ALICE IN GAMELAND: SMART ESCAPE ROOM FOR EXPERIENTIAL LEARNING

ALICE IN GAMELAND: SMART ESCAPE ROOMS PER L'APPRENDIMENTO ESPERIENZIALE

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ABSTRACT

The use of Educational Escape Rooms (EERs) enhanced with Augmented Reality (AR) and Tangible User Interfaces (TUIs) represents an innovative frontier in experiential learning. *Alice in GAMEland* is a digital escape room designed to improve language skills through gamification, real-time feedback, and interaction with physical objects. This study analyses usability and game experience in a sample of 148 university students from four European countries.

L'uso di escape room educative arricchite con realtà aumentata (AR) e interfacce utente tangibili (TUI) rappresenta una frontiera innovativa dell'apprendimento esperienziale. Alice in GAMEland è un'escape room digitale progettata per migliorare le competenze linguistiche attraverso gamification, feedback in tempo reale e interazione con oggetti fisici. Questo studio analizza usabilità ed esperienza di gioco su un campione di 148 studenti universitari provenienti da quattro paesi europei.

KEYWORDS

Experiential learning, Educational Escape Rooms (EERs), gamification, Technology-Enhanced Learning (TEL), Augmented Reality (AR), Tangible User Interfaces (TUIs).

Apprendimento esperienziale, escape room, gamificazione, apprendimento aumentato supportato dalla tecnologia, realtà aumentata, interfacce tangibili.

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Introduction

The landscape of higher education is constantly evolving, shaped by emerging challenges that demand the enhancement of students' learning experiences through innovative methodological and pedagogical responses, identified as key drivers by Dichev and Dicheva (2017). The GAMEland project (Gamification Assets for Multisensorial Educative tools in Language learning using co-creation for addressing Needs and Desires of students), co-funded by the Erasmus+ programme (Project number: 2022-1-PL01-KA220-HED-000085438) and accessible at https://gamelandproject.eu, represents a revolutionary approach to language teaching and learning. It leverages innovative technologies, such as Educational Escape Rooms (EERs) enhanced by Augmented Reality (AR) and Tangible User Interfaces (TUIs).

This article outlines the theoretical foundations underpinning the design, and trialing in real educational context, of the educational escape room "Alice in Gameland,", a mobile application developed to improve university students' English language proficiency. Specifically, the research focuses on exploring how the use of educational escape rooms enhanced by AR and TUIs can be integrated into educational settings, with particular attention to usability and gameplay experience.

Educational Escape Rooms (EERs) represent one of the most promising innovations within contemporary teaching and learning methodologies, as they combine the dynamics of gameplay with highly immersive and motivational learning experiences (Fotaris & Mastoras, 2019). According to Veldkamp et al. (2020), EERs constitute experiential learning environments that promote active engagement, peer collaboration, and the development of critical thinking skills, offering an effective opportunity to foster transversal competencies through problem-solving. The convergence of cutting-edge pedagogical experimentation and the ludic dimension—intrinsically connected to the structure of escape rooms—has contributed to positioning EERs as highly functional educational tools capable of aligning learning objectives with meaningful and structured gameplay dynamics and scenarios. As emphasised by Dichev and Dicheva (2017), when gamification is coherently aligned with pedagogical goals, it can serve as a powerful ally in promoting active and personalised learning, particularly within higher education contexts.

Veldkamp and colleagues define EERs as learning activities inspired by live-action escape games, designed to foster learning through gamification and active pedagogy. These are immersive and collaborative environments in which students "escape" from a purposefully constructed scenario or narrative by solving puzzles, tasks, and challenges requiring the application of knowledge, transversal skills, and problem-solving abilities. The proposed definition highlights the main characteristics of EERs, both in terms of their structural elements—such as immersive environments, use of challenges, and storytelling— and the personal skills they help develop, including collaboration, metacognitive skills, and problem-solving capabilities. Unlike commercial escape rooms, primarily aimed at entertainment, Educational Escape Rooms are designed to align with specific learning objectives, integrating curriculum content within a game-based narrative that simulate real-world scenarios in order to promote active learning (Fotaris & Mastoras, 2019). The more context a learning objects has, more the learning experience become meaningful, as the internalisation of the learning experience, fundamental in the learning process, is successful when concepts and knowledge are anchored to real-life problems and scenarios (Mazzuccato & Kic-Drgas, 2022)

