion.

answers

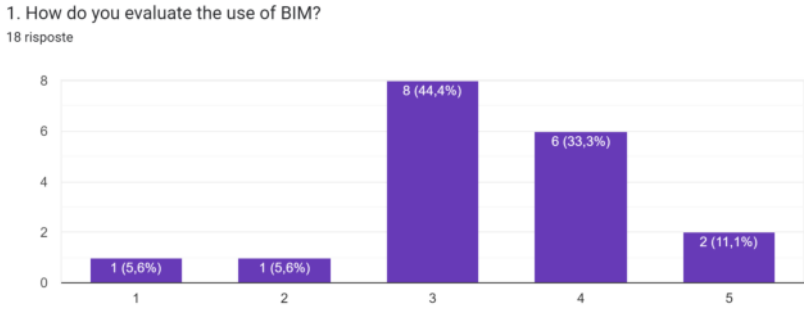
1. Yes. It would be better if we saw each other 2/3 times more I know it can be very expensive but that was just a idea because online it's a little bit difficult and sometimes we lost our motivation
2. Maybe be more strict about which programs to use, so it would smoother to work
3. To demand less
4. Much less platforms
5. Nothing
6. No
7. I think that is important some lesson in classroom of every category

8. It was good, maybe using less platform, a little bit confusing.
9. I would like more contact with the teachers. Maybe some video instructions would help too
10. I would set obligatory weekly meetings with tutors, to make sure the students' work is efficient and systematic.
11. Some videos that explained the working material would be nice and a Q&A page with the most asked questions and answers so there is less confusion.
12. To make it more concrete to make one Plattform there these file are to upload
13. Maybe every two weeks a zoom call
14. For me it wasn't so clear what exactly should be done. Also couple more milestones meeting should help to get more progress
15. It would have been better to use only one site to load or download tasks, becoming too confusing with too many sites to go to
16. Are too many platforms for one project.
17. Works fine

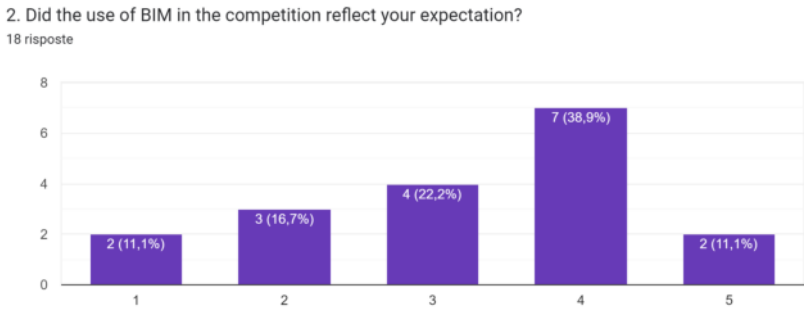
C. BIM ADOPTION

1. How do you evaluate the use of BIM?
2. Did the use of BIM in the competition reflect your expectation?
3. In your opinion, how much did you increase your BIM skills?

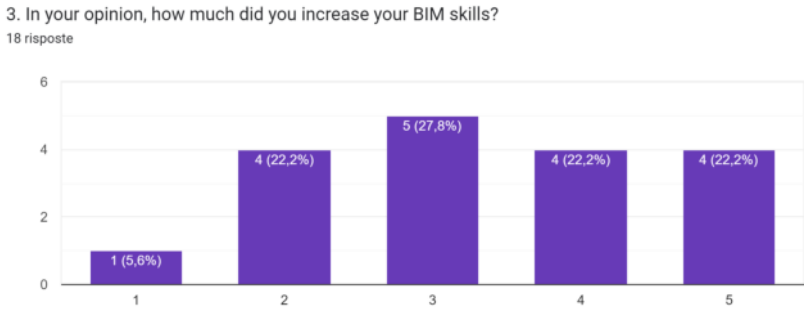
According to students' answers , the use of BIM in the DD is considered as satisfactory, with just two respondents reporting a negative judgement.



In most cases, the use of BIM reflected the initial expectations of students, so confirming expectations/results.



