Designing Games for GDPR: Negotiating Understandings of GDPR in EU Schools

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Abstract: In this study we combine a participatory design process with a citizen science framing, to foster a dialogue on GDPR in the school. We focus on the perspective of students, approaching them as co-researchers, in designing and evaluating a series of apps, aimed at spreading knowledge on GDPR. We have created a design space between secondary school students in Denmark and Italy, to gather insights across different countries. Results show that approaching students as designers and testers enabled them to provide honest and concrete insights on their experience with GDPR. We identified a detachment related to their posting activities, caused by how social media platforms (SoMe) challenge the boundaries between their personal and school-related ecologies.

Keywords: GDPR, Games-design Based Learning, Participatory Design, Technological Literacy.

1. Introduction

Students and teachers live in a complex world, constantly facing new challenges, such as technological change. From a citizen science perspective, design practice can provide room for students to reflect on their experience, speak their mind, and propose actual change.

This paper investigates how a game-design based learning approach can contribute to the integration of GDPR in the school, fostering a dialogue across schools in Europe. We have engaged students from a high school in Copenhagen, to develop an app to enable other students, their teachers, and friends to learn about GDPR. They created a series of prototypes for their Informatics class, conducting a user-centered design process within their schools, interviewing teachers and schoolmates. A total of five prototypes were created, conceived as gamified quizzes with colorful themes. The three most complete prototypes were tested through online workshops, with teachers and students from two Italian schools (a junior and a senior high school).

Our goal was to enable teachers, and both designer and evaluator students to express their perspectives, regarding emergent challenges on the integration of GDPR in the school, fostering a democratic dialogue. We look at schools as ecologies for learning and social interaction, whose boundaries have been challenged by the digitalization of teaching practice and increasing use of SoMe (Marchetti et al 2024). Our studies show that the involved students believe they know how to manage online, but are not aware of how their school ecology overlaps with their personal ecologies, generating unintended consequences. However, participating in the design process enabled students to engage in a playful dialogue, concretizing their doubts through their perception of the prototypes, without feeling judged for eventual misconduct. Both student groups felt as "experts" supporting other students from other countries, as the Danish students were approached as "designers" and the Italian as "testers".

Following a citizen science approach, students from different countries also acted as co-researchers providing insights on SoMe in the school, contributing to the GDPR sociopolitical debate, while developing playful solutions from their own perspective.

2. Theory – An Ecological Citizen Science Approach

The goal of our project is to explore how to promote awareness and an open dialogue in European schools, about GDPR laws and data protection, targeting teachers, teenagers, and young adults. Therefore, we created a design space to engage secondary education students in a game-design-based learning intervention, as part of a larger project named Spadatas: Security and Privacy in Academic Data management at Schools (Amo-Filvà et al 2023, https://spadatas.eu/), funded by the Erasmus+ program of the European Union. GDPR or General Data Protection Regulations refers to a body of laws promulgated by the EU, to provide commonly approved guidelines for the treatment of people's personal data, addressing private citizens, companies, and public institutions (Amo-Filvà et al 2023, 2022, Marchetti et al 2024).

GDPR has become a major concern for schools through the past 10 years, in correspondence to societal changes, such as the increasing integration of ICT systems in every aspect of our lives, including the school, with the agenda of fostering technological literacy among young people in our digitized society (Heywood 2021, di Sessa 2001). By technological literacy, we refer to a set of knowledge and skills enabling citizens to be aware of their rights in the use of digital platforms, not to feel controlled or misled by these platforms (Heywood 2021). Acting responsibly on SoMe platforms has been included in the list of desirable skills within technological literacy in schools, as the digitization of the school acted as a transformative force pushing teachers and school administration to educate themselves at multiple organizational levels, and to act as disseminators with respect to their students (Marchetti et al 2024).

Our approach leverages an ecological perspective on the digitization of the school following the consolidated perspectives of Raptis et al (2017) and Nardi and O'Day (2000). From an ecological perspective, the school appears as a network including a series or actors: students, teachers, school principals and other professionals working in the school, including the parents of the students (Raptis et al 2017). Within this network teachers and students constitute core actors, as schools are eulogies finalized towards learning and teaching practice (Nardi and O'Day, 1999). A series of tools is used daily to support these practices, which have increasingly become more digitized, imposing new requirements with respect to the teachers' competences. A main issue that has emerged through the Spadatas project is that teachers are forced to constantly educate themselves on GDPR and the use of digital platforms, while at the same time provide the same knowledge to their students (Marchetti et al 2024).