The defining features of EERs include: a) Challenge: The challenge component is essential for stimulating student engagement, encouraging the active overcoming of cognitive obstacles. According to Csikszentmihalyi (1990), the challenge must be balanced with students' competencies to facilitate a state of flow, in which the difficulty level matches perceived abilities, thus promoting an immersive and motivational experience. b) Flow: The concept of flow, developed by Csikszentmihalyi (1990), describes a psychological state of total immersion in an activity, characterised by high concentration and satisfaction. In EERs, flow is activated through a continuous alternation of difficulty and progress, which keeps students engaged without overwhelming them. This immersive state supports deep learning and long-term retention (Dichev & Dicheva, 2017). c) Storytelling: Engaging narratives are essential in making the escape room experience meaningful and motivating. According to Bruner (1991), stories are powerful learning tools as they create emotional connections and contextualize content within a broader framework, rendering learning more relevant and memorable. In EERs, the narrative is intertwined with puzzles, stimulating curiosity and enhancing student engagement.

In educational settings, EERs can serve various functions: from introducing and consolidating theoretical concepts to formative assessment of skills, and fostering cooperative peer learning. Their effectiveness is closely linked to their ability to combine cognitive challenge with gamification elements such as goal-oriented tasks, compelling narratives, and gameplay dynamics that foster flow and increase intrinsic motivation (Dichev & Dicheva, 2017; Veldkamp et al., 2020). The flexibility of EERs makes them versatile tools suitable for heterogeneous educational contexts—from primary school to university, as well as professional and specialised training. Notably, they are increasingly employed in fields such as medicine, chemistry, nursing, and second language acquisition (L2), demonstrating their adaptability to complex content through innovative, student-centered teaching methods (Chen, Liu, Zhu, et al., 2023; Alonso & Schroeder, 2020; Gómez-Urquiza et al., 2022).

Educational escape rooms (EERs) already embody a strong element of innovation, but their potential is further amplified by integrating virtual and extended reality technologies. By incorporating virtual reality (VR), mixed reality (MR), and augmented reality (AR) into EERs, educators can create highly immersive environments that boost student engagement and interactivity. Such immersive technologies have been widely studied in educational settings for their ability to foster motivation and provide hands-on, experiential learning opportunities (Bailenson, 2021; Freina & Ott, 2020).VR, in particular, is recognised as an effective medium for creating immersive learning environments that promote active participation, reflection, and problem-solving (González et al., 2020). Conversely, AR enriches the physical environment with digital elements, offering more interactive learning experiences. Recent studies have shown that AR can enhance conceptual understanding and support collaborative learning, especially in contexts where active participation is critical, such as in EERs (Cai et al., 2022).

The integration of these technologies enables the design of gamified experiences that promote not only cognitive learning but also teamwork and social interaction among participants (Pujol et al., 2021). The immersive dimension, which plays a pivotal role in escape rooms, has been extensively studied in the context of VR. Research suggests that VR can significantly amplify the sense of “presence” in a virtual environment, a phenomenon that facilitates deep interaction with educational content and gameplay activities (Slater et al., 2020). When participants are immersed in a highly engaging virtual setting, their attention and motivation tend to be more focused, thereby enhancing the learning experience (Tussyadiah et al., 2021).

Escape Rooms, when combined with XR technologies, offer the possibility of overcoming the physical limitations of traditional learning environments, enabling the creation of complex scenarios that would not be feasible in the real world. The use of XR in educational contexts thus provides new avenues for exploration and problem-solving, promoting the development of cognitive, social, and practical skills through interaction with digital environments (Bailenson et al., 2021; Alcañiz et al., 2021).

In summary, the integration of XR into Educational Escape Rooms constitutes an innovation that enhances immersion and stimulates active and collaborative learning. These technologies not only improve the gamified experience but also create highly motivating and interactive learning environments, yielding significant benefits for students' skill development.

