

DEPIT application: open and shared digital artefacts for visible design

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Abstract

In the complex contexts of nowadays classes, there is the need for a Learning Design not limited to linearize both objectives and contents, but that is guide, orientation, support to the teaching-learning process. This contribution describes the implementation of DEPIT app for learning design, developed as a part of a project financed by the European Community and carried out by three networks of schools and 4 universities through DBIR methodology. This app produces visual, digital and multimodal design artefacts, which can be used with students in a classroom during the action and shared with a community of teachers. According to OER principles, this app is internationally disseminated through a MOOC available on a European platform. Teachers’ design becomes common heritage (Open Educational Practices) between teachers and students and it is replicable and reusable in different contexts. The experimentation of this app highlighted its transformative feature in comparison with the teachers’ design practices, which become explicit, sustainable and shared with students.

KEYWORDS: Learning Design, DEPIT App, Transformative, MOOC, OEP.

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1. Introduction

The complexity of teaching-learning processes and school in the current liquid and constantly changing cultural context (Barnett, 2013; Bauman, 1997), the cultural, cognitive and experiential differences among students (Rivoltella & Rossi, 2019), the multimodal items in didactics (Kress, 2009) create the need for an accurate and explicit learning design, which is located concerning the context and the class, respectful of differences and inclusive (Laurillard, 2012) and it can be explained and shared through digital artefacts designed in an open perspective (UNESCO, 2019).

The teacher is required to have the competence to design paths related to the context, which enhance and aggregate young people’s informal knowledge, to create situated modal maps connecting knowledge, experiences and emotions, intra and inter-personal disciplinary dimensions (Fishman & Dede, 2016). To be effective, this complex design must be made explicit with the students, to whom the awareness of a global path only allows them to be oriented and motivated and to anticipate various steps (Berthoz, 2009). In fact, the design is not simply the process preceding the action, to fix its steps and development, anticipating it and taking into account the students’ reactions, but it becomes a space, where prediction, action, reflection and sharing intertwine and create, involving not only the designer teacher, but also the students: this design is both addressed and devolved to them in some of its dimensions and perspectives making them co-creators. The design must also be made explicit with the community of teachers to share it and to try to contribute to the innovation of teaching-learning processes and pedagogical and inclusive approaches in an Open Educational Practices (OEP) perspective (UNESCO,

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2019; Ehlers, 2011) through communities of practice (Wenger et al., 2002), which design, experiment and reflect on teaching activities.

In this way, this design artefact can become a teaching mediator, which builds a bridge between the teacher's idea and classroom practices. If the artefact, used for explicitation, is digital it can be an aggregator between the structure and the materials, a bridge between designing, action and documentation (Bannan, Cook & Pachler, 2016). A digital artefact supports teachers and can be shared with the educational community. If the design artefact is a Graphic Organizer, the students in class can visualise it (Visible Design). It could favour their orientation, motivation and awareness about the global path.

In this way, a school can be defined as a “public good”, a meeting place for the enhancement of personal experiences and their awareness and reconstruction, respecting the diversity and the multiplicity of both students and cultural reference perspectives and, at the same time, trying to offer everyone some paths which intercept their personal attitudes and postures. This approach, which sees the creation of explicit, co-constructed and shared digital design artefacts, is consistent with that OER (Open Educational Resources) perspective, intended as

“Learning, teaching and research materials in any format and medium that reside in the public domain or are under copyright that have been released under an open license, that permit no-cost access, re-use, re-purpose, adaptation and redistribution by others” (UNESCO, 2019, p. 5)

and it extends, beyond the mere production and availability of open content, towards what are called OEP (Open Educational Practices), a multidimensional and unifying construct, which recalls all that

“collaborative practice in which resources are shared by making them openly available, and pedagogical practices are employed which rely on social interaction, knowledge creation, peer-learning, and shared learning practices” (Ehlers, 2011, p. 6).

Therefore, it is important to wonder: can a digital artefact turn the teacher into the protagonist in the design phase becoming an orientation tool for the students? Can it join sense and sustainability? What is the added value of being explicit, open and shareable?