In our study we combined the notion of digital ecology with a citizen science approach, to address students dealing with GDPR as citizens and participants in their school ecology.

The citizen science approach aims at involving the public in scientific inquiries and data gathering (Dickinson et al 2010) as scientific co-researchers (Hidalgo et al 2021). The term citizen science was coined in the 90's and it has become a growing field of research for the scientific community, municipalities and policy making, and education. According to Vohland et al (2021), the notion of citizen science still needs to be understood in depth, in relation to its essence and legitimate use, for instance if it has been abused by institutions and researchers to gain more funds, or for exploiting citizens' workforce to gain new data for free. Areas of investigations can be identified in real world problems, ranging from ecological and environmental research as in Dickinson et al (2010), to urban planning and technology related topics, social sciences and humanities, all lacking a clear scientific framing and demanding open-ended approaches, that could address the individuals and communities involved in a sensible way (Hidalgo et al 2021).

The European Citizen Science Association has provided a 10-principles framework for conducting citizen science inquiries, summarized by Haklay et al (2020, p. 1) in five crucial areas, such as: 1. Core concepts, 2. Disciplinary aspects, 3. Leadership and participation, 4. Financial aspects, and 5. Data and knowledge. According to Haklay et al (2020) the citizen science framework includes a variety of activities and practices, actively involving volunteers in data collection or analysis for different scientific disciplines, such as natural, social sciences and the humanities. Roles and responsibilities of volunteers emerge as a main ethical aspect, as volunteers and researchers should act as equal, for instance roles and responsibilities of volunteers should be discussed transparently with researchers. However, it is the researchers who set the agenda for the inquiry and must provide clear guidelines for participation. Dickinson et al (2010) propose as an example of early citizen science the inquiry *Transit of Venus* project, which was funded by the British government in 1874 and engaged amateur astronomers all over the world to measure the distance between the Earth and the Sun.

In this respect, an interesting angle of investigation for our study is the relation between citizen science and participatory approaches applied to innovation, education, and policy making (Vohland et al 2021, Hidalgo et al 2021), underlining the importance of conducting co-creation workshops.

Our project is positioned at the intersection between citizen science and participatory design, as we are involving higher education students as co-researchers, in collecting data regarding how to support school and their fellow students in navigating GDPR norms across European borders.

According to Hidalgo et al (2021) co-creation approaches are being increasingly adopted in collective decision-making processes, however, the majority of citizen science projects rely on participation for data collection, sometimes for analysis, to allow for larger scale investigations, while forms of co-creation would allow for deeper involvement of citizens. Hidalgo et al (2021) proposes the *PAR* model (Participatory Action Research) for community-based research practices, in which citizens are invited to design and implement research processes as co-researchers. In these processes, citizens can be approached as "competent in-the-field experts" (Hidalgo et al 2021, p. 203) able to provide valuable insights, not differently from user-centered and participatory design approaches, in which individuals of different ages, including children (Druin and Kolko 2017, McNally et al 2017), are approached as experts of their own practice (Björgvinsson et al 2010).

We see as a common point of departure, for researchers engaging in participatory design and citizen science approaches, an assumption of humility of being aware of not knowing all about the situation under investigation, which lead them to include other people, who might be involved in the given situation as peer investigators, to gain new meaningful knowledge from the field. The role of the researcher becomes, therefore, that of a facilitator, creating room for shared discussion and providing a framework for the investigators to contribute to the inquiry. In our study, students and teachers are involved as co-researchers, where students are given the task to act as developers of learning resources addressed to fellow students or their younger siblings, and for their teachers, so that teachers might gain more awareness but also potentially use the students' applications in their class, to discuss GDPR-related issues with other students.

