European Commission

Creativity – a transversal skill for lifelong learning. An overview of existing concepts and practices

Final report – Annex I
Case Studies

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2020

Joint Research Centre

This report was prepared as part of the study' Creativity – a transversal skill. An overview of existing concepts and practices', which was commissioned by the European Commission's Joint Research Centre and conducted by PPMI and prof. Bill Lucas.

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EU Science Hub
https://ec.europa.eu/jrc

JRC122016

PDF ISBN 978-92-76-27447-6 doi:10.2760/33215

Luxembourg: Publications Office of the European Union, 2020

How to cite this report: Venckutė, M., Berg Mulvik, I., Lucas, B., Creativity – a transversal skill for lifelong learning. An overview of existing concepts and practices. Final report, Annex I (Bacigalupo, M., Cachia, R., Kampylis, P., Eds.), EUR 30479 EN, Publications Office of the European Union, Luxembourg, 2020, ISBN 978-92-76-27447-6, doi:10.2760/33215, JRC122016.

Contents

List of abbreviations

CPSI	Creative problem-solving institute
CCT	Critical and creative thinking
DeSeCo	Definition and selection of competencies
DigComp	The European Digital Competence Framework for Citizens
ECEC	Early childhood education and care
EntreComp	The European Entrepreneurship Competence Framework
ERI-Net	Asia-Pacific Education Research Institutes Networks
EU	European union
ICT	Information and communication technology
JRC	Joint Research Centre
HE	Higher education
LifeComp	The European Framework for the Personal, Social, and Learning to Learn Key Competence
MENA	Middle East and North-Africa
MOOC	Massive open online course
NGO	Non-governmental organisation
OECD	Organisation for Economic Co-operation and Development
O*NET	Occupational Information Network
P21	Partnership for the 21st Century Learning
PISA	Programme for International Student Assessment
STEM	Science, technology, engineering and mathematics
TTCT	Torrance tests of creative thinking
UNICEF	United Nations Children's Fund
UNESCO	United Nations Educational, Scientific and Cultural Organization
VET	Vocational education and training
WEF	World Economic Forum

Introduction

The purpose of the case studies was to reveal how creativity is conceptualised, translated into learning objectives, taught, and assessed.

Out of 34 cases described for the inventory (see Annex II to the present report), eight were selected for a more detailed review:

- Three 'Tinkering EU' projects: 'Tinkering: Contemporary Education for Innovators of Tomorrow', 'Tinkering EU: Building Science Capital for ALL', and 'Tinkering EU: Addressing the Adults';
- 'Design thinking in higher education for promoting human-centred innovation in business and society';
- 'Teaching creativity in engineering';
- Victorian curriculum and assessment;
- IDEO Creative Difference;
- Lead Creative Schools;
- 'Creative thinking in youth work';
- High-performing cycles (ETHAZI).

These are well-documented policy and grass-root initiatives of broad scope, high degree of maturity, and observable impact. Together, they cover different countries, sectors, levels and settings of education and training, focus areas, target groups, levels of implementation, and funding arrangements.

For each case, desk research was conducted along with email enquiries and telephone interviews with the people involved in their design and/or implementation. Concise yet informative case study reports were then prepared, covering such aspects as design features, conceptualisation of creativity, teaching and learning, assessment, results, key drivers and challenges, and lessons learned. To boost the accuracy and facilitate the interpretation of the descriptions, throughout them, terms adopted by the case owners are used

Tinkering EU

At a glance

Target group(s)	Adults as educators and learners; in the first two projects, school-age children as well
Sector(s), level(s), and settings covered	Non-formal learning, museum, and other non-formal settings
Level of implementation	European
Funding arrangements	Funded by the European Commission (Erasmus+ Programme 2014-2020)
Key premises	Making and tinkering practices serve to develop important lifelong learning skills such as creativity, divergent thinking, innovation, problem-solving, persistence, determination, self-motivation, and entrepreneurship
Definition of creativity	Creativity was not clearly defined but linked to thinking creatively, working creatively with others, and implementing innovations
Related competences and skills	Innovation, entrepreneurship, self-confidence, and critical thinking
Pedagogical approaches and methods	Tinkering
Assessment approaches and methods	No formal assessment, in the second project – an observation of learners and reflection upon their experience
Drivers	- The novelty and potential of tinkering, which allowed to build a strong case for learning - The strength of the Consortium and complementary experiences of its members - Training workshops for museum educators and teachers before involving them in the tinkering activities with the children through the multiplier events - Having teacher ambassadors in the second project - Beginning at the museums, and then moving on to engaging the disadvantaged communities and adults
Barriers	- Challenges to sustain the engagement of teachers throughout the project duration (three years) - Lack of direct interaction among the partners throughout the project duration (three years)
Results	Promotion of tinkering and improvement of learner skills (including creativity).
Key messages and lessons learned	- Tinkering offers much potential for the development of creativity as a transversal skill and is particularly well suited for informal learning. - Tinkering also has much potential towards underserved/vulnerable groups. Tinkering activities may look simple, but they are underpinned by complex pedagogies

and based on thorough research; to conduct them successfully, one needs to study the methodology (ideally, participate in training), try to deliver activities that have already been tested, observe the participation of learners and reflect upon it.

Introduction

In the sections below, we provide a detailed description of three Erasmus+ projects implemented one after the other under the same name 'Tinkering EU'. These are:

- 'Tinkering: Contemporary Education for Innovators of Tomorrow' (project reference: 2014-1-IT-02-KA200-003510), henceforth 'Tinkering EU 1'
- 'Tinkering EU: Building Science Capital for ALL' (project reference: 2017-1-IT02-KA201-036513), henceforth 'Tinkering EU 2'
- 'Tinkering EU: Addressing the Adults' (project reference: 2019-1-NL01-KA204-060251), henceforth 'Tinkering EU 3'

First, we outline the design of each project, specifying the context, objectives, timeframe, level of implementation, geographical scope, target groups, sectors, levels, and settings covered, key activities, actors involved and funding arrangements. Second, we explore how creativity has been defined and embedded in project activities. Third, we explain the Tinkering methodology and how it has been applied to develop the 21st century skills. Fourth, to the extent that existing data allows, we present the results of and lessons learned from the first two projects.

The description of 'Tinkering EU' is primarily based on desk research. All projects have been very well documented. Key sources reviewed include project websites,[1] the Final Report of the 'Tinkering EU 1', the Interim Report of the 'Tinkering EU 2', descriptions of projects retrieved from the Erasmus+ Project Results Platform and project resources. To complement desk research, in-depth interviews were conducted with the coordinator of 'Tinkering EU 1' and 'Tinkering EU 2' – dr. Maria Xanthoudaki (Director of Education and Centre of Research in Informal Education (CREI) at the National Museum of Science and Technology 'Leonardo da Vinci', Milan, Italy) and coordinator of 'Tinkering EU 3' – Inka de Pijper (Senior Project Manager in Education at the NEMO Science Museum, Amsterdam, the Netherlands). To boost the validity of the analysis and reliability of the research results, we have applied the principle of triangulation – where possible, verified information by cross-checking different data sources.

Design of the initiative

Context and objectives

The three 'Tinkering EU' projects were launched to help individuals develop their STEM competences and 21st century skills such as creativity, innovation, entrepreneurship, self-confidence, and critical thinking. Each initiative intended to do so through the international cooperation for the educational innovation – the promotion of Tinkering mainly in the informal (museum) but also formal (school) settings. Developed by the Exploratorium in San Francisco, California, Tinkering had proven to be a powerful tool contributing to the improvement of the key competences and transversal skills, and connecting science knowledge and skills with the requirements of the contemporary labour markets (National Museum of Science and Technology 'Leonardo da Vinci', 2020a).

Tinkering has emerged over the last decade from the successful 'maker movement' – a social, technological, and economic grassroots movement which celebrates do-it-yourself (DIY) and do-it-with-others (DIWO) making practice through artisan crafts and emergent technologies using physical and digital resources (Brahms, 2014). Within the maker community, 'making' is typically characterised by people coming together to use, share, manipulate and innovate tools, materials, ideas, and methods (Harris, Winterbottom, Xanthoudaki, Calcagnini, and de Pijper, 2016). The outcomes of the making process can be very diverse. These features of making attract tens of thousands of people each year, all despite the concerns of the scientific education community about the increasing disaffection with the role of science and technology (Ibid). According to Harris et al., practices emerging within maker communities embody many of the core features of the inquiry-based science education approaches often applied in STEM (2016). Moreover, evidence shows that making practices serve to develop important lifelong learning skills such as creativity, divergent thinking, innovation, problem solving, persistence, determination, self-motivation, and entrepreneurship. For these reasons, informal science learning institutions, mainly in the USA, set out to get people to explore scientific phenomena directly through playful, immersive, creative, and physical activities that are learner-centred and driven by individual motivations and personal interests (Ibid). The Exploratorium has been developing, testing, and refining

[1] The website of Tinkering EU 1 is available at http://www.museoscienza.it/tinkering-eu/, the website of Tinkering EU 2 – at http://www.museoscienza.it/tinkering-eu2/, and that of Tinkering EU 3 – at http://www.museoscienza.it/tinkering-eu3/.

making activities since 2008 and continues to invite visitors to investigate, experience, and explore scientific phenomena through carefully designed making activities using a range of tools, materials and technologies. This is called Tinkering, work on which was consolidated into methodology – STEM-rich branch of making which emphasises creative problem solving, thinking with hands learning through iterative design and testing (Ibid).

Key learning dimensions of tinkering include initiative and intentionality, problem-solving and critical thinking, conceptual understanding, creativity and self-expression, social and emotional engagement. Thus, creativity is required in any tinkering activity (Exploratorium, 2017).

Inspired by the potential of this methodology, maker movement placing value on an individual's capability to create, and a shift in the discourse on education towards student-centred learning, 'Tinkering EU 1' was launched. The key goal was to introduce Tinkering in Europe – build the know-how within the Consortium and then disseminate it to create a community of practitioners working with this methodology (National Museum of Science and Technology 'Leonardo da Vinci', 2020b). The first project suggested that Tinkering may have potential in school education, hence the aim of 'Tinkering EU 2' to explore the use of Tinkering for the development of science capital in schools of the disadvantaged communities (National Museum of Science and Technology 'Leonardo da Vinci', 2020a). Having learned about the potential of Tinkering to help engage vulnerable groups, 'Tinkering EU 3' was launched to foster the socio-educational and personal development of disadvantaged adults (National Museum of Science and Technology 'Leonardo da Vinci', 2020c).

The context, general and specific objectives of each project are outlined in the table below. While all the three projects centre on the promotion of Tinkering, certain aspects of them differ, e.g. the empowerment and social inclusion through the engagement in science have been addressed in the second and third projects only.

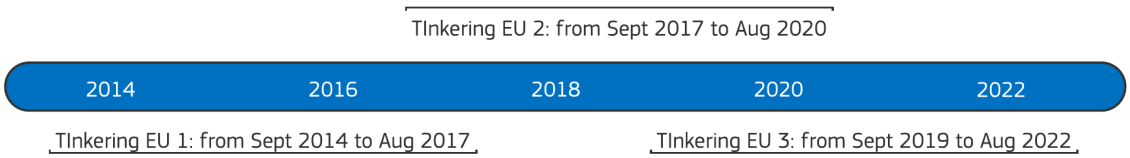
Table 1. Context, General and specific objectives of the 'Tinkering EU' projects

	Context	General objectives	Specific objectives
Tinkering EU 1	- Need for the 21st century skills such as self-confidence, critical thinking, social engagement, innovation and entrepreneurship - Need for science and technology competence	Implement tinkering as an innovative pedagogy at a European level by creating a Europe-wide community of practitioners and encouraging the exchange of the expertise and practice between formal and informal learning institutions	- Enrich skills and competences with specific reference to STEM - Contribute to the development of the 21st century (transversal) skills: creativity, innovation, and entrepreneurship - Promote a learner-centred pedagogical approach (tinkering) - Improve the attractiveness of, attainment in, and lifelong relationship with science and technology for adults and students - Implement the innovative pedagogy of tinkering in school and out-of-school contexts at a European level and create a Europe-wide community of practice working with this pedagogy - Encourage the cooperation and exchange of the expertise and practice between formal and informal learning institutions and professionals
Tinkering EU 2	- Need for the 21st century skills, hence pedagogic approaches and tools to help develop these - Increasing demand for special attention to learners from vulnerable groups, hence need for action towards social inclusion and equity - Increasing importance of science as a tool for active citizenship - Dificulties encountered by schools in building a positive relationship between young people and science, especially in the disadvantaged communities	Develop the 21st century skills and the science capital of the disadvantaged youth and contribute to the improvement of the science education in schools of disadvantaged communities	- Develop young people's 21st century skills – creativity, innovation, entrepreneurship, and critical thinking – and science capital - Empower young people through their engagement in science - Improve school practice through the innovative pedagogy (tinkering) and a new science education approach (science capital) - Encourage the exchange of expertise and practice in science education and social inclusion between formal and informal learning institutions - Expand and strengthen the Europe-wide community of practice working with tinkering
Tinkering EU 3	- Poor engagement of adults with science and technology - Increasing science and techology competence gap between generations - Need for the 21st century skills in social and professional life - Low science capital of disadvantaged adults	Foster the socio-educational and personal development of adults, as well as their participation in civic and social life	- Develop adults' 21st century skills and address their low science capital - Empower adults through their engagement in science - Encourage the exchange of knowledge and expertise in science education and social inclusion between the community and informal learning sectors - Sustain the Europe-wide community of practice working with tinkering and help the informal learning organisations to become more inclusive

Source: Compiled by the authors based on the data retrieved from the Erasmus+ Project Results Platform and project websites.

Timeframe

The three projects have been implemented one after the other since 2014. Each has or will have had taken three years. The timeline of the three projects is outlined in the figure below.



Source: Compiled by the authors based on the data retrieved from the Erasmus+ Project Results Platform.

Figure 1. Timeline of the 'Tinkering EU' projects

Level of implementation and geographical scope

'Tinkering EU' projects have been implemented at the European level. The number of countries participating in 'Tinkering EU 1' was five. It increased to seven in 'Tinkering EU 2' and dropped by one in 'Tinkering EU 3'. While Italy, the Netherlands and the United Kingdom have engaged in all three projects, Austria has participated in the last two, and the rest of the countries have been involved in either the first (Germany and Hungary), or second (Ireland, Spain and Greece), or third (France and Poland) project. The map below identifies countries that have participated in 'Tinkering EU' and specifies how many projects they have joined.

Map 1. The geographical scope of the 'Tinkering EU' projects

Source: Compiled by the authors based on the data retrieved from the Erasmus+ Project Results Platform.
Note: The darker the colour, the more 'Tinkering EU' projects an organisation(s) from a given country joined.

Target groups, sectors, levels and settings of education and training covered

The primary target group of 'Tinkering EU 1' was adults, particularly parents, museum educators and teachers of secondary schools. Parents participated in the tinkering activities with their children, whereas teachers – with students from 12 to 18 years old (National Museum of Science and Technology 'Leonardo da Vinci', 2020b).

'Tinkering EU 2' set out to address museum educators as well as primary and junior high school teachers. The latter have joined tinkering activities with their students from 8 to 14 years old (European Commission, n.d.). The focus has been on school groups from communities characterised by a socio-economic, educational, cultural, and/or linguistic disadvantage.

The third and on-going 'Tinkering EU' project aims to address adults from underserved groups, e.g. refugees, asylum-seekers, people with low income, mental health issues, ex-offenders, unemployed adults and young adults not in formal education (National Museum of Science and Technology 'Leonardo da Vinci', 2020c). The intention is to reach these adults through the involvement of their educators.

All the three projects have been heavily focused on the professional development of educators – museum and school educators in the first two, museum and other adult educators in 'Tinkering EU3'. Learners have also been directly involved, primarily through the multiplier events. The last two projects have been set out to reach vulnerable groups (school students in the second project and adults in the third one).

All project activities have been implemented in science museums where informal learning takes place. Partners of the first two projects intended for Tinkering to also be transferred by teachers from there to schools.

Key activities

'Tinkering EU' projects have been designed in a similar way and comprised certain types of activities each:[2]

- **Development of the (theoretical and) methodological frameworks**. While the first one focused on the key features, benefits, and applications of Tinkering, the second one linked it to the development of science capital and inclusive STEM teaching at school. As part of the third project, a framework linking Tinkering with equity and inclusion in STEM and education of underserved adult groups is now being prepared.
- **Tinkering activities**. In the first project, new activities were designed and tested with school and family audiences. In the second one, activities well-suited for schools were selected and tested with teachers and students from disadvantaged communities. The third project intends to tailor certain activities for the disadvantaged adults and test them with adult educators and learners.
- **Development of pedagogical materials**. As part of the first project, the following were produced: a practitioner guide, a guide to tinkering activities and professional development guidelines. In the second project, tinkering activities for schools from the disadvantaged communities have been compiled, and observation and reflection tools are now being prepared. Within the frames of the third project, guidelines for focus groups will be developed to help museum educators work with adult groups and families, especially those from the disadvantaged communities.
- **Training workshops**. All workshops have focused on sharing the knowledge and practice of Tinkering. In the first two projects, educators from museums and schools joined, whereas the third project foresees training for those working with disadvantaged adults (be it museum staff or educators from the community organisations).
- **Multiplier events**. In all the three projects, multiplier events (will) have been used to showcase tinkering activities and promote Tinkering at a larger scale. While the first project focused on engaging families and school groups, the second one – teachers and students from disadvantaged communities, the third project is set out to reach adult educators and learners from vulnerable groups.
- **Project management, monitoring and dissemination**. So far, the latter has been done mainly through presentations at conferences and other events, publications, and project websites.

The activities of each project are specified in the table below.

[2] The following overview is a synthesis of information retrieved from the project websites, Erasmus+ Project Results Platform, and verified with the project coordinators.

Table 2. Activities of the 'Tinkering EU' projects

Tinkering EU 1 (activities implemented)	Tinkering EU 2 (activities implemented)	Tinkering EU 3 (activities planned)
- Development of a methodological framework on tinkering as a founding element of the work - Design and testing of new tinkering activities for adult learners and schools - Development of pedagogical materials on tinkering - Training workshops for adult and school educators - Multiplier events - Project management, monitoring and dissemination	- Development of a theoretical and methodological framework on the role of tinkering in building science capital - Selection and testing of tinkering activities for schools - Training workshops for adult and school educators - Development of observation and self-reflection tools - Multiplier events - Project management, monitoring and dissemination	- Development of a theoretical and methodological framework on the role of tinkering in engaging adults - Selection and testing of tinkering activities for adults - Training workshops for adult educators - Development of guidelines for focus groups to explore how museum educators work with adult groups and families from disadvantaged communities - Multiplier events - Project management, monitoring and dissemination

Source: Compiled by the authors based on the data retrieved from the Erasmus+ Project Results Platform and project websites.

Key actors involved

The consortia of the first two projects comprised seven organisations, whereas that of 'Tinkering EU 3' – one less. The National Museum of Science and Technology 'Leonardo da Vinci' (Italy), NEMO Science Museum (the Netherlands) and Cambridge University (the United Kingdom) have joined all three projects; ScienceCenterNetzwerk has participated in the last two; whereas the rest of the partners in either 'Tinkering EU 1', 'Tinkering EU 2' or 'Tinkering EU 3' (see the table below).

The National Museum of Science and Technology 'Leonardo da Vinci' has served as a coordinator of 'Tinkering EU 1' and 'Tinkering EU 2', whereas NEMO Science Museum has been coordinating the third one. Partners involved have contributed to the implementation of all project activities, except for Cambridge University, which has been focusing on the development of the theoretical and methodological frameworks as well as pedagogic materials and educational tools.

Table 3. Organisations involved in the implementation of the 'Tinkering EU' projects

Legal name	Short name in English	Type of organisation	Country	Role in the project(s)	Projects participated
Participated in all three projects					
Fondazione Museo Nazionale della Scienza e della Tecnologia 'Leonardo da Vinci'	National Museum of Science and Technology 'Leonardo da Vinci'	Science and technology museum	Italy	Project coordinator	Tinkering EU 1 and 2
				Project partner	Tinkering EU 3
Stichting Nationaal Centrum voor Wetenschap en Technologie, NEMO Science Museum	NEMO Science Museum	Science museum	The Netherlands	Project partner	Tinkering EU 1 and 2
				Project coordinator	Tinkering EU 3
University of Cambridge, Faculty of Education	Cambridge University	University	The United Kingdom	Project partner	Tinkering EU 1, 2 and 3
Participated in two out of three projects					

ScienceCenter Netzwerk	ScienceCenter Network	Network for science and technology learning	Austria	Project partner	Tinkering EU 2 and 3
Participated in one out of three projects					
International Centre for Life Trust	Life	Science centre	The United Kingdom	Project partner	Tinkering EU 1
Deutsches Museum von Meisterwerken der Naturwissenschaft und Technik	Deutsches Museum	Science and technology museum	Germany	Project partner	Tinkering EU 1
Jedlik Ányos Gépipari és Informatikai Középiskola és Kollégium	Jedlik Ányos Vocational School	Vocational school	Hungary	Project partner	Tinkering EU 1
MOBILIS Közhasznú Nonprofit Korlátolt Felelősségű Társaság	MOBILIS	Science centre	Hungary	Project partner	Tinkering EU 1
College of the Holy and Undivided Trinity of Queen Elizabeth near Dublin, Science Gallery Dublin	Science Gallery of the Trinity College Dublin	Science gallery in the institution of higher education	Ireland	Project partner	Tinkering EU 2
Fundación Bancaria Caixa d'Estalvis i Pensions de Barcelona 'la Caixa', Cosmo Caixa	Cosmo Caixa Museum	Science museum	Spain	Project partner	Tinkering EU 2
Κέντρο Διάδοσης Επιστημών & Μουσείο Τεχνολογίας	NOESIS	Science centre and technology museum	Greece	Project partner	Tinkering EU 2
Théories et Réflexions sur l'Apprendre, la Communication et l'Éducation Scientifiques	TRACES	Association for science, its communication and relationship with society	France	Project partner	Tinkering EU 3
Centrum Nauki Kopernik	Copernicus Science Centre	Science centre	Poland	Project partner	Tinkering EU 3

Source: Compiled by the authors based on the data retrieved from the Erasmus+ Project Results Platform.

The Exploratorium, which pioneered Tinkering in the USA, has been involved as a special consultant in all three projects. Also, the second and third ones have been encouraging and relying on networking. While 'Tinkering EU 2' focused on schools, 'Tinkering EU 3' has partnered with the local community leaders.

Funding arrangements

All three projects have been funded as strategic partnerships under the Erasmus+ Programme. Key financing mechanisms have been contribution to unit costs and real costs. Since only 75% of the exceptional costs[3] can be covered by grants (European Commission, 2020), the amounts awarded and total costs of the projects differ, although little (see the table below).

Table 4. Grants awarded and total costs of the 'Tinkering EU' projects

	Tinkering EU 1	Tinkering EU 2	Tinkering EU 3
Grant	EUR 436 168	EUR 443 162	EUR 439 418
Total costs	EUR 438 668	EUR 449 162	EUR 443 168

Source: Compiled by the authors based on the data provided by the project coordinators.

Conceptualisation of creativity

The concept of creativity used in the 'Tinkering EU' projects is two-fold. First, creativity has been referred to as one of the 21st century skills. Second, it has been treated as one of the learning dimensions of making and tinkering. Hence, creativity has been both a target of the three projects and a key feature of the Tinkering methodology central to them.

Although creativity has not been defined in the project documentation, it is evident the Consortium considered descriptors of creativity and innovation prepared by the Partnership for the 21st Century Learning – a Network of Battelle for Kids (see the box below). These descriptors were used to outline opportunities Tinkering offers for the development of creativity and divergent thinking among other skills (see the section on 'Fostering creativity' where we explain how Tinkering can be used to develop creativity as a transversal skill).

Box 1. Conceptualisation of creativity by the Partnership for the 21st century learning

In its framework for 21st century learning, the Partnership specifies the key subjects and 21st century themes as well as three blocks of skills. Creativity is identified as one of the learning and innovation skills and defined in three strands:

- **Think creatively**: use a wide range of idea creation techniques (such as brainstorming); create new and worthwhile ideas (both incremental and radical concepts); elaborate, refine, analyse and evaluate their ideas in order to improve and maximise creative efforts
- **Work creatively with others**: develop, implement and communicate new ideas to others effectively; be open and responsive to new and diverse perspectives, incorporate group input and feedback into the work; demonstrate originality and inventiveness in work and understand the real-world limits to adopting new ideas; view failure as an opportunity to learn, understand that creativity and innovation is a long-term cyclical process of small success and frequent mistakes
- **Implement innovations**: action creative ideas to make a tangible and useful contribution to the field in which the innovation will occur

Source: Adapted by the authors from Partnership for 21st Century Learning-Battelle for Kids. (2019). *Framework for 21st Century Learning: Definitions*. Retrieved from http://static.battelleforkids.org/documents/p21/P21_Framework_DefinitionsBFK.pdf.

Fostering creativity

Tinkering can be described as a playful way to approach and solve problems through direct experience, experimentation, and discovery (Martinez and Stager, 2013). It is all about hands-on activities, learning from failures, and unstructured time to

[3] According to the Erasmus+ Programme Guide, these are costs related to subcontracting or purchase of goods and services. These can also be costs for providing a financial guarantee, if the National Agency asks for it.

explore and invent (Doorley, 2015). Tinkering is also an innovative learning approach, which builds on constructivism, constructionism and inquiry-based pedagogy and exploits some of the most engaging and motivational elements of learner-centred and personalised learning (Harris, Xanthoudaki, and Winterbottom, 2018). The range of tinkering activities can be wide, but they have ten common key features (Harris, Winterbottom, Xanthoudaki, Calcagnini, and de Pijper, 2016):

- Work best in the atmosphere of play, innovation, and creativity
- Are sensorial and manual in nature – enable learners to engage in a generative process of making something physical by using tools and materials
- Are physical, immersive, creative, and playful
- Allow people to try out technical processes, tools, and/or artisan crafts
- Use materials that are enticing, evocative, inspiring, and exciting – the materials should be inviting and spark people's curiosity and interest
- Give learners the freedom and opportunity to pursue their interests, hence create their learning pathways
- Provide opportunities for different levels of challenge, hence allow for highly variable and often unexpected outcomes
- Have a long-term goal or a starting point but no specific challenge or problem to solve – this allows creative ideas for new goals to emerge
- Are designed so that learners can negotiate their own goals, pursue, and express their individual interests and engage in activities that are personally meaningful
- Provide opportunities for learners to try something repeatedly and/or work in an iterative, improvisational way – they should challenge learners to ponder, puzzle, build, test, plan, re-design, tweak and refine

These features imply that any tinkering activity should be intentionally set to promote transversal skills, including creativity.

Specific opportunities that Tinkering offers for the development of creativity and divergent thinking include (Harris et al., 2016):

- Using a wide range of idea creation techniques, e.g. planning, sketching, brainstorming
- Developing unique strategies, tools, objects, or outcomes
- Creating new ways to use materials or tools
- Setting personal long- and short-term goals and planning ways to achieve these

This suggests that Tinkering links creativity to idea creation and implementation techniques. The focus is on the creative process where progress is driven by tinkerers themselves rather than firmly led by the facilitators (Tinkering: Contemporary Education for Innovators of Tomorrow, n.d.).

