GENERAL PROJECT REVIEW CONSOLIDATED REPORT (HE)

COVER PAGE

PROJECT	
Project number:	101060231
Project acronym:	Exten.D.T.2
Project name:	Extending Design Thinking with Emerging Digital Technologies
Call:	HORIZON-CL2-2021-TRANSFORMATIONS-01
Topic:	HORIZON-CL2-2021-TRANSFORMATIONS-01-05
Type of action:	HORIZON-RIA
Service:	REA/C/01
Project starting date:	1/9/2022
Project duration:	36 months

PROJECT REVIEW	
Period covered:	from 1/9/2022 to 29/2/2024
Reporting period number:	1
Date of the latest version of DoA against which the assessment is performed:	8/6/2022
Date of meeting with consortium (if applicable):	19/4/2024 – 19/4/2024
Name of project officer:	Angel FUENTES MATEOS
Name(s) of monitors:	- Davinia Hernández Leo - Markus VINCZE

1. OVERALL ASSESSMENT

1. Overall assessment

- ◉ The project has fully achieved its objectives and milestones for the period.
- ○ The project has achieved most of its objectives and milestones for the period, with relatively minor deviations.
- ○ The project has achieved some of its objectives and milestones. However, corrective action will be required.
- ○ The project has failed to achieve critical objectives and/or milestones and/or is severely delayed.

2. General comments (executive summary)

The project's research and innovation focus on integrating the use of emerging technologies effectively to enhance the pedagogical value and address the shortcomings related to the application of the design thinking methodology. It also aims to promote sustainable digitization, supporting the widespread deployment of design thinking methodologies. This has the potential to redefine educational paradigms to bring Design Thinking (DT) and skills of the 21st century to future learners.

The project has made significant progress in all the foreseen areas. The project exceeds the expected numbers of participating teachers, students, publications, etc. at this stage. Upcoming actions involve raising the TRL of the project's technologies, expanding the empirical evidence supporting the approach, increasing dissemination efforts, and targeting policy making. To scale out to teachers, students, policymakers and other stakeholders will be then main challenge for the final period.

3. Recommendations

Recommendation 1: The consortium is already anticipating the challenge of reaching higher numbers of participants for pilots, teacher training actions, and dissemination activities across all stakeholders. To address this challenge, the consortium is encouraged to develop a comprehensive plan. The plan should also tackle the objective of creating a network of schools (and other organizations) that collaborate on design projects during and beyond the project timeframe. This effort would not only help achieve the promised indicators and ensure sufficient participation for generating significant empirical findings, but also serve as a foundation for articulating inputs for policymaking and for fostering the adoption of the project outcomes. Some suggestions for the plan include, but of course are not limited to, framing the teacher training in the country strategies for developing digital competences for education (DigiComEdu) (or other policies), an alignment with the school curriculum (e.g. using full-fledged pedagogically-sound examples), connecting with other frameworks such as the Education for Sustainable Development (ESD) framework of UNESCO, linking with topics such as AI and modern technologies, establishing links with teacher networks and teacher-oriented conferences, providing multilingual support, etc. Questions to be answered in this line be the consortium include: How to articulate to a policy for teacher training using the ExtenDT2 framework? How to push policy makers to extend their knowledge and push emerging technologies for young learners? How is the ExtenDT2 framework distributed to teachers? How to obtain uptake by students? Policy making could be also strengthened jointly with the sister projects.

Recommendation 2: An angle contributing to sustainability refers also to the decisions made in the design of the technological infrastructure and the strategies (from a technology perspective) for facilitating exploitation. Related considerations include the use of learning technology standards (or well-justified, worthwhile alternatives) and open science principles. The consortium is encouraged to clarify these decisions and plans, providing necessary documentation to support sustainability and exploitation.
In doing so, the consortium may consider all the possible options of for reaching sustainable maintenance, i.e. by the consortium, or/and the EC (if there are options e.g. in collaboration with sister projects or other spaces supported by the Commission), or/and other parties.

Recommendation 3: The consortium is encouraged to think of additional dimensions that might contribute to adoption, such as those related to user experience and usability or to the notion of inclusive education addressed by the project.