3. Method

Our study adopts a qualitative participatory design approach inspired by the works of Björgvinsson et al (2010), Druin and Kolko (2017), and McNally et al (2017), where students act as co-designers of playful-gamified applications about GDPR. The citizen science framework provided additional guidelines for fostering a democratic, constructive debate with the students, as actors in society and not only in the school, engaged in data gathering. We have initiated, therefore, a design space, in which students acted as experts (designers and testers) on their experience with GDPR, engaged in gathering data and deepening their knowledge of GDPR among their peers and their teachers. Following Druin (2002) and Druin and Kolko (2017), we have involved secondary education students from Denmark and Italy, providing a frame for the role of the students in two main groups:

1. Designers

    - Students from Oerestad gymnasium, technical highschool in Denmark, age group 17-19

2. Testers

    - Students from IIS Eugenio Bona, technical high school in Italy, age group 15-19
    - Students from An Italian middle school, age group 13-14

At Oerestad, our study leverages study activities related to the *privacy-app-project,* which was conducted in the auspices of the subject Informatics B (a 2-year course), addressed to 3. Grade high school students, who had chosen Informatics B as a non-mandatory subject. The students came from various study lines, but most had a focus on media science, a relevant subject to our study. Informatics is a very broad subject area covering issues like app-development, website design, game design, databases, it-security, SoMe and more. At Oerestad the chosen learning approach in ICT is inspired by Caspersen and Nowack (2013) and by the American tradition represented by Seymour Papert and Mitch Resnick (see for instance Resnick 2022). Hence, students from Oerestad were involved in gathering data while being already in the process of learning how to develop digital games and apps.

On the other hand, we involved the Italian students and their teachers as expert testers, evaluating how well the proposed apps could fit their needs regarding awareness of GDPR. The students from IIS Bona belong to the same age group as those from Oerestad, and are engaged in a technical education, while the students from Arborio school are enrolled in the final grades of their 3-years middle school, just before highschool, hence they could represent younger friends or siblings to the designer-students from Oerestad.

As previously mentioned, we combine participatory design with citizen science, which are generally presented as large-scale inquiries, potentially involving a municipality, or even all the citizens of a country or even people all over the world through web pages and online applications (Haklay et al 2020, Dickinson et al 2010, Hidalgo et al 2021).

A little discrepancy can be found between citizen science and participatory studies, which privilege co-design activities within small-scale inquiries. Our study represents a sub-inquiry involving three schools in Italy and Denmark and it is part of a large-scale study on GDPR in the school involving schools in several countries within the EU.

Figure 1: Observation setup for online workshops.

Our approach is to involve teachers and pupils from these schools in situated workshops, with the goal of gaining authentic data, specific to the different contexts, in contraposition with average abstract data, which might not represent truthfully what happens in European schools. Therefore, our study can be seen from a multidimensional perspective, as the researchers conduct participatory inquiries locally and across different countries, but the gathered data are shared and compared among the researchers, to gain a larger-scale

perspective on the similarities and differences among the experiences of teachers and students, and to facilitate sharing of strategies developed in the different countries. We collected data through ethnographic methods physically and online (Fig. 1), mostly note taking, but we are avoiding intensive video-recordings so as not to risk data leaks. However, we adopt sketching as a supportive practice (Causey 2017), to gather visual evidence of the students' engagement during the workshop.

Our study embodied ethical values as we approach students as adults with respect, not as kids to be educated or preached, as potentially guilty of sharing inappropriate content. In this way we hope to engage in an honest exchange, we do not expect them to admit any wrong doings regarding GDPR or need for guidance, which might lead them to feel patronized and ditch our collaboration. On the other hand, our focus is on the prototypes and the design process as room for negotiation and exchange, so we are not interested in gathering personal data from the students, and we can respect GDPR to the core, without exposing the participants to our studies in any ways, going beyond basic guidelines from our study boards.

4. Prototypes, the BASIC Model, and Testing

The design of the prototypes was supported by one of the authors and teacher, by means of the *BASIC model* for design and innovation, which builds on the Danish tradition of learning based on the spoken word, ideas of problem-based project-based learning Holm-Larsen (2004). This model was developed on top of the *DesignToImproveLifeEducation-model*[1], specifically for high schools, and it is a simpler version of well-known models like for instance the double diamond-model[2].
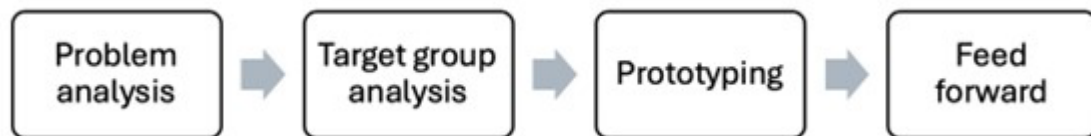

Figure 2: The BASIC model.