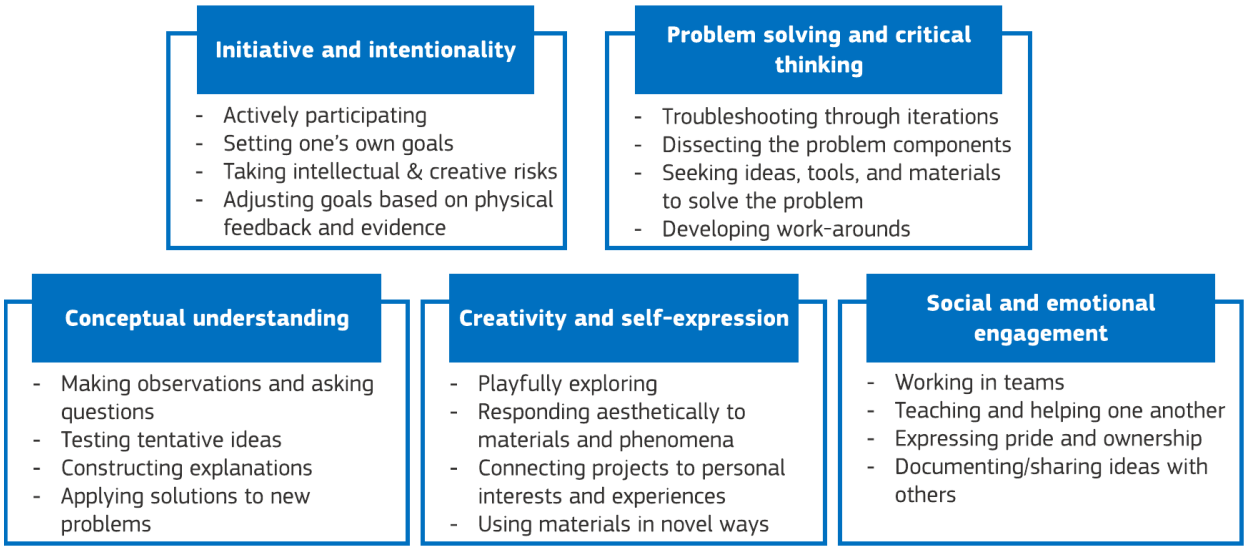
Assessing creativity

Within the frames of the 'Tinkering EU' projects, learning outcomes have not been assessed. Project coordinators argue this has been the case because:

- Assessment is neither necessary nor desirable in the context of informal learning, which the three projects have focused on
- Tinkering focuses on the processes rather than results
- Learning is such a complex process that one cannot expect to improve certain skills having participated in one or a few activities only
- One may internalise the experience long after the visit to the museum where the activities took place
- If designed well, tinkering activities support the development of 21st century skills. However, learning outcomes also depend on the paths chosen by the participants

Nevertheless, it is argued that Tinkering invites rich reflections from museum and school educators (National Museum of Science and Technology 'Leonardo da Vinci', 2020d). To facilitate reflective practice and in turn assessment of the behaviour of the learners, quality of their experience and its use for the development of the 21st century skills and science capital, the Consortium of 'Tinkering EU 2' designed the process and observation as well as reflection tools (Ibid).

Even earlier, the Exploratorium had developed a framework that can be used to observe, support, document, and reflect on how tinkering environment, activities, and facilitation support or impede learning (see the figure below).



Source: Adapted by the authors from Exploratorium. (2017). Learning Dimensions of Making and Tinkering. Retrieved from https://www.exploratorium.edu/sites/default/files/files/Learning%20Dimensions%20of%20Making%20and%20Tinkering.pdf

Figure 2. Learning dimensions of making and tinkering

The framework explicitly refers to creativity and provides indicators that can be treated as learning objectives or outcomes related to it.

Results of the initiative

Since 'Tinkering EU 3' was launched in September 2019, and soon after that frozen due to the rapid spread of the COVID-19, it is too early to discuss the results of this project. Hence, in this section, we focus on the results of the first and second initiatives.

Within the frames of the 'Tinkering EU 1', a series of intellectual outputs was produced, including a practitioner guide, a guide to tinkering activities and professional development guidelines. Moreover, based on the final report[4], the project reached 27 213 individuals through the multiplier events and around 450 professionals through training, and:

- Enriched educational practice in school and out-of-school environments
- Helped to improve the facilitation skills of educators involved in STEM-oriented experience in both formal and informal learning contexts
- Contributed to the increasing consideration of the innovative pedagogy of Tinkering at a policy level in relation to the curriculum and lifelong learning
- Helped to understand the conditions fostering the involvement and motivation of early school leavers
- Contributed to the reinforcement of skills relevant to the labour market
- Informed directly interested target groups and stakeholders at a local, national, and European levels

As part of 'Tinkering EU 2' some intellectual outputs were also prepared. These include a theoretical and methodological framework, tinkering activities for schools, observation and reflection tools. In total, 141 events were held; 138 teachers attended, and 3110 students were reached through them. These numbers illustrate how the scale of the project was limited by the rapid spread of the COVID-19. Nevertheless, based on the interim report[5] the project has:

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4 A detailed final report was submitted to the National Agency in 2017. It is not available to the public, but was shared with the research team by the project coordinators for the purpose of this assignment.

5 The interim report was submitted to the National Agency in April, 2019. It is not available to the public but was shared with the research team by the project coordinators for the purpose of this assignment. As of August 2020, the final report is pending.

- Helped to improve the understanding of teachers on the Tinkering approach and its potential for STEM education
- Contributed to the teacher awareness of what needs to be changed in their practice
- Helped to enrich the work of the museums by engaging with teachers
- Contributed to the development of the science capital of the students
- Benefited schools from the disadvantaged communities
- Involved into a positive, hands-on experience those students who would otherwise not have the opportunity to participate in such activities or visit a museum
- Helped to strengthen a hands-on approach to learning across the curriculum
- Contributed to an inclusive STEM teaching and learning through the combination of Tinkering and science capital approaches
- Informed certain educational organisations, taking care of the preparation of future teachers
- Contributed to the promotion of Tinkering at a policy level

It is impossible to robustly assess whether the projects have had any impact on the development of creativity as a transversal skill, although it is clear that both of them were designed to do so. Moreover, most teachers surveyed in 'Tinkering EU 2' argued that the experience helped students develop broad-ranging skills, particularly in the areas of collaboration, teamwork, problem-solving, resilience and creativity (Harris, E., Winterbottom, M, and Xanthoudaki, M., 2020). Teachers also saw evidence of how Tinkering levels the playing field for students with a special educational need or disability as well as those with lower science capital as it deeply values their existing skills, interests and talents, encourages creativity, provides multiple pathways for success and therefore boosts student motivation and confidence (Ibid).

Conclusions

Both the first project completed in 2017 and the second one which is going to an end in summer, 2019 can be treated as successful initiatives. This was recognised by the European Commission which labelled 'Tinkering EU 1' as a good practice example. Together, 'Tinkering EU' projects have built a community of practice working with Tinkering in different contexts. According to the project coordinators, key success factors were:

- The novelty and potential of Tinkering, which allowed to build a strong case for learning
- The strength of the Consortium and complementary experiences of its members
- Training workshops for museum educators and teachers before involving them in the tinkering activities with the children through the multiplier events
- Having teacher ambassadors in the second project
- Beginning at the museums, targeting family and school groups that the museums typically work with, and then moving on to engaging the disadvantaged communities and adults, which most of the participating organisations have less experience with

This is not to suggest the projects had no weaknesses:

- Challenges to sustaining the engagement of teachers throughout the project duration (three years)
- Lack of direct interaction among the partners throughout the project duration (three years)

Overall, Tinkering offers much potential for the development of creativity as a transversal skill. Certain features of this methodology make it particularly well suited for informal learning. It also has much potential towards underserved/vulnerable groups and can foster a more inclusive approach to STEM learning for all students, including those with a special educational need or disability. According to the project coordinators, tinkering activities may look simple, but they are underpinned by complex pedagogies and based on thorough research. To conduct them successfully, one needs to study the methodology (ideally, participate in training), try to deliver activities that have already been tested, observe the participation of learners and reflect upon it.

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Victorian Curriculum and Assessment

At a glance

Target group(s)	Students in their first 11 years of school
Sector(s), level(s), and settings covered	Primary and secondary school education, institutional settings
Level of implementation	Sub-national (state)
Funding arrangements	Funded by the Victorian Government
Key premises	- Responding effectively to challenges requires young people to be creative, innovative, enterprising, and adaptable - Explicit attention to and application of thinking skills enables students to develop an increasingly sophisticated understanding of the processes they can employ - Thinking that is productive, purposeful, and intentional is at the centre of effective learning and the creation of new knowledge
Definition of creativity	The focus is on creative thinking. Together with critical thinking, it is described as comprising three strands - questions and possibilities, reasoning, and meta-cognition.
Related competences and skills	Creative thinking is linked with and described together with critical thinking
Pedagogical approaches and methods	Visual argument mapping, self-reflection, thinking routines, using rubrics, and students seeking peer or teacher feedback
Assessment approaches and methods	Scenario-based assessment tasks mapped to the three strands of the CCT and a sample assessment programme for Year 6 and Year 10 students
Drivers	- Political will, support, and commitment to teach and assess CCT - Buy-in at different levels, including school leaders, teachers, and parents of students learning CCT
Barriers	- F-10 curriculum is quite new; hence it will take time to consolidate every new curriculum area, including CCT - Perception of crowded curriculum, but this can be mitigated by showing teachers that teaching CCT is part of good practice
Results	22.4% of students tested in 2018 achieved the highest levels in CCT (the target for 2025 was 20.8%).
Key messages and	- CCT is not soft; it has discrete knowledge and skills; CCT is not replacing

lessons learned	discipline-based learning areas. - For teachers to treat capabilities in the same way as discipline-based learning areas, they have to be presented in the same way. - Being transparent about the need to explicitly teach underlying knowledge and skills enables assessment to be planned for and implemented. - Investing in resources, i.e. teacher and school support, is crucial; giving attention to links between discipline-based learning areas and CCT is also important.

Introduction

In the sections below, we provide a detailed description of critical and creative thinking (henceforth, CCT) as it is embedded in the Victorian Curriculum Foundation-10 (henceforth, F-10), taught, and assessed in Victoria – a state of Australia.

First, we overview the design of the state initiative to teach and assess CCT, specifying the context, objectives, timeframe, level of implementation, geographical scope, target groups, sectors, levels, and settings covered, key measures, actors involved and funding arrangements. Second, we explore how critical and creative thinking have been conceptualised and described in the F-10 curriculum. Third, we outline the achievement standards, pedagogical principles, and teaching resources produced, and elaborate on the sample assessment programme. Fourth, to the extent that existing data allows, we present the results achieved in and lessons learned from the Victorian state.

The description of the Victorian CCT curriculum and assessment is primarily based on desk research. The initiative has been very well documented. Key sources reviewed include websites of the Victorian Curriculum and Assessment Authority (henceforth, VCAA) and the Department of Education and Training of the Victorian Government, as well as a wide range of planning, teaching, and assessment resources they offer. To complement desk research, we interviewed Monica Bini (Capabilities Curriculum Manager at the VCAA) and Sharon Foster (Victorian Curriculum F-10 Manager, focusing on the assessment of the CCT at the VCAA). To boost the validity of the analysis and reliability of the research results, we have applied the principle of triangulation – where possible, verified information by cross-checking different data sources.

Design of the initiative

Context and objectives

In 2008, the Australian Ministers of Education adopted a Melbourne Declaration on Educational Goals for Young Australians (Ministerial Council on Education, Employment, Training and Youth Affairs, 2008). It set two goals:

- Australian schooling promotes equity and excellence
- All young Australians become successful learners, confident and creative individuals, and active and informed citizens

The Declaration stated that the 'curriculum will support young people to develop a range of generic and employability skills that have particular application to the world of work and further education and training'. Also, it explicitly noted that among other general capabilities, young people 'need to develop the capacity to think creatively, innovate, solve problems and engage with new disciplines'. The Declaration set the political basis for the development of the Australian Curriculum. Each state jurisdiction in Australia has responsibility for the implementation of it. The Victorian Curriculum F–10 incorporates the Australian Curriculum and reflects Victorian priorities and standards. The F-10 in Victoria was released in 2015 as a central component of the Education State. The latter implies a commitment to build a world-class system of education and improve outcomes for children, young people, and adult learners across the Victorian state (Department of Education and Training, 2018). The goal is to support all students, regardless of their start in life, promoting foundational learning domains such as reading, mathematics, and science, alongside other important areas such as CCT, the arts, physical education, and resilience (Ibid).

With regards to CCT, it is argued that (VCAA, 2020f):

- Responding effectively to environmental, social, and economic challenges requires young people to be creative, innovative, enterprising, and adaptable, with the motivation, confidence, and skills to use critical and creative thinking purposefully.
- Explicit attention to and application of thinking skills enables students to develop an increasingly sophisticated understanding of the processes they can employ whenever they encounter both the familiar

and unfamiliar, to break ineffective habits and build on successful ones, developing a capacity to manage own thinking.

- Thinking that is productive, purposeful and intentional is at the centre of effective learning and the creation of new knowledge, with the progressive development of knowledge about thinking and the practice of using thinking strategies fostering students' motivation for and management of their learning.

In this context, the purpose of having CCT as a discrete component of the F-10 is to ensure that students develop:

- Understanding of thinking processes and an ability to manage and apply these intentionally
- Skills and learning dispositions that support logical, strategic, flexible, and adventurous thinking
- Confidence in evaluating thinking / thinking processes across a range of familiar and unfamiliar contexts

The CCT sample assessment programme is a measure adopted to see if Victoria is on track to reach its ambitious CCT Education State target, which is that by 2025, '25% more Year 10 students will reach the highest levels of achievement in critical and creative thinking skills'.

Timeframe

Victoria introduced CCT as an explicit component of the curriculum in 2015. It did so with the launch of the F-10, but the basis for this was set a decade earlier.

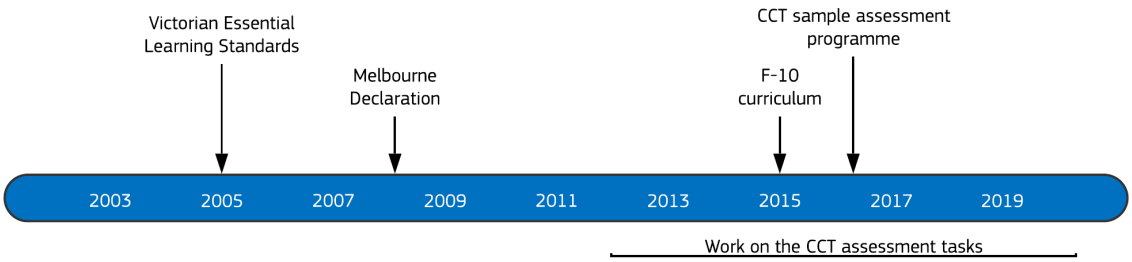
In 2003, work began on the development of the Victorian Essential Learning Standards (henceforth, VELS) to 'identify and develop a broad framework of "essential learnings" for all Victorian students' (Department of Education and Training, 2003). The standards were published in 2005. They were based on the premise that any curriculum should comprise three components to enable students to meet the demands of the contemporary, globalised world (VCAA, 2015):

- The processes of physical, personal, and social development, and growth
- The branches of learning reflected in the traditional disciplines
- The interdisciplinary capacities needed for effective functioning within and beyond school

VELS not only mapped student progress in interdisciplinary learning, physical, personal and social learning, as well as discipline-based learning, but also gave these equal status, treating all as discrete areas of learning (Ibid). Interdisciplinary learning comprised standards for thinking processes, and these became antecedent to CCT as described in F-10.

While the F-10 was launched in 2015, schools were required to implement it from the beginning of the 2017 school year and given the option to do so during 2016.

In 2016, the CCT sample assessment programme was launched. According to the interviewees, this was possible only because a set of CCT assessment tasks had already been developed. Initial work on these started in 2012. The focus then was on the VELS thinking processes, but with the introduction of the Australian and then Victorian F-10 curricula it quickly shifted to CCT.



Source: Compiled by the authors.

Figure 3. Evolution of the Victorian curriculum and assessment in time

Level of implementation and geographical scope

Launched in Victoria – second-most populous state, located in the southeast of Australia (see the map below) – the initiative has been implemented at the sub-national level. The F-10 curriculum is required to be implemented by government and

Catholic schools, but not independent ones which can choose whether to do so or not (VCAA, 2020c). The Department of Education and Catholic Education Commission of Victoria are responsible for curriculum implementation in the government and Catholic schools respectively.

Map 2. Victoria among Australian states and territories

Source: Compiled by the authors.

Target groups, sectors, levels and settings of education and training covered

The F-10 curriculum where the CCT is embedded sets out what every student should learn during their first 11 years of schooling (Victorian Curriculum and Assessment Authority, 2020a). It has been developed to enable continuous learning for all students, including learners with disabilities and additional learning needs, those with English as an additional language, and gifted and talented students (VCAA, 2020b).

According to the interviewees, as of June 2020, the VCAA is exploring two ways to ensure the coherence of learning, considering the transition from early childhood services and setting to the first 11 years of schooling, and then the transition into senior secondary courses and higher education institutions. First, it is monitoring the implementation of the early years learning and development framework (which covers birth to eight-year-olds) in non-school settings. This will inform a future review of early years learning and the transition to the F-10 curriculum, including the role of the capabilities. Second, the VCAA is investigating ways that capabilities could be taught in senior secondary years and beyond. There needs to be links between F-10, senior secondary education, future pathways, and work.

Assessment tasks have been developed for levels F-2, 3-4, 5-6, 7-8, and 9-10, yet the CCT sample assessment programme targets Year 6 and Year 10 students only (VCAA, 2020d).

Key measures

Three strands of work to promote CCT can be distinguished. They are specified in the figure below.

Source: Compiled by the authors.

Figure 4. Measures adopted to promote CCT

Key actors involved

Central to the initiative has been the VCAA. This independent statutory authority provides curricula, assessment and reporting to enable learning for life (VCAA, 2020e). Developing the CCT capability of the F-10, the VCAA drew upon the work undertaken by the Australian Curriculum and Assessment Authority when writing the Australian Curriculum, and consulted academics, including Associate Professor John Munro (University of Melbourne) and Associate Professor Philip Cam (University of New South Wales). Designing, testing, and validating the CCT assessment tasks, the VCAA worked with external contractors – the Australian Council for Educational Research (first batch of 32 tasks) and the National Foundation for Educational Research (second batch of 30 tasks). In the task review process, the government agency also involved individual outside experts, including Professor Bill Lucas (University of Winchester) and Dr Aristidis Galatis (University of Melbourne), and practicing classroom teachers.

Funding arrangements

The development of the F-10 curriculum, resources, and CCT assessment tasks, as well as the implementation of the CCT sample assessment programme, have been funded by the Victorian government. While most resources and professional learning are funded as part of business as usual, some additional funds have been allocated to engage external contractors to develop the CCT assessment tasks, and to administer and report on the CCT sample assessment programme.

Conceptualisation of critical and creative thinking

In Victoria, critical and creative thinking are treated as strongly linked. According to the interviewees, F-10 presents them together because:

- The curriculum is about creative thinking, not creativity *per se*.
- Bringing critical and creative thinking together allows schools to apply the curriculum flexibly across learning areas, giving different emphasis to the specific components when appropriate.
- The curriculum promotes the development of the whole child, which underpins the decision to make capabilities explicit.
- Critical and creative thinking processes are not discrete. For example, 'part of creative thinking is establishing and using criteria to critically evaluate the merits of various propositions generated by creative thinking processes' (VCAA, 2020i). Likewise, 'critical thinking can involve the application of creative thinking processes to generate novel criteria that can then be used to evaluate propositions in innovative and productive ways' (Ibid).
- VCAA has no empirical evidence showing that critical and creative thinking should be addressed as discrete constructs. To the opposite, early research revealed that critical and creative thinking scale very closely together.

CCT is one of the four capabilities covered in the curriculum. It is positioned as a curriculum area in its own right and treated as discrete knowledge and skills that can be taught, learned, and assessed (VCAA, 2015). The purpose of this is to guarantee a viable curriculum for every student, rejecting the notion that if the right conditions of learning are put in place and the right learning experiences provided, students will naturally pick up, acquire and develop CCT (Ibid). In other words, Victoria chose to create a discrete curriculum for CCT that could be taught and assessed, and progress in learning tracked, rather than rely on the osmosis, or contingent unpacking of certain content descriptions by good teachers.

CCT focuses on the development of increasingly complex and sophisticated thinking, which is treated as fundamental to effective learning across the curriculum (VCAA, 2020i).

The curriculum outlines the content of the CCT in three strands. These are the following (VCAA, 2020i, 2020j):

- **Questions and possibilities**: explore the nature of questioning and a range of processes and techniques to develop ideas. This strand contributes to a structure for inquiry-based approaches to teaching. The VCAA argues that 'helping students to understand the fundamental role that questions and questioning play in enabling learning and developing a learning disposition is a necessary condition for deep learning'.
- **Reasoning**: explore how to compose, analyse, and evaluate arguments. This strand provides students with the knowledge and tools to construct and evaluate ideas and arguments that they may be

unfamiliar with. The VCAA argues that it 'underpins other areas of the curriculum in which students are required to gather, consider and evaluate data, evidence and propositions and then form conclusions'.

- **Meta-cognition**: explore the use of strategies to understand, manage and reflect on problem-solving, and thinking and learning processes. This strand defines the knowledge and skills that enable students to better identify, describe, understand, problem-solve, practice, develop and manage their own learning processes.

According to the interviewees, CCT was never intended to exhaust every aspect of what it is to think critically and creatively. Some of these are well covered in other curriculum areas, hence the idea that every curriculum area (rather than CCT only) contributes to the development of a holistic critical and creative thinker. Moreover, CCT concerns only one element of creativity, that is creative thinking. The VCAA suggests that 'other vital elements of creativity, for example, creative expression, creative endeavour and creative collaboration, are included in other learning areas and capabilities' (VCAA, 2020i).

CCT was designed as a continuum of learning and sets out what the students are expected to learn by level rather than the year of school (VCAA, 2020h). According to the interviewees, such an approach enables student progression from the actual knowledge and skills demonstrated rather than what is assumed based on age or school year. CCT knowledge and skills are not fully covered by each learning area but they can and should be addressed within and across them.

The curriculum includes two components: content descriptions explaining what is to be taught, and achievement standards describing what students should be able to understand and do. These standards could and should be used to measure where students are and identify what the next steps of teaching and learning will be. The two components must be read together. They are presented in the table below.

Table 5. CCT content descriptions and achievement standards by level

Towards Foundation Level D	Foundation to Level 2	Levels 3 and 4
Questions and Possibilities		
Pose questions to gather information	Identify, describe and use different kinds of question stems to gather information and ideas	Construct and use open and closed questions for different purposes
Investigate how past experience influences thinking and reactions to situations and problems	Consider personal reactions to situations or problems and how these reactions may influence thinking	Explore reactions to a given situation or problem and consider the effect of pre-established preferences
Generate different ideas and possibilities	Make simple modifications to known ideas and routine solutions to generate some different ideas and possibilities	Investigate different techniques to sort facts and extend known ideas to generate novel and imaginative ideas
Reasoning		
Explore reasons and conclusions through investigation	Examine words that show reasons and words that show conclusions	Examine and use the structure of a basic argument, with an aim, reasons and conclusion to present a point of view
Identify own reasoning and explore ideas, information and options with others	Compare and contrast information and ideas in own and others reasoning	Distinguish between main and peripheral ideas in own and others information and points of view
Use examples and past experience to illustrate understanding and point of view	Consider how reasons and examples are used to support a point of view and illustrate meaning	Investigate why and when the consequences of a point of view should be considered
		Identify and use 'If, then…' and 'what if…' reasoning
		Explore distinctions when organising and sorting information and ideas from a range of sources
Meta-Cognition		
Experience ways to express their thinking, including expression of ideas and feelings about learning	Consider ways to express and describe thinking activity, including the expression of feelings about learning, both to others and self	Consider concrete and pictorial models to facilitate thinking, including a range of visualisation strategies
Explore learning strategies required to address everyday	Explore some learning strategies, including planning, repetition,	Examine an increased range of learning strategies, including

problems and situations	rewording, memorisation, and use of mnemonics	visualisation, note-taking, peer instruction and incubation, and reflect on how these can be applied to different tasks to reach a goal
Investigate problems and begin to identify different prospects and possible solutions	Investigate ways to problem-solve, using egocentric and experiential language	Investigate a range of problem-solving strategies, including brainstorming, identifying, comparing and selecting options, and developing and testing hypotheses
Achievement Standard		
By the end of Level D, students answer simple questions related to their own investigation, their feelings or a concept. They identify and describe an event or a scientific experiment. They generate ideas based on past experience and make choices based on their personal preferences. Students can identify some components of a point of view. They draw on previous experience to assist with their ideas, reasoning and when drawing a conclusion. Students actively participate in structured thinking activities. They practice some learning strategies to assist them to organise and demonstrate their ideas. Students participate in problem-solving activities and can articulate some possible solutions and their outcome in structured practical situations.	By the end of Level 2, students use and give examples of different kinds of questions. Students generate ideas that are new to them and make choices after considering personal preferences. Students identify words that indicate components of a point of view. They use reasons and examples for different purposes. Students express and describe thinking activity. They practice some learning strategies. Students demonstrate and articulate some problem-solving approaches.	By the end of Level 4, students explain how to construct open and closed questions and use them for different purposes. Students select and apply techniques to generate a range of ideas that extend how problems are solved. Students describe and structure arguments with clearly identified aims, premises and conclusions. They use and explain a range of strategies to develop their arguments. They identify the need to make distinctions and apply strategies to make these. Students use concrete and pictorial models to facilitate thinking, including a range of visualisation strategies. They practice and apply an increased range of learning strategies, including visualisation, note-taking, peer instruction and incubation. Students select and apply a range of problem-solving strategies.

