

# EDULEARN<sub>21</sub>

13TH INTERNATIONAL CONFERENCE  
ON EDUCATION AND NEW LEARNING  
TECHNOLOGIES



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# GAMIFICATION IN THE NEW LEARNING CONTEXT: CHANGE OF PERSPECTIVE THROUGH NEW TECHNOLOGIES

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## Abstract

"An effort to escort students in learning some abilities, awareness, ideas, approach and skills is called teaching." [1]

According to the literature [2], the transmission of knowledge occurs mainly according to three methodologies, that are strongly influenced by the context of reference, the physical space and the relationships between the different actors.

However, as in today's "liquid" and unpredictable environment, the more traditional social constructs may lose their importance to make room for new paradigms, also those related to learning activities may become obsolete.

Regarding to this vision, the research here presented proposes three possible future scenarios, described through three neologisms, which define the change of human behaviour in relation to new digital technologies: (un)plugged humans, de(smart)erialization and (ex)temporary. Subsequently, the starting question for the development of the case histories is: "how to modify and actualise the learning experience, in order to make it suitable for its new context, improving its efficiency?"

In response to this question, an interesting opportunity is offered by gamification, which can increase user engagement [3].

Other distinguishing elements of the fluid society are the new technologies, which must be taken into account in the process of adaptation and improvement of the learning experience, because they are not only founding elements of the new modernity, but also have a strong impact on the way of learning, as demonstrated by Siemens' theory of connectivism [4].

The technologies, in this paper, are considered through the filter of "cardboardification". This neologism, born from the insights of the research process, describes the phenomenon of the union of advanced technologies and cardboard, a typically basic and poor material, that generates benefits for both parties; cardboard becomes "enhanced" and advanced technologies become democratized and affordable.

Referring to the new scenarios mentioned above, the concepts of cardboardification and gamification are applied to two case histories, with two different micro scenarios, to improve the learning experience:

1. Making first learning of music fun and enjoyable for digital native school age children, with the aim of learning music theory, sound synthesis and manipulation in a playful way through a tinkering and hands-on approach.
2. Materializing the independent learning experience of online streaming platforms, turning a relationship that was previously only digital, in a physical touch point.

The theoretical approach was validated by practical application in case histories, suggesting its actual validity and inviting the exploration of even new contexts of use that encourage the replicability of the system.

Keywords: gamification, new technologies, learning, cardboardification, innovation.

## 1 INTRODUCTION

Teaching is a continuous process, which, in addition to the transfer of knowledge, also includes aspects such as testing and guiding activities to facilitate learning, leading to desirable changes in learners through the use of appropriate methods [2, 5]: methods that interact and change as the context changes, evolving and adapting to ever-changing needs.



The learning experience is traditionally seen as an activity performed in dedicated spaces, which typically consist of physical places: schools, universities and spaces where knowledge is transmitted from a single individual, the teacher, to a group of people, the students, through an activity of transmission of knowledge and contents to be memorised and remembered (sometimes applied); all in presence.

It is unthinkable in a liquid society [4] to look for firm reference points that provide certainty, change is part of its very structure and teaching, as a vehicle of information and education, must take this into consideration. Adunola [2] indicated that in order to achieve desirable changes in students, the teaching methods used by educators should be adapted to each different teaching subject in order to become the best for it.

This last statement can also be confirmed in the light of the latest events regarding Covid-19. As we have seen over the last year, the arrival of the pandemic has drastically changed the teaching methods and the interaction with the classroom, highlighting how different disciplines need different elements, tools and characteristics to be addressed in their complexity. In summary, we can say that the learning experience should become flexible enough to be able to adapt to the needs that the context presents and in the content to deal with.

## 2 METHODOLOGY

The research was born from a brief proposed by Ghelfi Ondulati spa, a company in the Valtellina area that is a leader in the processing and transformation of corrugated cardboard, with the aim of investigating the potential of the relationship between corrugated cardboard and digital technologies: leveraging the company's know-how acquired in the field of high-speed digital printing and its unexpressed potential. The first phase of context exploration was divided into: an internal analysis, carried out through the use of strategic design tools [6], necessary for a total understanding of the company, and an external analysis, which compared Ghelfi with direct and indirect competitors, considering them into their own operative context.

By analysing the company's main competitors from the point of view of their value proposition, clusters were created based on their approach at sustainability, customer focus or attitude to research and development. Research was then carried out on trends in materials, inks and coatings, production technologies and digital technologies, and trends in services, strategies and marketing, identifying the most interesting case studies.