The BASIC model (Fig. 2) proposes a series of phases, first letting the students to investigate the problem area and defining the problem that they will address through divergent activities. Afterwards (phase 2) they will converge, focusing on a specific target group. In the 3rd phase, they will create mockups of solutions to the problems, and in the last phase (4), the students present their problems, target groups and prototypes and get feed-forward from other groups and the teachers on how to move on and elaborate more on the developed solutions. The process can then be repeated as many times as possible, in line with iterative design methodology (Preece et al 2017).

Through the BASIC model, students can work alone or in groups, taking a point of departure in a general subject area, like for instance privacy, and exploit design and game-based learning methods to create interesting solutions for their target group, which can constitute a motivating factor.

After the initial design-phase, the students developed high-fi prototypes in the *Code.org* environment, a very simple yet powerful app-development tool, where users can produce actually working, very nice-looking apps, with databases and more in a JavaScript-like programming language, using block-based as well as textual coding.

The students could choose their target group, most students chose to address their peers at high school, others opted for parents, younger students, or children in compulsory school, while a group addressed their former teachers from compulsory school in Denmark.

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[1] https://blog.folkeskolen.dk/blog-hogd-handvaerk-og-design/design-to-improve-life/165249
[2] https://www.designpsykologi.dk/hvad-er-double-diamond

Figure 3: First and last pages of the apps tested with the Italian students.

The students were quite creative and leveraged game elements to make the subject area more interesting and graspable to the target group, including quizzes, simple games, sound effects, surprising and fun elements and more; they spent around 10 hours on this project. A total of five prototypes were created and three were selected for testing, as they were the most complete (Fig. 3).

These three apps were structured as self-evaluation quizzes, completed with guidelines and summaries of GDPR norms. One app targeted small children proposing a farm animal-inspired theme (Fig. 3 left), another one started with the image of a cat but similarly to the third prototype proposed a high-contrast graphic style with bold headlines (Fig. 3 center and right).

Links to the three apps were sent off to members of the target group by email, SoMe and more, together with questionnaires, so their target group could get back with feedback about the apps, their contents, and playability.

To test the prototypes in Italy, we edited a PowerPoint with an Italian translation of each page of the quizzes, that the teachers printed and distributed to the students to support them during the test. This test was conducted online in an ethnographic fashion, as one of the authors collaborated with local teachers, observing, and taking notes and sketches on the tester-students' responses and comments. At Arborio the test was framed within their citizenship-related teaching and was split in two sessions with three classes, during the first session the students got an introduction to GDPR, during the second session the students tried the prototypes and had to answer a short questionnaire. At IIS Bona we conducted one session with three classes, as the students were previously introduced to GDPR.

In conclusion the tester-students were learning about GDPR norms, in relation to social sciences-related subjects and were introduced to iterative testing methodology. The students from Oerestad learned about idea-generation and app-development, working with real world problems, databases, flow in games design and other relevant theories about computer games-design, making appealing interfaces to various user interfaces (the rule of thirds, various gestalt rules, color theory). We also covered databases and E/R-diagrams (so they could make a simple login system), agile systems development methods like scrum. Furthermore, the designer-students need to learn a lot about data privacy and how to make these very complicated issues available to a target group.

5.   Analysis and Discussion - the Prototypes and GDPR

In general tests with Italian schools assumed an amusing tone, students and teachers were collaborative, they laughed, and seemed thrilled by the event (Fig. 4). The evaluator-students were generally impressed by the prototypes of the designer-students, their feedback could be grouped into two main categories: the *perception of the apps* and their *perception of GDPR in the school* as potential users of the apps. The prototypes were evaluated as "very good", "fun" and even "impressive" by both schools, a rating emerged in which the app with the cat in the starting page was rated as the best, as the students liked the idea of having a mascot while keeping a professional appearance. The animal-farm app, rated as second best, was found cute but a little "childish", suitable for younger users; interestingly the younger students from Arborio also agreed with this judgment. The third prototype was found to be well-developed and "serious", students from Bona said it would be more suitable for teachers or adults.

Figure 4: Sketches from online workshops. Left: Teacher and students from Arborio. Right: Teacher and students from Bona.

Emerging sub-themes related to the perception of the apps were that of *playability* and *inspiration sources*. The quiz concept was found relevant, however, several students desired a more playful experience, inspired by RPGs or platform games, such as *Fortnight* as according to a student from Arborio. A few girls from both schools said that they would prefer an app reproducing their experience with their favorite SoMe platforms - *TikTok* or *Instagram* - with reference to fashion or pop music, a girl from Arborio explicitly mentioned her Instagram stories as a model. Discussing the use of apps in Denmark and Italy with Arborio classes, Instagram and TikTok were equally popular, but The Italian students were then surprised to hear that Danish students do not use much Whatsapp, while it was said to be very popular in Italy. Other students from Arborio suggested reproducing "phishing" messages, suggesting clicking on a button to: send credit to a friend in need, or to get credit sent by a parent. Recalling these phishing messages, which were deemed as "fake" or "frauds", fostered laughs among the students.