Levels 5 and 6	Levels 7 and 8	Levels 9 and 10
	Questions and Possibilities	
Examine how different kinds of questions can be used to identify and clarify information, ideas and possibilities	Consider how to approach and use questions that have different elements, including factual, temporal and conceptual elements	Investigate the characteristics of effective questions in different contexts to examine information and test possibilities
Experiment with alternative ideas and actions by setting preconceptions to one side	Suspend judgements temporarily and consider how preconceptions may limit ideas and alternatives	Suspend judgements to allow new possibilities to emerge and investigate how this can broaden ideas and solutions
Identify and form links and patterns from multiple information sources to generate non-routine ideas and possibilities	Synthesise information from multiple sources and use lateral thinking techniques to draw parallels between known and new solutions and ideas when creating original proposals and artefacts	Challenge previously held assumptions and create new links, proposals and artefacts by investigating ideas that provoke shifts in perspectives and cross boundaries to generate ideas and solutions
	Reasoning	
Investigate common reasoning errors including contradiction and inconsistency, and the influence of context	Examine common reasoning errors including circular arguments and cause and effect fallacies	Examine a range of rhetorical devices and reasoning errors, including false dichotomies and begging the question
Consider the importance of giving reasons and evidence and how the strength of these can be evaluated	Investigate the difference between a description, an explanation and a correlation and scepticism about cause and effect	Examine how to identify and analyse suppressed premises and assumptions
Consider when analogies might be used in expressing a point of view and how they should be expressed and evaluated	Investigate when counter examples might be used in expressing a point of view	Investigate the nature and use of counterexamples structured as arguments
Examine the difference between valid and sound arguments and between inductive and deductive reasoning, and their degrees of certainty	Consider how to settle matters of fact and matters of value and the degree of confidence in the conclusions	Consider ambiguity and equivocation and how they affect the strength of arguments
Explore what a criterion is, different kinds of criteria, and how to select appropriate criteria for the purposes of filtering information and ideas	Examine how to select appropriate criteria and how criteria are used in clarifying and challenging arguments and ideas	Investigate the use of additional or refined criteria when the application of original criteria does not produce a clear conclusion
	Meta-Cognition	
Investigate thinking processes using visual models and language	Consider a range of strategies to represent ideas and explain and justify	Critically examine their own and others thinking

strategies	thinking processes to others	processes and discuss factors that influence thinking, including cognitive biases
Examine learning strategies, including constructing analogies, visualising ideas, summarising and paraphrasing information and reflect on the application of these strategies in different situations	Examine a range of learning strategies and how to select strategies that best meet the requirements of a task	Investigate how the use of a range of learning strategies can be monitored, evaluated and re-directed as necessary
Investigate how ideas and problems can be disaggregated into smaller elements or ideas, how criteria can be used to identify gaps in existing knowledge, and assess and test ideas and proposals	Consider how problems can be segmented into discrete stages, new knowledge synthesised during problem-solving and criteria used to assess emerging ideas and proposals	Investigate the kind of criteria that can be used to rationally evaluate the quality of ideas and proposals, including the qualities of viability and workability
Achievement Standard		
By the end of Level 6, students apply questioning as a tool to focus or expand thinking. They use appropriate techniques to copy, borrow and compare aspects of existing solutions in order to identify relationships and apply these to new situations. Students distinguish between valid and sound arguments and between deductive and inductive reasoning. They explain how reasons and evidence can be evaluated. They explain and apply basic techniques to construct valid arguments and test the strength of arguments. Students represent thinking processes using visual models and language. They practice and apply learning strategies, including constructing analogies, visualising ideas, summarising and paraphrasing information. Students disaggregate ideas and problems into smaller elements or ideas, develop criteria to assess and test thinking, and identify and seek out new relevant information as required.	By the end of Level 8, students prioritise the elements of a question and justify their selection. Students demonstrate flexibility in thinking by using a range of techniques in order to repurpose existing ideas or solutions to meet needs in new contexts. Students explain different ways to settle matters of fact and matters of value and issues concerned with these. They explain and apply a range of techniques to test the strength of arguments. Students use a range of strategies to represent ideas and explain and justify thinking processes to others. They evaluate the effectiveness of a range of learning strategies and select strategies that best meet the requirements of a task. Students independently segment problems into discrete stages, synthesise new knowledge at intermediate stages during problem-solving and develop and apply criteria to assess ideas, proposals and emerging thinking.	By the end of Level 10, students construct and evaluate questions, including their own, for their effectiveness. They demonstrate a willingness to shift their perspective when generating ideas, resulting in new ways of perceiving solutions. Students structure complex, valid arguments. They explain and apply a range of techniques to test validity within and between arguments. Students identify, articulate, analyse and reflect on their own and others thinking processes. They use, monitor, evaluate and redirect as necessary a range of learning strategies. Students develop, justify and refine criteria to evaluate the quality of ideas, proposals and thinking processes.

Source: Adapted by the authors from the Victorian Curriculum and Assessment Authority. (2020g). Critical and Creative Thinking: Curriculum. Retrieved from https://victoriancurriculum.vcaa.vic.edu.au/critical-and-creative-thinking/curriculum/f-10

Fostering critical and creative thinking

The state does not mandate any pedagogies, hence the schools are free to choose how to teach CCT. According to the interviewees, in Victoria, a rich culture of grassroots pedagogy innovation exists. Nevertheless, in its resources, VCAA showcases certain approaches and methods, e.g. visual argument mapping, self-reflection, thinking routines, using rubrics, and students seeking peer or teacher feedback. Moreover, it promotes certain pedagogical principles that reveal how to best explicitly teach CCT (VCAA, 2019):

- Build deep familiarity with the CCT, i.e. its aims, structure, content descriptions and achievement standards
- Determine what new knowledge and skills students need to develop (this is typically done through formative assessment)
- Develop high-level whole school curriculum plans to identify where and when CCT will be explicitly taught in and through the learning areas
- Introduce CCT by unpacking the knowledge and skills required to progress towards the achievement standards
- Create opportunities for students to become confident with the new knowledge and skills
- Provide opportunities for the students to demonstrate CCT knowledge and skills and use this to plan the next teaching and learning activities and progress students' learning

To facilitate the realisation of the CCT, VCAA has also developed a wide range of resources. These include Introduction to explicitly teaching and assessing the capabilities and area-specific resources such as:

- A presentation on the CCT which covers the context, aims, structure of and key messages on CCT
- CCT mapping templates that have been designed to support teachers in identifying where content descriptions and achievements standards are being explicitly addressed within the school's teaching and learning programme
- Scope and sequence charts which present content descriptions and achievements standards of the CCT and help teachers to easily see the expected student progression and plan teaching and learning programmes to meet diverse student needs
- Curriculum Planning Resource and the Victorian Curriculum F-10 Revised curriculum planning and reporting guidelines, both of which provide information and tools to support the school leaders in planning and documenting a comprehensive school-wide curriculum as well as reporting student learning achievements based on the F-10
- Sample learning activities for the development of the CCT and Visual Arts (levels 3-10) which illustrate how content descriptions of the CCT and Visual Arts can be unpacked by using artworks to teach both
- Indicative progress in CCT template that has been developed to assist teachers in designing their own indicative progress descriptions. These can help teachers describe student progress between the achievement standards; report on student outcomes when they are only partially through teaching the level. The template includes an annotated example, a curriculum-specific example of indicative progress and a template prepopulated with the curriculum-specific achievement standards
- Guide to Formative Assessment Rubrics, which provides more general information about how to develop formative assessment rubrics linked to the F-10, i.e. identify the actual learning level of students and identify what they are ready to learn next
- Validated CCT assessment tasks, which are aligned to the curriculum and illustrate how all three strands of the CCT can be assessed (the first batch to be released in October 2020). These are designed to be used 'on-demand' as part of classroom teaching and learning. The evidence gathered is for use by the teacher and the school. It is not reported to the sectors.
- Videos which explain the importance of the CCT, recommended approach to navigating the curriculum, and advice on how to teach and assess CCT
- References to other useful resources

If possible, professional learning opportunities are also provided for the school leadership and teaching staff.

Assessing critical and creative thinking

According to the interviewees, rather than to assess how creative students are, the goal is to see if they have a repertoire of techniques they can draw on and if they know when and how to use these to assist them with thinking and beyond. Assessment involves teachers collecting evidence of student progress using the CCT achievement standards which describe the continuum of learning. Be it formative or summative, a critical aspect of any assessment is for teachers to set clear expectations – identify specific knowledge and skills that students are to develop and then explicitly introduce these (VCAA, 2019). Moreover, VCAA argues that the assessment of the CCT should be thought of in broader terms, as anything that students make, say, write or do that gives an insight into their thinking (VCAA, n.d.). The focus is on the uncovering of the student thinking, hence an interest in the process rather than the final product.

VCAA conducts two strands of work to support the assessment of the CCT. These include the development of the CCT assessment tasks and the implementation of the CCT sample assessment programme. Each is described in more detail below.

CCT assessment tasks have been developed as a vehicle for exploring student thinking. They are scenario-based, and each item is mapped to strands of the CCT. Moreover, the tasks build on the premise that, in each classroom, students have unequal abilities, hence the lower- and higher-level questions within each task. The first suite of 12 validated tasks will become available to all schools in October 2020, and another 15 tasks will be released in early 2021. Examples from the first batch of psychometrically validated CCT assessment tasks can be accessed online; they are presented by level (see 1-2, 3-4, 5-6, 7-8, and 9-10). Seven tasks from this first batch have been quarantined for the CCT sample assessment programme and are kept in strict confidence. Thirty new tasks have been developed but require trialling and psychometric validation before they are released to schools in 2021.

Designed to keep track of the Education State targets, CCT sample assessment programme was launched in 2016, and it has been implemented every year since (VCAA, 2020k). VCAA conducts the assessments in schools across Victoria to collect Year 6 and Year 10 student data in CCT. Students (hence schools) are selected based on the random sampling techniques, but ensuring the representation of all three sectors – government, Catholic and independent schools, as well as taking into account the student family occupation and education, i.e. what level of disadvantage may be displayed in a school. Once schools are selected and students randomly chosen, the VCAA employs invigilators who go to schools and administer tasks. The assessment takes place online and lasts approximately 75 minutes (including practice items and introduction to tasks) (VCAA, 2020l). Collected data is used to determine the percentage of students in Year 6 and Year 10 who are achieving 'excellence' in CCT (Ibid). Aggregate numbers are then reported to the Department of Education and Training. The results of individual schools or students are not published.

Results of the initiative

The VCAA has implemented an F-10 monitoring framework to gather feedback from schools in relation to successes and challenges in curriculum implementation. This is a voluntary process when schools self-report. There are standard questions used each year and discretionary ones employed to explore points of interest. The data gathered has shown that schools are implementing CCT, but this is has not progressed as well as the more traditional discipline-based learning areas. The schools have indicated they require additional support materials. Resources prepared and professional learning opportunities offered were welcomed and continue to support schools in becoming more confident and advanced in their approach to CCT implementation.

According to the interviewees, at least 800 students are tested each year as part of the CCT sample assessment programme. Results reveal that the target set for 10 years was achieved in the first 3 (e.g. in 2018, 22.4% tested students reached the highest level of achievement, while the target set for 2025 was 20.8% (Department of Education and Training, n.d.)). Although good news, the results need to be considered over a longer period, in addition to the annual outcomes.

Conclusions

In Victoria, CCT knowledge and skills are regarded as fundamental to effective learning across the curriculum (2020i), hence the commitment to explicitly teach, assess, and report on CCT. The VCAA recognises the contribution of learning areas to CCT but also stresses that the latter complements and helps to ensure a guaranteed and viable curriculum for every student. According to the interviewees, key strengths of this state-level curriculum innovation include:

- Political will to support CCT, i.e. recognition of it as contributing to high-quality learning outcomes in the disciplinary curriculum areas and supporting the long-term goal to have informed citizens who can participate in a wide range of the democratic debates.
- Attention is given by the Department of Education and Training to metacognition and self-regulated learning since in the F-10 these are integral to CCT.
- Continuous commitment of the state to teach and assess CCT explicitly.

Key challenges have been:

- F-10 curriculum is quite new; hence it will take time to consolidate every new curriculum area, including CCT.
- Perception of crowded curriculum, but this can be mitigated by showing teachers that teaching CCT is part of good practice.

Key messages for those willing to take up similar actions include:

- For teachers to treat capabilities in the same way as discipline-based learning areas, they have to be presented in the same way.
- Being transparent about the need to explicitly teach underlying knowledge and skills enables assessment to be planned for and implemented.
- Investing in resources, i.e. teacher and school support, is crucial; giving attention to links between discipline-based learning areas and CCT is also important.

According to the interviewees, for such a curriculum reform to work, it is crucial to understand that CCT plays a role in developing good and informed citizens; CCT is not soft but has discrete knowledge and skills; CCT is not replacing learning areas, and disciplinary knowledge and skills contribute to the development of the CCT; the knowledge and skills specified in the CCT are transferable. Moreover, buy-in at different levels is needed. Not only political will is important but also teachers have to be confident in their approach to teaching and assessment, thus need resources to support them; school leaders must understand the significance of CCT and help to champion the cause; parents need to appreciate explicit teaching of CCT and the progression of learning for their child, and see the value in it.

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IDEO Creative Difference

At a glance

Target group(s)	Organisations and teams
Sector(s), level(s), and settings covered	Adult learning, workplace settings
Level of implementation	Local (organisation)
Funding arrangements	Organisations can purchase the product for a certain price
Key premises	- Everyone is creative - Creative organisations are more agile - Complex problems are best solved collaboratively - Innovation starts with people - Technology moves fast, human needs change slowly - Venturing is R&D
Definition of creativity	Creativity is defined as a capability that everybody has
Related competences and skills	Creative confidence, innovation, adaptability, agility, creative competitiveness, and creative problem solving
Pedagogical approaches and methods	Design thinking, learning by doing and iteration
Assessment approaches and methods	A survey to measure six qualities essential to innovation or behaviours of creative teams
Drivers	- Team- rather than individual-level assessment - Data-driven solutions - Learning by doing - A human-centred approach
Barriers	- Different connotations of the concept of creativity - Leaders of organisations having little time
Results	54,000 respondents at 600+ organisations have taken the test; testimonials suggest improved business outcomes.
Key messages and lessons learned	- Creativity is not just a warm and fuzzy thing. - However, good a business strategy is, a creative culture, capabilities and behaviours are central to change and being future fit. - Humans are metric-driven and want to see how they progress. - People often forget that there is a level of mastery to every skill and treat capabilities as checkboxes they have to tick once. - The world, hence, the skillsets we need to change so fast that we need to create organisations that support and enable learning of their employees.

Introduction

In the sections below, we provide a detailed description of Creative Difference (henceforth, CΔ) – a tool powered by global design company, IDEO.

First, we overview the design of the CΔ tool, specifying the context, objectives, timeframe, level of implementation, geographical scope, target groups, sectors, levels, and settings covered, key activities, actors involved and funding arrangements. Second, we explore IDEO's understanding of creativity and how it underpins the CΔ tool. Third, we describe the essence of CΔ and provide a brief overview of other tools offered by IDEO to help organisations not only measure but also cultivate creativity. Fourth, we shed light on the uptake of and feedback on the CΔ tool as well as data-driven insights gathered since its launch.

The description of the CΔ tool is primarily based on desk research. The product has been very well documented. Key sources reviewed include IDEO and Creative Difference websites, online media articles featuring CΔ, and customer testimonials shared by the company's staff. To complement desk research, we interviewed Bryan Walker (Partner and Managing Director), David Aycan (Managing Director, IDEO Products), and Virginia Martinez (Director, Capability Building Advisor) from IDEO's San Francisco location. To boost the validity of the analysis and reliability of the research results, we have applied the principle of triangulation – where possible, verified information by cross-checking different data sources.

Design of the initiative

Context and objectives

IDEO is a global design company whose community is made up of designers, entrepreneurs, engineers, teachers, researchers, and others who share six core beliefs (IDEO, 2020a):

- Everyone is creative
- Creative organisations are more agile
- Complex problems are best solved collaboratively
- Innovation starts with people
- Technology moves fast, human needs change slowly
- Venturing is R&D

The company not only nurtures a creative culture and capabilities of its employees but also offers a wide range of resources to help other organisations unlock the power of creativity (IDEO, 2020b). One of these is CΔ – a digital tool to assess, guide, and track the development of creative and innovative teams (IDEO, n.d.), i.e. help leaders identify strengths and blind spots, develop a strategy and prepare a focused plan to take their organisations to the next level (IDEO, 2020c).

Four contexts explain why IDEO moved from nurturing creativity to measuring it as well (interviews with IDEO):

- IDEO had been working on scaling the impact and enabling organisations to drive change on their own, without direct consulting engagement with it.
- IDEO had been working on product, and service design yet had been asked continuously to facilitate capacity building within organisations as well.
- IDEO learned that people passionate about the behaviour change needed support in making a business case for creativity to their superiors, be it the board of directors or CEO.
- IDEO realised that organisations working on innovation struggled to figure out where to focus, wanted to be customer-centred or challenge the *status quo* yet had no tactical steps to achieve this.
- Having defined the process of creative problem solving and helped individuals understand it so that they can apply it at work, IDEO decided to move on to working with leadership and designing organisational conditions that are better set up to empower the employees.

Timeframe

Before launching the product in 2016, IDEO spent a year developing the algorithm (IDEO, 2020d). For the last four years, the team has been analysing the data and gathering insights on what differentiates high- and low- performing teams.

Level of implementation and geographical scope

IDEO has studios in nine locations – North America (Cambridge, Chicago, New York, Palo Alto, San Francisco), Europe (London, Munich) and Asia (Shanghai, Tokyo), as well as project spaces around the world (IDEO, 2019). CΔ has been taken up globally but employed by individual organisations and teams, hence run at the local level (IDEO, 2020d). To facilitate access, the survey is available in English, Spanish, Japanese, Simplified Chinese, Portuguese, Hebrew, French, Polish, Italian, and German (IDEO, 2020e).

Target groups, sectors, levels and settings of education and training covered

CΔ is a team (business unit) assessment, which can be applied across industries, and by organisations of all types and sizes, including start-ups, large companies, non-profits, and government departments (IDEO, 2020d, 2020g). According to the interviewees, many organisations IDEO works with already have a good culture, but want to grasp the key strengths and uniqueness of it so that they can scale it as they grow or otherwise evolve to be future fit.

The process of gathering and interpreting data, as well as sharing results, can be treated as a non-formal learning experience for adults, in particular employees.

Key activities

As stated on the Creative Difference website, the team began to develop CΔ by polling dozens of innovation, design, and creativity experts in and outside of IDEO. These experts, ranging from academics, to practitioners, to leaders of the world's most innovative companies, enabled the team to identify factors that most frequently lead to successful teams. IDEO then compiled a comprehensive list of more than 120 factors that experts claimed were important and collected data from hundreds of organisations to identify which of the possible levers lead to effective teams and improved business performance. The most impactful factors resulted in six Creative Qualities (see Section 1.3). To assess against them, IDEO crafted questions best suited to learn an objective account of whether appropriate methods and behaviours are exhibited by employees at work.

Having developed the tool, IDEO now helps organisations deploy the assessment and provides a consultative review of results to help them interpret key insights, identify focus areas, and act (IDEO, 2020e).

Key actors involved

IDEO developed CΔ tool in consultation with outside experts. The team continues to offer the product and data-driven insights with no external support.

Funding arrangements

Organisations can purchase the product for an agreed price.

Conceptualisation of creativity

Interviewees argue that the word 'creativity' is polarising, bears different connotations and can easily throw people off, mainly because many associate it with arts. Yet all agree that employees should be able to effectively drive change, whether that is to modernise operations, evolve offerings, or innovate to create new products (Colon, 2017). While these are creative tasks, many organisations remain uncomfortable with such framing. Hence, describing CΔ, IDEO heavily focuses on innovation, adaptability, agility, creative competitiveness, and creative problem-solving. This is in line with the notion that creativity needs to be developed not for the sake of it but rather to achieve certain goals.

Although the wording is different, the interviewees explain that the sentiment is the same – unleash creativity that lies within employees. This links to the idea of creative confidence, put forward by IDEO founder and Stanford d.school creator David Kelley and his brother Tom Kelley, IDEO partner and the author of the bestselling 'The Art of Innovation'. The two argue that 'too often, companies and individuals assume that creativity and innovation are the domain of the "creative types." <...> everyone is creative.' In their book 'Creative Confidence' David and Tom Kelley even list 'principles and strategies that will allow us to tap into our creative potential in our work and personal lives, and innovatively approach and solve problems' (IDEO, 2020h). According to the interviewees, indeed, creativity is an innate capacity that everybody has, but with time people lose confidence in it, hence the focus on creative confidence rather than creativity *per se*.

CΔ measures six qualities essential to innovation or behaviours of creative teams. The tool is tailored to organisations, hence the focus on the creative capacity of a group rather than individual, i.e. conditions allowing for creative outcomes within teams. Creative qualities concern purpose, looking out, experimentation, collaboration, empowerment, and refinement (IDEO, 2020d). They are described in detail in the figure below.

PURPOSE:
a clear, inspiring reason for the company to exist - beyond making money

The degree to which there is alignment about a meaningful change that leadership and employees want to make in the world. Scoring high on purpose requires that the purpose is clear, inspires passion in employees, and helps to inform most major decisions.

COLLABORATION:
working together across business functions to approach opportunities and challenges from all angles

The degree to which employees of different roles and within different departments work together to bring new ideas forward. Organizations with a high collaboration score tend to create multi-disciplined teams where members with different skills respect and value each other's craft.

LOOKING OUT:
looking beyond the company's walls to understand customers, technologies, and cultural shifts

The degree to which employees get insights and inspiration from beyond the company's walls. Companies who do well on this score have a strong sense of who their customer is, what's happening in their market, and what major trends (technical or social) might be leveraged towards the organization's goals.

EMPOWERMENT:
providing a clear path to create change in all corners of the company by reducing unneccessary constraints

The degree to which the organization provides a clear path for employees to create change. These organizations create meaningful jobs where employees are confident that they can improve things for the better if they do their job well. Employees have a reasonable amount of autonomy, and performance metrics and responsibilities are well calibrated to provide guidance, without perverting incentives to cause unproductive behavior.

EXPERIMENTATION:
the degree to which a company is able to explore new ideas quickly and inexpensively

The degree to which a company is able to explore new ideas quickly and inexpensively, and evolve them towards a successful solution. Good experimenters have low bureaucracy in the way of testing new ideas with customers or other users. They do a good job of sharing discoveries across the organization, and have a healthy attitude towards controlled failure, knowing that some will be necessary to help discover new opportunities.

REFINEMENT:
elegantly bridging vision and execution

The degree to which the strategy, product, and design functions within a company play nicely with the execution roles as new ideas move towards implementation. These companies do a good job of problem solving as concepts move from broad outlines to detailed specifics. These companies avoid feature creep and find elegant solutions to the technical challenges that emerge during development. The results are beautiful, well crafted products or systems that achieve the original purpose of the design.

Source: Adapted by the authors from IDEO. (2020d). *Our Approach*. Retrieved from https://creativedifference.ideo.com/approach

Figure 5. Six Creative Qualities

Assessing creativity

CΔ comprises two steps – a survey to help organisations understand their creative capabilities; and a follow-up to guide the growth of these capabilities, focusing on selected areas and employing the most relevant tools. The expectation is that individuals understand capabilities, teams apply them, while organisations share the good practice through storytelling, case studies, resources, etc., all to empower the individuals and support teams.

CΔ introduction provided by IDEO states that, in short, the exercise starts with a 15-20 minute assessment, consisting of questions that measure conditions and behaviours influencing team capabilities across the six qualities and sub-qualities. The survey uncovers a team's ways of working and provides language to describe certain behaviours and mindsets. Results are delivered in a customised online dashboard. Team-level scores are presented with benchmarks by industry or team. Alongside scores, CΔ delivers a guide surfacing strengths, areas for improvement, relevant case studies, and tools to help teams focus their efforts and act.

To ensure anonymity, IDEO recommends that, as a minimum, five people participate in the survey. Each type of role/business function should be represented, covering at least 30% of the population in total (IDEO, 2020e). According to the interviewee, the higher engagement, the better ownership of results.

Moreover, CΔ is intended to be used over time, allowing organisations to measure progress and provide insights on the behaviour change based on activities a team pursues (IDEO, 2020e). IDEO's recommendation is to run the assessment every six months, but, according to the interviewees, some smaller teams do it every three. The tool can be used complementary to engagement surveys since it addresses engagement as a secondary but highly correlated factor (IDEO, 2020e).

Fostering creativity

According to the interviewees, there is no one-size-fits-all approach for organisations to unleash their creative potential after CΔ. Sometimes results require a facilitated leadership meeting; others it is a design sprint or a much longer engagement with IDEO.

Indeed, the company offers a broad array of other tools to help organisations move forward. These include but are not limited to the following:

- Creative Difference Workshop is designed to help teams become more adaptive and innovative by identifying and honing in on the most significant opportunity areas within their organisations. The workshop centres on the development of an achievable action plan to help strengthen the teams and foster creative problem-solving on the ground.
- IDEO CoLab is a collaborative future lab. Through venture design sprints, residencies, and special events, it helps organisations incubate, accelerate and launch ventures. From four-day sprints to multi-week projects, the lab begins with identifying an organisation's problems and then proceeds to creating experience prototypes that look 12+ months ahead of the market.
- IDEO U is an online school where anyone can unlock their creative potential through design thinking and collaboration. IDEO U courses are available for individuals, teams, and organisations. Examples include 'Leading for Creativity', 'Insights for Innovation', 'From Ideas to Action', and 'Storytelling for Influence'.
- ExperienceInnovation is a workshop in innovation, giving teams meaningful experience with design thinking. Teams compete to solve a realistic and complex challenge while engaging with terms, techniques, and thought patterns of successful innovators. Built for designers and non-designers alike, ExperienceInnovation creates an energising, practical, and relevant learning experience that supports tangible business objectives using leading-edge technology.
- Shape is an innovation management, visual, collaborative space to build, test, and refine new ideas. It helps team collaboration – from ideation and synthesis to gathering feedback from customers – and supports organisations in moving innovation towards results.
- The Teachers Guild is a professional community that activates teachers' creativity to solve the biggest challenges in education today. While learning and doing design thinking, teachers build their creative muscles and connect to diverse partner organisations that are committed to bringing their solutions to life.

Organisations choose from several different paths depending on survey results, timeline, budget, appetite and desire for change.

Central to all is design thinking – a concept which well defines how IDEO works. The team argues that we live and work in a world of interlocking systems, where many of the problems we face are dynamic, multifaceted, and inherently human (IDEO, 2020k). For IDEO, design thinking offers a way to solve problems through creativity. It concerns the use of creative activities to foster collaboration and solve problems in human-centred ways. IDEO argues three core activities of design thinking are ideation, inspiration, and implementation (IDEO, 2020k). Moreover, anyone can approach the world like a designer, but to unlock greater potential, creative confidence – the belief that everyone is creative, and that creativity is not the ability to draw or compose or sculpt, but a way of understanding the world – is key (IDEO, 2020k).

Other concepts central to IDEO's pedagogy are learning by doing and iteration.

Results of the initiative

Since launching CΔ, IDEO has run it with more than 54,000 respondents at 600+ organisations across every industry category, including such brands as Nike, Swarovski, Nationwide, Sky, Ford, Michelin, Zalando, Marvin, Pfizer, and Bill & Melinda Gates foundation (IDEO, 2020d, 2020i).

The company argues this way it helps organisations address why change is important, what levers or actions one can take to enact change, who in an organisation should be a part of this change, and how one can start taking action (IDEO, 2020e). More specifically, CΔ is supposed to help organisations develop a common language for innovation; offers a baseline which teams can use to improve and validate progress over time; provides methods, case studies, and a collaborative space to enable organisations to drive change (IDEO, 2020e).