This contribution is going to illustrate how the European DEPIT project (<http://depit.eu/>) tries to answer the previous questions and to introduce and to discuss the results of this project:

- the creation of a shared method and an open app² to support the teachers' design and the students' orientation, disseminated and shared in the international community through a MOOC³;
- the production of open design artefacts, which are shared with students and the community of teachers in the form of a Graphic Organizer;
- the use of these artefacts in the design, action and documentation phase.

2. DEPIT project

National and international research on learning design methods, which were proposed by teachers, generated the idea for the DEPIT (Design for Personalization and Inclusion with Technologies) project, launched in 2017 by an international partnership, who won a call for funding from the European Community. The project leader was the University of Macerata (Italy), supported by the Catholic University of Milan (Italy), the University of Seville (Spain), the University College of London (UK) and the Italian start-up Infactory and three networks of schools (two Italian and one Spanish).

Starting from the intuition developed by Diane Laurillard through her Learning Designer, this project had as its main objective to develop an application which can be used by teachers for teaching design at the level both of annual course and daily activities. This had to be reified in digital artefacts, which were realised in the form of graphic organizers and did not just describe the teaching path, but they became a support for the action, a guide and a reference point for both teachers and students. These artefacts are produced in the form of a deep and navigable map at various levels of granularity, with immediate shift between upper and lower knots. Moreover, the map also becomes an aggregator, as it allows both the uploading of digital materials, which the teacher is going to use during the lesson or to make available to his/her students, and the addition of the students' products created during the lesson.

The design artifacts provided with the uploaded teaching materials are available both online and offline and the application allows different levels of sharing, which are selected by the designer teacher with his/her school community, the teachers with whom he/she shares parts of the curriculum, the classes and the entire international practice community. This latter aspect takes on a particular relevance from an OER point of view, in fact, the application is open. Moreover, the last phase of this project, which was implemented between 2019 and early 2020, provided for two dimensions of diffusion and dissemination at an international level. On the one hand, it wanted to encourage the sharing of the results of the experimentation carried out both with networks of Italian and Spanish schools and the international

² Downloadable at the following link
<https://infactory.it/media/trial/files.html>

³ Accessible at the following link:
<https://bit.ly/30oKhAV>

community of practitioners and academics, through a series of seminars for the introduction of the results, and the validation of teaching and pedagogical processes activated thanks to the use of the application both European and American scholars, involved in ICT field for teaching and curriculum studies. On the other hand, it made this application available to the teachers all over the world through the implementation of an open MOOC, joining the diffusion process with both technical, pedagogical- didactic and practical methods, where the experimenter teachers show the possible ways of use, to learn how to fully exploit all the potential of this tool and to share the principles which inspired its realization. In this sense, it is possible to state that we move from an OER point of view towards an OEP point of view, to encourage the creation of an international community of practice, who shares and collaboratively works on design artefacts, starting from common epistemological and teaching assumptions, which are scientifically validated by the researchers who led this project and the experimenter teachers who tried the use of this application in the classroom.

The meeting between researchers and practitioners and the experimentation carried out throughout the project highlighted the needs and the problems which the realization of these design artefacts through DEPIT app and their use in the classroom let them intercept, allowing innovative solutions, which are grounded to the reality of school contexts:

1. The need to make a transition from a bureaucratic vision of teaching design to a fluid, non-rigid, continuously revisable design artefact intended as a support for teaching action, a direction for students and a mediator of knowledge involved in the practice.
2. The need to design explicit, visible, shareable, sustainable and viable paths for teachers.
3. The chance to increase the functions of the design artefact: it is used not only to design, but also to implement, to document, to reflect on the action.
4. The need to overcome the virtual and real walls of the school micro-community, to share and to discuss their design artefacts and the teaching points of view involved in them with colleagues coming from other countries and cultures. This is to build open and shareable digital design resources, available to the whole community: it is a matter of reifying OEP key principles, that is creating flexible spaces, where teachers and students interact and make free and divergent choices and have the opportunity to integrate different subjects and knowledge (Cronin & McLaren, 2018).

3. Background

The need for designing and building digital artefacts for the learning design places itself in the Learning Design

(LD) research field (Koper, 2005; Laurillard, 2012; Dalziel et al., 2016).