1. Escape Room Features and Operation

Alice in Gameland is an interactive application built to boost students' English language proficiency by placing them inside an escape room–inspired environment. Through narrative-driven puzzles and context-rich challenges, learners actively practice vocabulary, grammar, and communication skills in a gamified setting that fosters engagement, collaboration, and sustained motivation. Alice in Gameland is structured as a ten-stage narrative adventure, with each chapter presenting a unique thematic puzzle. Drawing on Lewis Carroll's *Alice's Adventures in Wonderland*, the game reimagines Wonderland's characters and settings within an educational framework. Delivered via an Android app, it leverages NFC (Near Field Communication) to merge the physical and digital worlds: NFC tags embedded in real-world objects act as "smart tokens" that, when tapped with a smartphone, unlock specific digital content—creating a seamless, hands-on learning experience.

The tool can be described by breaking it down into two main components: a) Software Component: represented by the application, which regulates the entire flow of the experience, from the narration and presentation of puzzles to the validation of responses. It acts as an intermediary between the user and the game environment, promoting immersion and constant interaction. b) Hardware Component: consisting of physical objects equipped with NFC tags. These objects, which may appear ordinary (such as posters, school supplies, or furniture), become augmented, and interactive, through NFC technology, enabling them to communicate with the mobile device. This integration between the physical and digital realms allows the user to access contextual digital content through interaction with the environment (Azuma, 1997; Milgram & Kishino, 1994; Cheng et al., 2017).

The application operates in three cyclical phases, repeating until the journey is completed:

Phase 1: Introductory Narrative. This phase aims to immerse the player in the story through the use of synergistic audiovisual stimuli. The narrator's voice guides the user through the plot, while the screen displays evocative images, generated by artificial intelligence, that enhance the immersive effect. This initial moment is not only functional in presenting the setting but also plays a key role in the emotional and cognitive engagement of the participant, preparing them for the subsequent challenge.

Phase 2: Presentation of the Puzzle. In this phase, the puzzle to be solved is introduced. It is presented both in textual and vocal formats to ensure accessibility for students with different learning styles (Figure 1). Each puzzle is designed according to a fundamental principle of gamification: the challenge. In this sense, the challenges are calibrated based on the linguistic level of the target users to promote a motivating, yet not frustrating, experience. To continue, users must physically select the correct object from the available options, simulating a real problem-solving interaction. The puzzles require players to locate the NFC-enhanced object within the play space that corresponds to the correct solution. The enhanced objects thus represent the response options available to the user to overcome the puzzles presented by the system. These objects, which include common items or paper posters, do not inherently possess any special characteristics apart from being enhanced through the application of an appropriately tagged NFC tag. The presence of such NFC-enhanced objects allows the transformation of the physical space into an augmented learning environment.

Figure 1. (Example of what is visible on the smartphone during the game session)

Phase 3: System Feedback. Once the response is selected, the smartphone reads the NFC tag of the chosen object and provides immediate feedback. In the case of an incorrect response, the system prompts the user to try again after reviewing the puzzle. If the response is correct, the game proceeds with a new narrative segment and a new puzzle, restarting the previously described cyclical dynamic. This cycle repeats until the completion of the ten stages that make up the entire journey. This recursive structure (narrative → puzzle → feedback) ensures the continuous engagement of the player, promoting the development of progressive and rewarding learning.

The Alice in Gameland app is designed to ensure an autonomous gaming experience, providing participants with all necessary information to overcome the puzzles and offering real-time feedback on the responses entered.

2. Data collection methods

The data collection on the Alice in Gameland Escape Room was conducted across four European Union countries, through collaboration with local universities: Université Rennes II (France), Università degli Studi di Napoli Federico II (Italy), Uniwersytet im. Adama Mickiewicza W Poznaniu (Poland), and Burdur Mehmet Akif Ersoy University (Turkey). The primary objective of the data collection was to gather the perspective of students, who are the intended recipients of this educational innovation. The total sample consisted of 148 participants, geographically distributed as follows: 47 participants from Italy, 15 from France, 50 from Poland, and 36 from Turkey. Participants were invited to take part in the study through an invitation from the involved universities. Participation in the study was voluntary, contingent upon reading and signing the informed consent form. Data were processed anonymously, in compliance with the Law of 22 December 2017, no. 219, regarding the protection of personal data and the processing of data in an anonymous form.