Recommendation 4: The project is producing excellent results. Make sure the Webpage is updated regularly and with all different aspects of communication and dissemination to the wider public, teachers, and researchers. Also, you have results to reach out to policy makers, use them and make them public.

Recommendation 5: Reporting, both written and in presentations, focused on what has been done in terms of actions and processes. The reporting would benefit from a focus more oriented towards the knowledge generated and the actions that contribute to adoption (both in terms of the knowledge and the technologies developed). For example, reporting should

emphasize more the the insights achieved in terms of addressing the shortcomings of the Design Thinking methodology or advancing educational technology state of the art, what is advanced in understanding DT and the uptake of ET, on how this has been used to approach schools, and what approaches to engage teachers and students and other stakeholders have been successful.
4. EIC follow up actions (for EIC actions)
N.A.
5. Does the project meet the necessary conditions for receiving additional grants under the EIC? (for EIC actions)
○ Yes ○ No ◉ Not applicable
N.A.

2. OBJECTIVES AND WORK PLAN

1. Is the progress reported in line with objectives and work plan as specified in the DoA? If there are significant deviations, please comment.

- (•) Yes
- ( ) No
- ( ) Partially
- ( ) Not applicable

General comments to all WPs:

WP1: Overall, the project management is very good. All procedures are in place. The consortium has been efficiently and effectively managed in all the relevant aspects. The partners had regular exchange and meetings. Deliverables have been submitted on time. The project includes a scientific advisory board comprised of members with relevant expertise. A risk table is continuously monitored. The project is communicating with the sister projects, e.g., invitations to kick-off meetings and an upcoming conference, where all sister projects will participate in a jointly organized workshop.
The use of resources is generally on track, with most of the partners having spent a bit less than half of the budget. Higher effort is expected in the next cycle of the project, which will include scaling up experimentation in schools. Deviations are observed in the spending of PM for UGent (only 24%), which are explained by internal issues and circumstances in their institution related to the high cost of the researchers that are actually working on the project. There is also a shift in the effort to align with the school year, which had a limited overall impact. For the development of the ExtenDT2 platform there was a shift of resources. Additional minor deviations relate to unplanned costs associated with Amazon Web Services and an independent ethics advisor.

WP2: A first version of the extenDT2 framework was developed based on a comprehensive literature review and an evaluation with stakeholders in a participatory workshop. The framework includes the guidelines that need to be considered in the implementation of Design Thinking (DT). The framework is represented as a tree with the trunk as actors, the leaves as components the air around as the perspectives, and the roots as the different types of competences (pedagogical, digital, personal, professional). It is presented on the webpage. The literature review has been also useful to identify the shortcomings of the application of the DT to be addressed by the project in terms of the opportunities for emerging technologies. A survey with 108 participants shows very positive response and points out more examples are needed. The partners succeeded to use media to engage teachers to fill the survey. Measures have been posts to reach beyond the project on mailing lists, Scientix, and facebook pages, as incentives gift cards have been used.

WP3: There have been co-design and co-development of seven lesson plans using the project technologies to apply the design thinking methodology (or some of its phases). The three levels of Co-design are: design activity plans, designing the DT activities, and the technologies including tutorials. 145 teachers participated in co-design workshops. The digital artifacts created are: a MaLT2 model representing a maquette of a construction for a vertical garden, a ChoiCo game related to environmental issues, a ChoiCo game about cybersecurity, a ChoiCo again food choices, a SorBET and a ChoiCo games for reducing school energy costs, a ChoiCo game on sustainable development goals, and a virtual robotic artifact based on GearsBot for fire rescue. Additional games (in ChoiCo, SorBET and MALT) with extended functionalities have been created to enable prototyping in the DT process. The artifacts were demonstrated during the review and are accessible in the extenDT2 platform. Moreover, WP3 developed content for teacher training workshops and additional support documents and templates. Remarkably, the WP has also created video tutorials as a response to teachers' requests. Difficulties found in the co-design and co-development process include that teachers have limited time to work with researchers and that is not easy to link school curriculum to DT activities. The challenge will be on how to engage teachers to reach out to schools and students in the next cycles of the project.