In fact, CΔ effectively achieves these objectives, as evidenced by the testimonials of and case studies on the organisations that have taken it up in the past, shared by IDEO:

- **Intercorp** is an economic group of more than 30 companies spanning banks, malls, cinemas, schools, and more, accounting for 2.5% of Peru's gross domestic product. Together, these organisations share a guiding purpose of improving the lives of the Peruvian middle class. Since 2015, IDEO has worked with Intercorp to build innovation capabilities across all portfolio companies. Using Creative Difference, each company received a report of their strengths and improvement areas, and as a result, has hosted workshops and community groups focused on building essential capabilities. The various companies have used their newfound skills to modernise and develop distinct and competitive services. A primary thrust in 2017 to 2018 has been building digital capabilities; Intercorp has gone from having a limited digital strategy to launching five new digital channels in 2018. Herman Carranza, Chief Innovation Officer of Intercorp says 'Creative Difference is our master tool to maximise the creativity of our 58,000 employees, and track how our 29 companies evolve year after year. It is measurable, scalable, and extremely actionable.' More information is available in the CΔ Introduction shared by IDEO.
- **Newton-Wellesley Hospital** (NWH) is a community teaching medical centre in Newton, Massachusetts. Because of its proximity to Boston – a city known for world-class healthcare institutions – NWH needed to differentiate itself, hence it reached out to IDEO. The two partnered for a year of work together, kicked off by defining the vision for NWH and ramping up to in-hospital prototyping and the launch of several new initiatives. A pilot project with the Women's Imaging Center (WIC) focused on solving departmental and employee challenges to provide a better experience for women getting mammograms. To start, the Women's Imaging Center employees participated in Creative Difference. Fuelled by this potential, the WIC team redesigned key work processes and created a set of experience principles that inspired new service prototypes. The experience of designing better services inspired the WIC staff to become ambassadors for the power of design thinking across other departments inside NWH and they continue to build on the work through new prototypes and experiments. At the end of the partnership, the team repeated the Creative Difference assessment and noticed improvement over time in their creative competencies. More information is available at IDEO, 2020j.
- **Michelin** is a French tyre manufacturer, the second-biggest tyre manufacturer in the world. It approached IDEO with a request to help it turn from an R&D powerhouse to a creator and innovator of services and business models. Michelin employees took CΔ and Johannes Mutzke, the Global Innovation Council Chairman said 'Creative difference was the best thing we did. It helped us completely rethink the way we innovate.' CΔ helped the company launch into a new category of activities, with new products being developed in less than one year (compared to two and more years before). Michelin also started testing new products before making significant R&D investments, allowing greater investment in proven areas, and launched an internal innovation lab to help entrepreneurs from around the world learn new skills, develop and commercialise products and ventures.
- **Sky** is a pan-European British media and telecommunications company headquartered in London. It has had great success in a complex marketplace, providing innovative and desirable products for customers. Sky recognised the need to support innovation in new and different ways so that it can remain relevant to its customer base in an exceptionally competitive sector. Sky understood that its leaders were critical to building and nurturing the culture that would allow innovation to flourish. Hence, to kick-start the shift, the company approached IDEO, and 130+ leaders took the CΔ test. The exercise helped leaders understand their own creative leadership style and its impact on their teams; provided tactics for leaders to actively lead their teams in developing creative behaviours; encouraged Sky to revise and re-energise its purpose and values, and made the organisation's purpose clearer and more useful to employees.

Conclusions

For many organisations, IDEO Creative Difference (CΔ) has effectively helped to unleash the creative potential of their employees and improve business performance. According to the interviewees, key strengths of the tool are the following:

- **Team-level assessment**: While IDEO has received requests for a self-assessment, surveying teams is more realistic. Changes require the evolution of the behaviours and micro-culture existing within the teams rather than one individual. Moreover, having a team-level assessment shifts blame and/or shame from any one person, boosting accountability and engagement, and commitment to change. In relation to leadership, the focus on teams helps to assess what influence leaders have on their teams rather than what specific competencies or skills they lack. This helps the leadership understand the different ways they can orientate themselves and build the environment more conducive to creative problem solving and change.
- **Data-driven solutions**: CΔ provides a way to measure creative qualities, capabilities, or behaviours. The tool itself is data-backed but also allows to collect quantitative data and benchmark against other organisations working in the same field. This helps to demystify creativity – often an ambiguous topic.
- **Learning by doing**: As other IDEO tools, CΔ boasts applied nature and encourages learning by doing. Assessment results invite action and hint certain areas for organisations to focus on. CΔ also provides suggestions on where to start, including methods, case studies, etc.
- **Human-centred approach**: CΔ builds on a human-centred approach to product design and encourages a team dialogue around culture.

The number of questions has been reduced over time to address the challenge of the test being time-consuming in the beginning. In the future, the CΔ team is planning to slice their data by demographics and consider not only the diversity of perspectives but also that of people. As of 2020, this has not yet been done.

Key insights from data collected over the last four years suggest that (IDEO, 2020i):

- Creativity – or the ability to effectively solve challenges in new, meaningful ways – is essential to compete in modern markets.
- 3.4 times more successful launches when teams practice even the most basic forms of the behaviours measured by CΔ.
- 180% more likely to achieve business goals when teams understand their market, the users they serve, and what relevant technologies exist.
- 50% higher rate of successful ideas when teams test and iterate five or more ideas, rather than anchoring on a single idea too early in their process.
- Teams that share credit for their success are more energising compared to those where colleagues take credit for success, not sharing it with the rest of the team.
- Brainstorming as a group at least once a week, helps teams work better together. These teams achieve their objectives at a significantly higher rate, compared to other teams who brainstorm monthly or even less frequently.

Other factors that facilitate business success include everyone feeling comfortable challenging the status quo, a clear and consistent purpose, remote team members, syncing up with the team every day, and leaders helping the teams, not the other way around (FastCompany, 2017).

Key messages for organisations include:

- Creativity is not just a warm and fuzzy thing. It has a measurable impact on business outcomes.
- However, good a business strategy is, a creative culture, capabilities and behaviours are central to change and being future fit.
- Humans are metric-driven and want to see how they progress in selected areas over time.
- People often forget that there is a level of mastery to every skill and treat capabilities as checkboxes they have to tick once.
- The world, hence, the skillsets we need change so fast that we need to create organisations that support and enable learning for their employees.

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Lead Creative Schools

At a glance

Target group(s)	Schools
Sector(s), level(s), and settings covered	School education, institutional settings
Level of implementation	Sub-national (country)
Funding arrangements	Funded by the Welsh Government and Arts Council of Wales (£9.5 million over five years)
Key premises	All people can develop their creative skills
Definition of creativity	Creativity is defined as five creative habits of mind – being inquisitive, persistent, collaborative, disciplined and imaginative – described by Claxton, Lucas, and Spencer
Related competences and skills	Not applicable
Pedagogical approaches and methods	Enquiry-based learning, five creative habits of mind, high-functioning learning space
Assessment approaches and methods	Self-evaluation based on the five creative habits of mind
Drivers	- Political commitment and policy buy-in - Launching a large-scale programme rather than piloting the action in a smaller selection of schools - Engaging pupils and allowing teachers to see the impact creative approaches have on their progress rather than focusing on the professional learning for teachers only
Barriers	Getting all partners fully engaged in the scheme early on, but this has changed once the positive impact on schools has become evident
Results	559 schools have participated in the LCS scheme; over 40,000 learners have benefitted to date (improved creative skills and attainment).
Key messages and lessons learned	- The intervention is suited for not only well-performing but also struggling schools. - Creative partnerships can improve the attainment of pupils regardless of their performance before and even decrease the level of absences. - Such projects help to re-ignite teachers' confidence and bring back the passion for the profession that they once felt. - Active engagement of senior management is central.

Introduction

In the sections below, we provide a detailed description of the Lead Creative Schools (henceforth, LCS) scheme, implemented as part of the Creative Learning through the Arts programme in Wales, the United Kingdom.

First, we overview the design of the LCS scheme, specifying the context, objectives, timeframe, level of implementation, geographical scope, target groups, sectors, levels, and settings covered, key activities, actors involved and funding arrangements. Second, we explore how creativity has been conceptualised and embedded in key activities of the LCS scheme. Third, we describe enquiry-based learning and how it has been used to develop five creative habits of mind. Fourth, we present the results achieved in and lessons learned from the first four years of implementing the LCS scheme.

The description of the LCS scheme is primarily based on desk research. The initiative has been very well documented. Key sources reviewed include the Creative Learning through the Arts action plan, and introduction to creative learning, a handbook on LCS scheme, annual and evaluation reports of the Creative Learning through the Arts programme, and other resources available on the website of the Arts Council of Wales. To complement desk research, we interviewed Sian James (Lead Creative Schools Programme Manager in the Arts Council of Wales) and Diane Hebb (Director of Arts Engagement in the Arts Council of Wales). To boost the validity of the analysis and reliability of the research results, we have applied the principle of triangulation – where possible, verified information by cross-checking different data sources.

Design of the initiative

Context and objectives

In 2013, the 'Arts in Education' report by Professor Dai Smith was published. It set 12 recommendations for the Welsh Government and Arts Council of Wales, all of which were accepted in March of 2014. The report invited the Government to assert the central role it envisages for arts in education and in general use the arts in support of the three national education priorities to improve literacy, numeracy and reduce the impact of disadvantage (Arts Council of Wales, 2015c).

Building on these recommendations, in 2015 the Welsh Government and Arts Council of Wales launched the Creative Learning through the Arts programme – a five-year action plan for Wales. The programme set three objectives (Welsh Government and Arts Council of Wales, 2015):

- Improve attainment through creativity
- Increase and improve arts experiences and opportunities in schools
- Support teachers and arts practitioners in developing their skills

LCS focuses on improving attainment through creativity. The scheme aims to promote new ways of working, with innovative and bespoke programmes of learning designed to improve the quality of teaching and learning (Arts Council of Wales, 2015a). It works with selected schools by providing creative people, skills and resources that are needed to help them address the challenges that they face. The scheme nurtures and develops the creativity of learners so that they achieve their potential, grow as well-rounded individuals and are prepared with skills for life, i.e. are able to meet the needs of the economy and to thrive within the increasingly competitive environment of day-to-day life (Arts Council of Wales, 2015a).

More specifically, the programme aims to support schools to (Welsh Government and Arts Council of Wales, 2015):

- Work with creative practitioners in their classrooms to transform teaching and learning
- Devise and implement a project or programme of work links to individual school development priorities
- Find creative approaches to improving literacy, numeracy and attainment, and to reducing the impact of deprivation on educational attainment
- Embed changes in teaching practice leading to sustainable impact
- Put the arts and creativity at the heart of school life
- Be recognised for their commitment to improvement through creative teaching and learning and the arts

Timeframe

The LCS scheme was launched in 2015. For the last five years, it has been running in parallel with the Welsh Government's intensive agenda for education reform and has substantially influenced the curriculum launched in 2020 for the introduction in schools from 2022 onwards (Arts Council of Wales, 2019). The new curriculum features creativity at its heart and has four purposes, one of which is to help ensure that all children and young people develop as enterprising, creative contributors who (Welsh Government, 2020):

- Connect and apply their knowledge and skills to create ideas and products
- Think creatively to reframe and solve problems
- Identify and grasp opportunities
- Take measured risks
- Lead and play different roles in teams effectively and responsibly
- Express ideas and emotions through different media
- Give of their energy and skills so that other people will benefit

To help schools develop their plans for delivering the new curriculum, the Arts Council of Wales and Welsh Government extended the Creative Learning through the Arts programme for two more years (Arts Council of Wales, 2020). The new phase of the LCS scheme will draw on the skills and knowledge of **existing** Lead Creative Schools and external agents (artists) to support **new** schools in developing and delivering enquiry-based projects which transform teaching and learning in support of the delivery of Curriculum for Wales 2022.[6]

Level of implementation and geographical scope

The scheme has been implemented at the country level. It has involved around a third of schools across Wales, the United Kingdom.

Target groups, sectors, levels and settings of education and training covered

LCS scheme targets schools. Individual schools as well as school groups can apply as long as they fall into the category of locally maintained or voluntary aided primary or secondary schools, including special schools and specialist teaching facilities within schools (Arts Council of Wales, 2015c).

Key activities

In Lead Creative Schools, pupils, teachers, and creative professionals work together to implement creative projects. Each encompasses five steps that schools take (Arts Council of Wales, n.d.):

- Decide on the enquiry question or title; consult the pupils; gather benchmarking data to compare to post-project results
- Together with the Creative Agent begin to plan a framework for the project
- Implement the project continually reflecting with the Creative Agent but also with learners
- Modify and adapt the project in response to reflections of pupils, staff, and the Creative Agent, and any formative assessments of learner progress
- Bring the project to a close with a sharing event for colleagues, pupils, and wider school community; evaluate the project; draw conclusions about the changes observed and the impact on teaching and learning

Key actors involved

The Arts Council of Wales has been central to the development and implementation of the LCS scheme. Other important partners include Regional Education Consortia and Challenge Advisers, and Estyn – an education and training inspectorate for Wales (Arts Council of Wales, 2015a). At the operational level, the scheme is managed by the Lead Creative Schools Team.

In the implementation of individual projects in schools, the following play central roles (Arts Council of Wales, n.d.):

- **School Coordinators** are typically members of the senior leadership team. They promote the work ensuring the project is focused on school priorities, offering practical and organisational support, and advocating the work to all staff and the wider school community.
- **Creative Agents** help schools through the process and bring a different perspective to the issues being addressed. They can also assist with recruiting and contracting suitable practitioners, and once work begins, they become a 'critical friend' by observing and offering support and advice.

[6] Based on the internal documentation shared by the Arts Council of Wales.

- **Teachers** co-plan and deliver alongside the Creative Practitioners. The teacher is a co-expert in the process but also open to exploring new approaches to teaching and learning through ongoing dialogue and reflection.
- **Creative Practitioners** understand the learning needs and priorities of the school as an ongoing feature of the collaborative relationship. The practitioner is a co-expert in the process but does not advise on curriculum; this remains the teacher's area of expertise. The Creative Practitioner is commissioned by the school to deliver the creative/arts project.
- **Pupils** are informed and consulted throughout the process. This not only improves engagement but also helps to reveal new creative opportunities and directions.

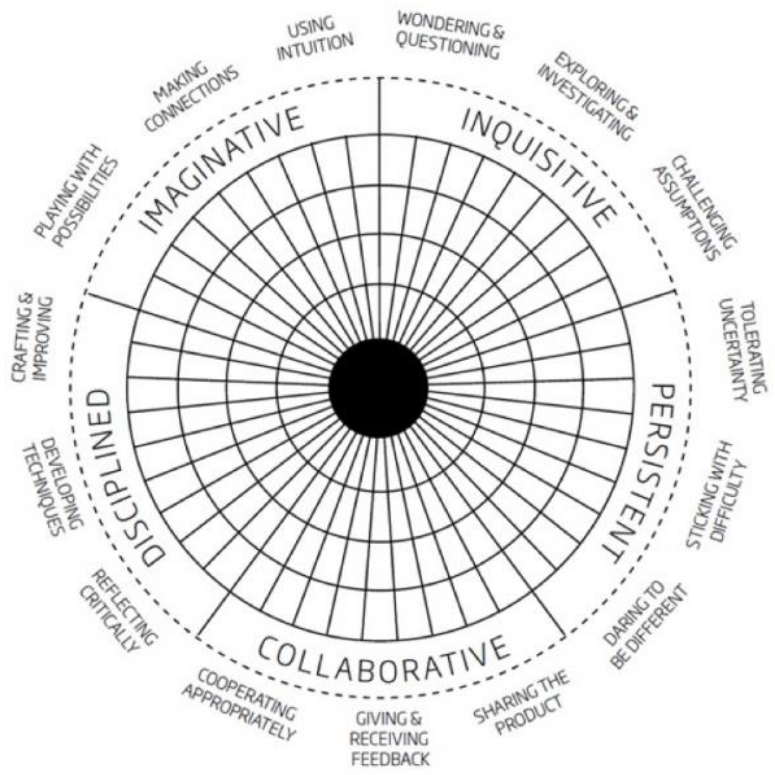
Funding arrangements

Creative Learning through the Arts programme is co-funded by the Welsh Government and Arts Council of Wales. The former pledged £10 million Lottery funding over five years between 2015 and 2020, whereas the latter agreed to match the amount over the same period (Arts Council of Wales, 2015c). 46% percent of the budget was planned to be allocated to the LCS strand (Welsh Government, 2017). According to the interviewees, around £9.5 million have been spent over five years.

As part of the scheme, schools receive grants on an annual basis. These can be used to reward the Creative Practitioners and cover material costs (Arts Council of Wales, 2015c).

Conceptualisation of creativity

The Arts Council of Wales (2015a) argues that the success of the scheme depends on promoting the forms of creativity which, based on evidence, produce positive educational outcomes. Hence the initiative builds on the creative habits of mind. Guy Claxton, Bill Lucas, and Ellen Spencer (2013) developed the model, focusing on the language around creativity which teachers and pupils recognised, valued, and felt comfortable with. The vocabulary was then tested in classrooms, and teachers confirmed that the creative habits of mind as defined by Claxton, Lucas and Spencer were important in learning and easy to recognise.



Source: Claxton, G. Lucas, B., and Spencer, E. (2013). Progression in Student Creativity in School: First Steps Towards New Forms of Formative Assessments, *OECD Education Working Papers*, No. 86, OECD Publishing.

Figure 6. A five-dimensional model of creativity developed by the Centre for Real-World Learning, Winchester University

The wheel builds on the premise that all people have the capacity to develop their creative skills. Within the LCS scheme, it helps pupils, teachers and creative professionals to not only develop a shared language of creativity but also reflect, self-assess and value their own creative skills/dispositions; gather supporting evidence; track their progress over time; be more self-aware of when they are using their creative skills; seek opportunities to be more creative; and identify future learning goals (Arts Council of Wales, n.d.).

Fostering creativity

Central to the initiative is creative teaching and learning taking place in a high functioning classroom, which encourages young people to believe in their creative identity, identifies young people's creative abilities, provides hands-on opportunities for young people to be creative and to develop their creative skills, and fosters creativity by developing young people's creative habits of mind (Arts Council of Wales, 2015a).

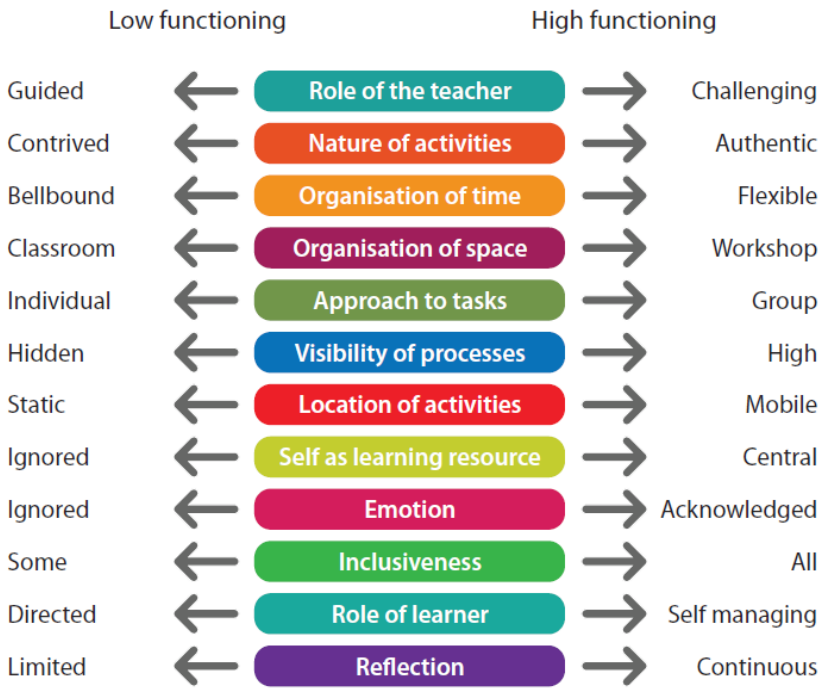
Creative teaching focuses on educators; they are expected to (Arts Council of Wales, 2015a):

- Use innovative approaches to teaching, curriculum delivery and assessment
- Prioritise strategies that engage learners
- Model creativity and adapt their strategies to meet the needs of learners
- Develop material and approaches that fire learner's interests and motivation to learn
- Make cross-curricula and wider links
- Focus on the relevance to the learner and plan based on learner's starting point, progress, and experiences
- Collaborate with learners and support them to take ownership of the experiences
- Provide exciting, memorable, and challenging lessons
- Make the design and use of learning spaces an integral part of their planning and use space flexibly and imaginatively
- Develop effective teacher-pupil relationships
- Provide the space for learners to plan their own learning and to reflect and evaluate progress
- Understand and use the characteristics of the high functioning classroom (see the figure below)

Creative learning implies that (Arts Council of Wales, 2015a):

- Pupils are consulted at all stages of the planning – they are placed centre stage in the learning process.
- School staff, creative professionals, and young people take part together, as equals, in a process of imaginative enquiry. They collaborate, explore, and learn together. Projects are journeys which are not pre-defined products.
- Creative Agents with a broad range of expertise – artists, architects, web designers, scientists – bring unique perspectives, ideas, and skills to the learning experience.
- Creative Practitioners act as arts professionals who work as part of a team over a sustained period of time, rather than coming in to deliver a defined activity with minimal teacher involvement.
- Programmes focus on developing pupils' creative habits of mind as well as wider outcomes. Artistic skills may be developed, but this is not the primary purpose.
- There is an opportunity to think broadly about learning cultures and the possibility of working with a wide range of people in the community and beyond.

Research reveals that effective creative learning takes place in environments which exhibit the features of high-functioning learning space (see the figure below). According to the Arts Council of Wales (n.d.), while this does not imply that a low-functioning approach is ineffective, it does not appeal to all learners; this warrants moving between the approaches to ensure that teaching and learning varies, and the pedagogy meets pupil needs.



Source: Arts Council of Wales. (n.d.). *An Introduction to Creative Learning.*

Figure 7. Characteristics of the learning space

Projects implemented in schools build on an enquiry-based approach to education and learning. A central idea behind it is involving learners in a discussion, formulation of questions, exploration, reflection, and evaluation of their own learning (Arts Council of Wales, 2015a). This helps to achieve the objectives of creative teaching and learning, i.e. lead to confident, motivated, inquisitive, collaborative, imaginative, resilient, disciplined and effective learners who fulfil their potential (Arts Council of Wales, 2015a).

Assessing creativity

Schools which participate in the LCS scheme are expected to self-assess, and in this way engage in the project and programme evaluation (Arts Council of Wales, 2015b). A few resources have been compiled to assist them in the process. These include the Lead Creative Schools Scheme Planning and Evaluation Framework as well as session reflection and project evaluation forms[7]. The documents help schools develop reflective processes which ensure that approaches to creative teaching and learning are built and that positive benefits arising from project activities are maintained in the long term (Arts Council of Wales, 2015a).

According to the interviewees, self-assessment includes a qualitative review of the impact on learners. While all schools are expected to build on the five creative habits of mind, each is free to choose the format best suits their needs.

With regards to outcomes, the Arts Council of Wales (2015a) argues that creative learners:

- Are open-minded and have a questioning attitude to learning and knowledge
- Are self-managing and see themselves and their peers as important resources to support their learning
- Provoke questions, identify problems, and open lines of enquiry
- Use a wide range of intelligences and learning styles
- Have a range of thinking skills that encourage them to come up with ideas and problems, choose which to pursue, and follow through in an effective and efficient way
- Critique their own work and accept constructive ideas and criticism from others

[7] Documents are available on the website of the Arts Council of Wales.

- Have the opportunity and impetus to work constructively, both individually and in teams of different sizes and compositions
- Take account of the influence of process, product, and audience

Results of the initiative

Since 2015, 559 schools have participated in the LCS scheme; 233 creative professionals have been trained as Creative Agents to help schools find creative approaches to teaching and learning; over 40,000 learners have benefitted to date (Arts Council of Wales, 2019).

Based on the most recent publicly available evaluation report (Welsh Government, 2019):

- LCS scheme is the most advanced element of the Creative Learning through the Arts programme to date.
- The level of interest in the LCS scheme from schools has been high.
- The uptake of the LCS strand is largely representative of Wales in terms of the geographical distribution of schools and the primary-secondary split. However, schools in Yellow or Green support categories — demonstrating good outcomes and improvement capacity — are much more likely to engage with the LCS scheme.
- The participation of largely 'the usual suspects' calls into question the degree to which the changes and innovations evidenced within schools benefitting from the LCS scheme can or will be replicated amongst other schools throughout Wales.
- Professional development has emerged as a key motivation for engaging in the Lead Creative Schools process, and developing pedagogy is a key programme outcome for teachers.
- Teachers perceive that the LCS activities have had a positive impact on the creative skills of learners. Improvements were evidenced and reported with regard to all five creative habits of mind.
- Due to a lack of access to key data, it is not possible to robustly evidence or rigorously evaluate the impact of LCS activities upon the attainment of pupils. Nevertheless, interviews with teachers suggest a positive impact upon attainment in many cases, while data provided through evaluation forms reveals a general correlation between participation in the LCS scheme and improving attainment.

The last point has been addressed in more detail in the fourth evaluation of the Creative Learning through the Arts programme. Although the publication of the report is still pending, indicative findings shared by the Arts Council of Wales reveal that most teachers believe the intervention to have had a positive impact upon the attainment of learners.

Conclusions

Evaluations reveal that the LCS scheme has been an outstanding success. Being a major strand of the Creative Learning through the Arts programme, the scheme has transformed teaching and learning in Wales and helped to place creativity at the heart of the curriculum. According to the interviewees, key strengths of the scheme are the following:

- Political commitment and policy buy-in
- Launching a large-scale programme rather than piloting the action in a smaller selection of schools
- Engaging pupils and allowing teachers to see the impact creative approaches have on their progress rather than focusing on the professional learning for teachers only

The key challenge for the Arts Council of Wales has been to get the Regional Education Consortia fully engaged in the scheme early on, but soon the positive impact on schools was evidenced, and this has changed.

The interviewees argue over the years they have learned that the intervention is suited for not only well-performing but also struggling schools and that creative partnerships can improve the attainment of pupils regardless of their performance before and even decrease the level of absences. Moreover, such projects help to re-ignite teachers' confidence and bring back the passion about the profession that they once felt. As for success factors, active engagement of senior management has proved to be central.

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Design IT

At a glance

Target group(s)	Students in higher education and their educators
Sector(s), level(s), and settings covered	Higher education, institutional settings
Level of implementation	European
Funding arrangements	Funded by the European Commission (Erasmus+ Programme 2014-2020)
Key premises	Transversal skills such as creativity can be fostered
Definition of creativity	Creativity was understood as encompassing 1) idea-exploration and the ability to come up with multiple and diverse ideas and 2) the action of bringing ideas into life and applying critical thinking
Related competences and skills	Innovation, entrepreneurship, collaboration, problem-solving, and critical thinking
Pedagogical approaches and methods	Gamified learning, experiential learning, and design thinking
Assessment approaches and methods	Coin system, formative evaluation of group work, problem statements, and out-of-the-box mentality
Drivers	- A well-developed and consistent methodological framework underpinning the game - The game and development of material were built in an extremely participatory manner - Flexibility of the game, which made in adaptable to several countries and disciplines
Barriers	- Challenges to disseminate and make the project well known - Not enough funding to sufficiently upscale the project - Although the game made students generate ideas, some found the online learning platform limiting design-wise
Results	A needs analysis of design thinking in higher education, an active learning framework for promoting design thinking in relation to entrepreneurship, and a validated gamified learning platform Design IT were developed; 358 students and their teachers tested the game, which helped them improve their creativity, interactivity and communication.
Key messages and lessons learned	- Gamified learning is very adaptable, hence well suited for various settings of learning. - Design thinking offers a lot of potential for addressing practical challenges in interdisciplinary teams. - Newly formed and very versatile teams, working in remote online mode, may lack motivation to find common ground.

Introduction

In the sections below, we provide a detailed description of the Erasmus+ project 'Design thinking in higher education for promoting human-centred innovation in business and society' (project reference: 2017-1-EE01-KA203-034889), henceforth 'Design IT'.

First, we overview the design of the project, specifying the context, objectives, timeframe, level of implementation, geographical scope, target groups, sectors, levels, and settings covered, key activities, actors involved and funding arrangements. Second, we explore how creativity was defined and embedded throughout the project activities. Third, we explain the methodology of the design thinking and how it has been applied to develop transversal skills. Fourth, to the extent that existing data allows, we present the results of and lessons learned from the project.

The description of 'Design IT' is primarily based on desk research since the project is well documented. Key sources reviewed include the project website, the methodological and evaluation report and information retrieved from the Erasmus+ Project Results Platform. To complement desk research, we interviewed the coordinator of the project – Dr Kai Pata (Senior Researcher at the Centre of Educational Technology at Tallinn University, Tallinn, Estonia). To boost the validity of the analysis and reliability of the research results, we have applied the principle of triangulation – where possible, verified information by cross-checking different data sources.