The experiment was organized by dividing participants into small groups, each comprising a maximum of seven individuals. No participant played the Escape Room individually. Each group participated in the game session following the procedures described in the previous paragraph, using a smartphone provided by the experimenter. The activity was conducted using a smartphone provided by the experimenter, randomly assigned to one of the group members. Participants were free to organize themselves internally, deciding whether to designate a "game leader," responsible for holding the device for the entire duration of the experience, or to alternate its use among the group members during different stages of the session. Before starting the game session, the designated researcher ensured that the setting was appropriately prepared according to the guidelines on the project's website (https://gamelandproject.eu). Specifically, it was verified that each object was equipped with its own properly coded tag and placed in the game environment appropriately. The experiment took place in a controlled environment, free from external stimuli, with the presence of an experimenter. After receiving instructions on the game mechanics from the researchers, participants were allowed to move freely within the game space. The experiment was considered concluded once the group solved all the puzzles presented by the app. After completing the experimental phase, each participant was invited to fill out a questionnaire aimed at evaluating perceived usability and the overall gaming experience. Prior to the questionnaire, participants were asked to provide some sociodemographic and linguistic information to further delineate the sample's characteristics. In particular, data was collected regarding age, gender, native language, English language proficiency level, as well as the degree of familiarity with general applications and, more specifically, with those designed for learning purposes.

Focusing on the tools used in the questionnaire, usability was measured using the System Usability Scale (SUS), proposed by Brooke (1986). The SUS is a self-assessment tool used to measure the usability of a system, considered a consolidated standard for evaluating the usability of tools such as applications. The tool is structured as a scale and consists of ten statements related to the experience of using a system, covering aspects such as ease of use, user satisfaction, and overall interface quality. Each statement is rated on a five-point Likert scale, ranging from "strongly disagree" to "strongly agree." The SUS includes both positive and negative statements, aiming to balance responses and reduce the risk of systematically favorable or unfavorable answers. The final SUS score is calculated using a formula that normalizes individual scores, resulting in a value ranging from 0 to 100, where higher values indicate greater perceived usability. The SUS is widely used in research and practical contexts to evaluate the quality of user interaction with various types of systems, including software, mobile applications, and hardware devices.

To assess the gaming experience, the core module of the Game Experience Questionnaire (GEQ) was employed. The GEQ is a psychometric tool developed to evaluate participants' gaming experiences during interaction with digital games (IJsselsteijn, de Kort & Poels, 2008). The questionnaire includes several modules, including the core module, which measures the primary psychological aspects related to the gaming experience. The core module of the GEQ is the first part of the questionnaire, designed to collect data regarding the players' thoughts and emotions during the game. It consists of 33 items exploring seven distinct dimensions of the gaming experience: Immersion, Flow, Competence, Positive and Negative Affect, Tension, and Challenge. Responses are provided on a five-point Likert scale, ranging from "not at all" to "extremely." Each item is designed to gather information about the players' emotions, thoughts, and psychological state during the game, enabling a detailed evaluation of their experience. The GEQ is widely used in game design research to analyze how different aspects of a game influence player experience and engagement with the game itself.

3. Results

Regarding the data characterizing the sample population, consisting of 148 individuals, the average age of the sample is 23.47 years. The gender distribution is predominantly female, with 96 women, 46 men, 3 non-binary individuals, and 3 participants who chose not to specify their gender. Concerning the native languages, most participants reported speaking Italian (47), Turkish (36), and Polish (19). Other languages mentioned include French (13), Russian (7), Ukrainian (7), English (3), Spanish (1), Chinese (1), Arabic (1), Persian (1), and Croatian (1). In terms of English proficiency, 21 participants self-identified as "Beginner," 88 as "Intermediate," 34 as "Advanced," and 5 as "native speakers." Regarding familiarity with app usage, 130 out of the 148 participants indicated familiarity with general app use, while 119 reported specific skills in using learning applications.

The analysis of the data obtained from the System Usability Scale (SUS) administered to the participants yielded an average score of 68.50, with a standard deviation of 17.66. According to Bangor, Kortum, and Miller (2009), the arithmetic mean calculated from over 2,300 cases is 68.0, with a standard deviation of approximately 12.5, a reference value commonly used in scientific literature to classify perceived usability levels (Table 1). Therefore, the average score observed in this study can be considered statistically consistent with the reference mean and falls within the interpretative range corresponding to an "acceptable" level of usability (Bangor et al., 2009), although it is positioned at the lower end of scale B (grade scale) according to the conversions proposed by Sauro and Lewis (2012). The observed standard deviation (SD = 17.66) is higher than that typically reported in the literature, suggesting greater variability in perceived usability among the subjects. This indicates the possible presence of subgroups with significantly divergent experiences, which could be attributed to differences in usage profiles, technological backgrounds, or demographic characteristics.