WP4: There has been good process in extending already existing digital educational tools with emerging technologies for the digital enhancement of DT learning, namely: a new nQuire version for students, extended MaLT2 tool connected with 3D printing (an export models in 3D), SorBET extended with a gesture interface (AR) and making changes possible with Blockly programming language and additional improvement in the graphical interface, a geolocated AR version of ChoiCo. The project has also created the ExtenDT2 platform to enable the learning design and enactment of DT activities supported by the tools. It integrates the extended learning tools, offering a dynamic environment with choices for different types of (embodied) interaction to classify, innovate, design, deliver, code, create, simulate & analyze (whole DT process, even though in cases teachers may not choose to use the ExtenDT2 platform for all the phases).
This integrative role was originally planned for nQuire, but the consortium justified this change in the plan due to institutional constraints (security standards in the hosting of nQuire at the OU UK) and has been able to offer an effective

alternative (development of the ExtenDT2 platform). All tools have been extended to capture and generate data from interaction events for analysis. The xAPI standard has been adopted for this purpose. Data is sent to the Learning Analytics component. A learning analytics dashboard visualizing the data to support teacher-led decision making during the teaching-learning process is being co-designed with the stakeholders and developed. This development is enabling the alignment of learning design with learning analytics, supporting customizable real-time feedback provision and data-driven learning redesign. Educators can configure data collection, send message to learners, configure feedback, and assess learner's actions for real-time feedback. Ethics requirements are considered, e.g. data download for research anonymized - of only those giving consent. Tools are at TRL5, dashboard and learning analytics at TRL4. This is excellent progress.

WP5: The project has completed a first cycle of school interventions (out of three planned). The Activity plans implement the DT structure, so implicitly aid in introducing teachers to the DT concept and phases. The 21st century skills are aspects linked to the specific phases. At present cycle 2 is ongoing using the newly developed tools. Here the goal is to obtain how the pedagogical concept work in practice. The goal is to co-design the DT activities by teachers and researchers. There have been a total of seven pilot interventions designed and implemented that have reached 212 students in four countries. The designs were co-created between project researchers and teachers. The pilots showed that reliable Internet and computational power in schools is a challenge in the use of the project tools. An outcome of WP5 is also a DT Activity Plan Template created and refined during this first phase that guides the learning design of DT activities. This template has been implemented in the nQuire and the ExtenDT2 platforms. WP5 has also developed the necessary guidelines for the implementation of the pilots in schools. Coordination measures for the organization and monitoring of pilot implementations have been in place. Participatory workshops (with 10 teachers) to inform the design of the learning analytics and feedback components have also been conducted. The research being done to associate learner interaction data with higher-level constructs (five categories) associated with 21st century skills will also represent an important contribution of the project. In addition to scaling up the school interventions, the project now faces the challenge of actually achieving the building of a network or community of schools (and other organizations) that are actually collaborating on co-design projects, as expected in one of the objectives. 21 pilots are planned for the 2nd cycle ongoing in 6 countries reaching to 600 students. The plan for cycle 3 is to reach 1.2K students.

WP6: This WP focuses on supporting teacher professional development. Activities completed include the creation and testing learning modules for the application of DT with emergent technologies. The testing reached 60 teachers in cycle 1. The analyses yielded insights into the DT methodology, the technologies used and the 21st century skills. For the 2nd cycle the learning modules were revised using the ExtenDT2 platform and extended technologies. So far 88 teachers have been reached.
Results so far show some relevant challenges, which include time requirements (training comprises multiple aspects: methodologies, tools, platforms, analytics), the clear link of DT and the tools extended to the school curriculum, the usability/readiness and digital skills required for using the tools, the applicability of the technologies for different subjects.

WP7: WP7 focuses on the iterative evaluation of project activities. The purpose is to use the 3 cycles to improve theory, methods, and tools iteratively. A data collection toolkit has been developed for use in the cycle 1 pilots in schools and professional development actions (WP5, 6). The data collected in the first cycle has been analyzed. The cross-case analysis is especially relevant. A cycle 2 evaluation toolkit has been iterated based on the lessons learnt in cycle 1 and the results from systematic reviews regarding instruments for assessing 21st century skills, digital competences, and design thinking skills. The literature survey showed that existing instruments are not suitable for 11–18-year-olds and assessment was on skills and not competencies. Bespoke survey instrument for teachers and students. As result, the toolkit adapts instruments from previous research and initiatives (e.g. SELFIE) addressing the identified limitations. I.e., the evaluation toolkit for cycle 2 includes a redesign of surveys nd additional data collection instruments to those in cycle 1. Cycle 2 will show the if this new measurement instrument delivers useful data for evaluation.