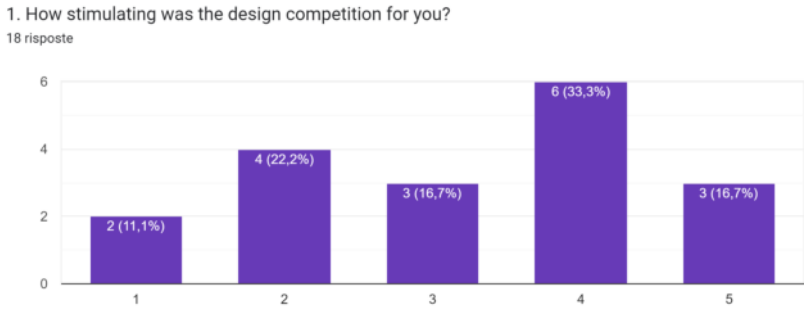
Even if with very different degrees of accordance, more than 70% of students considered the DD improving their BIM skills.



D. DESIGN COMPETITION

1. How stimulating was the design competition for you?
2. Please list what you like and what you dislike.

Very divergent have been the opinions about the design competition's format in terms of positive stimuli:



According to students, the design competition experience had several positive aspects: many participants appreciated the opportunity to work on a project that felt like a real-world professional task, providing a valuable learning experience. They enjoyed meeting new people, collaborating with peers from different countries, and working with students from various professional backgrounds. Students also liked the freedom in design, the exposure to BIM, and the opportunity to travel.
However, some negative aspects have been reported: participants felt the need for a clearer project frame, such as the imposition of sequential deadlines for the different tasks, consenting to facilitate a smoother passage from a discipline to another. Moreover, students noticed the different commitment among team members, thus creating frustration for more committed students. Some participants experienced challenges due to the varying levels of experience among team members, creating frustration. Additionally, some participants felt pressured coming from some competitive team members.

answers

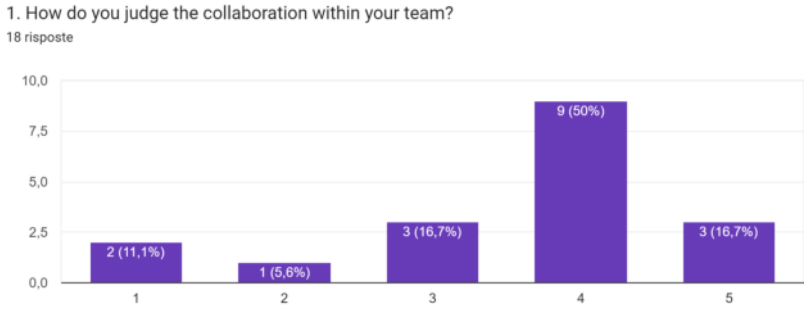
1. etween knowledge. I think it should be for bachelor only or for masters only, it would be more equal
2. I liked the interaction with people of other nationalities and the opportunity to learn from them. What I didn't like was the absence of lessons but the presence of tutorials
3. I liked the concept of it, like to learn how to work in a group with people from different countries and who are having different professions. Also it was interesting seeing the different levels of knowledge energy single person had. And the experience they had before. At the same time I think it was too much for me personally, because im not that advanced in programs and I did not bring the same experience like other people who are in their masters degree. I also had struggle with some people from the group who pushed pressure on me. And sometime the person pointed me out for not doing something even if I didn’t react to his massage for a day.

E. COLLABORATION AND SUPPORT

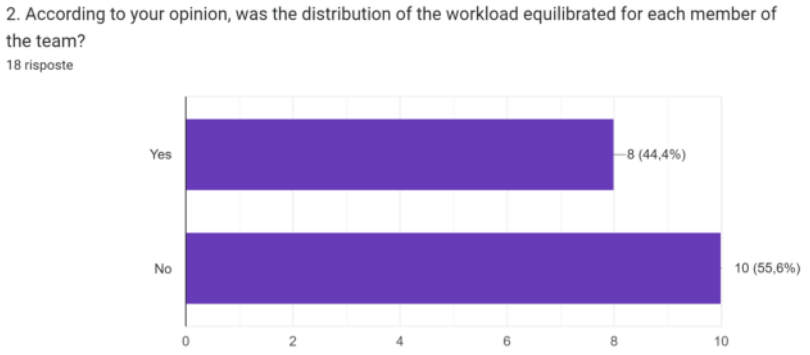
1. How do you judge the collaboration within your team?
2. According to your opinion, was the distribution of the workload equilibrated for each member of the team?
3. If not, please explain why.
4. Please list what went well and what was bad in your team working experience.

5. How do you evaluate the support of tutors?
6. Do you have any suggestions to improve collaboration and support in the DD?

The majority of students considered the collaboration within teams; yes, some bad experiences can be noticed by the three students providing a negative judgement.



Not all students agreed about the distribution of the workload in the various disciplines, with almost half of them considering it equilibrated and half not.