First of all, designing means planning macro-structures, which are the organizational and conceptual outlines of the learning path and give account of the epistemological, pedagogical and teaching lines followed by teachers: the Curriculum Studies area (Joannert, 2011) epistemologically and didactically explores, analyses and supports the mechanisms underlying this macro-design dimension. At the same time, the design also concerns the micro-dimension, that is the complexity of Teaching and Learning Activities (TLA), linearized in teaching-learning sequences (Rossi, 2017a) and represented by the designer teacher in different and mixed forms: the teacher produces mediation artefacts (Conole & Wills, 2013), through which he/she codifies and represents his/her choices and intentions, illustrating the intrinsic meaning of his/her planned activities. These artefacts can be narrative, iconic, taxonomic and modular (Falconer & Littlejohn, 2009) and refer to the material and semiotic tools through which a person exercises his/her control and manages the change processes on the object of the activities which he/she intends to put in place to produce cognitive development, according to Vygotskij (1990).

So, this multimodal artefact assumes the characteristics of a layout (Kress, 2010; Falconer & Littlejohn, 2009), a Graphic Organizer (GO), intended as a logical-cognitive structure, which can support abstract thinking (Starling, 2017).

This visual dimension (Kimbal, 2013) allows to explicit, to systematize, to organize courses and materials in shared, interactive graphic forms, which favour the management of classroom activities, the awareness, the process orientation, the constructive alignment (Rossi, 2017) between teachers and students, the activation of the Conversational Framework (Laurillard, 2012). All that is favoured if this artefact is a visible object (Visible Design) and can be shared with students.

Representing design and making it visible and tangible also allow to make it a common and shared practice: this is in the perspective of an Open & Participatory Culture (Jenkins, 2006), which requires renewing the skills of those working in the educational field to adapt them to the needs of the contexts based on informal and peer-to-peer learning, having innovative attitudes towards intellectual property, mixing cultural identity to increase a more proactive concept of citizenship: according to Nascimbeni (2018), these are the potentials and the benefits of these emerging, open and participatory dynamics.

The Open Education Practices paradigm (Cronin & MacLaren, 2018), which encourage the reuse of Open Educational Resources (Downes, 2007) to promote the innovation of the teachers' pedagogical models and the empowerment of learners intended as co-producers in their lifelong learning course (Ehlers, 2011) can be used to understand the idea of sharing, interaction and exchange, which is inherent in the idea of an open

application acting as a bridge between teachers and learners at an international level.

4. Materials and Methods

The main methodological reference of this research project was the Design-Based Research (Brown, 1992; Collins, 1992) in its extension of Design-Based Implementation Research (DBIR) (Fishman & Dede, 2016; Gomez Zaccarelli & Fishman 2017), whose application in the educational field enables the cooperation between theorists and practitioners to implement and improve innovative contexts and artefacts (Jacobson & Reimann, 2010; Kelly, 2004). In fact, from the beginning this project provided the main role of networks of schools and teachers, who took part in all the work phases as co-investigators together with researchers, collaborating in the initial examination, the design of the app, the experimentation of the beta version and, in the final phase, the production of video and paper materials to support the dissemination of the project idea and the app through MOOC in other European schools. The school-university relationship was proactive and generative and significantly contributed to the success of this project.

DBR methodology does not concern if a particular technology works better than others, but it focuses on the context where the teaching-learning process takes place, wondering how the whole system can work better to support learning. However, a DBR limitation is that it often focuses on the analysis of a single class or group of classes and not on the school level or the school system. While particularly enhancing close partnerships between researchers and teachers, working on small-case DBR does not usually lead to a product that is designed with scalability and sustainability over the period of its active research and development, and there is a long history of well-validated interventions fading away as their developers turned their attention to other projects (Gitomer & Bell, 2016). For this reason, some scholars (Fishman et al., 2013) proposed a DBR form, which considers scalability and sustainability as a central aspect from the beginning of the design process. DBIR combines the iterative and learning-focused work of the learning sciences field with a focus on organizational change and the conditions for implementation effectiveness (Gitomer & Bell, 2016). On this regard, Fishman, Penuel and some colleagues imagine a particular form of partnership between researchers and practitioners to identify and solve persistent problems of practice in education and they believe that DBIR creates a sort of "third space" understood as a culture and a hybrid place built together by researchers and professionals and that is organised to be self-sustaining over time (Gutiérrez, Rymes & Larson, 1995).