WP8: This WP has to do with dissemination, exploitation and impact generation. Most efforts have been concentrated so far in dissemination. There is a website with the key information and some resources, but which will benefit from more regular updates (e.g., list of publications). The project has produced videos, a flier, three newsletters, a podcast with a sister project. Research papers have been presented in international conferences, there has been co-organization of a workshop with a sister project (two editions), workshops for teachers (145 teachers, several outside the participating countries, e.g, 23 from Nepal), and there has been participation (including talks) in EU Researcher's night and other outreach events. Presentations in non-scientific events are indeed relevant to reach all the stakeholders and the broader audience and in the search for ways that facilitate adoption. They reached out in social media X, Linked-In, YouTube, where numbers indicated the proposal goals will be reached. There is a first draft for an Open Learn Course with a plan

to offer micro-credentials. Policy briefs contributing to exploitation and impact generation are planned for the second half of the project. I would be relevant that all the results, news, etc. are actually on the webpage and used in other media channels.

WP9: The project has established ethical oversight mechanisms to provide input on planned research and technology development, ensuring responsible progress and adherence to ethical standards. There is an external ethics advisor as well as an Ethics Advisory Board (EAB). Independent assessment of ethical issues is ensured. There is a monitoring of the data management plan, project development and data collection. There are periodic meetings with the EAB and project members. From project meetings several challenges have been raised, e.g., balancing pedagogic needs vs stakeholder interests. Challenges and approaches are discussed with sister projects. The overall work in this WP is enabling the exploration of complex issues relevant for the project and which might be worth documenting and sharing with the broader research community. Complex issues relate to the consideration of stakeholder values, the perspective of gender and special needs, the boundaries of informed consent and absence, or the tensions between ethics, research needs and educational requirements.

The periodic report is very good, complete and informative. The summary of "Activity highlights" is especially helpful. And it would be even more useful to give also (or rather) "Result highlights" in relation to project objectives and expected outcomes.

2. Are the objectives of the project still scientifically, technologically and economically relevant?

- ◉ Yes
- ○ No
- ○ Partially
- ○ Not applicable

Project's objectives remain highly relevant from scientific, technological, and economic perspectives.

3. Critical risks

- ◉ Yes
- ○ No
- ○ Partially
- ○ Not applicable

There are no critical risks at the moment. Risk monitoring is in place.

4. Does the project respect the 'do no significant harm' principle?

- ◉ Yes
- ○ No
- ○ Partially
- ○ Not applicable

This is taken care of by the management team.

5. Is the gender dimension appropriately taken into account?

- ◉ Yes
- ○ No
- ○ Partially
- ○ Not applicable

The gender dimension is considered both in the work implementation and in the research studies.

6. Does the project respect the commitments concerning open science as described in the DoA? Is it undertaking additional open science practices?

- ◉ Yes
- ○ No
- ○ Partially

○ Not applicable

The project is respecting commitments regarding open science so far.

7. Is the project adequately integrating social sciences or/and humanities? (for SSH topics)

◉ Yes
○ No
○ Partially
○ Not applicable

The project is interdisciplinary in its conception, composition, work plan and implementation.

8. Have the ethics/security deliverables due for the current period been adequately addressed and approved?

◉ Yes
○ No
○ Partially
○ Not applicable

There is an Ethics Advisory board that meets regularly to cope with these issues.

9. Did the fellows/staff members demonstrate sufficient knowledge of the research project?

◉ Yes
○ No
○ Partially
○ Not applicable

Both in documents and during the review, the project members demonstrated expertise in the project topics.

10. Were the fellows aware of their rights and obligations as a Marie Skłodowska Curie fellow?

○ Yes
○ No
○ Partially
◉ Not applicable

No comment provided

11. Did any issues requiring REA follow-up arise during the meeting?

○ Yes
◉ No
○ Partially
○ Not applicable

No.