Starting from these case studies and the cardboard and technology opportunities resulting from the research, four possible areas of intervention were defined, useful to start the subsequent brainstorming activity useful for the generation of different futuristic scenarios. The focus then returned to the role of cardboard, highlighting his advantages and disadvantages in order to use it as a filter to imagine what the future of the company might look like.

## 3 RESULTS

### 3.1 New scenarios based on cardboard and new technologies

As mentioned above, during the analysis phase, a number of trends were identified from the different case studies found and they are related to: emergency, well-being, digitalisation, personalisation, technology and sustainability. These trends were the starting point for generating a series of scenarios linked by various elements, whether social, technological or experiential, that characterise daily life. These scenarios outline the change in human behaviour in relation to new digital technologies:

- **(ex)temporary:**

(Ex)temporary defines the continuous and often sudden change that we experience every day in society: elements that used to be durable become volatile over time, much more so than before, leading to technological obsolescence, even if this was not planned at the design stage. Technology is developing too fast and the changing world requires people to constantly adapt and update, as we saw during the pandemic.

- **de(smart)erialization:**

Shifts such as from DVD to Netflix, from books to ebooks, highlight the inexorable dematerialisation of canonical material objects that are being redesigned and transformed into ad hoc digital services based on the needs of users. The physical world is increasingly merging with the digital one, creating an increasingly phygital reality.

- **(un)plugged humans:**

As a consequence of de(serialization), human beings are constantly in contact with electronic devices, becoming so dependent on them that they almost need to recharge themselves after use. Human action is filtered by the electronic device, and although this allows the fruition of new experiences, it is essential to remain in contact with physical reality as well.

### 3.1.1 *Cardboardification*

In light of these scenarios, we asked ourselves what the role of cardboard might be. We then defined its characteristics that we believe could become strong points for future products: **low cost, lightness and strength, ease of customisation, high productivity, and ease of disposal, recycling and environmental friendliness.**

Our vision is therefore articulated under the term '**cardboardification**': corrugated cardboard achieves added value within certain contexts when it meets technology. This combination of an extremely inexpensive material with a very low perceived value and digital technologies with a very high perceived value generates a dual benefit, both for the cardboard, which becomes an advanced material thanks to the technologies, and for the technologies, which are democratized thanks to the low cost of cardboard, becoming accessible to more and more users.

Cardboardification can be applied to various fields of intervention; here we list those that emerged during the analysis and research carried out with Ghelfi Ondulati, choosing one that is particularly significant for our intervention:

- **out of the box**, in which the cardboard goes beyond the idea of packaging, positioning itself towards emergency or healthcare contexts, with a focus on outdoor experiences;
- **travel safe**, cardboard takes up the concept of integration and control, covering areas such as the supply chain, large-scale retail trade, Made in Italy and both physical and digital commerce;
- **networking night**, which deals with advertising and communication, with the idea of "making yourself known" and interacting with users in contexts characterised by temporariness such as fairs, exhibitions or shows.
- **software update**, which embraces the concept of technology and innovation, through the perspective of hacking. The cardboard places itself in contexts such as the personal sphere, entertainment and everything related to 'indoor';

Our proposals focus on the latter context, "software update", an area that presents a very wide range of possibilities for innovation, in which cardboardification finds fertile ground for experimentation and original solutions, derived from a brainstorming phase based on the concept of entertainment and education.

## 3.2 **How the learning experience changes through gamification**

Into the abstract, we asked ourselves the question: "how will it be possible to modify and update the learning experience, in order to make it suitable for its new context and improve its efficiency?"

In relation to the above-mentioned fields, it is interesting to note that in the current context the transmission of knowledge takes place mainly through three methods [2]:

1. the "teacher centred-method" in which it is the teacher who controls the knowledge transmitted, the topics and the mode, everything remains at a very theoretical level and students fail to maintain a high level of interest, engagement and comprehension;
2. the "student-centred-method" which is based on the concept of "discovery learning" which encourages students to learn actively and to develop critical thinking and enjoyment;
3. the "teacher-student interactive method" which combines the strategies of the previous two methods and the knowledge is generated by the students themselves and shared among them, leading them to remember topics better.

In the light of these considerations, we believe that the answer to our question is gamification, since, in order to stimulate users to learn in a playful, effective and conscious way, regardless of generational differences, gamification combined with cardboardification is effective.