DBIR is a systematic and flexible methodology, which is articulated in the following steps: design, direct

implementation, analysis of the effects and redesign (Wang & Hannafin 2005); and it has four key principles: A focus on persistent problems of practice from multiple stakeholders' points of view; A commitment to iterative, collaborative design; A concern with developing theory and knowledge related to both classroom learning and implementation through systematic inquiry; A concern with developing capacity for sustaining change in systems (Fishman et al., 2013).

Therefore, DBIR is connected with

"developing knowledge, tools, and practices related to equitable implementation of innovations and the capacity of partnerships to improve outcomes through inclusive research and development processes" (Penuel, 2019, p. 391).

This methodological approach, which considers the role of partnership between theoreticians and practitioners and collaborative co-design in a community of practice fundamental, can be integrated and find a particular coherence in supporting the transition from content-centred approaches, which focus on educational resources (creation, sharing, etc.), to more practice-centred ones that foster collaboration between learners and teachers for creating and sharing knowledge (Cronin, 2017), that is that transition from creating and publishing OER to practices that can be implemented using OER for education, referred to as OEP (Huang et al., 2020).

4.1 Research approach

According to DBIR principles, extensive data containing different aspects were collected and documented using different research methods, located in a real learning context (Collins et al., 2004). The "real world design settings" perspective was examined in consecutive stages with various tools.

This project was configured according to a recursive work scheme, which included the following actions: statement of the researchers' principles and hypotheses, technical implementation of the product by technicians, practitioners' experimentation, data analysis and their interpretation for co-explanation and co-confrontation to set new perspectives and to identify the necessary innovations for the structure of the application.

The planned steps were the following ones:

1. Initial examination to define the context and to bring out the needs in terms of learning design.

To support the design of this application, a two-perspective research was carried out and firstly included a survey of the international literature relating to curriculum studies and teaching transposition. This produced a collective research report, shared by four universities involved, to create a common lexicon and to establish the theoretical assumptions of the examination. Subsequently, a direct survey was carried out through

questionnaires with closed and open questions to get a general real framework, that is to understand how the teachers' plan. The first questionnaire distributed in both Italian and Spanish schools taking part in this project was answered by 289 teachers.

2. Implementation of DEPIT application.

In the second phase, the exclusively qualitative data were collected through a series of meetings between experimenter-teachers and researchers, which were intended to test and to collect the impressions, the strengths and the weaknesses of the subsequent versions of the application released. Researchers filled in summary sheets noting the explicit requests at a technical and functional level and the shared needs at a design level, which could have been translated into the functionality of the app.

3. Testing the application in the classroom.

The test and the evaluation of this artefact involved more than 40 Italian and Spanish institutes and over 200 teachers. Test data were carried out in two ways:

- questionnaires with open questions to mainly examine three aspects: 1. data collection on timing, organization and design structure carried out through DEPIT app. 2. Involvement and sharing with students 3. Reflection and/or reflexivity activated thanks to the design created with the app. The collected data subsequently oriented the definition of the questions for the focus groups;
- focus groups (Krueger & Casey, 2001) with experimenter-teachers: 7 focus groups were carried out in Italian schools, in which more than 50 teachers took part, selected among those who had made most of the work sessions with this application, also using it with students in a shared way. The transcripts of the focus groups were analysed according to the rules of a dialectical comparison, trying to understand the depths of the evidence and the arguments which supported various points of view.

4. Dissemination, sharing and availability of this application through a MOOC.

The researchers involved in this project developed a multilingual MOOC "Designing for Personalization and Inclusion with Technologies", which is supported by the European Schoolnet Academy international platform and aimed at a both technical and teaching training of all the teachers interested in this project and the dissemination of this application as a freely available tool for learning design in schools all over the world. MOOC is configured as a training, which is made available to all the teachers interested in using this application in their classes and promotes the sharing of practices and the reflection on them through a space for discussion and collective debate. Being still in progress

in its first edition, now it is not possible to account for the results of both the diffusion and the reflections generated within the community of learners.