Design of the initiative

Context and objectives

According to the project evaluation report, the rapid evolution of technology today results in solutions and services becoming out-dated and replaced by emerging innovations. Therefore, the project aimed to address the challenge faced by higher education institutions to create adaptive adults that are critical thinkers with entrepreneurial mind-sets. The project saw a great necessity for incorporating entrepreneurial processes into the already existent curricula in a manner that allowed students to build new skills and competences in innovative learning platforms. '*Entrepreneurial capacity is long considered as a key transversal competency applicable in all subjects and educational levels (ET2020). It empowers individuals to explore their talents, to introduce creative ideas, and to take action towards turning ideas into viable solutions that contribute to business growth and social well-being*' (Erasmus+ Project Description). In addition to the need to develop students' transversal skills to prepare them for and contribute to rapidly changing labour markets and technologies, Dr Kai Pata (coordinator of the project) stated that at the time of the project implementation there were no online learning platforms in formal education making use of gaming technology to foster students' transversal skills.

The project partners aimed to fill this gap and foster the transversal skills that students need to develop in the new labour market by creating an online gamified learning platform and basing it on the design thinking method. As a methodology studied in depth since 1969, when Herbert A. Simon wrote 'The Sciences of the Artificial', design thinking has evolved from strategies in the field of architecture and design into being frequently applied in the field of science and entrepreneurship. The approach has generated interest across sectors and industries as an alternative method for introducing innovative solutions even in situations where no solution exists, as a solution to so-called 'wicked' or unclear problems. In the context of this project, design thinking was described as a human-centred, solution-oriented approach to entrepreneurial innovation that aims at a better understanding of how a user will experience a proposed solution. This methodology fits well with a problem-based pedagogy frequently used in education settings to promote creativity and critical thinking. In the game, students were challenged to solve a real-world problem set out by the teacher (the game master).

Fostering creativity was not only an explicit objective of the project but came through in the project documents discussing the methodology. It is the creative approach to problem-solving through a process of idea-expansion that distinguishes design thinking from analytical thinking. For example, the final evaluation report reads: '*Design thinking combines empathy for the customer's problem, creativity so as to generate brand-new solutions, practicality, and feedback, so as to analyse a given situation and find the most appropriate solution.*'

The goal, to prepare students for the contemporary labour market, was achieved by introducing an innovative methodology, design thinking and game-based learning, to improve students' entrepreneurial mindset, into higher education and training. The project trained teachers and students in universities in applying a problem-based and case-based pedagogy to their own learning, where they had to understand problems in-depth (empathise), define them and ideate, prototype and test solutions. Furthermore, the project partners involved a large group of teachers from different disciplines and students with various interests and experience in gaming, in the development and testing of the online platform. The context, general and specific objectives of Design IT are outlined in the table below.

Table 6. Context, General and specific objectives of the 'DESIGN IT' project

Context	General objectives	Specific objectives
- Need for **transversial skills** such as critical thinking, entrepreneurial mindset, digital problem-solving skills and soft skills in a rapidly evolving society and labour market - Need for **gamified online learning enviornments** to be tested in formal higher education	- Introduce innovative **design thinking** interventions into **entrepreneurial higher education** towards preparing students to enter evolving economies by being adaptive, resilient, innovative, and creative and by possessing the practical entrepreneurial skills that will allow them to put ideas into action in business as well as social well-being contexts	- Enrich skills and competences with specific reference to **technology, entrepreneurship and social innovation** - Contribute to the development of creativity (ideation), critical thinking (evaluation of ideas), entrepreneurship (putting ideas into action) and the following soft skills: adaptability, resilience, group-work, and customer understanding. - Promote a problem-solving pedagogical approach (**Design Thinking**) based on ideation, brainstorming, prioritization of ideas, evaluation of ideas, leading to the design of economically viable services to successfully address the needs of end users - Implement the innovative pedagogy of Design thinking in higher education and VET contexts at a European level

Source: Compiled by the authors based on the data retrieved from the Erasmus+ Project Results Platform and the final evaluation report.
Note: In the project documentation, no distinction is made between the general and specific objectives, hence the latter has been identified by the authors, based on the information available.

Timeframe

The project was implemented between September 2017 and December 2019 in five stages covering a kick-off meeting, a field study on students' knowledge of and need for training on games, a workshop and brainstorming session with teachers, a workshop with a design company and a workshop with students testing the flow of the game. The last part of the project dealt with the evaluation of the project results – collection of feedback from students and partners involved. The project website with all the materials is still available online.

Level of implementation and geographical scope

'Design IT' was implemented at the European level. Four countries and five organisations participated as organisers. The map below identifies the countries that participated in 'Design IT' and specifies how many partners implemented the project there (light blue – one, dark blue – two).

Map 3. Geographical scope of the 'DESIGN IT' project

Source: Compiled by the authors based on the data retrieved from the Erasmus+ Project Results Platform.

Target groups, sectors, levels and settings of education and training covered

The primary target group of 'Design IT' was students in higher education. Students took part in the gamified online learning sessions, and some of them provided input in the design stage. 'Design IT' set out to target students in formal education, particularly higher education institutions that cooperate with workplaces, especially SMEs. In Finland, VET students were also involved. According to Dr Kai Pata, although most students participating in the project as a part of their university courses were young adults, some were up to 40 years of age.

In addition, 'Design IT' targeted the educators of courses where the game was adopted. It did so through instructor support content on the understanding and integration of design thinking into the gamified learning platform. Some teachers were also targeted through the multiplier events (see key activities), but their involvement aimed to let them test and give input to the design of the game rather than improve their creativity and skills or train them on how to use the game.

Key activities

The core activity of the project was the development and testing of the gamified learning platform. The core and functions in the game were the same, but the topic students had to address inside the game differed from institution to institution. The students mostly participated in each country as players of the game, playing an active role in carrying out the design procedure. In each country, a certain number of students also answered a questionnaire and gave interviews about their experience of the structure of the game. The following activities cut across the work of the partner organisations:

- **A small-scale study[8] to identify student needs for building design thinking skills.** The intention was to map the prior knowledge of the students about design thinking and gamified learning methodologies, to find the knowledge gaps and needs that the game had to address. This activity was implemented in all countries but with students of different courses and experiences with gaming, including students with no or a lot of experience. In Greece, the questionnaire was implemented during the course 'Educational Technologies', in Finland, with students of design courses, in Portugal, with graduate students who were experienced gamers, and finally, in Estonia, undergraduate students in activities related to social change answered to the questionnaire.
- **Development of the methodological framework[9] for design thinking in higher education.** The methodological framework underpinned the development of the game and active learning approaches for building design thinking skills of students by use of the game. The developed framework combined three dimensions: practice, cognitive, and mind-set (see the section 'Fostering creativity'). The framework adopted tools and lean service creation canvases from design companies, a human-centred approach, thinking by doing and collaborative work style.
- **Development of a gamified online learning platform.** The project produced a learning game for promoting design thinking mind-sets in formal entrepreneurship education contexts as a complementary learning tool. In the game, students were challenged to solve a real-world problem or challenge set out by the teacher. All stakeholders, teachers and students were involved in this activity, as game masters and gamers respectively, through the courses at their universities. In addition, educators ran events where students and educators tested the tool and gave feedback (see next bullet point).
- **Multiplier events**. Multiplier events were used to share ideas, brainstorm, and test the gamified online learning platform. According to Dr Kai Pata, the plan had originally been that the gamified learning platform would strengthen individualised learning of students. However, the discussions in the multiplier events steered the design towards collaborative learning instead. A collaborative learning style where students worked in teams inside the game was also requested by the student needs survey and student feedback. The multiplier events were not implemented the same way in all partner countries.
    - In Estonia, one multiplier event was conducted as a training session with teachers from schools and vocational universities who played the game and discussed its applicability in educational contexts. Another multiplier event was organised with two groups of students engaged into testing when the tool was not completely ready. In one group the students had to design the smart learning platform/ the learning platform for health and wellbeing with digital tools, in second case they had to think of informal learning opportunities digital media offers for adult learners. Lastly, a third group of 12 students and two supervisors (from Schools of Digital

[8] The study on learners' needs is described in Intellectual Output 1 'Learning needs analysis and development of methodological learning frameworks for design thinking in higher education'.

[9] The methodological framework is explained in Intellectual Output 1 'Learning needs analysis and development of methodological learning frameworks for design thinking in higher education'.

technologies and Education) evaluated the Design IT on the challenge of designing future technologies for learning spaces towards the end of the project.

- In Finland[10], a multiplier event took part during the global event, 'System 2020', which aimed to gain understanding, and to ideate solutions around inclusion, engagement, as well as assessment and recognition of science learning outside the classroom. The Design IT platform was used to support and document the groups' work during the event. The participants consisted of the museum, maker space, youth association facilitators as well as institute members representing immigrant and disabled people who all knew and used design thinking methods in their work. The participants came from 19 countries from Europe and the Middle East and 42 partners took part in the multiplier event.
- In Greece, a presentation of the gamified tool and a practical workshop with 75 STEM teachers were organised. During the workshop, the teachers worked in teams to design a learning process for mathematics using the gamified Design IT tool.
- In Portugal, a practical workshop where participants tested the gamified learning platform was organised. Due to time restrictions, participants (students and teachers) were only able to follow the two first stages of the Design Thinking model.

- **Educator support**. Instructional support materials were developed for educators working in higher education institutions. These materials focused on how to adopt design thinking tools in higher education courses, particularly those on entrepreneurship. The materials included: a user guide providing step by step information on the deployment of the game-based learning platform for design thinking skill development, instructional videos demonstrating how the active learning design and digital, gamified design thinking environment can contribute to the development of entrepreneurial skills among students and comprehensive learning activities, a portfolio of 17 Learning Sheets describing the usage of Design IT platform in different design thinking contexts for entrepreneurship education courses (in English) including the learning scenarios tested out by the partners.
- **Project management, monitoring and dissemination**. The project was monitored, validated, and evaluated throughout the project period. The project was evaluated by use of formative evaluation strategies. Qualitative formative strategies were used to evaluate the game design at the initial phase and to test the prototype of the game, and, at later stages of the game, validate and analyse survey data and open-ended questions. The process and results were disseminated through the project website and at dissemination and multiplier events.

Key actors involved

The consortia of DESIGN IT consisted of five partners: Tallinn University (Estonia), Metropolia (Finland), University of Thessaly and Centre for Research & Technology Hellas (Greece) and Polytechnic Institute of Porto (Portugal). Tallinn University and Dr Kai Pata at the Centre of Educational Technology coordinated the project and contributed to overall project development and design. Partners involved have contributed to the implementation of all project activities.

Table 7. Organisations involved in the implementation of the 'DESIGN IT' projects

Legal name	Short name in English	Type of organisation	Country	Role in the project(s)
Tallinn University	Tallinn University	University	Estonia	Project coordinator
Metropolia Ammattikorkeakoulu oy	Metropolia	University	Finland	Project partner
Panepistimio Thessalias	University of Thessaly	University	Greece	Project partner
Ethniko Kentro	Centre for Research	University	Greece	Project partner

[10] More information is available at https://docs.google.com/document/d/1ISqEv6aAIsBCiO2FbU-XEA6PrfUe4qpi/edit#.

Erevnas Kai Technologikis Anaptyxis	& Technology Hellas			
Insitutto Politechnico do Porto	Polytechnic Institute of Porto	University	Portugal	Project partner

Source: Compiled by the authors based on the data retrieved from the Erasmus+ Project Results Platform.

The design organisations Futurice, Gofore and IDEO contributed to the project as specialised consultants. The former two provided templates and canvases for design, whereas the latter provided a design kit and method guidelines used for each phase of the design process.

Funding arrangements

The project was funded as a strategic partnership for higher education (cooperation for innovation and the exchange of good practices) under the Erasmus+ Programme. It was awarded a grant of EUR 232 710.

Conceptualisation of creativity

Creativity was not clearly defined in the project documentation. However, the term is understood to have two capabilities. First of all, creativity is described in several places as idea-exploration and the ability to come up with multiple and diverse ideas. For example, in the Final Report, a good problem statement has to be 'wide' in order to foster creativity. Secondly, in another evaluation report, creativity was described as the act of bringing ideas into action and applying critical thinking (critical thinking was not used here, own interpretation) by 'rationalising the ideas to potentially working solutions'.

Especially the latter capability of creativity was emphasised in the project documents to the conceptualisation of creativity and 'transversal' skills. Transversal skills were used in the project documents, and the gamified learning platform was tested among students attending a course on transversal skills. Creativity was referred to as a transversal skill and linked to innovation and entrepreneurship, and this was tied to national education policy documents. In the Final report, critical and creative thinking is given as examples, together with entrepreneurial capacity, as transversal skills that the project fosters. The learning scenarios inspired by real-world case studies were designed around the objective to promote creativity as a transversal soft skill, as it challenges students to generate solutions from their ideas through teamwork and solve societal and business-related problems through brainstorming out-of-the-box thinking and collaboration (see the next section).

Overall, creativity was seen as an integral part of the problem-solving process necessary in design thinking and gamification (Olding, 2012). Creativity is especially important in solving problems where there are no solutions. Hence, creativity has been both a target of the project and a key feature of the design thinking methodology central to it.

Fostering creativity

This project aimed at facilitating design thinking in higher education by introducing an active, experiential learning approach that engages students with design thinking principles towards building their capacity to act as innovators in business and civic contents (Design IT project, 2018). Design thinking is a solution-based approach that is used to solve problems and correct faulty definitions of problems. It has a human-centric characteristic because it stresses that the process of "thinking out of the box" towards introducing solutions need to address actual user needs (Design IT project, 2018). A good statement of a problem according to the method focuses on people, their needs, their emotions, and their desires rather than specifications, solutions, technology, or resources (Design IT project, 2018). The platform allows students to experiment with design thinking practices by working on problems inspired by the real world and go through the five stages of design thinking: empathising, defining, ideation, prototyping and testing (Design IT project, 2018). In the game, they are challenged to solve a problem set out by the teacher.

Creativity was considered a soft skill promoted through the gamified learning platform, especially in the parts of the game that dealt with idea-exploration and finetuning iteration of ideas that 'work' in the real world. Furthermore, the design thinking framework underpinning the project considered classic readings of creativity (Simon 1969; Schön 1983) as well as IDEO and Stanford University design thinking methods along three dimensions: practice, cognitive and mindset (see Hassi and Laakso, 2011 and 2011a).

The *practice dimension* adopted tools and lean service creation canvases from design companies, human-centred approaches (Norman, 2010), thinking by doing (Schön, 1983) and collaborative work style (Paavola and Hakkarainen, 2014**;** Seitamaa-

Hakkarainen and Hakkarainen, 2001; Rylander, 2009; Brown, 2009; Sato et al., 2010). In the evaluation report[11], the project partners considered that the practice dimension of the game was achieved and fostered design thinking in the three ways listed below:

- **Visualisation** is a powerful tool to express intangible concepts, ideas and models and supports the development of common understanding in the design thinking method. In the game, participants can use different canvases to share the visual resource/materials within the team for the design of their product or project. The scoring features incentivise the participants to share visual materials among the teams and encourage all teams to build up the common understanding of their project concept outside the team also.
- **Combination of divergent and convergent approaches** encourages designers to look on their challenge through the broader spectrum, open up to a wider range of ideas and explore multiple paths to the solution. The preferred convergent approach in the game was chosen only after exploring divergent paths, recognising the patterns and relationships of the diverse variables. The game platform encouraged the participants to generate and diversify ideas through the brainstorming canvass, organise virtual brainstorming session within the team, and gain different perspectives from outside the team to include in the brainstorming process and, finally, use the feedback from the experts and members of other teams to combine the diverse variables in their design solution.
- **Collaborative work style** in design thinking considers collaboration within team members as well as with different stakeholders to get as many different perspectives for the solution as possible. The game design, a team-owned activity, encouraged the collaboration of the participants within and outside the team through different canvasses and built-in awards system to gain extra points for collaborative efforts, e.g. exchange of resources within and among the teams, brainstorming and ideation collaboratively, interaction with the teams and experts and etc.

The *cognitive dimension* regarded the research of creative thinking which was mainly based on abductive reasoning (Paavola, 2015; 2015a; Lockwood, 2009; Dew, 2007) and hands-on research on thinking and doing by Seitamaa-Hakkarainen et al. (2014). Abductive reasoning provides a means to understand how to foster creative activities appropriately. Ideation, creative thinking or in other words coming up with ideas out of the box requires the following activities and characteristics (Paavola, 2014):

- Searching anomalous, surprising, or disturbing phenomena and observations
- Detecting details, little clues, and tones
- A continuous search for hypotheses and understanding their presumptive nature
- Aiming at finding what kind or type of explanations might be viable for scoping the challenge
- Aiming at finding ideas which can be explained or rather be experimented if they work
- Searching for "patterns" and connections that fit together to make a reasonable unity
- Understanding and paying attention to the process of discovery – its different phases

In the evaluation report[12], the project partners considered that the game had abductive reasoning, reflective reframing and holistic view elements built into it. The formed was added with questions in the game such as 'What is something completely new that would be lovely if it existed but doesn't now?', according to the report *'it prompts the generation of new ideas and emergence of possible new worlds'*(Evaluation report). Reflective framing was prompted by giving the participants room to identify, frame and reframe a problem to look beyond the immediate boundaries of the challenge. The holistic view regarded the challenge of making participants understand the users' needs and end-users' environment with its functional, emotional, social and cultural aspects.

The last dimension *mindset* regards how problems and challenges are approached and includes orientation characteristics needed to be fostered, such as: being able to stand uncertainty, willing to learn from mistakes and being emphatic. These characteristics are learnable (Cooper and Lockwood, 2009; Drews, 2009, Hassi and Tuulenmäki, 2012: Mattelmäki and Battarbee, 2002). In the game, all these three dimensions were targeted through student engagement, thematic focus areas of interest to the students, assessment system that scored the students for how many ideas they could create and how well they cooperated. In the game, students had to define problems and challenges and collect experience needed to pass levels and receive coins by doing peer-reviewing and brainstorming. The evaluation report read: '*The way our game platform*

[11] The evaluation report that includes exemplary learning scenarios.
[12] The evaluation report that includes exemplary learning scenarios.

suggests the prompts from the experts and additional points for the game, encourages the experimental and optimistic mindset of the participants in the game.'

In general, pedagogical approaches that exercise problem-based learning, project-based learning and inquiry-based learning are well fitted into design thinking mentality (Dym, Agogino, Eris, Frey and Leifeet, 2005). These learner-centred approaches increase students' awareness of good design processes. Furthermore, the platform was designed to include: generation of ideas/solutions, receiving support, e.g. 'on-going feedback about the feasibility of various solutions by providing multiple and varied opportunities to design and create prototypes, experiment with different ideas, collaborate with others, reflect on their learning, and repeat the cycle while revising and improving each time' (Razzouk and Shute, 2012: 343).

Assessing creativity

Within the frames of the 'Design IT' projects, learning outcomes were not assessed. However, Dr Kai Pata explains that students received scores during the game based on their creativity and entrepreneurial skills and, most importantly, based on their ability to collaborate in solving problems and ideation[13]. Each team in the game gets three coins once in every level once they confirm their work to their game master (teacher). The coins can be used to unlock other teams' confirmed work, to start a chat with a teacher or create a brainstorm where gamers indulge in idea-exploration. These actions all provided experience points for the teams but by writing reviews on other teams' effort students receive individual experience coins. The final assessment, so to say, is done when the game master (teacher) evaluates and accepts the work after the players have improved it based on feedback (formative evaluation). The teacher's acceptance of the work by the student inside the game is necessary for moving on to the next level. Some characteristics of the coin system in the game could be seen as a competitive feature of the game, to keep it fun for the students, rather than meaningful assessment.

Regarding learning outcomes, the key idea of design thinking is that students must fully understand the game, accurately define a problem statement, collaborate, and think out of the box to introduce solutions to 'wicked' problems to which none appears to exist at first glance since this will prepare students to face future risky situations at their workplace. In addition to targeting students, Design IT aimed to develop the following skills and/or knowledge of educators: the ability to integrate new methodologies into courses, awareness of the need for integrating ICT into HE in alignment with the needs of the entrepreneurial and social-entrepreneurial sectors, linking of theoretical knowledge to business practices, linking newly developed knowledge to educational goals, ability to build high-level knowledge among students, fostering students' motivation and creativity on engaging in problem-solving activities, critical thinking, innovation, know-how exchange networks and the ability to integrate design thinking into their practices.

Furthermore, below we give an overview of the learning requirements that relate in particular to creativity and other transversal skills prompted in this project (own selection).

[13] The descriptions of the functions of the game is available at https://docs.google.com/document/d/1olynX-2vdohfH8NBRDOFZ0DpiOCDHcMlipAz4oHZM8g/edit

Flexible thinking and adaptability to change

In DesignIT scenarios, students come face-to-face with individuals who deal with difficult issues. They should be ready to listen to them, record their experiences and their complaints, and provide them with viable solutions. Students should be flexible to change. They should accept the challenge and adapt in order to satisfy their customers.

Critical and decision thinking

'The implementation requirements for a specific pro-ject may evolve through time. Students will need to make decisions throughout project implementation. To make informed decisions, students should be ready to understand the users' needs. As a result, students will develop critical thinking by making, sup-porting, and evaluating decisions.'

Efficient teamwork, building relationships with the customer, and collaborative learning

This serious game includes scenarios in which stu-dents learn how to exist together with others so as to accomplish a specific goal. Furthermore, they learn to communicate with customers effectively in order to empathise with them. What is more, through all the aforementioned, they participate in collaborative learning.

Support ideas that lead to their design

Students learn how to make their case about ideas and solutions that they suggest. They become self-confident and get prepared for the fact that others maybe adopt their opinion or reject it. They learn not to be afraid to express their viewpoints and be coura-geous.

Promotion of creative thinking and brainstorming

Students learn that brainstorming is a way of dealing with problems; they come face-to-face with difficult issues and after synthesizing the necessary infor-mation, they can ideate without being judged about their ideas.

Providing viable solutions towards real market and social needs

A gamified learning environment challenges students to apply end to end the design thinking process until they reach an effective solution. Students learn how to see a problem to completion.

Learning in a supportive and harmonious environment

Students feel secure in virtual learning environment and game-based learning processes. They have the opportunity of experimenting and learning in a virtual context that simulates the real world. There is no risk of poor judgements or underachievement.

Source: Adapted by the authors from Final Evaluation Report Output 1. Available at https://projectdesignit.eu/wp-content/uploads/2019/10/DesignIT-O1Final.pdf

Figure 8. Student learning requirements related to creativity

Results of the initiative

Since 'DESIGN IT' was completed in December 2019, in this section, we focus on the results of the project.

The outputs of the project were[14]:

- A needs analysis for design thinking in higher education courses in four countries
- An active learning framework for promoting design thinking in entrepreneurship higher education through exploration, collaboration, and creativity
- A validated gamified learning platform Design IT that familiarises students with design thinking concepts and helps to build practical skills
- An Educator support in learning scenarios and best practice guidelines for the integration of the proposed methodologies and tools into classroom practices

Students from each partner country (100 students from Finland, 64 students from Estonia, 140 students from Greece, 54 students from Portugal) participated in the game validation phase in 8 activities from Fall 2018 to Spring 2019.

Regarding the ability of Design IT to foster creativity, the two first questions of the questionnaire participating students were answering were about creativity and collaboration, and answers were reported for Greece and Finland: 1. Please describe in what ways the tool helped you to be creative, to experiment and explore the opportunities, and design the challenge? 2. Please describe in what ways the tool supported collaboration within and outside the team to solve the problems and find the opportunities? For some of the students, those from Metropolia (Finland), the question on creativeness (Q1) was hard to answer since the tool was used for documenting and organising, and it was not perceived that their usage of the tool was aimed for creativity per se but for supporting creative actions executed in the field. The few students who tried to formulate the answer stated: 'Helped me look at the challenge from other team members' points of views; It forced us to properly dissect the problem and explore different angles; In organising and structuring prototyping, brainstorming, sketching.

In the case of the Greek partners, the tool was evaluated by the students to promote creativity, interactivity and communication between team members. It was explained as follows: '*The Design IT interface acts like a blackboard with stickers, where it is easier to categorize your ideas, and break the initial problem into smaller ones, so that each post-it sticker represents a smaller problem. Additionally, you can visualize your ideas and edit them whenever you want, which helps you be creative and process your ideas. It also helps you work step by step and gradually improve your idea'* (Final Evaluation Report). The students stated that the easy collaboration further fostered their creativity as transversal skills (actualisation of problem-solving ideas): '*Users can also communicate with members from the other teams, who can help them design and implement their ideas. There is also the review and help canvas, which can be used by team members in the case they get stuck or need help with their project.*'

All the student teams developed innovations and mostly experienced designing for human-centred innovations positively. In addition, most teachers testing the tool in multipliers event were positive[15]. The peer evaluation results[16] integrated from different countries highlight the learners' perception of the design thinking process with the Design IT app regarding the following:

- **Team and collaborative creation**: The interface incentivises collaboration, for example, all team members must sign up in a "challenge" and then have a common workspace. The students found it is easy to creatively organise ideas, and work together as a team inside the platform. The fact that the team members could communicate with each other whenever they wanted on the platform further facilitated collaboration and fruitful brainstorming. Users could also communicate with members from the other teams, who can help them design and implement their ideas. As the peer evaluation and interview with Dr Kai Pata confirms, the ability to facilitate good collaboration was likely the strongest point of the platform.
- **Design thinking process ownership and time management**: According to the student, the Design IT tool helped with the designing process and made it more efficient, since the users had to follow certain steps and rules, which made the way of thinking and designing more structured and functional.
- **Ideation and shared canvases**: The tool helped students express their ideas and be creative with the presentations of their ideas. Users could upload text, photos, audio, videos, links etc., which makes

[14] In line with the project leaflet available at https://projectdesignit.eu/wp-content/uploads/2018/09/designit-leaflet-1.pdf

[15] This interpretation is made based on the descriptions and evaluations of the multiplier events listed here: https://projectdesignit.eu/news/

[16] Available in the evaluation report.

information easier to process and brainstorming more creative and fun. The post-it stickers helped students organise and categorising ideas. Due to the anonymity of the people who posted students thought that more creative ideas and experiments arose from the process.

- **Canvases and idea representation**: The Design IT interface acted like a blackboard with stickers in different colours, making it is easy to categorise ideas, and break the initial problems into smaller ones, so that each post-it sticker represented a smaller problem. The tool also helped in the process of visualising and step-wise editing of ideas. However, not all students felt that this helped them to be creative. This was due to the options being available in the online platform, nevertheless being limited compared to the wishes of some students.
- **Gamification and competition between design teams**: The students highly appreciated the getting points based on the number of ideas and collaboration they showed in solving the problem. However, some stated that it did not affect their involvement and that the coin system could be improved.

Conclusions

Based on external and internal review, Design IT can be deemed a successful initiative. According to the project coordinators, key success factors were:

- Well-developed and consistent methodological framework underpinning the game.
- The game and development of material were built in an extremely participatory manner
- The flexibility of the game to different contexts, which made in adaptable to several countries and disciplines.

This is not to suggest the projects had no weaknesses:

- Challenges to disseminate and make the project well known
- Not enough funding to sufficiently upscale the project
- Although the game made students generate ideas, some found the online learning platform limiting as there were not always that many options and ways to act during the game.

Overall, 'Design IT' helped to foster creativity as a transversal skill – especially in the ways creativity links to problem-solving and collaboration. Certain features of this methodology make it particularly well suited for learning in various settings. This was because gamified learning platform could be changed to make students solve any form of problem in any field through games and collaboration. According to the project coordinators, the project is still unique and should have gotten more publicity. To make it more popular, one needs more funding but also to share the platform on the right websites.