Parameter	Observed value	Reference value (Bangor et al., 2008)
Number of participants	148	2300+
Mean SUS score	68,50	68,00
Standard deviation	17,66	12,50
Qualitative classification	Acceptable (Grade B)	

Table 1. SUS Results

The analysis of the data obtained through the administration of the Core Module of the GEQ, which measures various dimensions of the subjective experience related to interaction with a digital activity such as an educational application, reveals a generally neutral or moderately positive profile, with values falling within the central range of the evaluation scale. The reference scale used ranges from 0 (“not at all”) to 4 (“extremely”), allowing for a detailed reading of the perceived intensity for each dimension.

The highest average score is observed in the dimension of "Competence" (M = 2.66; SD = 1.04), which reflects the extent to which participants felt capable of effectively tackling the task at hand. This score, falling between “moderately” and “fairly,” suggests a widespread perception of adequacy in relation to the required tasks, although it also highlights notable variability within the sample, as indicated by the relatively high standard deviation. The dimensions of “Flow” (M = 2.44; SD = 0.97) and “Sensory & Imaginative Immersion” (M = 2.41; SD = 1.00) show similar scores, also clustering around the “moderately” range. This suggests that the experience was perceived as moderately engaging, without reaching particularly intense levels of absorption or immersion. The presence of considerable individual variability suggests subjective differences in the quality of the experience.

The “Challenge” dimension (M = 1.98; SD = 0.80) is closer to the “moderately” value, indicating that the activity was perceived as moderately challenging. However, the score remains below the midpoint of the scale, suggesting that the level of difficulty did not strongly stimulate the sensation of challenge. Again, a certain heterogeneity in responses is observed.

Particularly notable are the relatively low scores associated with the emotional dimensions. “Tension / Annoyance” (M = 1.45; SD = 0.58) and “Negative Affect” (M

= 1.43; SD = 0.66) show that participants experienced only mild levels of discomfort, frustration, or negative emotions. These data suggest that the experience, while not highly engaging, was mostly experienced in a calm manner, free from significant distress. Lastly, the “Positive Affect” dimension (M = 1.40; SD = 0.57) yields surprisingly low scores, comparable to those of negative affect. This highlights that, on one hand, the activity did not evoke unpleasant emotions; on the other, it did not generate significant positive emotional reactions. The limited intensity of both positive and negative emotions contributes to defining an overall neutral emotional experience.

The results obtained through the administration of the GEQ are presented in the table below (Table 2).

Dimension	**Item**	**Average**	**Standard deviation**	**Synthetic interpretation**
Competence	6, 14, 21	2.66	1.04	between "moderately" and "fairly"
Sensory & Imaginative Immersion	2, 10, 18, 26	2.41	1.00	"Moderately"
Flow	5, 12, 19, 27	2.44	0.97	"Moderately"
Tension /Annoyance	4, 11, 22	1.45	0.58	between "slightly" and "moderately"
Challenge	3, 9, 17, 25	1.98	0.80	approximately "moderately"
Negative Affect	7, 15, 23, 31	1.43	0.66	between "slightly" and "moderately"
Positive Affect	8, 16, 24, 30, 32, 33	1.40	0.57	between "slightly" and "moderately"

Table 2. GEQ Results

Conclusions

The analysis of the data obtained through the System Usability Scale (SUS) questionnaire yielded an average score of 68.5 from a sample of 148 participants. While this value exceeds the conventional threshold of 68, which is considered a reference for good perceived usability (Bangor et al., 2009), it still reflects a marginal usability condition, which can be described as sufficient but not optimal.

In other words, the evaluated system is generally usable, but it does not excel in terms of efficiency, satisfaction, or ease of use. A noteworthy element is the relatively high standard deviation (SD = 17.66), which indicates a strong variability in user experiences. This suggests that while some participants found the system accessible and intuitive, others likely encountered difficulties related to interaction, interface comprehension, or task complexity. This heterogeneity may be linked to individual differences in technological background, language skills, or familiarity with similar tools. Specifically, given that the sample included users with highly diverse levels of English proficiency (ranging from Beginner to Native speaker), it is plausible that these differences significantly influenced the perception of usability. In a system that requires linguistic comprehension, even an English-only interface may present a barrier for some users.