5. Results

The recursive course described above essentially produced three types of results: the first one is linked to the development and the improvement of DEPIT app, which was implemented according to the needs of the teachers and was internationally shared through MOOC. The development of this project was carried out both in international meetings among partners and local meetings with groups of teachers; the project constraints have been just defined in these meetings:

- map structure of the artefact and connection of the maps in matryoshkas;
- possibility of using the artefact both online and offline or synchronizable;
- working in PCs and tablets, in IOS, Windows, Android;
- structure for schools and discussion of the roles assigned to various types of administrable accounts.

The course is organized on several levels (Dalziel et al., 2016): each of them represents a map where each knot/card refers to the lower level. The macro map represents the curriculum and contains the module cards, the meso map represents the module and contains the session cards, the micro map represents the session and contains the activity cards. Each card is joined to a sheet where descriptors can be inserted. In the activity card it is possible to insert digital materials and in this sense the application acts as an aggregator⁴ (Figure n.1).

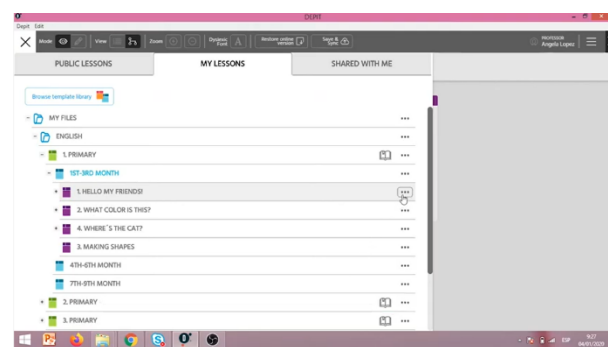


Figure 1 - The tree structure of the maps.

This design artefact can be viewed in the classroom (Figure n. 2), shared and often co-designed with students, promoting their orientation in complex paths and their motivation. Being even implemented with the materials produced during the activities in real time, it

⁴ The following video shows an example of map structuring: <https://youtu.be/5Qdkj3mpLyw>

also acts as a design artefact, as a support during the action, and for documentation.



Figure 2 - Example of a micro level map.

The versions released (Table 1) are the result of various meetings between teachers and researchers and the

analysis of the results of the experimentation carried out in the classroom. The application has been progressively modified in order to cover the needs and to overcome the problems which were noted in the use.

The second and the third results involved testing the effectiveness of the design artefacts created with DEPIT app in teaching/learning contexts. Two aspects emerged - one related to the teacher’s point of view, the other to the student’s one.

As for teachers, the keywords that emerged both from the questionnaires and the focus groups are:

- transformation: teachers chronologically highlight a before and an after in their design methods, especially in the articulation of the course and the timing management;
- safety: the path is always available and can be retraced, both in the design and in the action phases, makes the teacher safer in teaching action in comparison to the course that the class is carrying out;

Version of the app	Implemented features	Research-training support
March 2018 Internal demo version - unsavable artefact	Graphical aspects of cards, map structure and design levels	Micro and macro design. Graphic Organizer for design Initial questionnaire on the teachers’ design needs
May 2018 Demo version - unsavable artefact	Implementation of the characteristics for an aggregator (uploading and downloading materials)	Multimodality and depth: integrated design with action Initial questionnaire on the teachers’ design needs
August 2018 Closed version with personal account	Releasing personal accounts to teachers. Editing module - session - activity cards	Curriculum for skills and teaching transposition. Teaching and Learning Activities Researchers’ assistance
October 2018 Closed version - update with personal account	Development of graphic and structural aspects related to teaching needs. Sharing artefacts among users	Design analysis Intermediate questionnaire on the first results of the classroom experimentation
April 2019 Open version with account released by schools	Central server: schools become administrators and release accounts to teachers. Sharing public and private artefacts	Design analysis Focus group on the transformativeness of the design artefacts Semi-structured interviews
September 2019 Open final version	Greater flexibility of the graphical elements in a design artefact. Arrangement of the inclusive graphics (font for Dyslexia)	Final questionnaire for experimenter teachers. Confrontation during transnational meetings between researchers and teachers coming from various countries

Table 1 - The app implementation process.