Specifically, gamification consists in "using game-based mechanics, aesthetics and game thinking to engage people, motivate action, promote learning, and solve problems" and is considered "the ideal process for creating engaging learning environments" (Karl M. Kapp) [7].

The game design elements [3, 8] that are used to gamify learning are: points, levels and stages, badges, leaderboards, prizes and rewards, progress bars, storyline and ultimately feedback. These are the elements that improve learning and bring benefits, such as: greater engagement and participation, higher grades on school tests, greater motivation to complete tasks, more enjoyable learning experience, motivation to improve performance, acquisition of more skills, more time spent learning, sense of accomplishment, greater concentration and interest, improved learning achievement, higher order skills, declarative and procedural knowledge and test performances [9, 10, 11].

In the following paragraphs we will present the case studies we have developed. They both have the goal of making learning enjoyable and playful, but they are aimed at two different targets: the first one is aimed at digital natives (in Italy those born between 1998 and 2010), the second one at Millennials (those born between 1981 and 1996).

### 3.3 Case studies: applying gamification and cardboardification to education

#### 3.3.1 Music Board



Figure 1. Music Board

The first concept in which cardboardification has been applied is "Music Board", a corrugated cardboard device dedicated to children from 6 to 11 years old, which allows them to approach the music for the first time and offers a formative experience for creative learning. With Music Board, children can learn music by playing and composing.

The key points on which the concept is based are: the characteristics of the digital native generation and the benefits of music and play for children.

Today's children, the so-called "digital natives"[12, 13], use technologies such as tablets and smartphones very often, which, if used incorrectly, can lead to some negative consequences, ranging from incorrect brain development to problems related to cognitive and motor skills[14].

The immoderate use of these technologies leads children to have little awareness of their manual dexterity; for example, by writing on a mobile phone they are less able to manage hand-eye coordination, which was previously stimulated by drawing and writing by hand. To avoid or reduce these serious consequences, we believe it is important to educate children to use technology responsibly by making it tangible and less alienating. Digital natives have more experience of the digital world, a world defined by technology and the possibilities offered by the web. With this in mind and the concepts outlined above, Music Board aims to be a new learning tool, which relies on the possibilities and methods offered by technology, with a particular emphasis on cardboardification. The concept leverages the

digital potential of the smartphone, used as a teaching aid, and of corrugated cardboard as a "corpus" for tangibility, so that children can interact with the physical matter, rather than the digital part: the display. The Music board system involves the use of interchangeable modules that have different functionalities, such as amplifiers or various musical instruments, which operate through the use of piezoelectric sensors, nfc tags or image recognition.

The main focus of Music Board, as the name suggests, is music; a discipline that, although undervalued, is considered very stimulating for children in terms of intellectual, social and personal development.

All the skills learned through the study of music can also be useful in other activities; it promotes brain and synapse development, improves linguistic intelligence and sound comprehension, fine motor skills, spatial reasoning, reading skills and mathematical skills [15].

According to the same study, for these benefits to occur, however, the study of music must be enjoyable and rewarding. For this reason, in order to give value, and make the study of the discipline complete and interesting, Music Board proposes the use of gamification as a teaching method, a method that proves to offer benefits also when applied to music teaching, it stimulates engagement and allows higher achievements [16, 17, 18].

The music learning takes place in a creative and playful way and aims to make children live this experience as a game, since the act of playing is important for the psychophysical development of children [19]: it allows the development of autonomy and individuality, sociability, physical and cerebral growth.

There are two ways of using Music Board: a "didactic mode" that allows children to learn music theory through a series of levels and tutorials, to be performed using the Board, and a "freestyle composition" mode that allows them to create sounds by synthesising them from different sources, manipulating them and creating new phonemes, or using samples of traditional instruments to create new arrangements.

Everything is controlled by the app, which takes care of sound synthesis and the storage, control and connection of the hardware.

As a result, kids have an active and decision-making role in his learning journey. Through theory, they learn the basics of the discipline and new skills that they can already apply during composition. At the same time, kids can play, even without any basis or knowledge, and learn by doing.

### 3.3.2 Twitch Board



Figure 2. Twitch Board

The second concept born from the application of the Cardboardification vision is the "Twitch Board" (Fig.2): a platform that is proposed as a physical touchpoint of the digital interaction of the homonymous streaming social network. The Twitch Board was created for the Millennials, the social network's main user group, aged between 18 and 35. This proposal wants to be the concretization of the interactions that take place on the social network, allowing to eliminate the gap between the digital and the physical, reducing the distances that are becoming more and more alienating.