In summary, it was found to be easy to set the human-centred innovation challenges in Design IT environment in higher education courses. The design thinking method was particularly useful for solving challenges in interdisciplinary teams, and together with customers from industry and society.

The team composition in courses was, in most cases, international and multidisciplinary, which promoted the diversity of ideas, but also caused tensions among team members. Working in remote online mode discouraged developing common ground, but shared canvases were found good for orchestrating the team activities and enabling everyone's contributions to be considered.

Another take-out was that educators used the opportunity to structure the templates in Design IT for creating the design thinking process but interpreted design thinking tasks and phases differently. The original design thinking boards are usually filled in face-to-face mode, and Design IT did not enable to create the template structures for all kinds of boards. The instruction notes with links to boards' printouts, and visual examples of the design thinking methods were presented on Design IT templates. In some cases (for persona cards) it was possible to create structured boards with other collaborative creation software. The canvases did not support well organising the collection of ideas, students often used other collaboration means and presented links of their work on canvases, but they appreciated seeing all in one place in each phase.

Due to structured canvases, students were aware of the design thinking phases and generally felt that this supported their design process. The students enjoyed reviewing other teams' canvases, and the teams benefitted from contributed ideas and comments. The gamification was quite seamless, and students were excited about the idea, but they noted that seeing other students and teams' points would have motivated them more to compete on challenges and perform in own teams. In total it was observed that students developed some design thinking competences when solving societal and business problems - they grasped the whole process better, and understood the need to extend and narrow the design space and using empathic and creative approaches, the role of visualisation and discussions in iterating the design space. The gamification with points

requires more time and technical development, and the impact of competing in design challenges could therefore not be fully exploited.

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TECRINO

At a glance

Target group(s)	VET teachers; indirectly, students as well
Sector(s), level(s), and settings covered	Vocational education and training, e-learning settings
Level of implementation	European
Funding arrangements	Funded by the European Commission (Lifelong Learning Programme – Leonardo da Vinci)
Key premises	Creativity can be taught
Definition of creativity	Creativity was defined as a multidimensional and dynamic process, involving conscious mental activity, affectivity, motivation and social interaction, and the general ability to solve problems
Related competences and skills	Innovation, intrinsic motivation, curiosity and exploration, choice and discovery, metacognition, creative performance, divergent thinking, and problem-solving
Pedagogical approaches and methods	Distance e-learning
Assessment approaches and methods	Divergent thinking test for students, assessment of creative management competences of teachers and their certification based on that
Drivers	- A well-developed and evidence-based coursebook - Academic publications that disseminated the findings and raised awareness of the importance of a systematic approach to education for creativity
Barriers	- Creative students being seen as disruptive and teachers not being motivated to foster creativity The lack of available assessment tools and lack of ways to assess learning scenarios where there are no right answers or where the process of thinking is more important than the outcome of the tasks
Results	Two online free courses for educators and learners. The partners reported that these were high-quality products that added value; attitudes towards the transferability of the tools were positive. TECRINO's approach and concepts have been used as a basis for other projects, although there has been no impact study so far into the effects of the project on creativity as a skill.
Key messages and lessons learned	- There is a need to develop course material and assessment tools in order to teach creativity. The project was a pioneer effort in terms of developing online free course material on creativity and encouraging the use of

established creativity tests for assessment.

- It is challenging to teach *for* rather than *about* creativity. Creative thinking is not solely about grasping information; this skill cannot be learned in the same way as other fields of knowledge are traditionally taught.
- There is a high demand for creativity in complex problem-solving situations, although the pressure of time and high expectations may kill creativity.

Introduction

In the sections below, we provide a detailed description of the Erasmus+ project 'Teaching creativity in engineering (project reference: 538710-LLP-1-2013-1-CY-LEONARDO-LMP), henceforth 'TECRINO'. TECRINO was a multinational e-learning platform containing learning material on creativity and techniques to foster creativity in engineering.

First, we overview the design of the project, specifying the context, objectives, timeframe, level of implementation, geographical scope, target groups, sectors, levels, and settings covered, key activities, actors involved and funding arrangements. Second, we explore how creativity was defined and embedded throughout the project activities. Third, we explain the methodology and how it has been applied to develop transversal skills in this context. Fourth, to the extent that existing data allows, we present the results of and lessons learned from the project.

The description of 'TECRINO' is primarily based on desk research since the project was very well documented. Key sources reviewed include project website, the guidelines, work packs and evaluation reports available as documents on the project website, several publications in journal evaluating the 'TECRINO' and predecessor project, i-lab, and the project description retrieved from the Erasmus+ Project Results Platform. To complement desk research, an in-depth interview was conducted with a partner of the project Dr Goran Hudec (Professor at the University of Zagreb). To boost the validity of the analysis and reliability of the research results, we have applied the principle of triangulation – where possible, verified information by cross-checking different data sources.

Design of the initiative

Context and objectives

The project documents describe a need to develop students' risk-taking skills and creativity in order to achieve the ambition set out by the EU to make the continent '*the most competitive and dynamic knowledge-driven economy by 2010*' since '*in a dynamic and highly competitive world, knowledge is intrinsically linked to learning and innovation*' (Erasmus+ Project page). In this context, the project partners also find a need to combat "the decline of creativity in the population" (Susnea, Pecheanu, Tudorie, and Cocu, 2014a). The project sees education for creativity as a necessity because creativity is the only instrument that enables today's students to cope with the uncertainties of the future, while some research suggests a correlation between higher creativity and lower levels of anxiety about the future (measured with the AAF scale[17], described in Bolanowski, 2005). Furthermore, by assuming that innovation and creativity can be taught (Erasmus+ Project page), the project aims to improve the awareness of teachers and students about the mental processes and educational techniques required by the concept of 'education for creativity'. The project builds on experiences from a preceding project, Innovation Laboratory (iLab), which was an innovative co-creation space online made to encourage creative thinking, problem-solving and to provide a long-term facility for education *for* creativity (Cocu, Pecheanu and Susnea, 2015).

The overarching objective of TECRINO was to develop to set up a pioneering Moodle platform for teaching creativity (Susnea et al., 2014a). Other project objectives were to study the link between creativity and anxiety about the future, and to develop a free, fast, and easy to use software tool for the assessment of creativity in the educational context. Through research on the outcomes of the initiative, the project partners wished to discover research findings that could put pressure on the education policymakers to review the curricula; improve the public awareness on the importance of reducing standardised testing, provide alternative solutions for the assessment of the students' performance, promoting review of quality norms and advocate for the creation of non-prescriptive and attractive learning environments in school (Susnea, Pecheanu and Dumitriuet, 2016a). More specific objectives of TECRINO were to train professionals to improve the transparency, visibility and the development of their students' competences linked to innovation (TECRINO, 2016b).

[17] Researchers have measured "Anxiety about professional future" (AAF) on a scalelooking at several factors that induce anxiety about professional future among students and young adults. Examples are 1) Difficulties in getting a job and growing anxiety for maintaining the job; 2) Low wages; 3) Negative impact of work on private and family life, in particular, a conflict between the professional role and mother's role; 4) Excessive level of organisational stress; 5) Lack of (individual) resources to cope with stress; 6) Institutional and financial limitations for professional development; and 7) Worldwide evolution of the professional role and the status of the profession.

The project documents clearly state that the aim was to address the key competence nr. 5 – "learning to learn" of the European Reference Framework "Key Competences for Lifelong Learning", by creating not only a problem-solving attitude, but also the ability of the students to handle obstacles and a rapidly changing environment (Erasmus+ project page). Such metacognitive, and transversal, skills were defined as key components of creativity in the project.

Timeframe, level of implementation and geographical scope

The project was implemented between 2013 and 2016. 'TECRINO' was implemented at the European level. Six countries participated as organisers. Two partners joined from Spain, two from Croatia, and one from Cyprus, Portugal, Romania, and Poland each.

Target groups, sectors, levels and settings of education and training covered

According to project documents, TECRINO targeted VET students, educations and institutions. The target group can be divided between a primary and secondary target group. The former consisted of education staff namely in the engineering sector; professionals of VET system, teachers and trainers in the engineering sector; learners and students which are undergoing the level of education and training from the level iv to viii. The secondary target groups were adult training centres; foundations and NGOs promoting the lifelong learning; vocational training centres; public and private education and training schools; public and private entities directly involved in lifelong learning; promotional and development of lifelong learning agencies (national and communitarian); networks of knowledge on vocational training, vocational guidance and training and employability; organisations supporting the field of lifelong learning, vocational guidance and training and employability. Summarised, the main target group of TECRINO were educators who would go on to target their students. Students were targeted indirectly.

The primary target group was those providing formal education and training, whereas the secondary - offering informal learning at workplaces and community centres. Although the project was implemented with teachers in formal educational settings, the aim of the project was that the project could go on to have a life on its own and be applied in informal learning settings too. Dr Goran Hudec explained that he started to test and use the methods he had learned in his own course at university, but that he later on also used the methodology in informal learning settings such as community workshops with participants outside of the university.

Key activities

Central to the project was the development of the platform and two coursebooks on creativity, one targeting educators and one targeting students. The project follows the generic ADDIE model (Molenda, 2003). According to this model, the activities required for the design and development of the appropriate educational content were sequenced in the following phases Analysis, Design, Development, Implementation and Evaluation. In this process, the key activities were[18]:

- **Set out a management and quality plan** to coordinate the development, define the strategies and ensure compliance with the timeline. 3 meetings were organised in the partner countries Cyprus, Spain and Croatia, where the partners contributed to the management and coordination of the project. During the life cycle of the projects 8 monitoring reports on the management and challenges of the project were published (each third month). The coordinator (RTD Talos) was responsible for drafting reports and sending out agendas.
- **Conduct research on trends in VET innovation and education** to find the most important needs and problems facing learners and teachers in promoting innovative skills in learning processes. The methodology applied to this activity could be separated into three parts.
    - Focus groups and meetings with groups of experts who have worked with innovation promotion were held to identify trends, needs and problems.
    - For the elaboration of a process map, semi-structured interviews with key informants and visits to VET providers (universities and VET centres) were conducted. The aim was to understand the best way and process to promote innovation in learning processes.
    - Each partner contributed with national reports on the needs and problems facing the development of learners' and teachers' innovation skills in each country. The coordinating partner of this activity (Euskadi) wrote up the draft European report and comparative report based on the findings.

[18] This part is based on the task planning document, available here http://www.tecrino-project.eu/repository/83191d55959c248c35d567bc807e412b9aec7e51522df39fa790b7c93f0b243d/140207_TECRINO_TASK%20PLANNING%20DOCUMENT_ED2_AT.pdf

- **Define the content of the educational materials**. In this activity, the partners set out to define technical aspects of key definitions important in teaching creativity. These covered the definitions of educational models (e.g. Face to Face and e-learning), learning management systems, metadata content descriptions according to accessible instructional material standards (AIM). The TRIZ theory[19] was defined, modules and lessons described, and a selection was made for the multimedia illustration of sections. During this activity, the partners reviewed professional terminology, revised, maintained and updated the educational content. UNIZg was responsible for drafting the reports related to this activity.
- **Development, design and implementation of the e-learning platform.** This activity aimed to create a group of modular training itineraries taking into consideration the methodology and lessons learnt in the prior activities. The e-learning platform was Moodle, an Open Source Course Management System (CMS), also known as a Learning management System (LMS) or a Virtual Learning Environment (VLE). This activity covered technical aspects with setting up, installing, designing and maintaining the platform structure. Inercia Digital was in charge of coordinating the task and drafting report related to it.
- **Development of educational content for the target group.** The partners developed the two courses tailored for tutors and students, multimedia content, peer-reviewed the educational content and analysis of peer feedback, translated and proofread the instructional materials and integrated them into the e-learning platform together with the assessment tools. Specific tasks that were completed was the creation of a group of didactic guides in CD-ROM format (trainer's version and trainee's version) to valorise, develop and mobilise the competences linked to innovation and acquired in informal contexts; Piloting and validating the pedagogic itinerary and the supporting didactic resources; Mediatisation and edition of the resulting products. This activity was coordinated by UDJG who drafted the materials.
- **Quality assurance and certification process.** In this activity, the aim was to document the technical planning process and assure the implementation of the project based on two requirements: flexibility and clear distinction of roles. The quality management plan, evaluation of quality management and the vocational competence certification guidelines (see assessment) were drafted and by the coordinator of this activity – Syntea.
- **Dissemination[20] and exploitation of training innovation products.** During this activity, the partners raised awareness among the target groups and stakeholders that the project aimed to solve severe socio-economic problems in Europe, that the project would contribute to the development of quality lifelong learning and personal and social competences in KETs sectors, and shared best practices. The means of communication was through stakeholder events, interregional seminars, conferences, fairs and through newsletters, CD-rooms and brochures. The coordinator of this activity was Epralima.
- **Exploitation of results.** During this part, the partners ensured the sustainability of the project, implementation and usage of the final e-course product. It commenced during the second year of the project when the main results of the methodology, development of the e-learning platform and content had been prepared. This activity promoted the features of the e-course that demonstrated impact in the way innovation is taught, and focused on ways partner organisations could incorporate this e-learning course in their services.

Key actors involved

The consortia of TECRINO consisted of eight partners: RTD Tallos (Cyprus), Epralima (Portugal), Inercia Digital (Spain), Fondo formacion Euskadi (Spain), Business Innovation Croatian Agency (Croatia), University of Zagreb (Croatia), Syntea (Poland) and the "Dunarea de Jos" University of Galati (Romania). The consultancy firm RTD Talos in Cyprus coordinated the project. Partners involved have contributed to the implementation of different parts of the project activities (see below).

[19] TRIZ (the Theory of Inventive Problem Solving) is a systematic approach for understanding and solving problems which allows clear thinking and the generation of innovative ideas, developed by the engineer and scientist Genrich S. Altshuller and his colleagues.

[20] Dissemination report available at http://www.tecrino-project.eu/repository/f08750f4d050ad4e0f58659830d52fa4a015dad83c120c34e8395ed9541502ec/DISSEMINATION%20REPORT.pdf

Table 8. Organisations involved in the implementation of the 'TECRINO' projects

Legal name	Short name in English	Type of organisation	Country	Role in the project
RTD TALOS	RTD TALOS	Consultancy firm	Cyprus	Project coordinator
EPRALIMA_Escola Profissional do Alto Lima C.I.P.R.L.	EPRALIMA	Professional School/ Non-governmental agency	Portugal	Project Partner: Responsible for the sustainability strategy, mainstreaming/ cooperating with potential partners and education of tutors
Inercia Digital S.L.	Inercia Digitral	Professional training company	Spain	Project partner: Designing and development of project website, event organising and translation of promotional material.
Fondo formacion Euskadi	Fondo formacion Euskadi	Training fund	Spain	Project partner- Designing, promoting, and translating material and events
Business Innovation Croatian Agency – BICRO -	Business Innovation Croatian Agency – BICRO -	Governmental organisation	Croatia	Project partner: Designing, promoting, and translating material and events
Sveučilište u Zagrebu	University of Zagreb	University	Croatia	Updating website, promoting, and translating material and events
Univerrsitea Dunarea de Jos din Galati	"Dunarea de Jos" University of Galati	University	Romania	Project partner: Updating website, promoting, and translating material, events, research, and dissemination of research results.
Syntea S.A	Syntea	Professional training company	Poland	Project partner: Updating website, promoting, and translating material and events

Source: Compiled by the authors based on the data retrieved from the Erasmus+ Project Results Platform.

Funding arrangements

The Lifelong Learning and Leonardo Da Vinci for Development of Innovation scheme funded the project.

Conceptualisation of creativity

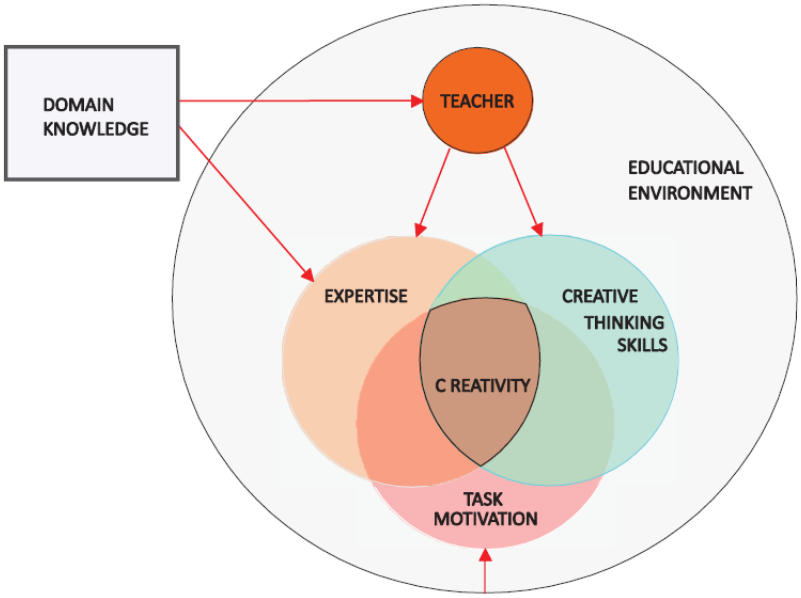
In TECRINO, creativity was defined as a multidimensional and dynamic process, involving conscious mental activity, affectivity, motivation and social interaction, and the general ability to solve problems. In a published article on TECRINO, creativity was defined as the process of developing ideas that are simultaneously novel, and valuable from a practical perspective (the inventions) (Susnea and Tataru, 2014). Creativity was linked to innovation, since '*the innovation is the process of capitalization of the results (ideas) within an organization*' (Susnea et al., 2014b). The components of creativity that the project focused on were intrinsic motivation, basic skills, curiosity and exploration, choice and discovery, metacognitive skills, creative performance and positive feedback. The 4Ps (Person, Process, Product, Press) of creativity was a theory about the dimension of creativity developed by Rhodes (1961) also adopted for this project. Person regards the creative abilities of an individual, e.g. divergent thinking. The process refers to the procedure used by the Person to develop the product, e.g. brainstorming. The product is the result of the creative process which usually must be both novel and useful for innovation to take place.

Fostering creativity

Creativity was defined as a multidimensional and dynamic process, involving conscious mental activity, affectivity, motivation and social interaction (Project website). Therefore, the TECRINO project, unlike previous similar projects, attempted not just to teach creativity techniques (e.g. TRIZ), but to teach for creativity and develop the general ability to solve problems in a creative way. According to the project description of the TECRINO website, the course focused on the following:

- Defining educational objectives and building motivation of the students (especially intrinsic motivation)
- Building basic skills
- Acquisition of domain-specific knowledge
- Encouraging and rewarding curiosity and exploration
- Creating opportunities for choice and discovery
- Developing metacognitive skills (awareness of the neuro-psychological processes related to learning and creativity, self-management)
- Teaching strategies and techniques to foster creative performance
- Providing positive feedback

Furthermore, in developing the course, the partners considered three aspects of creativity as set out by the Amabile (1996) model of creativity: the expertise, creative thinking skills and motivation. The former regards the individual knowledge base, which is the starting point of any creative processing of information. Creative thinking skills regards how new cognitive paths are explored and strengthened through personality traits such as independence, the capacity to take moderate risks and the ability to tolerate ambiguity. Lastly, motivation is the energy source of any human, and the lack of it was seen to inhibit creativity (Susnea et al., 2014a). By analysing the factors that influence the education for creativity, the team came up with five actions that could further strengthen the development of creativity, which the course aimed to address through ICT problem-solving and ICT tools for assessment of creativity.



Source: Susnea, I., & Tataru, A. (2014b). Fostering creativity through education-key factors, and action directions. *Research & Science Today*, 7, 194.

Figure 9. The proposed extended model of creativity in the educational context

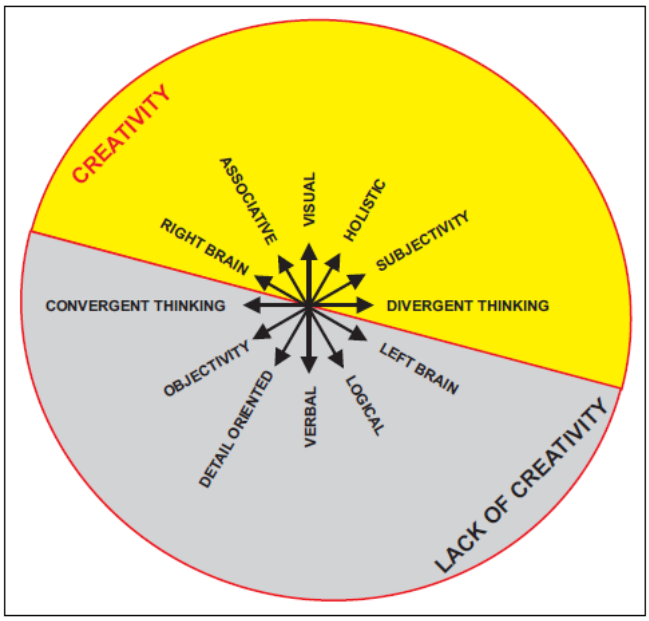
The output of the project, the e-learning courses on creativity, cover most of the existing techniques (e.g. six thinking hats and the Torrance Tests of Creative Thinking (TTCT)) for stimulating individual or group creativity, and presented some IT&C tools known as creativity aid. Dr Goran Hudec described examples of such tools as the six hats test or a test in which students had to come up with as many ideas as possible in a short time.

Assessing creativity

The students of secondary school engineering topics were assessed formatively, based on an existing divergent thinking test, and further developed by the project team. Besides, the teachers were also assessed for Creativity Management competences and could receive Vocational Competence Certificates (VCC) based on their performance.

Assessment approaches, strategies, and methods

One possible approach to facilitate the understanding of complex intellectual constructs of creativity, applied in the project, is to consider their opposite, 'negative space' or 'thinking inside a box', a style of thinking heavily biased by stereotypes, prejudices, illicit generalisations, superficiality and conformism. Unlike the vast majority of the existing psychometric approaches, which treat the tendency towards social conformity as a bias. In TECRINO it was assumed that the social conformity is a clue indicating a type of "stereotypical thinking" that blocks creative thinking itself. In other words, the social conformity was treated as a signal, not as noise. This followed the idea that creativity is multi-faceted (see figure below).



Source: The multiple facets of creativity cited in Susnea, I. & Vasiliu, G. (2016b). A Fuzzy Logic Software Tool and a New Scale for the Assessment of Creativity. In *International Journal of Computers Communications & Control*, 11(3), 441-449.

Figure 10. Multiple facets of creativity

In the online platform, therefore, automatic scoring was performed using a fuzzy logic algorithm starting from two subscales, each having 10 items, focused on different "dimensions" of the creativity: one subscale assessing the ideational behaviour, the other aimed to measure the stereotypical thinking and social conformity. The proposed solution was interesting because it easily integrated almost any e-learning platform or used as a stand-alone tool for tracing the evolution of the students involved in courses for the development of creative thinking skills, and also for possible other applications.

An example of the list of statements students were assessed along can be seen in the table below. The fuzzy logic algorithm was used to give students scores based on how they rated these questions (Susnea and Vasiliu, 2016b).

Table 9. Item statements included in students' creativity assessment tool

An image is worth a thousand words.
People say I am a bit lazy and scatterbrained.
I have a great sense of humor, and I always see the funny side of life.
Sometimes I get obsessed with a problem, and I keep trying until I find a solution.

A bit of adrenaline is always welcome. Life is boring without it.
I am very curious.
People think that I am good at finding solutions to common problems.
I enjoy trying to find new solutions to problems.
I have lots of ideas in every domain.
One plus one does not always equal two

Assessment of teachers

Teachers could obtain a Vocational Competence Certificate[21] (VCC). The project partners developed a theoretical examination template based on the syllabus and required learning outcomes (see list below). It supported the certification of the new skills and knowledge according to the European Qualifications Framework for lifelong learning. The syllabus tailored for the project, described how "Creativity Management Competences" can be divided into competence K1 Identifying and fostering creativity enablers/driving factors and K2 Planning for the systematic development of creativity.

K1 learners should be able to:

- Distinguish creativity facets (Person, Product, Process, and Place)
- Recognise creative patterns in creative products,
- Discuss the mental processes that lead to new ideas,
- Suggest procedures on „how to generate (many) new ideas?"
- Know the basics of person's creativity assessment
- Promote "lateral thinking" as a tool to enhance those aspects of creative thinking that can be acquired through education.

Learners acquiring competence K2 would:

- Set up features of a working environment from the perspective of the creativity
- Select different Information Technology Tools to help creativity enhancement in the educational process
- Recognise systematic creativity in patterns of development of technical systems, as they do not evolve at random, but follow certain objective "laws of evolution".
- Apply „the 40 inventive TRIZ principles" in solving technical systems optimisation.
- Distinguish different intellectual property (IP) rights covering the innovation and creativity protection

Results of the initiative

The project resulted in two distinct courses for educators and learners that were available online. The course for educators collected the best techniques on teaching creativity available, whereas the course for students included more content on the foundations of creative thinking and how it relates to innovation. Both shared the same practical methodology of learning by example, as well as a wealth of examples of creative products and ideas from various domains (visual arts, science and technology, literature, etc.) designed with the intention to offer students the opportunity to rediscover the principles of inventive problem-solving.

The project was not evaluated by external agencies, but the partners themselves reported that the project activities created added value and high-quality products (Final evaluation report). Attitudes towards the transferability of the tools created were positive. Products of the project were in line with application and of good quality and in line with objectives. The Narrative Evaluations found that Creativity Toolbox was highly appreciated, and the course was particularly well designed for learning about creativity. Furthermore, Dr Goran Hudec noted that the content of the course for educators successfully taught him techniques to foster creativity among students that he continues to use regularly.

[21] The syllabus is available from the Document section here under WP6: http://www.tecrino-project.eu/repository

The approach and concepts developed within TECRINO have been used as a basis for other projects such as 'Evoke your creativity' which was an experiential six days course about creativity in action, rapid innovation, and deep presence. However, there has been no impact study so far into the effects of the project on creativity, and it is, therefore, hard to say what the impact was. The fact that the project was widely researched and mentioned in journals, suggest that it had an impact on the wider community of researchers and educators.

In discussion with Dr Goran Hudec, it was assessed that the methods and tools developed during TECRINO project were highly innovative and enjoyable for the students. The course was especially useful in developing students critical thinking because some of the parts of the lessons required the students to take different roles (six hats methods) and criticise each other's ideas. Furthermore, they may have been some benefit from the collaboration among the students in their sense of motivation to learn (related to creativity according to project's definition). Overall, the feedback from the students was overtly positive, although Dr Goran hesitated to say that there was a positive long-term impact (not evaluated).

Conclusions

The strength of the project was the well-developed course book basing itself on the latest research in creativity. For example, the main finding of the study by the team into the inhibiting factors of creativity found that unsupervised e-learning is more efficient than other learning environments, because the most important factors that block creativity in formal education are avoided. This made Dr Hudec believe that the methods had a positive effect and were positive on student's creativity (also their critical thinking, which he considered a key transversal skill). The educator himself has applied the course in many instances since the end of the project. This suggests that the lessons of the course were flexible and easily applied in other learning context.

Another strength was the effort of the coordinator to the project, who was passionate about the topic and had developed an expertise on the subject as well as published academic articles to disseminate it. Due to the attention, the project achieved from the research and policy community; the project did achieve to raise awareness of the importance of a systematic education for creativity.

This is not to suggest the projects had no weaknesses. In fact, Dr Hudec suggests that it was challenging to disseminate the course among educators and that the course has not been used much after the project ended besides of the educators participating in the development of the course.