- aggregation/availability of digital materials: the application replaces the mobile memories which teachers had to bring in the classroom by selecting materials and mediators from time to time and allows to organize them in a quicker and easily recoverable way, based on various sessions and work activities;
- documentation: the artefact is also a documental support, which summarizes and keeps track of what was done by teachers and students during the school year.

As for students, the main effects of using design artefacts for their learning posture are:

- orientation: students share the entire educational path with teachers from the beginning, they can retrace it and safely move through the topics already carried out and to be carried out;
- awareness: the explicit expression of objectives, activities and contents makes students more aware of what they did and what they are going to do;
- reduction of anxiety/security: the most insecure students are especially reassured by a representation which anticipates what will be done.

6. Discussion and Conclusions

Retracing various phases of this project, its transformative feature is evident among the characteristics of the DEPIT App.

Transformation is not limited to a simple transition from a paper-based design of notes, which is often non-institutional or produced in draft form for personal use and consumption by teachers, towards an explicit design, realized through a technological tool and reified in multimedia and multimodal artefacts.

The analysis of the design and the focus groups carried out with experimenter teachers highlight a transformation in teachers' practice and design posture.

Firstly, design becomes a guide shared between teachers and learners, which allows continuous retracing and, therefore, reflection and regulation in the action of classroom teaching action. Secondly, the function of aggregator of materials, held by design artefacts, makes possible that the activity materializes and directly takes shape in digital artefacts: design and action hybridize; design is part of the action and it is never a concluded process, but in constant evolution.

Thirdly, the possibility of sharing their design products makes them Open Educational Resources both in their own school community and outside it, with the possibility not only of reusing them by other teachers in other contexts, but also modifying, expanding and implementing them. We are always in a hybridization dimension, understood as a form of shared authorship, which is typical of the new production methods in social environments.

Transformativeness is not made explicit only by teachers. In fact, in the interviews released, the latter ones highlight that the use of digital design artefacts also tends to transform the learners' posture.

This is mainly due to the visual dimension of GO products. Indeed, students become aware of what they are going to do and always keep track of what they have already done in an almost tangible visual way. In design, they find out both the annual curriculum and the materials used in each lesson and their contributions, which can be loaded into the cards of the specific activities. This allows orientation and awareness concerning the learning process which makes learners more secure on the one hand and allows them to act in anticipation of what will have to be learned on the other hand, creating cognitive bridges between their experience, knowledge and predictions about the future of their cognitive course.

Research in progress in the experimental classrooms is also showing that the systematization process of knowledge carried out a posteriori is even safer: students can develop different metacognitive and retracing skills of their learning process, which are more organized than the control classes, whose teachers did not use the DEPIT application for teaching design.

Finally, it is possible to generally hypothesize a transformation in terms of flexibility and alignment to the teachers' design needs, which is implicit in the pedagogical-teaching assumptions leading to the creation of the application. In fact, compared to other technological products for learning design (e.g. Diana Laurillard's Learning Designer, that remains the starting point for the idea behind DEPIT project), it has a system designed from below: its features were structured starting from the requests and the needs found among teachers. So, it does not "force" their design into predefined schemes or fields already given, but it adapts and can be modified according to different reference contexts.

From this consideration, some tracks of examination for the near future are opened.

On the one hand, it is possible to wonder how the mutual adaptation between user and tool will be codified in the use of technologies: will teachers adapt and bend the use of the app to their mental models, also finding alternative and unforeseen solutions and methods of use? Or will the pedagogy in the application change and enrich the reference epistemologies and the teaching models of the teachers?

From the beginning, this project was international and designed the app and the multilingual MOOC with the aim not only at conceiving and sharing the product created in OER terms, but also promoting a method and a pedagogical-didactic approach based on Visible Design, the use of Graphic Organizers and the role of designer and director teachers for teaching action, which actively involves students in a work of alignment, co-creation of objectives and courses in action, but also anticipation, orientation and awareness in a constant

hybridization between design-action-documentation. Therefore, this is a possible example of how openness can contribute to innovate practices and teaching-learning processes in an OEP perspective.

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