A final live session was organized between the students from Arborio and Oerestad gymnasium, months after the creation of the prototypes. During this session there was a nice atmosphere and connection between the students, despite the session being mediated online by the teachers, the language barrier, and the age difference between the students (from 12 in Arborio up to 19 circa in Oerestad). The Italian students presented their country and local environment and what they have learned about data privacy, the Danes asked questions to the Italians as informers regarding their prototypes. In the end the students continued talking about their daily lives in the two countries. This session was successful as it showed potential benefits for both student groups, engaging youngsters in creating and exchanging game-based learning materials across different European countries about complex topics, like data privacy; however, it should have been closer to the apps development to be meaningful for our study, as the Italian tester-students could have been more precise about their feedback and the Danish designer-students had moved on to other projects, so they could not use the feedback anymore.

Regarding the second theme, *perception of GDPR in the school*, the students from Arborio said to have never heard of GDPR, but to be aware of the risks of posting online. The older students from Bona and Oerestad claimed to have had training, as a girl from Bona said: "We know!" another from Oerestad said: "At our age we are aware, maybe we could address younger kids!" Interestingly all students believe to be informed enough on data privacy, even those who were new to GDPR, hence they do not identify with the target group around this study, pointing at a "younger" age group.

However, two incidents reported by Italian teachers reveal a more complex landscape. A teacher from Bona said that once a student spilled cocoa on the floor and offered to clean up. During the cleaning, the student and a few classmates started teasing each other innocently, according to the teacher, one of them filmed the student cleaning and posted the video on Facebook. The student's mother found the video and complained with the teacher, thinking that her child was being bullied. A teacher from Arborio told us that a student shared negative comments about a teacher in a SoMe group, which were re-shared outside the group, reaching that teacher, hence a disciplinary meeting was arranged with the student's parents.

These cases reveal a form of detachment of the students regarding their posting activity, they claim not to "post about school" or to "only post about their personal life", such as: selfies or videos about holidays, nights out, or weekend activities, mostly on Instagram. However, the teachers mentioned having seen students posting about

class trips or content involving classmates, at times girls exposing themselves in revealing clothing, hence unconsciously posting inappropriate content about school.

From an ecological perspective, the students do not seem aware about how their personal and school ecologies intersect with each other through social media, and how adults (teachers and parents) participate in both even if they are not intended receivers of the shared content. We find this the most problematic result of our study, suggesting the need to visualize in a playful way, how apparently innocent posting activities might cross boundaries between the two ecologies, involuntarily infringing GDPR norms.

From an overall perspective, our contribution revolves around three main areas as in Table 1.

Table 1: Contribution areas from our study.

1. Participation	Blending citizen science and participatory design,
2. Concretization	The role of a design space in negotiating meaning of GDPR in schools,
3. Sense-making	Prototyping and testing as epistemic practices

Since the students believe to be aware of how to post correctly, in spite of emerging issues, our design space enabled us to avoid preaching and foster an honest dialogue, inviting the students as co-researchers following a citizen science approach (Hidalgo et al 2021) framed through a participatory design process (Björgvinsson et al 2010). Moreover, designing around GDPR, potentially an abstract topic, enabled us to concretize our dialogue with the students focusing on the prototypes. Finally, testing and prototyping emerged as epistemic practices, as the prototypes elicited concrete thinking on what is GDPR, the playability of the apps, and their learning value, across different countries.

6. Conclusion

Mixing citizen science and participatory design proved to be profitable strategy for involving students, it

enabled us to engage students from different secondary schools across Europe giving them a voice, about issues that might concern them directly. A main finding from this study deals with students' perception of GDPR and of the boundaries between personal and school ecologies, as something they think they know, but leading to unintended consequences. Moreover, the design intervention provided room for self-paced game-based learning for students (designers and testers), emerging as a promising practice, when engaging young learners across European borders, sharing small games and learning materials, in complicated topics like data privacy. However, more work needs to be done in this field regarding how to frame these interventions, overcoming cultural and linguistic boundaries.

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