The analysis of the data collected through the Game Experience Questionnaire (GEQ) provided a more in-depth exploration of the subjective perceptions related to the interactive experience. The questionnaire, which is structured across multiple dimensions, highlighted both positive and critical aspects of the evaluated system. In general terms, the dimensions “Competence” (M = 2.66), “Flow” (M = 2.44), and “Sensory and Imaginative Immersion” (M = 2.41) received the highest average scores. These results indicate that the proposed experience managed to engage users to a moderate extent, promoting a certain mastery of the interactive dynamics. Specifically, the relatively high score in the Competence scale suggests that users felt capable of effectively completing the tasks, while the value associated with Flow indicates a moderate level of experiential immersion. On the other hand, the dimensions “Positive Affect” (M = 1.40), “Negative Affect” (M = 1.43), and “Tension / Annoyance” (M = 1.45) reported the lowest average scores. This consistency in values suggests that the experience was emotionally mild, generating low levels of both positive and negative emotions. This can be interpreted in two ways: on one hand, as an indication of a stable experience free from significant frustrations (as also confirmed by the low Tension level); on the other hand, it may point to a lack of emotional stimulation and limited affective involvement. The average score for the “Challenge” dimension (M = 1.98) indicates a perception of moderate challenge, but not absence of it. In combination with the Flow data, this suggests that the system was able to maintain an adequate level of engagement, though without presenting particularly stimulating obstacles.

Overall, the psychometric profile that emerged describes an experience perceived as technically accessible, emotionally neutral, and moderately engaging. The absence of extreme scores, either positive or negative, suggests that, while the experience was generally positive, it was not particularly memorable or immersive. The application was perceived as functional and usable, but with room for improvement, especially regarding emotional stimulation and the depth of the experience. These results, considered alongside the SUS score, outline a promising system, but one that requires targeted interventions to enhance its communicative and experiential effectiveness.

In addition, although the study successfully met its primary aims concerning usability and gameplay experience, it is important to recognize that the evaluation did not extend to direct measures of English language learning outcomes. This represents a valuable opportunity for future research to explore the actual educational impact of the tool, potentially through longitudinal studies or experimental designs comparing the escape room intervention with traditional language learning methods. Such investigations would be essential to comprehensively assess the system's effectiveness in achieving its core pedagogical goals.

Based on the evidence presented, several development directions can be outlined to improve the quality of the user experience. First, it is crucial to enhance emotional engagement, which is currently limited. Another area for intervention concerns the management of perceived difficulty. The data suggest that while the experience is accessible, it may be insufficiently stimulating for some users. In this regard, it may be useful to implement adaptive mechanisms that adjust the difficulty according to the user's competence level and progress, thereby maintaining an optimal balance between challenge and satisfaction, a condition essential for promoting a flow state. Finally, the heterogeneous composition of the sample in terms of native language and linguistic proficiency suggests the opportunity for user segmentation. A comparative analysis of experiential perceptions across subgroups could guide more targeted design decisions, promoting greater inclusivity. It is also recommended to adopt an integrated methodological approach, complementing quantitative tools with qualitative and observational methodologies (e.g., interviews, focus groups, usage behaviour analysis), in order to obtain a more in-depth understanding of user needs. Moreover, the absence of subgroup analyses in this study points to promising directions for future work. By conducting detailed analyses on sub-samples defined by country, language proficiency, or familiarity with educational technology, subsequent research could provide a more nuanced understanding of how different user profiles interact with and benefit from the educational escape room experience. This would not only strengthen the robustness of the findings but also support the design of more tailored and effective interventions. Taken together, these considerations frame the current study as a foundational step that opens meaningful pathways for future research aimed at both deepening pedagogical insights and refining technological implementations. Such continued inquiry will be critical to fully harness the potential of gamified learning environments for language acquisition and beyond.

Author contributions

The work of the authors was distributed as follows: Dr Clarissa Lella was responsible for data analysis, defining the research setting, and analysing and supporting the design of the instrument; Dr Annaleda Mazzucato was responsible for the preliminary phase of the literature search and defining the objectives of the study. Dr Christine Evain and Dr Madelyn Lines played a central role in data collection and defining the storytelling that framed the application under study.

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