Not all students agreed about the distribution of the workload in the various disciplines, with almost half of them considering it equilibrated and half not.
The students' feedback on the distribution of the workload within their team presents a range of perspectives. Several students highlighted imbalances, noting that disciplines such as Architecture (D01) and Construction (D02) demanded significantly more effort

compared to others, resulting in unequal work distribution. Some students acknowledged that despite contributing, they felt like they were free riders, while others believed the workload was manageable if team members knew their roles. Additionally, issues such as changes in plans due to architectural dependencies impacted workload. Conversely, a few students felt the workload was well-distributed, indicating varied experiences across the team. Overall, the responses suggest a need for more equitable task distribution and better coordination to ensure a balanced workload.

Answers from students: (question 3)

1. I say it again I think is better if 2 Students work an architecture because everything depends on architecture model and it take a time and after that because of support system or MEP we have to change the plan maybe more than twice and it's took a long time
2. Its hard because some person can have other things, or other projects at the same time
3. For example 01 and 02 had way more work load to do
4. I did a lot of work but I still feel like I was partly a free rider
5. I put yes
6. D1 was toooooo much work
7. For me yes
8. It was a good workload in case the people know what to do.
9. Some tasks are more demanding than others
10. We didnt
11. divide the disciplines fairly.
12. Because some of the discipline where less workload then other.
13. I think it was okey
14. I said yes
15. I got to the first discipline and also the 9.th and helped regularly with the reporting. For example Video doing
16. The workload for architecture, structure discipline was much greater then the others

The students' reflections on their team working experience reveal a mix of positive and negative aspects. On the positive side, many students appreciated the overall teamwork and communication, noting effective use of tools like WhatsApp for coordination. They also highlighted that the work across various disciplines, particularly structural and MEP, was completed in a timely manner. Some felt their team was calm and supportive, with good communication and workflow. However, several challenges were also identified. A recurring issue was the uneven distribution of

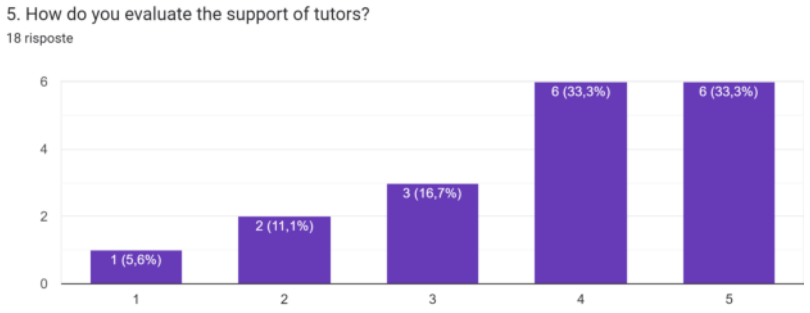
knowledge and engagement among team members, leading to frustration and additional pressure on some students. The constraints of working online, especially via Zoom, were mentioned as demotivating, suggesting a preference for in-person collaboration. Timing issues were another significant concern, with many students struggling to balance this project with other academic commitments, particularly during exam periods. Additionally, there were reports of inconsistent seriousness towards the project among team members and difficulties in achieving uniform understanding of tasks. Some students mentioned excessive workload and issues with communication with teachers. Overall, these challenges indicate areas for improvement in future projects.

Answers from students: (question 4)

1. Everything was good
2. Timing, Personally I had lots of other things to do. And they took lots of time from my work
3. The thing that not all of us were on the same degree and couldn't understand same things
4. Everything went well
5. Well: work of all disciplines done
6. Bad: too much work do review
7. Good teamwork good communication bad communication with the teachers
8. I think that we are good team but not all thing are done well like MEP part
9. The structural and the MEP were good, very responsive to the work and time schedule.
10. Students were most of the time busy with other studies. On the positive side we had good communication through whatsapp
11. Having to work online it had come across really hard to motivate ourselves, when the only way we could connect was through zoom and messages. I suggest not making this online even though it may stand for „digital" in the name of the project.
12. Nearly every student was in there exam phase and hat struggle to take time extra for DD
13. The communication was really good. We were a calm team and really supportive. It's sad that one student in our group couldn't make it to the final presentation in Florence. So we couldn't end one discipline
14. Some people took it too seriously and some not enough. It was sometimes a lot of pressure
15. The main problem was the difference between knowledge. That was frustrating for some of us when somebody don't know how to make his job because he haven't done it on studies
16. Everything went well both on the communication side and on the workflow

17. Some of them put pressure on me
18. Some team members weren't engaged to the project as much as the others

The majority of students reported as positive the support of tutors, also with some exceptions.