The project team's position paper on the challenges of applying e-learning platforms to teaching creativity found two main challenges. First, despite the claim that the '*an open access e-learning platform dedicated to teaching creativity might be the most efficient way to solve this problem uncertain future on a large scale'*, the fast pace of modern life require 'instant judgement' (Susnea, Pecheanu and Costache, 2015). The team states that it is challenging to get time and space for creative thinking, because the fast-speed modern life is less and less compatible with creativity. This situation causes a paradox, in which more and more creativity is required to solve unpredictable change, but the same situation makes forces humans to think on autopilot to save time and process a huge amount of information. Precisely because creative thinking is not solely about grasping information, this is a skill that cannot simply be learned, as other fields of knowledge traditionally is taught. The project tried to solve this by selecting the most successful and practical techniques to teach and assess creativity.

However, in building the website the project team ran into the same problem regarding content, noting that it is easier to write *about* creativity than *for* creativity. The reason that it is hard to develop courses that really improve creativity is that there is no textbook of creativity that fully understands the phenomenon. "Learn by example" was the only approach proven to be effective in the improvement of inborn creativity, the course, therefore, included carefully selected examples of creative ideas. The motivation to fill this knowledge gap drove the project team forward in the development of the online course.

Based on an analysis of what hinders creativity from flourishing overall in school environments, the project team found several challenges such as creative students being seen as disruptive, teachers not being motivated or prepared to foster creativity, the lack of available assessment tools and lack of valuation of creating learning scenarios where there are no right answers or where the process of thinking is more important than the outcome of the tasks. The project could, to some extent, address these challenges by providing open-access content on creativity.

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Creative Thinking in Youth Work

At a glance

Target group(s)	Youth workers from NGOs
Sector(s), level(s), and settings covered	Adult learning, community settings
Level of implementation	European
Funding arrangements	Funded by the European Commission (Erasmus + Programme 2014-2020, Youth in Action); awarded a grant of EUR 27,700
Key premises	The creative process is personal, hence, to be more creative, one needs to better understand one's own personality.
Definition of creativity	Creativity is a process consisting of two necessary elements: thinking and production
Related competences and skills	Creative thinking, problem-solving, civic awareness, innovation, and learning autonomy
Pedagogical approaches and methods	Pre-assessment of needs, collaboration, participation in teaching, personalised learning and e-learning
Assessment approaches and methods	Personality tests: Adobe Creative Type Quiz, Belbin team roles test, Myers Briggs personality test
Drivers	- Experience and commitment of partners - Focus on personalised and participatory learning - A collaborative, engaging and international learning environment
Barriers	- Similar platforms exist - Limited resources for the co-creation part of the training course
Results	MOOC for creative thinking in youth work; 35 youth workers were trained and shared their experience with 100 more professionals in their field.
Key messages and lessons learned	- Non-formal learning plays a crucial role in developing the skills of youth workers and improves the effectiveness of their work. - Creative thinking skills improved by youth workers are transferable to such fields as personal development, lifelong learning and can be useful for boosting one's digital competences and skills - Creativity is abundant, but time and resources are not. Once need to make sure that enough time is put into the implementation of ideas and development of products. - One needs to make use of the digital tools available to guide the learning experience and disseminate the results.

Introduction

In the sections below, we provide a detailed description of the weeklong training to foster the creative thinking of youth workers, as it was taught and approached during a weeklong training in Bulgaria.

First, we overview the design of the training, setting out the context, objectives, timeframe, level of implementation, geographical scope, target groups, sectors, levels, and settings covered, key activities, actors involved and funding arrangements. Next, we explore how creative thinking was conceptualised and described in the course, and what pedagogical principles, teaching methods and assessment techniques were prompted. Lastly, to the extent that existing data allows, we present the results achieved in and lessons learned from the 'Creative thinking in youth work' initiative.

The description of the training is based on desk research that was complemented by an interview with the project coordinator of the course, Mrs. Vilislava Metodieva. To boost the validity of the analysis and reliability of the research results, we have applied the principle of triangulation – where possible, verified information by cross-checking different data sources. Key sources reviewed were the info pack available at the website for Support, Advanced Learning and Training Opportunities for Youth (SALTO-YOUTH), the massive open online course (MOOC) available at Monomyths, a lifelong learning platform for youth workers, and a range of participant stories shared through social media.

Design of the initiative

Context and objectives

By the onset of 2018, a group of NGOs working in the field of youth empowerment and employability had noticed that 'creativity skills' are increasingly sought after in educational and work-related settings. Furthermore, the partners recognised that creative thinking has many positive benefits for the social, education and professional development of youth. Creative thinking can help youth develop the 'flexible edge' needed for a rapidly changing labour market and strengthen their ability to make the best of diverse learning situations[22].

A survey conducted by the consortium before the planning of the training further informed the need to develop the creative thinking abilities of youth workers. In January 2019, the consortium conducted an online survey with youth workers on the topic of innovation and creativity in the youth field. Two key findings were:

- Out of 264 respondents, 67 per cent struggled to create alternatives of action for their beneficiaries outside of the mainstream thinking.
- This inability explained low active participation and engagement of youth in the organisations of the respective respondents.

To address the low active participation and engagement of youth on the one hand and strengthening the social and professional skills of youth on the other, the partners decided to develop a training on creative thinking for youth workers. The 'Creative thinking in youth work' training was launched to help youth workers develop their creativity, sense of initiative and problem-solving skills that could help them in their role as leaders of youth NGOs or otherwise influencers in the youth work sector, among youth and their communities (SALTO-YOUTH, 2019).

With regards to creativity and creativity thinking, it was argued that (SALTO-YOUTH, 2019):

- Young people have, as everyone else, the potential to innovate. Learning to think creatively, by exercising imagination and playfulness, can strengthen youth workers ability to solve problems and envisage new solution for social problems.
- Creativity is not just an economic engine or one of the 3 most desired skill by employers, but also a way to make social, political and cultural changes. This skill is crucial for youth workers who often are at the forefront of change-making.
- Learning about methods and techniques that bring out creativity can increase the capacity of youth workers to innovate. With the know-how and right attitude towards the needs of their organisations and communities they can act more efficiently.

In this context, the objectives of the training for youth workers have been (SALTO-YOUTH, 2019):

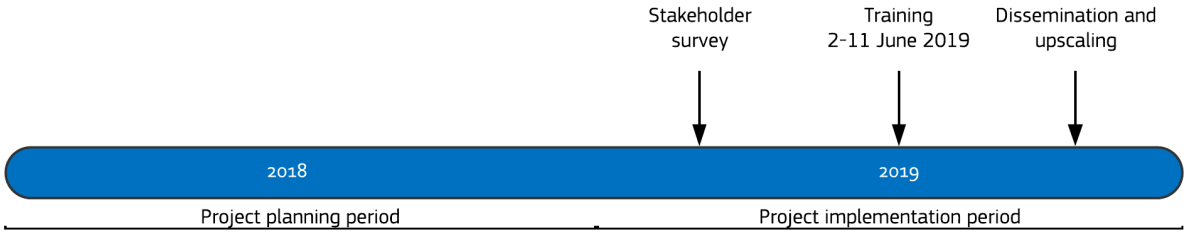
- To support the professional development of and increase the capacity of the participants to be creative and innovative.

[22] The project coordinator of 'Creative thinking in youth work' described this background to PPMI during an interview on the 17th of July, 2020.

- To raise the participants' awareness of how innovation and developing creative projects can increase the impact and efficiency of youth activities.
- To upscale the impact of the training by setting up a network of Youth NGOs where knowledge on how to bring innovation into their organisations and communities can be shared.

Timeframe

WalkTogether presented the initial plan of the project to the National Agency of Bulgaria at the beginning of 2018. The National Agency of Bulgaria approved it in June 2018, and the partners made a successful application for the first deadline of Erasmus+ funding for 2019. In January 2019, the consortium conducted a survey on the needs for training among NGO workers. The training itself lasted between 2nd of June to 11th of June 2019. In the aftermath of the training, followed several months where the participants disseminated and shared their experiences with their organisations and communities. Taking the preparation, planning, implementation and dissemination into account, the project lasted from beginning of 2018 until the end of 2019.



Source: Compiled by the authors

Figure 11. Evolution of 'creative thinking in youth work' in time

Level of implementation and geographical scope

'Creative thinking in youth work' has been implemented at the European level. The number of countries from which participants travelled to attend the training was seven. These included Bulgaria, Croatia, Cyprus, Czech Republic, Hungary, Romania and Serbia. The map below identifies the origin countries of the 35 participants that have participated in 'Creative thinking in youth work'.

Map 4. Geographical scope of the 'Creative thinking in youth work' project

Source: Compiled by the authors.

Note: Cyprus was also covered, although not included in the figure above.

Target groups, sectors, levels and settings of education and training covered

The 'Creative thinking in youth work' training targeted a selected group of youth workers: those who had expressed interest in joining the training in the stakeholder survey on creativity and innovation. The youth workers selected to participate in the training course were full-time, part-time or contract-based volunteers in hosting and partner organisations, and they coordinate local programmes and events dedicated to youth with fewer opportunities. The interviewee informed that besides being five from each of the seven different partner countries, the participants represented a diverse group of youth: NGO workers, students of advertisement, early-stage professionals and teachers.

The primary target group, the 35 participants, were responsible for designing the MOOC on creativity that they would then mainstream and share with their peers in their respective countries. Those peers constituted the secondary target group of the initiative. The course was designed in English to facilitate international collaboration, but the multiplier events were held in the native language and in the specific sector where the respective participants worked, volunteered or studied.

According to the interviewee, all learning that the primary or secondary target group took part in was non-formal community adult learning.

Key activities

'Creative thinking in youth work' was an intensive training course spanning over nine days and covering topics such as design thinking, creativity and e-learning. The training course compromised the six activities described below:[23] Each workshop described lasted one day except for the creation of the MOOC, which took two. All participants joined each activity, but to be more efficient, they sometimes split in teams to work more intensively on specific tasks related to each module.

- **Introduction about creativity** - This part of the training course focused on the art and science of creative thinking, what it means and how it can benefit the participants. After a short period of exploring the literature, and to follow a participatory method, the participants were encouraged to come up with their own informed definitions of creativity.
- **Think creatively** - This part of the training course was dedicated to practical challenges and testing methods to generate new ideas and solutions by use of creative thinking tools. As an example, the participants were challenged to write creative briefs. A creative brief is a document used by creative professionals to develop engaging deliverables that maximise on visual design and digital skills. To bring the challenge close to home, the participants worked only on creative briefs of their own NGO.
- **Process tools** – Seeing that a process can kill an idea before it has had a chance to fully mature and be fairly evaluated, this part was devoted to teaching the participants how to practice active listening and feedback during idea generation and brainstorming sessions. In this workshop, the trainers also analysed blocks of creativity and how the environment can negatively or positively affect creativity and idea generation processes. The participants practice techniques for keeping the idea process on track and removing blocks on creativity caused by external factors.
- **Innovate** - This module focused on how to evaluate and select ideas, refine and further develop them to best solve problems and create new solutions. Whereas this section was more heavily focused on critical thinking and selection of ideas, it emphasised that the idea exploration phase never ends but rather continues on a higher level where the aim is to best fit the idea to the needs of the local community and the organisation.
- **Leading Innovation** - This part was designed to ensure that the leaders from different NGO are not unconscious impediments of creativity, but rather mature enablers of innovation. This workshop, therefore, regarded self-development and teaching the participants to have a proactive approach to and positive attitude towards innovation and change.
- **E-learning platform and MOOC design** – In this section, the participants provided their expertise in selected areas and imagination to create a product that could offer support and build capacity for innovation in other Youth NGOs. Each participant produced one video each for the explanation of their topic in the MOOC.

In addition, two other activities were crucial for the implementation of the project:

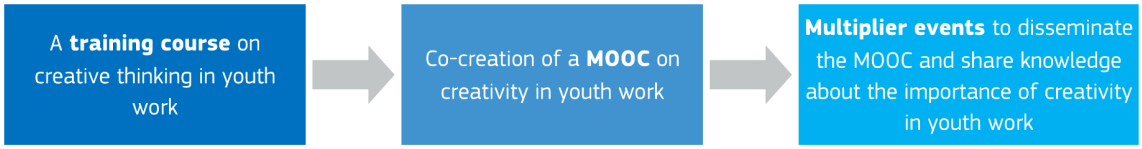
- **Uploading the MOOC materials into the Monomyths lifelong learning platform** – The Monomyths associations created the course 'Creative thinking in youth work' on their lifelong learning platform. In

[23] The following overview is a synthesis of information learned from the project description and the project coordinator.

collaboration with the participants, Monomyths uploaded the videos and descriptions for each module onto the online course and made the course presentable.

- **Multiplier events** - Multiplier events where held in the origin countries of the participants to showcase the 'Creative thinking in youth work' activities and promote creative thinking at a larger scale among youth workers. Each participant held an event to present the lessons from the training and disseminate the MOOC in his/her community.

The figure below presents the key measures the project took to strengthen the creative thinking of youth workers, which can be summarised as a training workshop, a co-created MOOC and multiplier events to disseminate knowledge.



Source: Compiled by the authors.

Figure 12. Measures adopted to promote the creative thinking of youth workers

Key actors involved

Central to the initiative was the Bulgarian organisation WalkTogether, which led the consortium, all the project activities and hosted the training. This non-governmental organisation offers non-formal education to adults and young people, covering the three main areas of non-formal education: socio-cultural and popular education, education for personal development, and professional training (SALTO-YOUTH, n.d.). Monomyths (Romania) and Tavo Europa (Lithuania) assisted WalkTogether in developing the training of creativity and the online MOOC. All the partner organisations distributed the initial survey, chose and sent five participants each to represent their country in the training. After the training, the NGOs let the participants to use their social media platforms for dissemination and their facilities for multiplier events.

Table 10. Youth NGOs involved in the creative thinking in youth work training

Legal name	Short name in English	NGO focus area	Country	Role in the project(s)
Асоциация „УолкТугедър“	Association Walk Together	Civil society Youth exchanges Non-formal education	Bulgaria	Coordinator
Ustanova za obrazovanje odraslih Dante	Dante Adult Education Institution	Adult education	Croatia	Sending out survey, sending participants, and disseminating results.
Social Policy and Action Organisation	Social Policy and Action Organisation	Social Policy Disadvantage Human wellbeing	Cyprus	Sending out survey, sending participants, and disseminating results.
Palangos Kultūros ir Jaunimo Centras	Palanga Culture and Youth Center	Art Culture Employment	Lithuania	Sending out survey, sending participants, and disseminating results.
Tavo Europa	Your Europe	Education Civil society Social development	Lithuania	Sending out survey, sending participants, and disseminating results.
AsociatiaMonomyths	Monomyths association	International learning	Romania	Sending out survey, sending participants,

		experiences Creative processes		setting up the MOOD and facilitate training
Best seller	Best seller	Civil society Civic values Social development	Serbia	Sending out survey, sending participants, and disseminating results.
Fiatalok az Élhető Környezetért Egyesület	Young People's Living Environment Association	Environment Entrepreneurship Non-formal learning	Hungary	Sending out survey, sending participants, and disseminating results.

Source: Compiled by the authors

Funding arrangements

The project was funded as a Youth in Action programme by the European Union's Erasmus+ Programme from February till October 2019. Besides, it was a Key Action 1 project, designed for projects that enable organisations to offer structured study, work experience, job shadowing, volunteering, training, and teaching opportunities through mobility. It was awarded a grant of EUR 27,700.

Conceptualisation of creativity

In 'Creative thinking in youth work', creativity was understood as a *process* consisting of two elements: thinking and production. The following can be said about how creativity was understood and how it was conceptualised vis-à-vis creative thinking (Monomyths, 2019):

- According to the interviewee, the consortium took an explorative approach to the conceptualisation of creativity in the training by letting the participants define creativity.
- The MOOC curriculum does not apply a holistic approach to defining creativity.
- The three definitions presented in 'Basics of creativity' were: 'Creativity is the process of change, of development, of evolution, in the organisation of subjective life' (Ghiselin, 1952), 'Creativity is the forming of associative elements into new combinations which either meet requirements or are in some way useful' (Mednick, 1962) and 'Creativity denotes a person's capacity to produce new or original ideas, insights, inventions, or artistic products, which are accepted by experts as being of scientific, aesthetic social or technical value' (Vernon, 1989).
- To bridge these definitions, creativity was described in the MOOC as consisting of two separate and necessary processes, that of thinking and that of production. This implies that being imaginative without implementing one's ideas does not make one creative.
- The focus on production in addition to thinking implies that the conceptualisation of creativity was both process and output-driven.
- The production of the MOOC by the participants is proof in itself that the training initiated and was a creative process.
- A distinction between creativity and creative thinking can be drawn as the former implies a combination of a thinking process and a valuable output, whereas the latter concerns the thinking process that is, depending on the output, potentially - but not necessarily - creative.
- Whereas the value or product outcome of a creative thinking process cannot be expected from the thinking process, the project presents the creative thinking process as a 'capability' and/or an 'ability' that can be trained. Besides, improving one's creative thinking ability is necessary to bring about innovative solutions to societal challenges (Vernon, 1989).

Since the focus area of the training and MOOC was on creative thinking, not creativity *per se*, the MOOC took care to define this thinking process separately, including the first four basic stages of a creative thinking according to Wallas (1926) and two additional key elements defined by the participants (Nikulina, 2019):

- **Preparation**: This stage deals with the collection of background information and reading of literature, recognising that knowledge is the foundation of good ideas.

- **Incubation:** The period of frustration, where one matches prior knowledge with theoretical facts learned during the preparation period. This stage is also important for matching ideas with the reality and considering the feasibility of one's ideas.
- **Illumination:** This is the 'Eureka' moment of the creative thinking process in which one finds a solution or idea that one is content with. It can occur at any points in the thinking process.
- **Verification**: Regards the period when an idea is tested and implemented, to learn whether it works as expected or not.
- **Problem-solving**: The creative thinking process was defined as a way to look at and solve problems from a different perspective, avoiding Orthodox solutions and thinking outside the box with the intention to arrive at solutions that are unusual, original and new.
- **Exploration:** Recognising that to excel at problem-solving, it may be necessary to explore and challenge the nature of the question, the direction of and the desired solutions, as well as the associations and connections between ideas and assumptions.

Finally, it should be noted that the project partners themselves did not clearly define creativity in their own project documents. The reason for this was an underlying notion that creativity must be defined on a personal and individual rather than an objective level.

Fostering creative thinking

The consortium did not set out a specific pedagogy on how to teach creativity. Nevertheless, the resources suggest that 'Creative thinking in youth work' showcases some pedagogical principles and a plethora of methods. The following pedagogical principles reveal how to best teach creative thinking for youth workers (SALTO-YOUTH, 2019):

- Determine what new knowledge and skills the youth need to develop through pre-assessment. According to the interviewee, the desire to remedy the low participation and engagement among youth workers seen in the stakeholder survey drove the consortium's participatory approach to the methods prompted.
- Allow for as much collaboration and participation in the teaching as possible to increase the activity, enthusiasm and feeling of ownership of the learners
- Focus on techniques that can be applied to the participant's context and personalise the learning experience as much as possible
- Make use of ICT, e-tools and e-learning (e.g. video making and visual design) to modernise the teaching, give the learners additional fun challenges and reach out to a bigger audience

To strengthen the creative thinking abilities of youth workers, the participants and the partner NGOs developed and uploaded a wide range of materials for the MOOC. Whereas the first module in the MOOC concerned the definition of creativity, the last three concerned methods that can be applied to foster the creative thinking of youth workers:

- **Creativity activators:** To think creatively requires more energy than our typical, behavioural mode of thinking, usually a break away from the typical or expected. This module focuses on tips and tricks to stay creative in spirit and how to deal with and avoid creativity blockers.
- **Creative environment**: It is well-known that the right working environment can stimulate learning – the same goes for creativity and innovation. This part teaches methods of how external factors ranging from lightening to the people one is surrounded with can be used to strengthen one's creativity.
- **Creativity tools:** To support in the explorative, incubating and illumination phase of the creative thinking process, this module gives a variety of tools and techniques that helps one to take new and different perspectives ranging from brainstorming tasks to interactive games.

The table below shows an overview of the creative activators, enablers in the environment and tools promoted in the MOOC to foster the creative thinking of youth workers. Whereas tools provided clear methods to enhance creativity of youth, creative activators and environment are two themes emphasised in the course for being crucial in bringing about effective creativity. The information is a synthesis of the 3 modules and the topics they cover taken from the course curriculum available inside the MOOC (Monomyths, 2019).

Table 11. Methods to foster the creative thinking of youth workers

Creativity activators	Creative environment	Creativity tools
- Creativity triggers and blockers - How to deal with creativity blockers - Training your brain to be creative - Creativity boosters - Tips to enhance you creativity - Websites and apps	- How to surround yourself with a creative environmentSelection and testing of tinkering activities for schools - What is a creative environment for different people - Creativity in daily life - Group dynamics - individual vs. group work	- Brainstorming - Disney method - Six thinking hats - Wordstorm - Lotus blossom - Fish battle - Twenty ways to use a spoon - 6-3-5 method - Impossible hybrids - Selection guide - Evaluation of ideas - Combining tools - Starbursting

Source: Compiled by the authors.

Assessing creative thinking

According to the interviewee, no assessment was applied to the participants regarding their creative thinking ability and no assessment was integral to the training or MOOC. However, along with the viewpoint that creativity should be understood and fostered on a personal level, the MOOC promoted personality type testing as a form of self-assessment of creativity. Understanding how one's personality type mattered in creative processes was seen as beneficial to the development of creativity skills, personal development and job opportunities (Monomyths, 2019).

The three tests of personal and/or creativity types mentioned and their benefits for creative thinking processes were (Monomyths, 2019):

- **Adobe – Creative Type Quiz:** From knowing one's dominant creative type among 'the artist', 'thinker', 'adventurer', 'maker', 'producer', 'dreamer', 'innovator' and 'visionary', youth can better understand how to turn their creative ideas into action.
- **Belbin team roles test:** Depending on the task at hand, building a team from individuals with diverse team role personalities, strengths and weaknesses, can help to solve a task or problem at the team level. The 9 team roles are: resource investigator, team worker, co-ordinator, plant, monitor evaluation, specialist, shaper, implementer and completer finisher.
- **Myers Briggs type indicator personality test:** Knowing one's placement on scales of extroversion versus introversion, sensing versus intuition, thinking versus feeling and judging versus perceiving can help youth in understanding needs and deciding on strategies in creative problem-solving situations.

Participants to the MOOC were particularly encouraged to take the Adobe – Creative Type test and reflect on how the results could help them strengthened their creativity. Besides this self-assessment, all participants to the training course received a certificate of attending the course - a customised Youth Pass section filled out for the 8 key competences.

Results of the initiative

WalkTogether and their partners have not done a full evaluation of the 'Creative thinking in youth work' training. The feedback from the participants and comments by the interviewee nevertheless suggests that the training reached its overall goals and that it taught creativity as a transversal skill.

The interviewee confirmed that by September/August 2019 the objectives had been reached. Central to those were the training, the creation of the MOOC and that the 35 participants in the 7 countries shared their newly acquired know-how and their curriculum on creativity and design thinking with other 100 local youth workers, teachers or disadvantaged learners.

The feedback from the participants regarding the training was overtly positive. The participants enjoyed the personalised learning experience, discovering their own form of creativity and how to put it into practice by solving problems faced by themselves or their community. On the one hand, the feedback suggests that enhancing creative thinking improves other transversal skills. On the other hand, creative thinking is a transversal skill in its own right. This is particularly visible in the participants' reflection on the applicability of creative thinking to diverse areas of their lives.

- **Regarding sense of initiative and entrepreneurship**: "The whole project was to enhance our creativity, and to do that the trainers showed us not only how to produce ideas but also how to use them effectively to solve real-world problems."
- **Regarding the personalised learning experience**: "Most powerful learning moment was discovering myself, dealing with my fears, fighting them and pushing my boundaries. This project helps us to explore our mind and creativity limits."
- **Regarding learning-to-learn:** "I found tools used during this training course such as brainstorming and mind mapping very useful and productive for me. I now know how to use them in order to organise and manage my learning experience better" and "We had to find many resources in the final task of the project to back up our video, so we learned in a way to gather information and distinguish what is useful from them."
- **Regarding the transferability of the methods**: "In this course I learned new methods to enhance creativity. I can use these methods at my work and school"
- **Regarding social skills**: "In this training course, most of the work was taking place in teams. This characteristic helps a lot an individual to learn how to interact with others, respect their opinions, solve conflicts and work harmonically with others in order to achieve a common goal" and "I am now more aware of both the differences and the similarities between other cultures and mine".

According to the interviewee, at least 150 people had signed up for the online course as of last year. Yet, looking at the participant lists in the course as of July 2020 reveals that work needs to be done to make sure that it is and remains a popular e-learning platform and that the course remains relevant. WalkTogether is collaborating with Monomyths to support the development and improvement of the e-learning platform, while making sure there is also a strong focus on creativity in the new courses.

Conclusions

In 'Creative thinking in youth work', improving the creative thinking abilities of the participants and creating an online MOOC to reflect this successful learning process sits at the heart of the training course. Improving creative thinking abilities was regarded as fundamental to the personal development of youth workers and leaders and, ultimately, to efficient and innovative change-making and social development at the community level. A synthesis of information from the interviewee and the project documents, suggests that the following were the key strengths of the initiative:

- Each NGO in the consortium was familiar with working on Erasmus+ projects. This meant that the tasks related to the management of the project were easy and more effort could be placed on the implementation of the activities.
- The NGO partners were committed to the implementation of the project and a long-term goal to enhance the creative thinking abilities of youth workers in Europe. To this day, the participants and NGO workers still keep in touch and learn from each other informally.
- The design of a personalised and participatory learning experience, where the participants were in charge of the creative thinking process and applied metacognition on their learning, brought out the intrinsic motivation needed for successful creative processes.

Key challenges have been:

- Several e-learning platforms for youth exist. This makes it hard to draw attention towards the Monomyths platform and the particular course on creative thinking.
- Not enough time and resources were put into the co-creation part of the training course where the MOOC was set up and developed. While the course is great for being free, open access and giving an overview of the creative thinking process, it does not include a designated place for assignments and assessment.

Key messages for those willing to take up similar actions include:

- Creativity is abundant, but time and resources is not. Make sure that enough time is put into the implementation of ideas and development of products.
- Make use of the digital tools available to guide the learning and disseminate results.

According to the interviewee, for workshops and online courses on creative thinking in youth work to be taken up, it is important to recognise that non-formal learning plays an additional but crucial role in developing the skills of youth workers

and the running of youth organisations. In that regards, non-formal learning focused on creative problem solving will show in the effectiveness of their work. On top of that, this training has generated creative thinking as a skill and method that is transferable beyond youth work – particularly in the field of personal development, digital competences and lifelong learning. While more resources are needed to upscale and reach out to a bigger audience of youth workers, youth work organisations need to show interest in and understand the value of non-formal education on creativity for their work. Youth organisations need to be supported in their endeavour to learn, up skill and, ultimately, bring about positive change and solutions for societies.