As explained in the previous paragraphs, the idea stems from the observation of the current context of education and entertainment, comparing it with the advancement of digital technologies and the acceleration of their use, also and especially due to the Covid pandemic<sup>19</sup>.

Twitch, like most social platforms that rely on the transmission of quality live multimedia content, has experienced accelerated growth, followed by a diversification in the proposal of content by streamers.

As shown in the study conducted by J. Pirker, A. Steinmaurer, A. Karakas : Twitch can become a really useful tool to improve the learning experience, stimulating interaction, allowing to relive content (without having to wait for the teacher to upload the lesson online) and creating a seemingly informal environment that enables even the most shy students to expose themselves, creating dialogue and richness. [20]

In a context such as the contemporary one, where the IRL and the URL are increasingly interconnected and their boundaries less and less defined, it becomes interesting to highlight how the intensification of digital relationships can be conveyed through the interaction with a physical object.

Precisely starting from this last statement it is possible to notice how cardboardification can become the mediation point between virtual and physical reality.

In other words, it is believed that corrugated cardboard, with its characteristics of low cost, flexibility of use, customisation and resistance, lends itself perfectly as a physical vehicle for these digital interactions.

In addition to this, another interesting factor is the ability of corrugated cardboard to democratise digital technologies, acting as an intermediary between innovation and users, making emerging technologies accessible, without confining the user to objects for which it is necessary to invest large sums of money and which risk becoming obsolete in an increasingly short time.

Interaction and entertainment are therefore the main fields of interest where attention was focused in the survey, with particular attention to the topics covered and the related communities.

Twitch, while remaining primarily a platform for gamers, has become very diversified over time, touching on the sharing of general experiences (just chatting), music, gambling, sports, art, design and innovation, and even the spreading of knowledge.

During the design phase, we wanted to keep the interaction with the Twitch Board as simple and intuitive as possible, in order to be able to adapt to different needs: a binary interaction, provided by the levers, an incremental interaction, provided by the slider, and a "voluntary" interaction offered by the knobs.

The interaction is deliberately simplified, because the objective of the Twitch Board is to be horizontal, transversal: in this case study it has been addressed to the Twitch's world, but its functionalities are designed to be adaptable to all platforms based on the online interaction between different actors, whether single-group (e.g. Twitch) or single-single (e.g. Webex teams).

Finally, it is essential to clarify the relationship between Ghelfi Ondulati's digital printing and the Twitch Board: the digital printing allows an aesthetic customization of the board (linking it to the single streamer, but also to a particular event, whether it is an anniversary or a videogame release), an anti-counterfeiting system based on the printing of unique tables (which take inspiration from the banking world, allowing the activation of the board by a possible selected user, 'the subscribers') and finally the targeted micro-marketing (which enables the printing of products by possible sponsors, to allow their advertising to arrive directly on the desk of the selected target).

## **4 CONCLUSIONS**

In conclusion, we have seen how the intelligent use of materials with a low environmental impact can become functional and useful for education and entertainment. The design of products that can be updated, customised and tailored to the values of users can enable us to rethink learning methods and logics, making them more stimulating and interactive.

In our opinion, these products should not be subjected to a logic of dematerialisation and uncontrolled approach to the technological world; they are part of it, but they must take into account the needs of users and must not harm their development. For these reasons, a mediated and thoughtful design between virtual and real is a must.

We have given insight on how cardboardification combined with gamification, allow to put the learner at the centre of their learning, giving them an active and decision-making role, allowing them to learn by doing, in an intuitive and engaging way. The use of corrugated cardboard, allows better access to the latest technology, which is fundamental for learning in an ever-changing context, such as the one we live in today, giving everyone, at the same time, equal opportunities regardless of their physical and social capabilities.

Cardboardification therefore makes technologies that were previously far away accessible, updatable and not bound in time and space, reducing production costs, allowing anyone to experiment and approach new learning contexts.

The learning systems proposed by our concepts, gamified learning experience with a connected physical touchpoint, can be scaled to different realities, potentially any subject or context of liking.

Our hope is that this paper will provide inspiration for the adoption of the cardboardification approach in order to find increasingly interesting, sustainable solutions and new ways to investigate the interaction between the physical and digital worlds, better integrating new technologies into everyday life.

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