12. Has the project effectively addressed the relevant standardisation aspects in R&I activities?

◉ Yes
○ No
○ Partially
○ Not applicable

Regarding educational technology standards, the project utilizes xAPI. Although the standard LTI was considered for tool integration, an alternative method was selected. It is important to document this approach and its rationale to support the project's sustainability and facilitate future extensions of the platform developed.

13. Did the EIC beneficiaries prioritise IP protection over dissemination when applicable, particularly with regards to results with market potential?

○ Yes

○ No ○ Partially ◉ Not applicable
N.A.
14. Have the comments and recommendations from previous project reviews been taken into account?
○ Yes ○ No ○ Partially ◉ Not applicable
N.A.

3. IMPACT

1. Is the proposed pathway to achieve the expected outcomes and impacts still credible?
◉ Yes ○ No ○ Partially ○ Not applicable
There has been excellent progress and it is expected to achieve the goals.
2. How will the project have an impact on policy making (if any)?
◉ Yes ○ No ○ Partially ○ Not applicable
The project is advancing learning technologies by providing tools enhanced with emergent technologies that addresses shortcomings of the digitally-mediated application of design thinking in learning scenarios. This offers important opportunities to uptake by policy. The consortium is planning now the actions to facilitate the attention and potential adoption by policy makers. Recommendations in this direction are provided.
3. Please indicate the EU headline priorities to which the project has contributed or will contribute to.
☐ European Green Deal ☑ Economy that works for people ☑ Europe for the digital age ☑ Promoting the European way of life ☑ A stronger Europe in the world ☑ A new push for democracy
Since the project advances teaching methodology and pedagogical approaches for all learners, it is possible to see a widespread push to promote many important aspects such as improving innovation and economy for people, the digital era, promoting the European way of life, a stronger Europe in the world, and a push for democracy.
4. Are the measures to maximise impact still suitable? (n/a for EIC Pathfinder)
◉ Yes ○ No ○ Partially ○ Not applicable
Yes so far. Recommendations in this direction are provided.
5. Are the measures for public/stakeholder engagement properly implemented? (for EIC Pathfinder)
○ Yes ○ No ○ Partially ◉ Not applicable
N.A.
6. Translation into innovation (for EIC Pathfinder)
○ Yes ○ No ○ Partially

◉ Not applicable
N.A.
7. Empowering key actors (for EIC Pathfinder)
○ Yes ○ No ○ Partially ◉ Not applicable
N.A.

4. IMPLEMENTATION

1. Has the project been efficiently and effectively managed (including risk management)?

- (●) Yes
- ( ) No
- ( ) Partially
- ( ) Not applicable

The project is being excellent in the management, including risk update and monitoring.

2. Have all the obligations described in the grant agreement (contract) been respected by the participants (including ethics and security requirements, if applicable)?

- (●) Yes
- ( ) No
- ( ) Partially
- ( ) Not applicable

The project progresses as planed, meeting requirements - including ethics.
The project actually exceeds the expected numbers of participating teachers, students, publications, etc.

3. Have all participants contributed to the project according to the work-plan described in the DoA?

- (●) Yes
- ( ) No
- ( ) Partially
- ( ) Not applicable

All partners are fully contributing and committed.

4. Have the EIC beneficiaries protected the IPR of the results with market potential (foreground) as planned in the DoA (including patents filing or any other formal IPR protection)? How do the beneficiaries plan to get return on investment over the generated IP? (for EIC Pathfinder)

- ( ) Yes
- ( ) No
- ( ) Partially
- (●) Not applicable

N.A.

5. Have the participants disseminated project results (foreground) and have they communicated project activities and results as planned in the DoA (e.g. through publications, a page for the project on social media, press-releases, a website, video/film, etc.) and have they included a reference to EU funding?

- (●) Yes
- ( ) No
- ( ) Partially
- ( ) Not applicable

There have been media and wider public articles and presentations and scientific publications, with more to be expected and under way.

6. If the plan for exploitation and dissemination provides for exploitation primarily in non-associated third countries, have the participants explained how that exploitation is still in the EU interest? Is it acceptable?