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High-performance cycles (ETHAZI)

At a glance

Target group(s)	VET teachers; indirectly, students as well
Sector(s), level(s), and settings covered	Vocational education and training, institutional settings
Level of implementation	Sub-national (region)
Funding arrangements	Funded by the Government of the Autonomous Community of the Basque Country's Ministry of Education
Key premises	Developing creativity for lifelong learning and employability requires close cooperation with local industry
Definition of creativity	The ability to put creative thought into action and offer ideas that contribute value to overcoming challenges
Related competences and skills	Idea generation and imagination, metacognition, divergent, parallel and critical thinking, cognitive flexibility, emotional skills, problem-solving, and innovation
Pedagogical approaches and methods	Challenge-based collaborative learning (CCBL) and its 11 steps
Assessment approaches and methods	Self-, formative, and summative assessment based on the framework of transversal and technical skills
Drivers	- An advanced model developed and improved over many years - Strong collaboration with local industry - Strong political will to innovate in VET - Follow-up with the participating schools
Barriers	- Teachers not understanding the value of creativity or not having the right mindset for innovative teaching - Teachers not following every step of the methodology
Results	12 training sessions and four tools to facilitate the assessment or implementation of the model. As of 2020, TKNIKA trained 2289 teachers who taught 8175 students across 327 cycles and 70 VET centres. Teachers and students improved their pro-activity, creativity and ability to develop ideas.
Key messages and lessons learned	- Collaborating with key stakeholders is crucial to ground the training and increase its take-up. - A careful assessment of how teachers and schools fare in the implementation of the model is crucial and makes it easier to ensure that

the approach has transformative effects.

- It can be challenging to make teachers understand the value of creativity, but with political will and industry support, the mindset can be changed.

Introduction

In the sections below, we provide a detailed description of the learning model to foster the creativity of VET students and teachers, as it is taught and approached in the Basque Country region in Spain.

First, we overview the design of the training, setting the context, objectives, timeframe, level of implementation, geographical scope, target groups, sectors, levels, and settings covered, key measures, actors involved and funding arrangements. Next, we explore how creative thinking was conceptualised and described in the course, and what pedagogical principles, teaching methods and assessment techniques were prompted. Lastly, to the extent that existing data allows, we present the results achieved in and lessons learned from the implementation of the 'High-performance cycles' (ETHAZI learning model).

The description of the learning model is based on desk research. In addition, an interview with a project manager who frequently works with the implementation of the model at the VET innovation centre TKNIKA, Mr. José Ramón Gomez Laconcha, complemented the desk research. To boost the validity of the analysis and reliability of the research results, we have applied the principle of triangulation – where possible, verified information by cross-checking different data sources. Key sources reviewed were the TKNIKA webpage and the ETHAZI repository at ETHAZI GUNEA.

Design of the initiative

Context and objectives

TKNIKA is a regional education innovation centre under the Education Department of the Basque Government. ETHAZI is a learning model developed by TKNIKA to be applied in VET centres across the region to ensure that they provide a high-quality innovative education. Whereas high-performance refer to the general ambitions of the program towards developing labour-market relevant competences of youth and supporting local industry, cycles refer to educational tracks (two semesters) that VET students go through.

According to the interviewee, TKNIKA has a long-running and good collaboration with regional companies. The Basque region is situated in the North of Spain, a region known for having a strong industry. The inspiration for the ETHAZI learning model and the implementation of the model through training of VET teachers came as a result of close cooperation and feedback from the local industry regarding which skills and competences were valuable and interesting for the local companies. Creativity was one of the key skills that employers recognised as crucial for the upcoming decades.

In addition, some political trends and policies influenced the design of the learning model. In the aftermath of the financial crisis, the Spanish education ministry decided to change the structure of the VET education, hoping to increase access to VET and support young people in the transition to the labour market. In 2012, the Spanish education policy established dual training structures ('Formación Profesional Dual'). In those regions where this new programme was introduced, including the Basque region, participants were no longer considered students, but employees covered by labour contracts (usually one to three years) who were eligible for a minimum wage.

Between 2013 and 2014, TKNIKA tested its first version of the learning model targeting cycles within the VET system. Backed with regional support from both government and companies, TKNIKA continued to develop and implement the model in close cooperation with both stakeholder groups. With regards to creativity, it was argued that (Vitoria-Gasteiz, 2019):

- Creativity precedes innovation. A creative attitude requires the ability to see multiple perspectives, critically and effectively chose the best solutions.
- Creativity has a collective dimension which is critical at the company level. For companies, it is essential to take advantage of the full creative potential of employees who can produce proposals, establish objectives, evaluate priorities and generate alternative solutions.
- Creativity can be taught and together with imagination, products and services can be designed to solve real problems in a variety of contexts, at the company, personal and community level.
- In this new technological era, the increase in person-machine collaboration in the workplace has increasingly eliminated the performance of routine tasks with low added value. Creativity is a great human ability that is not in danger of being snatched away and imitated.

The interviewee confirmed that the objectives of the ETHAZI learning model for VET education and educators in this context have been:

- To develop processes for learning, designing, experimenting and rolling out innovative learning models in VET.
- To activate and spark the talent of people and organisations in being agile and proactive about solving real-world problems.
- To respond to the skill needs of companies and the future of work.

Timeframe

TKNIKA started developing the model in 2010, and piloted it in 2013 at five vocational training centres in the Basque Country. Since the successful pilot, TKNIKA has worked on implementation and continuous follow-up and evaluation of the learning model. The figure below shows the evolution of the initiative over the last 6 years and key points in time.

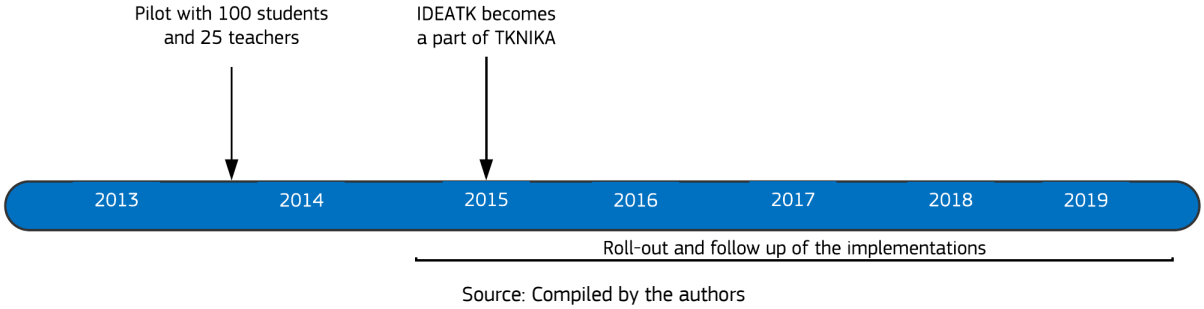


Figure 13. Timeline of the 'ETHAZI' learning model

Level of implementation and geographical scope

The ETHAZI learning model has been taught at the regional level in the Basque Country region of Spain situated in the North of the country.

Target groups, sectors, levels and settings of education and training covered

ETHAZI targeted all teachers and schools involved in VET education in the Basque region. However, to reach out widely, the training by TKNIKA on the ETHAZI model focused first of all on groups of teachers at selected VET institutions or schools. The teachers were selected to participate in training because their school showed interest or groups of teachers responded positively to invitations to the training sent out by TKNIKA.

The primary target group, the VET teachers, were responsible for implementing the learning model in their classes. In this way, the method reached its final target group, which were students of VET education. VET students in the Basque region are 16 to 25 years old. ETHAZI was primarily meant for VET schools or schools that teach VET subjects. However, due to the big uptake of the model by institutions in the Basque region and their close cooperation with the industry, it is likely that the method also has benefited youth in non-formal, adult learning or workplace training who otherwise got exposed to the method at their institutions.

Key measures

'The High-Performance Cycles (ETHAZI)' learning model is developed and implemented in the Basque region of Spain (Euskadi) through several training programmes.

The Learning and High Performance Department of TKNIKA mainly has five fields of actions in the implementation strategy of ETHAZI that can be further broken down by lines of action and programmes (TKNIKA, n.d.a):

- Seven lines of action:
    - **STEAM:** Enriches the methodological proposal of the regional VET policy by adding relevant methodological innovation proposals in STEAM, Visual Thinking, and more. It is a training course to answer practical questions on how to translate STEAM into educational activities.
    - **Collaborative challenge-based learning (CCBL):** CCBL is one of the core elements upon which the ETHAZI model rest. In CCBL, teachers introduce problematic situation, turn it into a

challenge, as well as the entire process until achieving a result, is structured around both the technical and specific skills of each cycle, as well as soft skills that are strategic at that time (see 6.4).

- **VALUES 4.0**: The project contributes to the comprehensive training of people who come to VET Euskadi to work. The objective is to learn to think and look at the world in all its three dimensions to bring about social responsibility: the ethical or values dimension, the social dimension and the environmental dimension.
- **Adapting spaces:** Collaborative learning needs to integrate working spaces that are conducive to learning and creativity. As a line of action, the focus has been put on transforming space, making it flexible, comfortable, colourful with good acoustics and setting up an internet connection that facilitates ICT.
- **Creating an entrepreneurial culture**: Ikasenpresa is an educational programme that focuses on creativity at the company level, making students aware of what being an entrepreneur entails and the steps they have to take to do so, develop student skills to make them good professionals — employable and active as well as entrepreneurs and intra-entrepreneurs.
- **Creative thinking**: Since it is an objective of the model to put creative thought into action and to offer ideas that contribute value to overcoming challenges, it is a line of action to train the flexibility (ability to change one's line of thought), fluidity (skill in having many ideas) and originality (skill for ideas to be different, for them to provide value and be feasible).
- **Developing learning tools:** Making use of learning accelerators that simulate the reality (virtual reality, augmented reality, immersive, 3D, interactive) in learning processes, and to turn any space into learning space. When using virtual reality in learning session, one's imagination about the future and development of skills for the future can be expanded.

- Four actions for roll-out through the TKNIKA teams:
  - **eNOLA:** A tool at the service of teacher teams to self-diagnose their situation in each cycle of the ETHAZI learning model implementation process, to spot, and then later propose actions for improvement. It also acts to validate the implementation of ETHAZI model in the training and at the centre.
  - **ETHAZI gunea**: The objective of ETHAZI gunea is to make everything related to the ETHAZI free and available online. It is a dynamic space where teachers generate content, boosted by ICT teachers and learning coordinators as an essential element.
  - **SET**: A tool that TKNIKA is offering to work on the skill evaluation and progress of the ETHAZI cycles. This tool was developed 8 years ago, but several improvements are constantly being added, based on suggestions sent by users. Originally, teacher teams used SET to evaluate soft skills, but today, it is normally used to evaluate specific skills and give overall feedback.
  - **Ikasenpresa:** See description above.
- Five learning actions aimed at developing the talent of teachers and their implementation of the ETHAZI model:
  - **Initial training**: Training focused on teamwork, an entrepreneurial attitude, creative thought, communication skills, commitment, solidarity, along with a skill set specific to each specialty. The objective is to develop new skills to start implementing ETHAZI. The training program is meant to make participants future learning coordinators and leaders in implementation of the model.
  - **8 Advanced trainings**. Besides for VALUES 4.0 and STEAM these were:
  - **Irakasle taldea**: One of the central elements around which the Euskadi VET Learning Model is structured is the cycle's teacher team, whose mission is to work toward applying advanced learning models. The objective of the training is to accompany the cycle's teacher team and reinforce their relational skills to improve their well-being and performance.
  - **Diving in challenges (epa):** A training for teacher teams that are already working within the context of CCBL who wish to delve deeper and enrich their challenges from a global perspective

with the following objectives: Adapting the challenge's phases to the classroom situation, Discovering techniques to boost each one of the learning process' phases, Offering a shared, global vision of challenges, Making progress in working as a teacher team and transferring learning.

- **Evaluation** of learning gleaned through challenge work is extremely important, since it largely defines how said challenges will be developed. At the evaluation team, we want to help all teacher teams that are already working with challenges to improve this part of the challenge. They can think about the focus of the evaluation they are using, improve their rubrics, increase or improve the quality of their indications, programme and improve how students are given feedback, or design better the scoring process and how to recover the modules that are part of the challenges.
- **ELKAR&EKIN:** A training itinerary on entrepreneurial culture, entrepreneurial initiatives and idea-generation and development.
- **SOR-GIM (TKNIKA, 2017)** was one training course in the package, initially developed by IDEATK. It was a training program to develop the creativity of teachers by use of creative techniques and close follow up.
- **Digital skills:** This training seeks to give structure to improvements in developing the digital skills necessary for the ETHAZI teacher team. In consists of training on the five areas falling under the DIGCOMP framework, drawn up by the European Commission.

In addition, the learning and high performance department provides consulting, diagnosing and designing the development and roll-out of ETHAZI.

Key actors involved

Central to the initiative was the education innovation centre TKNIKA. The education innovation centre is responsible for implementing the innovation policies set out by the regional VET minister, as well as doing training and applied research in the areas of technology, education and management. The Basque centre led the implementation of the learning model across the region. Within TKNIKA, The Learning and High Performance Department is responsible for implementing the model. IDEATK, a parallel training and research centre under VET that focuses solely on creativity, has also contributed to the training under ETHAZI. For instance, IDEATK developed the SOR-GIM course (see key measures). According to the interviewee, in order to create a more holistic VET strategy in the region, IDEATK merged with and operates under TKNIKA in 2015. Another important actor driving the implementation of the model and activities is the regional government who sets out the policy agenda that TKNIKA follows.

Funding arrangements

ETHAZI is funded on a regular basis by the Government of the Autonomous Community of the Basque Country's Ministry of Education.

Conceptualisation of creativity

In ETHAZI, creativity was defined as the ability to put creative thought into action, and offer ideas that contributed value to overcoming challenges. The following can be said about how creativity was understood and how conceptualised (TKNIKA, n.d.a):

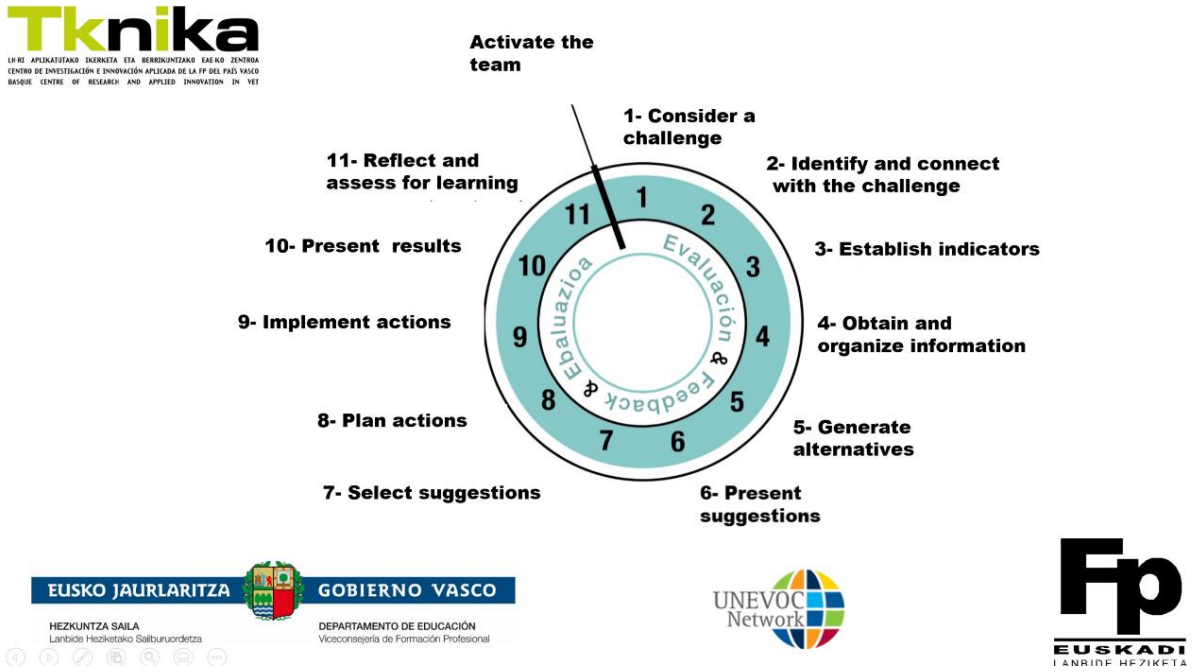
- Based on analysis of the learning outcomes, it can be said that creativity in the course was related to critical thinking, idea generation and imagination, metacognition, divergent thinking, parallel thinking, emotional management and problem-solving and innovation.
- According to the interviewee, the most important elements in the creativity process is the cognitive **flexibility**, the ability to change the line of thought; **fluidity**, the ability to come up with many ideas; **originality**, the ability to come up with ideas that are original and new, provide value and are feasible; and, lastly, the ability to **filter** and choose the best ideas. These elements cover divergent, latent and convergent thinking.

Fostering creative thinking

ETHAZI follows a challenge-based collaborative learning method (CCBL) for the training for VET students. The resources suggest that CCBL showcases the following pedagogical principles and characteristics (ETHAZI GUNEA, 2020a):

- **Working in teams and rotating challenges:** In CCBL, the teacher introduces a 'problem' scenario in that students need to face at a team level. After the problem-solving session, the teams analyse what worked and did not, to prepare better for the next challenge. The teachers rotate different challenges between the teams.
- **Learning as evolution:** The model sees learning as a process of evolution and where the students are responsible for their learning.
- **New and non-formal settings:** The model encourages using new and non-formal settings as a method to make the experience of a challenge more realistic.
- **Moving towards social innovation:** According to the project manager of ETHAZI, the challenges are usually technical, but in the last years TKNIKA encouraged teachers to focus more on societal challenges, soft skills or technical challenges that relate to social innovation.
- **Intermodulation**: The challenges should be relevant for and remind the students of possible situations in the labour market. This requires an in-depth analysis of professional competencies and the learning outcomes of the cycle.
- **Self-managed cycle teaching teams:** Within the cycle, the teachers operate in the same team, dividing tasks and responsibilities between themselves. Students learn to practice self-management and are supported by a small number of teachers throughout the cycle.
- **Evaluate to evolve in development of key competences:** Assessment is integrated as a key element within the students' learning process and providing them with frequent feedback on their evolution in the degree of acquisition of the expected professional competences. The specific tool SET (Skills Evolution) has been developed to promote this assessment approach and encourage participation by teachers and students (personally and as part of teams) and other agents who can contribute to the assessment process. Tool).
- **Adequacy of learning spaces:** The implementation of these new methodologies requires classrooms, equipment, furniture and specific spaces different from those that usually exist in training centres. Their design mainly caters for the characteristics of flexible, open, interconnected spaces that foster environmental situations that favour active-collaborative work.

Particularly important to the CCBL pedagogy is the 11 steps or dimensions of CCBL (ETHAZI GUNEA, 2020b) presented in the figure below. In stage 5 of the process, regarding the generation of ideas, creativity techniques such as brainstorming and the six hats test are applied. Furthermore, the aim of the model below is to integrate the creative thinking process into the challenge and thereby foster transversal competences. In the original figure, transversal competences at written at the core of the circle in the figure.



Source: ETHAZI GUNEA. (2020b). Retos. Basque Government, Formación Profesional de Euskadi. https://ETHAZI.tknika.eus/es/retos

Figure 14. 11 stages of collaborative challenge-based learning

Whereas most of the training of teachers focused on teaching them the CCBL model that they implemented with the students, some courses within ETHAZI focused on developing the creativity of teachers. One such complementary course was SOR-GIM, which made use of the following rationale and methods to develop the creativity of teachers in VET education (TKNIKA 2017a):

- Training for the development of parallel thinking:
    - Activities of using the six hats to think.
    - Design and sequence generation activities.
- Training for the development of the creative process:
    - Activities to sharpen the focus, identify and define challenges
    - Activities to generate ideas
    - Activities to select and evaluate ideas
- Training for the development of emotional and executive intelligence:
    - Activities to train the Emotional Management of curiosity, admiration and security.
    - Activities to train Executive Intelligence (choice of goals and planning, initiation of action and organisation, maintenance of action and effort, cognitive flexibility and metacognition).
    - Conceptualisation of critical and creative thinking

Assessing creativity

TKNIKA has developed tools and materials for assessing both teachers and students' transversal skills and creativity. was assessed at the VET centre/teacher and student levels. 2 tools based on self-assessment and answers to simple questions in rubrics and 360-degree measure were used to assess and present teachers' and students' creativity:

- SET is an online tool that gives an overview of how each teacher and student fact according to the learning objectives/framework of the model. SET shows a holistic assessment of the full classroom, displayed in a table with the grades of the teacher, students individually and in teams on the same row. Within SET, there is dedicated space for comments and exchange of feedback. According to the

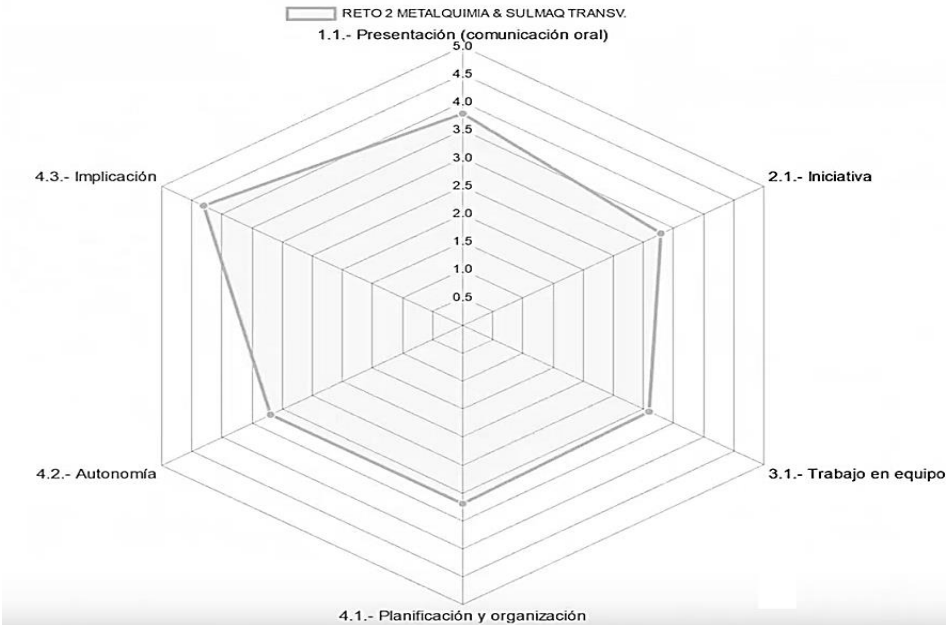
interviewee, this is because TKNIKA is concerned about moving towards more formative and less summative assessment.

- Besides from this tool, eNOLA is a tool at the service of teacher teams to self-diagnose their situation in each stage of the ETHAZI learning model implementation process, to spot, and then later propose actions for improvement of their implementation of the model. The tools then show how each school that implemented ETHAZI fare against a long list of dimensions (e.g. do their follow up with assessment, do they implement the model in cross-disciplinary settings). TKNIKA follows the assessment of schools from within eNOLA and can contact the school that do not comprehensively implement the model to support them in the implementation. TKNIKA has an employees that visit the degrees five times a year to follow up of the schools' implementation of the model.

Regarding assessment of students, the teachers assess their students in a summative and formative way according to a transversal and technical skills assessment framework going from grade 1 (poor) to 5 (excellent). The transversal skills are:

- Personal (Entrepreneurial initiative; Autonomy; Implication)
- Communication (Oral communication; Written communication)
- Digital (Information and data literacy;
- Communication and collaboration;
- Digital content creation; Security; Problem resolution)
- Collaborative (Teamwork; Problem resolution; Decision making)

The first transversal skill, the personal, incorporates the creative process described in the project as that of coming up with many unique ideas and take them into action. Especially the element of implication clearly links to the definition and conceptualisation of creativity in the ETHAZI learning model. In the assessment system SET, the personal competence was also presenting as a 'learn to learn' skill. Those with the highest marks on this skill were active in their teams and able to select and drive the implementation of their innovative ideas. According to the interviewee, the training encourages teacher to give frequent feedback to students on how they fare along the transversal skills in a spider diagram. An example of a spider diagram visualising the scores of a student on entrepreneurial initiative, autonomy and implication can be seen in the figure below.



Source: ETHAZI. (2020). *SET*. Basque Government, Formación Profesional de Euskadi. https://ethazi.tknika.eus/es/set/

Figure 15. Example of assessment of transversal skills of an ETHAZI student

Results of the initiative

ETHAZI has been particularly successful in rolling out the model across the region, nationally and internationally. As of 2020, TKNIKA trained 2289 teachers who taught 8175 students across 327 cycles and 70 VET centres in the Basque region (ETHAZI GUNEA, 2020a). According to the interviewee, due to the training and follow-up by TKNIKA, the model has been implemented in 40 per cent of VET centres in the Basque region. In addition, TKNIKA has trained other Spanish VET teachers and centres, especially in Andalucía, Chile and El Salvador. TKNIKA was recognised for its international work in educational innovation by becoming a member of the UNESCO-UNEVOC network in 2017. Due to its big outreach, we can assume that ETHAZI has been successful in teaching its model, which is based on creative thinking, and transversal skills into VET education systems nationally and internationally. In addition, feedback and evaluation show that students are content about their learning experience and that ETHAZI improved their pro-activity, creativity and ability to develop ideas (Egigure et al., 2020).

Conclusions

In 'High performance cycles (ETHAZI learning model), creativity defined as a transversal skill related to real-world problem-solving, in particular, was a key component of the learning model. Being creative has been regarded as fundamental to the employability of youth and to the social and technical innovation needed in the region and in the world. A synthesis of information from the interviewee and the project documents, suggests that the following were the key strengths of the initiative:

- ETHAZI has developed an advanced model and several accompanying training programs for developing transversal competences making use of an innovative challenge-based design that incorporates creative thinking throughout its stages.
- Strong collaboration and network with local industry and companies make sure that the model is grounded in the real-world and stays relevant.
- Strong political will from the regional government to innovate in VET education.
- According to the interviewee, the strength of the programme is its ability to include the creative thinking process throughout the process of solving a challenge.
- Advanced ICT solutions for assessment and close follow-up of the schools that apply the learning model to make sure that they continue to apply it and in a transformative way.

Key challenges have been:

- To change the mindset of certain teachers and teach them the attitude needed to implement the model effectively and comprehensively.
- According to the interviewee, the biggest challenge in implementing the model has been that not all teachers understand the value or concept of creativity. Teachers tend to rush the 7th and 8th step of the 11 stages (select suggestions and plan actions). This is due to time limitations and the process of problem-solving real-world challenges being time intensive. It is challenging it is to make teachers understand the value of creativity, as they tend to focus on the number of ideas elaborated in a short time rather than helping students to develop ideas of high quality.
- According to the interviewee, some VET teachers are technically minded and struggle to grasp that 'soft skills', creativity and feedback have meaning and are not just 'decoration terms'.
- For the students, the 11 stages are hard to remember and they, therefore, have to go through the process many times in order to remember it.

According to the interviewee, for models that incorporate creativity and teaches it as a transversal skill related to challenges in the real world, two things are important to recognise. On the one hand, collaborating with key stakeholders including future employees of students in VET education is crucial to ground the training, make it popular, relevant and increase the take-up of the model and training. On the other hand, a careful assessment, although formative or based on self-assessment, can be crucial in following up and making sure that the model and training has the indented effects. As the interviewee described, the longer the model has been implemented, the more important methodological innovation, assessment and adaptation of the model and related training become. This model and training to implement it has generated creative thinking as a skill and method that is useful in the labour market but, importantly, it tries to go beyond the technical skills that students usually get in VET. In doing so, TKNIKA faced some challenges because the teachers in VET were not always as forward-thinking and open-minded to creativity and skills that are more socially minded.

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KJ-03-20-860-EN-N

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Publications Office of the European Union

doi:10.2760/33215

ISBN 978-92-76-27447-6