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Students offered several suggestions to improve collaboration and support:

1. Simplify documentation: Reduce the number of documents to follow, making it easier to track and manage information;
2. Dedicated Tutor Support: Assign a dedicated tutor to each group from the project's start to assist with collaboration, file uploads, and software installation, including necessary plugins for Revit.
3. Flexible Tutorial Times: Offer more flexible and evening tutorial sessions to accommodate students' schedules better.
4. Consistent Tutor Engagement: Ensure tutors are consistently supportive and engaged, with balanced demands across the board.
5. Notification System: Improve the notification system, such as ensuring teachers are always informed through Moodle.
6. Equal Work Distribution: Strive for a more equitable distribution of work and ensure participants have similar experience levels.
7. Reduce Competition: Consider making the project less of a competition to reduce stress and pressure on student

These suggestions aim to enhance the overall collaboration, support, and efficiency of the project.

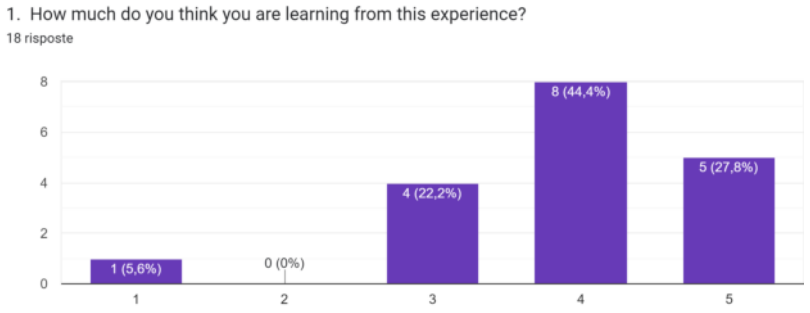
Answers from students: (question 6)

1. Answer to the emails
2. It will be better to have less different documents to follow for the work. And if the first day of the project it will be possible that each group gets an tutor that assigned to help with all the collaboration part, where to upload that files, how to install the programs, AND PLUGINS for revit.
3. Offer more flexible and evening tutorial times. The teachers were not always notified through the moodle.
4. Some tutors were overly supporting while others seemed not to care so much. The same was with demands.
5. Don't make it a competition maybe, because some of the people took it to seriously and so it was really tressfull and way to much
6. No, in my case tutors was really helpful
7. Distribution of the work should be better and the participants should be somehow on the same experience level

F. VALUE FOR THE FUTURE

1. How much do you think you are learning from this experience?
2. Do you have any suggestion to make Digital Decathlon competition more attractive?
3. How much do you value the DD experience in your CV?

Beyond one exclusion, all students considered the Digital Decathlon as a learning experience.



Some suggestions have been provided to improve the attractiveness of the DD:

1. Public Presentations: Showcase projects to a wider audience, including all students and external guests, especially during events like in Florence.
2. Extend On-Site Time: Allocate more time for in-person collaboration and reduce reliance on online work.
3. Balance Workload and Improve Communication: Ensure a fairer workload, offer more help, and improve communication between students and tutors.
4. More Teacher Interaction: Offer more frequent contact with teachers through online lectures and in-person sessions.
5. Longer, Focused Trips: Make trips longer with intensive collaborative work and less at-home tasks
6. Increase Credit Points: Award more credit points to reflect the project's effort and workload.
7. Maximize In-Person Collaboration: Schedule more in-person collaboration during trips for better teamwork and outcomes.

1. If you show the project other student it or in Internet it would be nice I mean in Florence we could present it for all of the students not just the

team from DD I think it can be nice if you invite external people for the presentation

2. More time in Florence!!
3. Do more in place and les online
4. Much sponsored
5. Less work more help and better communication
6. Friends, new competition, improve the language
7. It's very attractive as is, again my experience based on the team work that didn't went well, but the importance of knowing new people from all Europe, that working in the construction industry its very important.
8. More contact with teachers, eg. Some online lecture
9. Maybe making the trips longer and there applied hard work, and no work on the project during staying at home.
10. Maybe to give from this competition more input for the future students
11. More credit points
12. I think it would be much better if it all took place in live meeting, for example one week working in Wuppertal
13. More time with people in present
14. I don’t have at the moment
15. More time collaborating while the trip, less online

Overall, not all students will value the DD experience in their CV, even if the majority of them will do so.