- (●) Yes
- ( ) No
- ( ) Partially
- ( ) Not applicable

Partners used links to reach out to non-associated third countries, which is fully in line with EU interests.
7. Are the critical implementation risks and mitigation actions described in the DoA still relevant?
◉ Yes ○ No ○ Partially ○ Not applicable
Identified risks are still up to date and monitored.

5. RESOURCES (N/A FOR LUMP SUM AND UNIT GRANTS)

1. Were the resources used as described in the DoA and were they necessary to achieve the project objectives?
◉ Yes ○ No ○ Partially ○ Not applicable
Resources used have been in line with half term project expectation and to achieve project objectives.
2. If there are significant deviations from planned budget, have they been satisfactorily justified?
◉ Yes ○ No ○ Partially ○ Not applicable
All as planned without minor exceptions that were handled well.
3. If unforeseen subcontracting costs are declared, do you agree with them?
○ Yes ○ No ○ Partially ◉ Not applicable
There have not been unforeseen subcontracting costs.
4. If unforeseen in-kind contributions costs are declared, do you agree with them?
○ Yes ○ No ○ Partially ◉ Not applicable
N.A.

Annex 1

Expert opinion on deliverables

Deliverable number	Deliverable name	Status	Comments
D1.1	Project Handbook	Accepted	No need for revision
D1.2	Initial Data Management Plan	Accepted	No need for revision
D1.3	Updated Data Management plan	Accepted	No need for revision
D1.4	Final Data Management Plan	Not submitted	
D2.1	Report on the Theoretical Review	Accepted	No need for revision
D2.2	The Exten.(D.T.)2 Framework	Accepted	No need for revision
D2.3	Guidelines for Mass Deployment	Accepted	No need for revision
D3.1	Report on educational activities for students	Accepted	No need for revision
D3.2	Report on supporting material for stakeholders	Not submitted	Submission date has officially been moved to M24, which is not in the system yet.
D3.3	Report on training material and guidelines for teachers	Accepted	No need for revision
D3.4	Report on the Exten.(D.T.)2 toolkit	Not submitted	
D4.1	Technical specifications for DT platform, LA, AR and 3D printing technologies	Accepted	No need for revision
D4.2	DT platform, LA, AR and 3D printing technologies for DT2 (1st report)	Accepted	No need for revision
D4.3	DT platform, LA, AR and 3D printing technologies for DT2 (2nd report)	Not submitted	
D4.4	DT platform, LA, AR and 3D printing technologies for DT2 (final report)	Not submitted	
D5.1	Report on the activities plans for school interventions	Accepted	No need for revision
D5.2	Report on the pilot implementation	Accepted	No need for revision
D5.3	Report on 2nd and 3rd year implementations	Not submitted	
D5.4	Report on ALA user analysis	Not submitted	
D6.1	Report on pilot PD activities	Accepted	No need for revision
D6.2	Report on the implementations of PD activities	Not submitted	

Deliverable number	Deliverable name	Status	Comments
D6.3	OpenLearn online course	Not submitted	
D7.1	Cycle 1 Evaluation Report	Accepted	No need for revision
D7.2	Cycle 2 Evaluation Report	Not submitted	
D7.3	Cycle 3 Evaluation Report	Not submitted	
D8.1	Dissemination and Exploitation plan.	Accepted	No need for revision
D8.2	Dissemination and Impact Report 1	Accepted	No need for revision
D8.3	Dissemination and Impact Report 2	Not submitted	
D8.4	D8.4 Policy Brief	Not submitted	
D9.1	OEI - Requirement No. 1	Accepted	No need for revision

Annex 2

Expert opinion on milestones

Milestone number	Milestone name	Achieved	Comments
MS2	Implementation plan is released	Yes	Achieved
MS3	Learning activities and resources for school interventions and for Professional Development are ready	Yes	Achieved
MS4	The enhanced educational technologies, i.e. AR Games, programming application for 3D printing/scanning, Virtual Robotics are developed in TRL4 and have been connected with the nQuire platform	Yes	Achieved
MS5	End of Cycle 1 evaluation & Roadmap for Cycle 2 based on evaluation input	Yes	Achieved
MS6	Authorable Learning Analytics and Dashboard are developed in TRL4 and have been connected with the nQuire platform	Yes	Achieved